EnergyCo

Central-West Orana Renewable Energy Zone Transmission project

Environmental Impact Statement

September 2023

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NSW GOVERNMENT

Acknowledgement of Country

The Energy Corporation of NSW acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land and we show our respect for Elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

Published by Energy Corporation of NSW

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Central-West Orana Renewable Energy Zone Transmission project

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Declaration

The project:	
Project name	Central-West Orana Renewable Energy Zone Transmission project
Application numbers	SSI-48323210 EPBC 2022/09353
The land on which the infrastructure is to be carried out	Generally the land which comprises a corridor approximately 220 kilometres long extending north to south from Cassilis to Wollar and east to west from Cassilis to Goolma.

Proponent:	
Name	Energy Corporation of New South Wales
Address	GPO Box 39, Sydney NSW 2001

Person by whom this EIS was prepared:	
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Address	Level 25, 680 George Street, Sydney
Professional qualifications	Bachelor of Science (Honours) (Agricultural and Environmental Science) Master of Science (Town and Country Planning)
Registration number	R80047
Organisation registered with	EIANZ
Declaration	

The undersigned declares that this Environmental Impact Statement (EIS):

- has been prepared in accordance with the Environmental Planning and Assessment Regulation 2021
- contains all available information relevant to the environmental assessment of the development, activity or infrastructure to which the EIS relates
- does not contain information that is false or misleading
- addresses the Planning Secretary’s environmental assessment requirements (SEARs) for the project
- identifies and addresses the relevant statutory requirements for the project, including any relevant matters for consideration in environmental planning instruments
- has been prepared having regard to the Department’s State Significant infrastructure Guidelines – Preparing an Environmental Impact Statement
- contains a simple and easy to understand summary of the project as a whole, having regard to the economic, environmental and social impacts of the project and the principles of ecologically sustainable development
- contains a consolidated description of the project in a single chapter of the EIS
- contains an accurate summary of the findings of any community engagement; and
- contains an accurate summary of the detailed technical assessment of the impacts of the project as a whole.

Signed:

Date: 21 September 2023

Glossary

Term	Definition
Access road	Permanent access roads to switching stations and energy hubs.
Access track	Temporary and permanent access tracks to transmission lines.
Central-West Orana Renewable Energy Zone	A geographic area of approximately 20,000 square kilometres centred on the regional towns of Dubbo and Dunedoo and extending west to Narromine and east beyond Mudgee and to Wellington in the south and Gilgandra in the north, that will combine renewable energy generation, storage and transmission infrastructure to deliver energy to electricity consumers.
Construction area	The area that would be directly impacted by the construction of the project, including (but not limited to) transmission towers and lines, brake and winch sites, access roads to the switching stations and energy hubs, access tracks, energy hubs, switching stations, communications infrastructure, workforce accommodation camps, construction compounds, laydown and staging areas.
Construction compound	An area used as the base for construction activities, usually for the storage of plant, equipment and materials, and/or construction site offices and worker facilities. It can also comprise concrete batching plant, crushing, grinding and screening plant, testing laboratory and wastewater treatment plant.
Construction routes	Roads used by construction vehicles (light and heavy).
Consumer Trustee	The *Electricity Infrastructure Investment Act 2020* (NSW) establishes the NSW Consumer Trustee as an independent statutory role with various planning, advisory and procurement functions which must be conducted in the long-term financial interests of NSW electricity customers. Australian Energy Market Operator services, as the NSW Consumer Trustee, runs competitive tenders for Long-Term Energy Services Agreements and Renewable Energy Zone Access Rights to support investment, construction and operation of renewable energy generation and long duration storage infrastructure in NSW.
Double circuit transmission lines	Transmission lines which typically comprise three conductors along with earthing and communications wires, carried by a single tower set. For 330 kilovolt (kV) lines, each conductor typically comprises two conductor cables (six conductor cables in total).
Enabling works	Activities that would be carried out before the start of substantial construction in order to make ready the key construction sites (including workforce accommodation camps and compounds), facilitate the commencement of substantial construction, manage specific features or issues and collect additional information required to finalise the final design and construction methodology.
Energy hub	A substation where energy exported from renewable energy generation projects is aggregated, transformed to 500 kV (where required) and exported to the transmission network, and may include battery storage.
EnergyCo	The Energy Corporation of New South Wales constituted by section 7 of the *Energy and Utilities Administration Act 1987* as the NSW Government statutory authority responsible for the delivery of NSW's Renewable Energy Zones.
Operation area	The area that would be occupied by permanent components of the project and/or maintained, including transmission line easements, transmission lines and towers, energy hubs, switching stations, communications infrastructure, access roads to the switching stations and energy hubs, maintenance facilities and permanent access tracks to the easements.
The project	The Central-West Orana REZ Transmission project as described in this EIS.
Renewable Energy Zone	A geographic area identified and declared by the NSW Government as a Renewable Energy Zone.

Term	Definition
Single circuit transmission lines	Transmission lines which typically comprise six conductors along with earthing and communications wires, paired on each phase, carried by a single tower set. For 500kV lines, each conductor typically comprises four conductor cables (24 conductor cables in total). For 330 kV lines, each conductor typically comprises two conductor cables (12 conductor cables in total).
Substation	A facility used to increase or decrease voltages between incoming and outgoing transmission lines (e.g. 330 kilovolts to 500 kilovolts).
Switching station	A facility used to connect two or more distinct transmission lines of the same designated voltage.
Transmission line easement	An area surrounding and including the transmission lines which is a legal 'right of way' and allows for ongoing access and maintenance of the transmission lines. Landowners can typically continue to use most of the land within transmission line easements, subject to some restrictions for safety and operational reasons
Transmission tower	A free-standing steel lattice tower (tension tower or suspension tower) or monopole.
Twin transmission lines	A pair of single or double circuit transmission lines running parallel.
Workforce accommodation camps	Areas that would be constructed and operated during construction to house the construction workforce.

Abbreviations

Term	Definition
ABS	Australian Bureau of Statistics
AC	Alternating Current
ACHA	Aboriginal Cultural Heritage Assessment
ACHMP	Aboriginal Cultural Heritage Management Plan
AEMO	Australian Energy Market Operator
AEP	Annual Exceedance Probability
AER	Australian Energy Regulator
AFG	Aboriginal Focus Group
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ALA	Aircraft Landing Areas
ANZECC	Australian and New Zealand Environment Conservation Council
ANZS	Australian and New Zealand Standard
ANZSIC	Australian and New Zealand Standard Industrial Classification
APZ	Asset Protection Zone
ARI	Average Recurrence Interval
ARMCANZ	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
AUL	Auxiliary Left Turn
AVTG	Assessing Vibration: A Technical Guideline
BAL	Bushfire Attack Level
BAM	Biodiversity Assessment Method
BCS	Biodiversity Conservation and Science
BDAR	Biodiversity Development Assessment Report
BESS	Battery Energy Storage System
BOM	Bureau of Meteorology
BSAL	Biophysical Strategic Agricultural Land
CASA	Civil Aviation Safety Authority
CEC	Clean Energy Council
CEMP	Construction Environmental Management Plan
CMSC	Coal Mine Subsidence Compensation
CNVG	Construction Noise and Vibration Guideline
CNVMP	Construction Noise and Vibration Management sub-plan
CSSI	Critical State Significant Infrastructure

Term	Definition
CTF	Controlled Traffic Farming
DA	Development application
DC	Direct Current
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DIDO	Drive-n-Drive-Out
DISER	Department of Industry, Science, Energy and Resources
DPI	Department of Primary Industries
DPE	Department of Planning & Environment
EIS	Environmental Impact Statement
EMF	Electric and Magnetic Field
EP&A Act	*Environmental Planning and Assessment Act 1979 (NSW)*
EPA	NSW Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Cth)*
EPI	Environmental Planning Instruments
ESD	Ecological Sustainable Development
FCNSW	Forestry Corporation NSW
FIFO	Fly-In-Fly-Out
FM Act	*Fisheries Management Act 1994 (NSW)*
GDE	Groundwater Dependant Ecosystems
GPS	Global Positioning System
GRIT	Generation of Regional Input Output Tables
HHMP	Historical Heritage Management Sub-Plan
HV	High Voltage
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission for Non-Ionizing Radiation Protection
ICOMOS	International Council on Monuments and Sites
IDA	International Dark Sky Park
IRSAD	Index of Relative Socio-economic Advantage and Disadvantage
ISP	Integrated Systems Plan
IVMS	In-Vehicle Monitoring System
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Areas
LLS	Local Land Services
LLS Act	*Local Land Services Act 2013 (NSW)*
LSC	Land and Soil Capability assessment scheme
MCP	Moolarben Coal Project
MDB	Murray-Darling Basin

Term	Definition
MNES	Matters of National Environmental Significance
NASAG	National Airports Safeguarding Advisory Group
NEM	National Energy Market
NHL	National Heritage List
NHVR	National Heavy Vehicle Regulator
NML	Noise Management Level
NP&W Act	*National Parks and Wildlife Act 1974 (NSW)*
NSW	New South Wales
NTSCORP	Native Title Service Provider for Aboriginal Traditional Owners in New South Wales and the Australian Capital Territory
OEH	Office of Environment and Heritage (former)
OEMP	Operational Environmental Management Plan
OJD	Ovine Johns Disease
OLS	Obstacle Limitation Surfaces
OOHW	Out of Hours Works
OSOM	Oversize and overmass
PAD	Potential Archaeological Deposits
PCT	Plant Community Type
PNTL	Project Noise Trigger Level
POEO Act	*Protection of the Environment Operations Act 1997 (NSW)*
QLD	Queensland
RAV	Restricted Access Vehicles
RBL	Ratings Background Levels
REZ	Renewable Energy Zone
RFS	Rural Fire Service
RNP	NSW Road Noise Policy
SBP	Strategic Benefit Payment
SEAR	Secretary’s Environmental Assessment Requirement
SEPP	State Environmental Planning Policy
SES	State Emergency Services
SF6	Sulfur hexafluoride
SIA	Social Impact Assessment
SIMP	Social Impact Management Plan
SMS	Safety Management System
SSAL	State Significant Agricultural Land
SSI	State Significant Infrastructure
TEC	Threatened Ecological Community
TRRA	Three Rivers Regional Assembly

Term	Definition
TSR	Travelling Stock Reserve
UNESCO	United Nations Educational, Scientific and Cultural Organization
WAL	Water Access Licence
WARR Act	*Waste Avoidance and Resource Recovery Act 2001 (NSW)*
WHL	World Heritage List
WHS	Work Health and Safety
WM Act	*Water Management Act 2000 (NSW)*

Summary

Overview

Renewable Energy Zones

The NSW Government is leading the development of Renewable Energy Zones (REZ) to deliver renewable energy generation and storage, supported by high voltage transmission infrastructure across NSW. REZs will play a vital role in delivering clean, affordable and reliable electricity for homes, businesses and industry in NSW to help replace the State's existing coal power stations as they come to their scheduled end of operational life.

REZs will group new renewable energy generation infrastructure into locations where it can be efficiently stored and transmitted across NSW. Five regions have been identified for the development of REZs: the Central-West Orana, South-West, New England, Hunter-Central Coast and Illawarra regions of NSW.

The Central-West Orana REZ

The Central-West Orana REZ is approximately 20,000 square kilometres in size and centred by Dubbo and Dunedoo (refer to Figure S-1), on the land of the Wiradjuri, Wailwan and Gamilaroi peoples. The Central-West Orana REZ was formally declared on 5 November 2021 under section 19(1) of the *Electricity Infrastructure Investment Act 2020*. Under the declaration, the Energy Corporation of NSW (EnergyCo) was appointed by the NSW Government as the Infrastructure Planner responsible for coordinating the development of generation and network infrastructure. The Central-West Orana REZ declaration provides for an initial intended network capacity of three gigawatts. The NSW Government is proposing to amend the declaration to increase the intended network capacity to six gigawatts, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network.

Figure S-1 Central-West Orana REZ geographical area (Source: EnergyCo)

The project

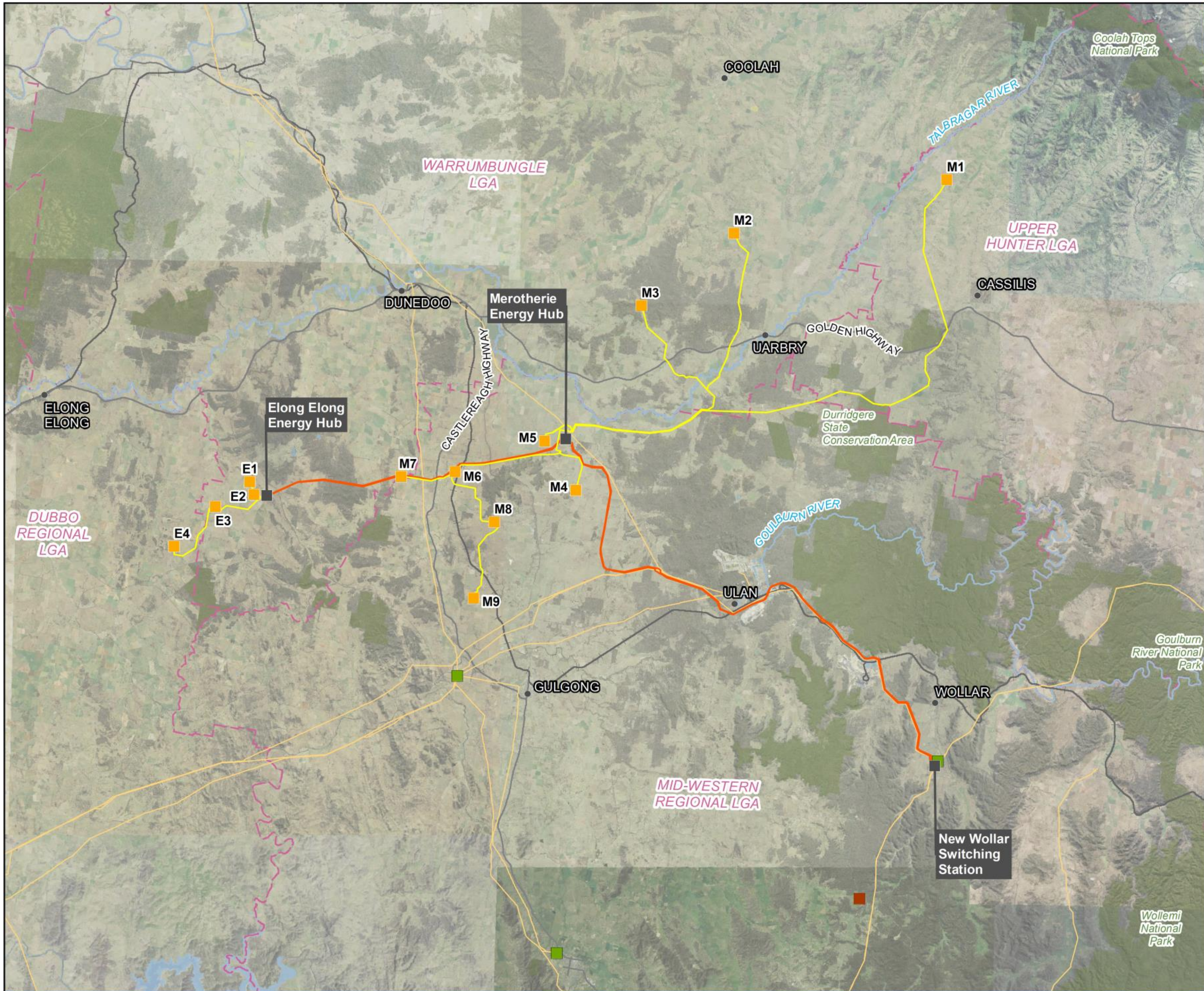
EnergyCo is proposing the construction and operation of new electricity transmission infrastructure, new energy hubs and switching stations and ancillary works required to connect new renewable energy generation and storage projects within the Central-West Orana REZ to the NSW transmission network (the project). The project is located within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter local government areas (LGAs) and generally extends north to south from Cassilis to Wollar and east to west from Cassilis to Goolma.

The project would enable 4.5 gigawatts of new network capacity to be unlocked by approximately the mid-2020s (noting the NSW Government's proposal to amend the Central-West Orana REZ declaration to increase the intended network capacity from three to six gigawatts). It would enable renewable energy generators to access new transmission infrastructure within the Central-West Orana REZ to export electricity to the NSW transmission network (as part of the National Electricity Market (NEM)). Importantly, the development of renewable energy generation projects in the Central-West Orana REZ is the responsibility of private generators and subject to separate planning and environmental approvals.

The project (refer to Figure S-2) would include the following features:

- a new switching station (the New Wollar Switching Station), located at Wollar to connect the project to the existing 500 kilovolts (kV) transmission network
- around 90 kilometres of twin double circuit 500 kV transmission lines and associated infrastructure to connect two energy hubs to the existing NSW transmission network via the New Wollar Switching Station
- energy hubs at Merotherie and Elong Elong (including a potential battery storage option at the Merotherie Energy Hub) to connect renewable energy generation projects within the Central-West Orana REZ to the 500 kV network infrastructure
- around 150 kilometres of single circuit, double circuit and twin double circuit 330 kV transmission lines, to connect renewable energy generation projects within the Central-West Orana REZ to the two energy hubs
- thirteen switching stations along the 330 kV network infrastructure at Cassilis, Coolah, Leadville, Merotherie, Tallawang, Dunedoo, Cobbora and Goolma, to transfer the energy generated from the renewable energy generation projects within the Central-West Orana REZ onto the project's 330 kV network infrastructure
- underground fibre optic communication cables along the 330 kV and 500 kV transmission lines between the energy hubs and switching stations
- construction of microwave repeater sites at locations along the alignment, as well as off the alignment at Botobolar, to provide a communications link between the project and the existing electricity transmission and distribution network
- a maintenance facility within the Merotherie Energy Hub to support the operational requirements of the project
- establishment of new, and upgrade of existing access tracks for transmission lines, energy hubs, switching stations and other ancillary works areas within the construction area (such as temporary waterway crossings, laydown and staging areas, earthwork material sites with crushing, grinding and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps)
- property adjustment works to facilitate access to the transmission lines and switching stations. These works include the relocation of existing infrastructure on properties that are impacted by the project
- utility adjustments required for the construction of the transmission network infrastructure, along with other adjustments to existing communications, water and wastewater utilities. This would include adjustments to existing Transgrid and Essential Energy transmission infrastructure. This includes adjustments to Transgrid's 500 kV transmission lines 5A3 (Bayswater to Mount Piper) and 5A5 (Wollar to Mount Piper) to provide a connection to the existing NSW transmission network, including new transmission line towers along the Transgrid network along the frontage of the New Wollar Switching Station, and other locations where there is an interface with Transgrid's network.

Figure S-2
The project



Legend

- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Indicitive microwave repeater site (Botobolar)
- Existing substation
- Existing transmission line
- State road
- Railway
- Watercourse
- Water body
- Local government area
- NPWS estate

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:500,000
Data sources: WSP 2023, EnergyCo, NSWSS

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Timing

Development of the project, including investigation of alignment options and other design alternatives, has been ongoing since 2018 (see Figure S-3).

Construction of the project would commence in approximately the second half of 2024, subject to NSW Government and Commonwealth planning approvals, and is estimated to take about four years. This includes an initial period of enabling works, main construction works and a commissioning period of around three years, and a construction site decommissioning and rehabilitation period. The project is expected to be commissioned/energised (i.e. become operational) in or around the second half of 2027.

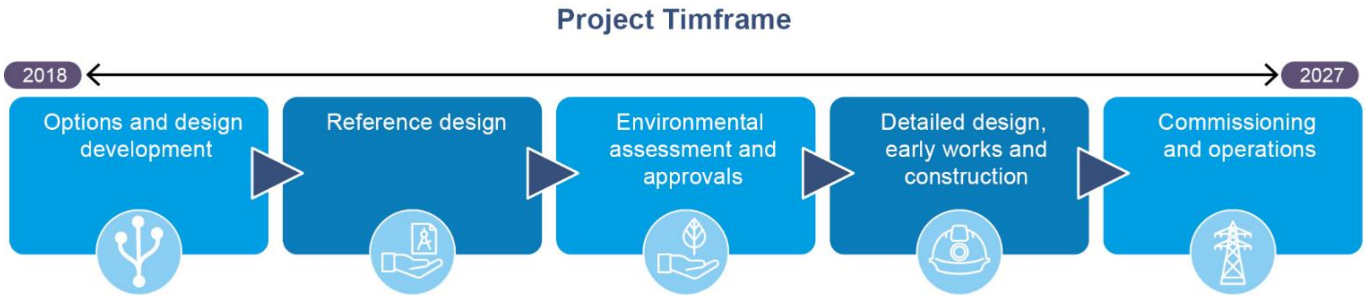


Figure S-3 Project timeframe

Related development

Related development is development that responds to the opportunities created by the project or which is required as a result of the project. All related development projects are subject to separate planning and approval processes.

A range of proposed renewable energy generation and storage projects located in the Central-West Orana REZ (and which are subject to separate approvals) would connect to the project, subject to the outcomes of the Consumer Trustees competitive tender process for rights to access the new transmission infrastructure. Where practicable, a number of the project's switching stations have been located with infrastructure from the renewable energy generation projects and, where suitable, the access road network provided under these projects would be utilised.

Other related development projects, which are subject to separate planning and approval processes, include:

- adjustments and upgrades to public roads that are required to facilitate access for construction of the project, including upgrades to the strategic road network (from the ports where equipment is imported) and localised upgrades to access the energy hubs. These upgrades would include replacement of existing bridges, culverts and/or causeways. These upgrades have also been included in the EIS so that in the event that they are not determined under separate planning and approval processes, they can be determined under this application.
- upgrade to the existing Transgrid network between Mount Piper and Wallerawang to strengthen the grid in the Central Tablelands, helping to ensure that power from the Central-West Orana REZ can be reliably moved back into the grid and to consumers.

Need for the project

The Australian Government is committed to coordinated global action to reduce greenhouse gas emissions in line with the Paris Agreement and has set targets to reduce emissions by 43 per cent below 2005 levels by 2030 and to net zero by 2050. Independently, the NSW Government has set a goal to achieve net-zero emissions by 2050 (NSW Department of Planning, Industry and Environment (DPIE), 2020a). Achieving these goals requires transformative low emissions technologies to be deployed at scale across all sectors of the economy. This includes the electricity generation sector which is currently Australia's largest source of greenhouse gas emissions, accounting for 33 per cent of Australia's total annual emissions in 2020 (Climate Change Authority, 2020).

Coal-fired generation is being withdrawn faster than anticipated (Australian Energy Market Operator, 2022a), due to large coal-fired power plants, such as the Eraring and Bayswater power stations, closing ahead of originally anticipated retirement dates (Eraring power station to potentially close by 2025 and Bayswater power station to close by 2033). This highlights the urgent need to develop and connect new renewable energy to the NEM, to continue to have enough energy to meet future demand, while meeting Australia's carbon emissions policy commitments.

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 able to connect to the network. The transmission grid therefore needs targeted augmentation, including strategically placed large-scale interconnectors and transmission line extensions, to balance resources and unlock REZs in new regions. The existing transmission network is not capable of transferring the scale of new electricity generation identified for the Central-West Orana REZ. Development of new electricity generation and storage projects in the Central-West Orana REZ will require new high voltage transmission infrastructure to connect to and provide enough capacity to meet demand. The project need is set out in further detail in Chapter 2 (Strategic context).

Project objectives

The project challenges, corresponding objectives and overall project outcomes are summarised from a strategic perspective in Figure S-4 and from a project design and delivery perspective in Figure S-5. The objectives respond to the project need and the strategic and regional context of the Central-West Orana REZ.

Strategic		
Challenges	**Objectives**	**Outcomes**
Ability to meet emission reduction targets set by the NSW Government and the Australian Government	• Support government decarbonisation targets and the transition of the NEM from traditional energy sources to lower emission alternatives based on renewable energy.	• Reduced emissions and a greater mix of renewable energy in the NEM.
Planned closure of aging major coal-fired power generators over the coming decade will create power shortages if this generation capacity is not replaced	• Develop the architecture for the Central-West Orana REZ so that it encourages delivery of, and reduce barriers to the development of viable grid-scale renewable energy projects within the REZ in the near term to deliver a source of affordable and reliable energy. • Deliver the Central-West Orana Transmission Project, a key element of the NSW Electricity Strategy and Electricity Infrastructure Roadmap, by the mid 2020's before the retirement of key coal-fired power stations. • Provide high-capacity connections to mature grid-scale generation projects within the Central-West Orana REZ to enable earlier delivery of bulk power.	• Improved reliability and energy security, by delivering large amounts of new energy supply into the NEM. • Unlock major investment in new renewable energy and regional economies. • Placing downward pressure on customer bills through lower energy generation costs and increased competition.
Increased demand for electricity as technology and industry shifts towards electrification	• Design the Central-West Orana REZ to meet current bulk energy demands and enable efficient expansion to meet future demand as this grows.	• Network infrastructure that will: – meet current and future needs efficiently, reducing ongoing impacts to the community by building it right the first time; and – support ongoing development and investment in renewable energy projects within the REZ to meet growth in demand.
Traditional sources of inertia and stability in the network are lost as fossil fuel generators are retired	• Design the Central-West Orana REZ to address issues of inertia and stability by including equipment and technology within the design of the Central-West Orana REZ to ensure stability and reliability.	• Delivery of a transmission network that can efficiently and reliably deliver bulk power from renewable sources at reliability levels consumers expect of the NEM.

Figure S-4 Strategic project challenges, objectives and outcomes

Project

Challenges	Objectives	Outcomes
Delivering a project that minimises impacts to local communities along the transmission route during construction and operation	• Engage in open and honest dialogue with the community and stakeholders during the development and delivery of the project, to improve the design and reduce impacts to the community and landowners where reasonable and feasible. • Through corridor development and refinement, avoid large centres of population. • Work with landowners to identify how the project may impact their properties and businesses and develop measures to manage and mitigate those impacts.	• Deliver a project that is supported by the local community and landowners by engaging in an open and transparent consultation process through the development of the projects design, as well as its construction and operation.
Potential for the project to result in conflict with other valued land uses such as agriculture	• Plan for, design and deliver a project that: – Seeks to utilise previously disturbed land to avoid and minimise impacts to other valued land uses. – Minimises the amount of prime agricultural land required for construction and permanent operational infrastructure. – Allows for continued agricultural land uses and farming practices within the Central-West Orana REZ.	• Impacts to agricultural land and farming practices would be avoided and minimised as much as possible throughout construction and operation of the project.
Cumulative impacts of network infrastructure and generation projects	• Plan and deliver transmission and generation projects in a coordinated manner and in consultation with stakeholders, including generators. • Reduce cumulative impacts from construction and operation of the project with other renewable energy projects in the Central-West Orana REZ.	• Efficient and coordinated delivery of network infrastructure and generation projects. • Reduced impacts on local communities during construction and operation.
Potential for the project to result in adverse environmental impacts	• Plan for, design and deliver a project that protects natural and cultural resources, and minimises impacts to: – natural systems, including biodiversity – Aboriginal and non-Aboriginal cultural heritage – visual amenity – water resources and water quality. • Implement strategies to mitigate and offset impacts and to recreate important environmental values in the region.	• Environmental impacts of the project during construction and operation would be avoided and minimised where feasible. • The scale of the project allows new environmental values to be recreated for the benefit of the region. • The project will support the delivery of viable grid-scale renewable energy to reduce the need for fossil fuel generators.

Figure S-5 Project delivery challenges, objectives and outcomes

Alternatives considered

The project has undergone a process of the development and evaluation of alternative transmission corridor options from feasibility to early design development. Once the need for the project was established, the following strategic alternatives were identified and evaluated between 2019 and 2021:

- Strategic option 1: Base case ('do nothing')
- Strategic option 2: Optimisation and modification of existing transmission line infrastructure ('do minimum')
- Strategic option 3: Provision of new transmission capacity to meet known renewable energy demand and allow for future expansion.

Strategic options 1 and 2 were considered unsuitable as they would not provide the increased network capacity needed to encourage the scale of renewable energy investment required to meet government emission reduction targets and to provide an affordable and reliable source of new energy to meet current and future electricity demand.

Strategic option 3 was selected as it includes new transmission lines that would be planned with consideration of the locations of known renewable energy projects currently under development. In addition, the transmission infrastructure to be provided as part of this option would be designed so that there is sufficient capacity for future renewable energy generators within the Central-West Orana REZ to connect. Strategic option 3 aligns with all of the strategic project objectives and is considered to be the preferred strategic option for the project.

In 2020, the NSW Government engaged Transgrid, as NSW's jurisdictional transmission planner at the time, to carry out early development work to guide the planning of new transmission infrastructure for the Central-West Orana REZ. In December 2020, Transgrid released a preliminary study corridor for the project that ran northwest from the existing network near Merriwa, passing south of Dunedoo before connecting to the existing network east of Wellington.

In November 2021, the Central-West Orana REZ was formally declared by the Minister for Energy and Environment and EnergyCo was appointed as the Infrastructure Planner to lead the delivery of REZs. At this time, EnergyCo assumed responsibility for planning and design of the transmission corridor and engaging local communities and stakeholders to inform the development of new transmission network infrastructure within the REZ.

In February 2022, EnergyCo released a revised study corridor for the project (shown in the *Central-West Orana Renewable Energy Zone Transmission project Scoping Report* (EnergyCo, 2022c)), which responded to community feedback Transgrid received on their December 2020 preliminary study corridor to reduce the extent of transmission infrastructure in high value agricultural land. The EnergyCo revised study corridor incorporated mining areas and existing transmission easements to the south of Goulburn River National Park. Importantly this section of the revised study corridor was intentionally narrow due to the presence of important biodiversity and heritage features including Goulburn River National Park, Munghorn Gap Nature Reserve, mapped important Regent Honeyeater habitat, and highly sensitive Aboriginal cultural heritage sites. By locating the revised study corridor in disturbed mining areas and with existing transmission lines, impacts to these important constraints were able to be avoided or minimised.

The design development of the project from the identification of the revised study corridor through to the current Environmental Impact Statement (EIS) alignment has aimed to avoid or minimise potential impacts. Continuous refinement at each stage of project development has included identification of significant environmental constraints that would be desirable to avoid or impact minimally.

The consideration of alternatives is set out in further detail in Chapter 2 (Strategic context).

Approval pathway

The project was declared as Critical State Significant Infrastructure (CSSI) under section 5.13 of the EP&A Act and is considered essential for the State for economic, environmental or social reasons. The project is subject to approval by the NSW Minister for Planning under Division 5.2 of the EP&A Act.

The project is also a controlled action and requires a separate approval from the Commonwealth Minister for the Environment and Water (or its delegate) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (Cth) (refer to Figure S-6). The project will be assessed under the NSW Assessment Bilateral Agreement under Part 9 of the EPBC Act, and the EPBC assessment requirements have been included in the Secretary's environmental assessment requirements (SEARs) issued for the project.

This EIS has been prepared to support EnergyCo's application for approval in accordance with the requirements of Division 5.2 of the EP&A Act. It has been prepared with regard to the NSW Department of Planning and Environment's (DPE) *State Significant Infrastructure Guidelines* (DPE, 2022i) and addresses the SEARs issued for the project.

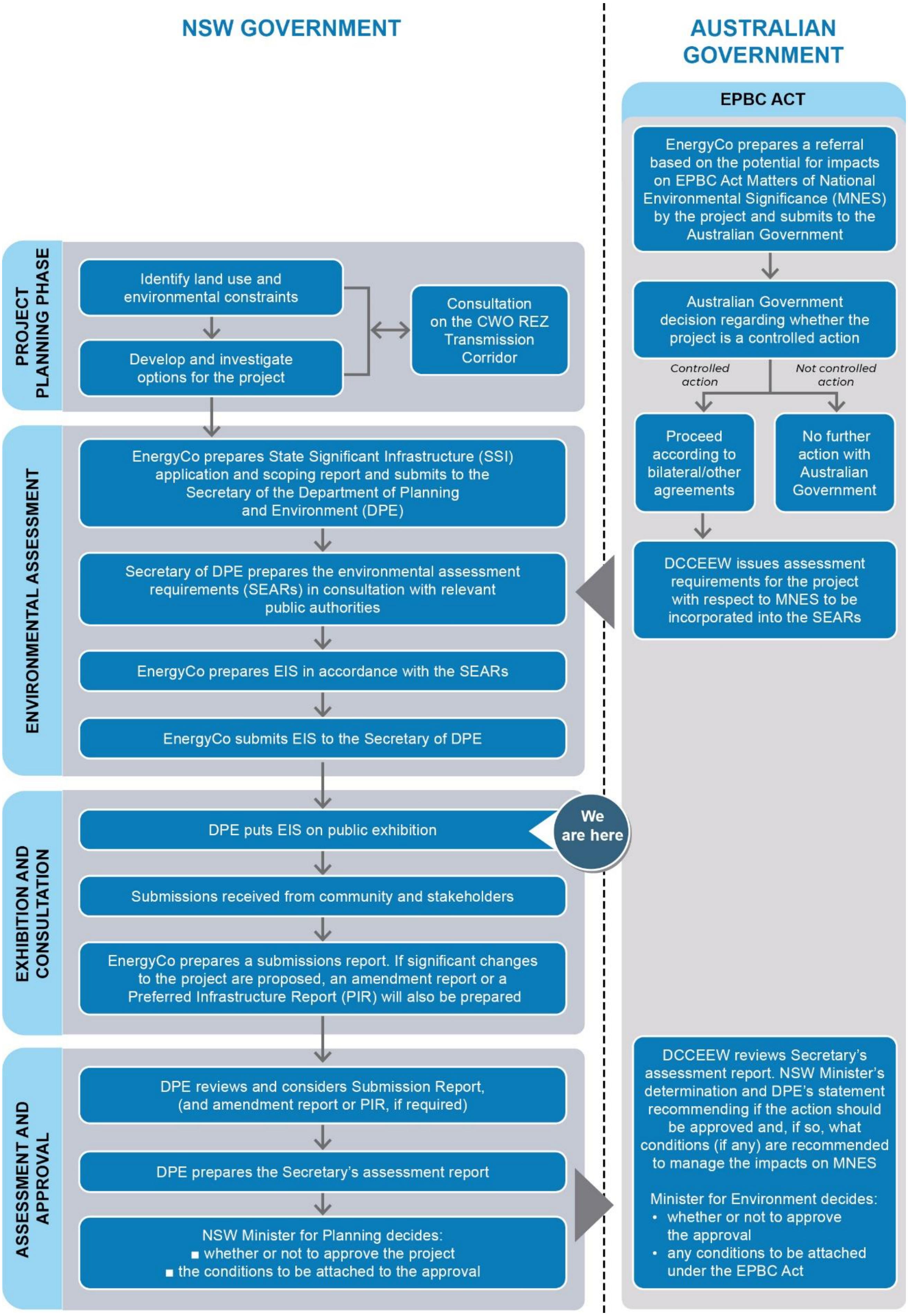


Figure S-6 Planning approval process for the project

Engagement

The project is a large and complex infrastructure project with a high level of interest from the community and other stakeholders, including renewable energy supplier generation projects in the Central-West Orana REZ. EnergyCo recognises the diverse engagement and information needs of the community and is committed to a robust plan of engagement that will continue to be inclusive and encourage participation.

Between December 2020 and September 2021, community consultation was carried out by Transgrid on the preliminary study corridor for new transmission network infrastructure in the Central-West Orana REZ. EnergyCo assumed responsibility for continuing engagement with communities and stakeholders for the project when it was appointed as Infrastructure Planner for the Central-West Orana REZ in November 2021. Since this time, EnergyCo has carried out a comprehensive program of community and stakeholder engagement to build on the engagement previously carried out by Transgrid. A key aim of engagement activities has been to gather community and stakeholder feedback to be considered in the refinement of the study corridor and design for the project.

A variety of engagement tools have been established for the project to seek input from the community and stakeholders, from a dedicated project phone number to sessions with the Community Reference Group established in August 2022 and more. The feedback and suggestions received from the community and stakeholders have been considered in combination with engineering and environmental studies, to further refine the project and the development of this EIS.

Key issues raised by the community and stakeholders include:

- concerns about the consultation process, including a view in the community that there was inadequate consultation on the project at the time, but also feedback that there was broader consultation fatigue as a result of the large number of development projects (and associated consultation processes) in the region
- the impact of construction, including disturbance of private land, disruption of social services, use of accommodation camps for the construction workforce and traffic management
- impacts to agricultural activities during construction and operation including any restrictions on activities as a result of the easement
- environmental impacts including vegetation clearing, erosion and waste generation
- visual impacts from project infrastructure
- bushfire risks associated with the transmission line as a source of ignition
- clarification of the process for the development of the alignment including any alternatives considered
- REZ planning and governance including the need and approach taken to developing the REZ
- socio-economic impacts including business impacts and community benefits.

Engagement for the project is further addressed in Chapter 5 (Community and stakeholder engagement).

Environmental assessment

Land use and property

The project has been designed, where feasible, to avoid or minimise potential land use and property impacts. This has included locating the project alignment along property boundaries, next to existing transmission line easements or positioning infrastructure in areas that align with current land use activities. The location of permanent infrastructure has also been guided by, amongst other things, landowner feedback, and the willingness of landowners to host project infrastructure on their property. Where feasible, the project has been designed to maximise the use of already disturbed land, such as mining land and industrial land.

The primary land use within the Central-West Orana region is agriculture. Other key land uses include protected areas (such as National Parks and State Conservation Areas) and mining operations. Land tenure is predominantly freehold, with some areas of Crown land, (including road reserves), rail corridors, travelling stock reserves, state forests and NSW National Parks and Wildlife estate.

Construction of the project would require around 4,000 hectares of land, which once established would result in a change in the existing land use, either permanently or temporarily until construction activities are completed. The operation area of the project is around 2,700 hectares, but is subject to ongoing refinement and would be finalised as part of continued design development. In particular, the operation area is expected to increase at the Elong Elong Energy Hub due to the configuration of the initial 330 kV operation. Within permanent easements for operation outside of transmission line tower footprints, agricultural land use would continue with some restrictions to certain agricultural activities (such as cropping or horticulture). There may be the requirement to adjust infrastructure on private property (such as sheds, fencing, dams and access tracks), which would be undertaken in consultation with the landowner.

The Central-West Orana REZ has a long history of agricultural and mining activities, and while these land uses are expected to continue, the region is experiencing a shift in land use, as part of the larger energy transition. This shift is supported by the *Central West and Orana Regional Plan 2041* (DPE, 2022a), which recognises and supports the establishment of the Central-West Orana REZ, while aiming to ensure compatibility with existing land use practices and minimise the associated environmental and social impacts. Once operational, the project would support the future land use as envisioned by the *Central-West and Orana Regional Plan 2041*.

Agriculture

Most agricultural operations in the region involve the production of livestock (sheep and cattle), with cropping operations focused in areas of higher quality soils. The total gross value of agricultural production in the four LGAs within which the project is located is around $652 million, with the grazing of cattle and calves the most valuable agricultural commodity.

The project would require the use of agricultural land either permanently for operation or temporarily until construction activities are completed. The level of impacts on agricultural land use and productivity would vary depending on the scale and intensity of construction activities. In areas where a higher intensity of construction activities is required, such as the location of transmission line towers, agricultural activities would be impacted, and in many locations, permanently removed from use. In areas where a lower intensity of construction activities are required, such as areas of land in between transmission line towers, impacts to agricultural productivity would not be affected to the same degree. It is expected there could be a continuation of some agricultural activities in these areas, subject to certain conditions that would be established through property management plans to be developed for each property, in consultation with the affected landowner.

During construction, around 1,820 hectares of agricultural land is expected be directly affected by the establishment of temporary and permanent structures and facilities, however for the purpose of estimating total impacts and presenting a worst case assessment, it is assumed the entire construction area (approximately 3,660 hectares of agricultural land) would be unavailable for use during construction. This would result in an estimated loss of agricultural production of around $1.35 million per annum during the construction period, which is equivalent to approximately 0.21 per cent of the total gross value of agricultural production across the four LGAs over the same period.

The project also has the potential to place restrictions on the movement of landowners, workers, livestock, and equipment within and across the construction area, temporarily and permanently limiting cropping and aerial agricultural operations, removal of vegetation (as shade or shelter), and changes to farm infrastructure such as fencing and dams. These impacts would be managed in accordance with Property Management Plans.

Once operational, around 825 hectares of agricultural land would be permanently removed due to the establishment of permanent infrastructure (the operation area is subject to ongoing refinement and would be finalised as part of continued design development). The remainder of the agricultural land within the operational area consists of transmission line easements, where land would continue to be used for grazing and other agricultural activities such as cropping, subject to certain restrictions. The permanent loss of agricultural land is equivalent to 0.04 per cent of the total area of agricultural land use in the four impacted LGAs and represents an estimated productivity loss of around $317,550 per annum.

Landscape character and visual amenity

The project consists of four landscape character areas; rural valleys, forested hills, mining areas, and undulating rural hills. The landscape and visual sensitivity of these landscape character areas varies and is influenced by scenic, historic and recreational sites. Localities identified as likely to have an elevated landscape character and visual sensitivity within and near the landscape and visual study area include:

- conservation and recreational landscapes such as Goulburn River National Park and Munghorn Gap Nature Reserve
- local highpoints offering views, such as Coolah valley lookout
- small rural towns, such as Ulan, Wollar and Cassilis
- heritage items such as Laheys Creek Cemetery along Spring Ridge Road and Wandoona Homestead south of Wollar.

Twenty-six publicly accessible viewpoints were selected as representative of the range of landscape views to the project. In addition to the ground level viewpoints, a viewpoint from the air was selected to represent recreational flights operating from Dubbo Airport and Mudgee Airports. The assessment also identified 91 private properties with the potential to have a visual impact during the operation of the project and were subject to a detailed visual assessment. Of these private viewpoints, 38 are host properties and 53 are properties that would not host project infrastructure (non-host). Public and private viewpoints were selected based on review of digital terrain mapping and site inspections.

The main visual impacts during construction would be from vegetation removal, earthworks and introduction of plant and equipment and ancillary facilities including the construction compounds and accommodation workforce camps. The impacts would be temporary and transient along the transmission line alignment. During construction, the project would result in negligible to moderate impacts at the landscape zone viewpoints and representative viewpoints during the day and night. Moderate impacts would occur in locations where views are close to the construction area, where there are views of concentrated construction activity (such as at energy hubs) and/or where there are clear views to construction activities.

The main visual impacts during operation would be from the introduction of large-scale structures including transmission towers and energy hubs. The project would have negligible to moderate visual impacts at the public viewpoints. The majority of public viewpoints would experience a moderate to high magnitude of change given the prominence of the project within a rural landscape with limited large-scale structures. Areas of moderate impact would occur at locations where there is a clear view of the project (often with little screening vegetation) or where the project would result in a substantial change in rural character or scenic values of the view. Low-moderate impacts would occur generally in locations with lower visual sensitivity and in locations away from energy hubs.

Of all the assessed private viewpoints, it was identified that 10 host properties and three non-host properties would experience a high visual impact, and seven host properties and 13 non-host properties would experience a moderate visual impact. However, these impacts may potentially be reduced through the implementation of mitigation measures. Photomontages and three-dimensional modelling has been prepared for some viewpoints to support the assessment of visual impact. These views illustrate locations where the project would be seen from locations of higher visual sensitivity and also to show a typical view within some of the landscape character types.

Operation of the transmission line would not require any lighting and would therefore have no impact during operation at night. The energy hubs at Merotherie and Elong Elong would have low-level lighting at night during operation for security and maintenance access. Four properties in close proximity to the energy hubs would experience views to the energy hub lighting at night. The switching stations would also be lit at night, including low-level lighting for security and maintenance access. Lighting at the energy hubs and switching stations will be designed and operated with consideration of minimising obtrusive lighting impacts.

Biodiversity

The project is located in an area which has been widely cleared for agriculture with scattered patches of woodland remaining. These remnant patches, while fragmented, provide important habitat for certain threatened species (such as the threatened Squirrel Glider).

Extensive field surveys of the construction area were undertaken between mid-2022 and mid-2023 to support the biodiversity assessment. Field surveys were generally carried out in accordance with the relevant NSW and Commonwealth guidelines and included:

- field validation of vegetation mapping using random meander surveys and vegetation integrity plots
- threatened flora survey for candidate threatened species
- threatened fauna survey using targeted seasonal surveys, and geographic and habitat constraints assessments.

Native vegetation covers around 58 per cent of the project's construction area, with the remaining areas consisting of buildings and roads, cropping land and pastures dominated by exotic pasture species. The project has sought to avoid and/or minimise biodiversity impacts where possible during design development and selection of the vegetation clearing strategies to avoid full clearing of the construction area and during ongoing maintenance.

While efforts have been made to avoid impacts to biodiversity, some impacts could not be avoided. A number of competing environmental and technical constraints are present which requires adopting a balanced approach to corridor planning to determine the most appropriate project alignment. Construction of the project would result in direct impacts to around 1,032 hectares of native vegetation, including 22 plant community types (PCT). Four of the 22 PCTs expected to be impacted are listed as threatened ecological communities (TECs) under the *Biodiversity Conservation Act 2016* (BC Act) and three are listed as TECs under the EPBC Act. In addition, construction of the project has the potential to directly impact 33 threatened flora and fauna species, or their habitats.

Indirect impacts during construction, where the project does not physically interfere with threatened species or their habitats, have all been assessed as negligible or low impact except for inadvertent impacts on adjacent habitat or vegetation, and the loss of breeding habitat such as hollow-bearing trees, nests, dreys and burrows and fallen timber, which has the potential to affect native animals within and adjacent to the construction area of the project.

The project would have limited additional or ongoing biodiversity impacts once operational. The key potential operational impacts are associated with the regular management of vegetation in the transmission line easements for safety and operational reasons, including bushfire risk management. The impacts of this activity on biodiversity values has been factored into the construction impact assessment through the predicted impacts to vegetation integrity of PCTs and threatened species habitat. During operation, the potential for collision with transmission lines, and the potential for impacts of electric and magnetic fields (EMF) on local fauna populations has the potential to impact larger and higher-flying birds which occupy the area. While the project is located well away from waterways and major wetlands that would provide habitat for large flocks of water birds, and is likely below the flight path of birds, biodiversity offsets have been calculated for key species.

Habitat connectivity for the Squirrel Glider, threatened woodland birds and threatened bat species also has the potential to be impacted where the transmission line easement intersects areas of native vegetation. However, as the transmission lines would be highly permeable, connectivity is expected to remain largely unaffected for all species and any impacts would be minor. Furthermore, impacts are likely to reduce over time as fauna acclimatises to the presence of the transmission line and towers. In terms of the risk of collision with transmission lines, while this type of indirect impact has the potential to lead to an increase in bird mortality, mitigation measures (including bird flappers/ divertors) would be implemented to ensure the likely impacts are minimised.

Biodiversity offsets would be required for impacts to PCTs, threatened species or populations. The offset obligation for the project has been calculated to require the following biodiversity credits:

- 52,089 species credits
- 21,434 ecosystem credits
- 163 ecosystem credits (scattered trees).

Offsets would be secured in stages to reflect the progressive delivery of the 500 kV and 330 kV transmission lines. The strategy for securing offsets and the proposed delivery approach would be confirmed by EnergyCo during detailed design when the final construction area is confirmed. The final offset requirements would also be confirmed during detailed design.

Aboriginal heritage

The project is located in an area primarily associated with Wiradjuri people, but partially encompasses the southern border of the Gamilaroi nation. The southeastern portion of the project has been extensively studied for over 30 years, largely in response to the development of several major coal mines. More recently, the surrounding area has been broadly studied as part of the development of renewable energy projects in the region.

The Aboriginal cultural heritage assessment involved desktop assessment and comprehensive field investigations. On-site validation of desktop assessment findings consisted of field surveys and test excavations undertaken over a 10 month period by archaeologists, subcontractors and 15 registered Aboriginal parties. Overall, approximately 79 per cent of the construction area was subject to linear pedestrian transects. Test excavations used desktop site predictions and results of field surveys to target key locales to supplement and confirm the field survey findings. The findings of the field investigations demonstrate that the most significant cultural deposits appear to primarily be found along major watercourses and/or strongly influenced by other environmental factors such as the presence of sandstone outcrops and over hangs.

There are several notable areas of Aboriginal cultural heritage value within the vicinity of the project including along the banks of Laheys Creek, the interface between Barneys Reef and the surrounding lowlands near Tallawang, a suite of grinding grooves on discrete sandstone dominated hills in the northwest of Merotherie Energy Hub, and an abundance of diverse sites along Wilpinjong Creek. The project has avoided impacts to some Aboriginal sites identified from desktop assessments or field surveys through relocation and refinement of the construction area as part of the project development process.

There are 46 Aboriginal objects and/or sites within the construction area consisting of eight rockshelters, nine culturally modified trees, 11 grinding grooves, five high density artefact scatters, seven moderate density artefact scatters, six areas of past foci and activity characterised by high densities of sub-surface artefacts. Of these, 17 are previously documented sites, recorded as part of previous studies undertaken within portions of the construction area, and the remaining 29 were identified as part of the various field activities and analysis undertaken as part of this assessment. In addition, zones with archaeological potential occur across the construction area as well as within approximately 150 m either side of moderately size watercourses across the construction area.

All of the Aboriginal sites and places within the construction area have been assessed as potentially subject to direct and indirect impacts from construction and operation of the project resulting in their complete or partial loss. Ground disturbance from construction activities to establish project infrastructure would result in damage to stone artefacts, grinding grooves and rockshelters. Vegetation clearance during construction and operation would primarily directly impact culturally modified trees. Indirect impacts to Aboriginal sites would primarily be as a result of visual impacts associated with establishing new infrastructure in the landscape.

Direct impacts to 37 Aboriginal sites would primarily be caused by ground disturbance which is conservatively assumed to occur throughout the construction area. However, in practice substantial avoidance of heritage sites would be achieved during detailed design through careful siting of the transmission line towers and other project infrastructure. EnergyCo is continuing to explore the potential avoidance of sites of high and moderate significance, and especially where they are located within the energy hubs and workforce accommodation camps. Additional works to further validate and explore the culturally modified trees and cultural deposits would also further refine these values.

Prior to construction, an Aboriginal Cultural Heritage Management Plan sub-plan would be developed by a heritage specialist in consultation with the registered Aboriginal parties to manage and avoid impacts to Aboriginal heritage within the construction area. A heritage-interpretation strategy will also be developed by a heritage specialist to identify the interpretive values of the area and to provide direction for potential interpretive opportunities for the project.

Non-Aboriginal heritage

The project is located in a landscape that retains evidence of the Australian colonial period to the present day. Based on a review of historical aerial mapping, previous heritage studies and field surveys, 24 unlisted heritage items and two locally listed heritage items were identified within and in close proximity to the project. The locally listed heritage items include the Wandoona Homestead and the Goulburn River National Park. The unlisted heritage items consist mainly of potential archaeological sites and homesteads of local heritage significance. Non-intrusive subsurface investigations using Ground Penetrating Radar have been undertaken to locate two potential cemetery areas on the corner of Tucklan and Spir Road in Tallawang. Results from these investigations will be incorporated into the assessment once processing of the investigation data is completed.

The project may result in direct impacts (full or partial disturbance) to 17 locally significant unlisted heritage items located partially or wholly within the construction area. The significance of these impacts would be neutral to slight/moderate. Indirect impacts of neutral/slight significance would occur at one unlisted heritage item and the two locally listed heritage items due to visual impacts arising from the presence of new transmission infrastructure. None of the impacts identified are significant enough to diminish cultural significance in the region to a degree where it is no longer recognisable.

To minimise and manage potential impacts on listed local heritage items and unlisted heritage items within the construction area, a range of mitigation measures would be implemented. Where possible, direct impacts to heritage items would be avoided and minimised through detailed design and tailoring of the construction methodology. If a heritage item cannot be avoided, a number of heritage management actions may be implemented, including archaeological test excavations, salvage or archival recording.

Social

The social impact assessment considered the local social locality (the suburbs expected to experience the most social change due to the project during construction and/or operation) and the regional social locality (the LGAs expected to experience indirect benefits or effects as a result of the project during construction and/or operation). The social impact assessment was informed by the findings of engagement activities conducted broadly by EnergyCo as part of project development, and targeted engagement undertaken for the purposes of this assessment which aimed to gather information from the perspective of those likely to be affected by the project.

Community values are diverse across the local and regional social localities in which the project is located. Based on stakeholder consultation undertaken as part of the social impact assessment, most community members in the region value the views, natural landscape, surroundings and agricultural potential of their properties. Another notable community value that was raised by multiple stakeholders is community cohesion. The rural, close-knit nature of the community is an important aspect of life for residents. Furthermore, the long-standing multi-generational connection many families have to their properties and the local community has also contributed to many residents valuing community cohesion.

Construction activities would result in the generation of noise, vibration and dust, and impacts on visual amenity and landscape character including to nearby residences. These impacts would affect landowners' and the broader community's sense of place and the natural 'peace and quiet' of the surrounding landscape in the local social locality. The potential visual, noise, vibration and air quality impacts of the project associated with construction activities would generally be temporary and short term as work progresses along the transmission line alignments. Potential impacts associated with the construction of energy hubs and switching station sites and use of workforce accommodation camps would persist for the duration of construction.

The most substantial negative social impacts during construction are associated with potential impacts on community cohesion and the ability to make or influence decisions, due to uncertainty around the potential impacts of acquisitions required for the project, and perceptions that there is a lack of detailed information available, and an unequal distribution of impacts and benefits of the project. Other potential negative social impacts may include impacts to local amenity and sense of safety from the introduction of additional traffic and a non-resident workforce in nearby towns. Increased biosecurity threats due to the movement of machinery, vehicles and people may significantly affect livelihoods of agricultural businesses and farmers. There would also be potential impacts on First Nations cultural values and wellbeing due to changes to the landscape, access and sites of cultural heritage significance.

During operation, the project would deliver broader social benefits associated with increased access to renewable energy sources, lowering of carbon emissions and cheaper energy. However, some local residents may experience an unequal distribution of impacts and benefits of the project, or experience stress due to perceived health and safety risks, bushfire risk and uncertainty about the impact of the project on property values. Members of the community that place importance on local landscape value and vistas could experience a diminished sense of belonging due to concerns about potential and perceived visual impacts and industrialisation of the local and regional area (i.e. the cumulative impact of the Central-West Orana REZ).

Mitigation measures would seek to address the potential social impacts of the project and maximise social benefits. Key measures include a project-specific landowner engagement strategy, property management plans, and a local workforce participation strategy (including First Nations participation).

Economic

Construction and operation of the project would provide positive economic activity for the regional and NSW economy. The positive impact of the project on the regional economy during construction is estimated to be up to $512 million in average annual output (the gross value of business turnover in a region). The impacts on the regional economy during project operation are estimated at up to $134 million in average annual output. The economic impacts are larger for the NSW economy because there is a smaller loss of direct and indirect expenditure out of the NSW economy compared to the regional economy.

The construction workforce would vary depending on the stage of construction and associated activities. During the peak construction period, it is expected around 1,800 full time equivalent construction workers would be employed. Increases in labour demand from the project could potentially lead to short term increases in construction wages and associated labour shortages in other areas of the economy. The operation of the project would create a small demand for regional labour resources and regional inputs to production. Consequently, no wage or price increases or production shortages are anticipated.

Construction of the project would result in a reduction in the land available for agricultural activity. The agricultural impacts of the project during construction are less than 0.3 per cent of agricultural economic activity in the region and a fraction of the economic activity gains from the project. Following construction, the project would result in a smaller reduction in agricultural land due to the comparatively smaller operational area.

Noise and vibration

The project is located in areas where background noise levels were generally measured to be low during the daytime period and dominated by rural and natural sounds, typical of the rural land uses.

During construction, noise impacts would generally be minor during standard work hours; however, the project has the potential to impact noise sensitive receivers (generally residences) in the vicinity of the project due to noise or vibration intensive activities such as earthworks. At energy hubs and switching stations, airborne noise impacts would be minor for most construction activities with exceedances of noise criteria predicted to occur at 14 receivers. Where construction works are carried out outside of standard working hours, noise levels are predicted to be more noticeable and result in exceedances of criteria for some activities. Typically, foundations and/or earthworks are expected to be the loudest out of hours work stage at most sites and this work would be avoided during night-time periods where reasonable and feasible.

Potential noise impacts during construction of the transmission lines are predicted to occur at 144 receivers, primarily as a result construction of the transmission line tower foundations undertaken outside of standard hours (including the daytime periods of Saturday afternoons and Sundays). Use of drones or helicopters for stringing transmission lines between towers may be required for short periods and would progress along the alignment. Where required, this activity would result in exceedances of noise criteria during the daytime (including outside of standard hours daytime) as noise levels would be approximately four decibels (dB) greater than the noisiest earthworks. This activity would not be undertaken during evening or night-time hours.

These impacts would generally be transient, as work moves along the transmission line alignment and impacts are not generally predicted to impact most receivers for any substantial length of time. Implementation of standard and site-specific noise and vibration mitigation measures would be implemented to reduce the impact on receivers.

Construction vehicles would generate road traffic noise along construction routes. Around 32 receivers are predicted to exceed construction traffic noise criteria, particularly during the night time on local roads, due to the existing low traffic volumes and the relative increase of traffic from the project. However, construction traffic movements would generally occur during daytime hours such that night time impacts are limited. Noise management measures would be implemented to minimise the potential for noise disturbance from construction traffic including limiting traffic movements to daytime periods as far as reasonable and feasible.

Noise would be generated from the operation of energy hubs, switching stations and transmission line infrastructure and maintenance activities once the project has been commissioned. Operational noise impacts from maintenance and inspection activities would be infrequent and short lived. Noise impacts from operation of the transmission line, associated with corona noise discharges, have been predicted to potentially affect up to two sensitive receivers. This corona discharge noise is more prominent during rain, mist or fog and often sounds like a 'crackling noise'. Three sensitive receivers near switching stations are also predicted to be affected by infrequent and brief noises from circuit breaker switches.

Due to the rural nature of the area and generally isolated nature of noise-sensitive receivers, receiver-based noise treatment(s) are considered feasible and reasonable to manage potential audible noise impacts from the operation of transmission lines. During detailed design and upon completion of a comprehensive assessment of feasible and reasonable mitigation options, residual impacts would be further considered to determine what appropriate mitigation treatments may be required. This includes monitoring after the commissioning of the project at each residence where potential operational noise levels are predicted to exceed project noise trigger levels. At-property treatments would need to be determined in consultation with the landowner and informed by a detailed building condition survey.

Hazard and risk

Potential hazards and risks associated with project which have been identified and assessed include:

- bushfire
- mine subsidence
- aviation safety
- the on-site storage, use and transport of dangerous goods and hazardous materials
- impacts to utilities
- electric and magnetic fields from transmission infrastructure
- the on-site storage, use and transport of dangerous goods and hazardous materials
- telecommunications inference.

Potential hazards and risks during construction of the project would be temporary and associated with the dangerous goods and hazardous materials for construction, activities within mine subsidence risk areas, aviation safety around cranes, drones and helicopters, impacts to existing utilities, and bushfire risks as a result of construction or from external sources. Emergency and incident response plans and procedures would be developed and implemented as part of the Construction Environmental Management Plan (CEMP) for the project, including a Bushfire Emergency Management and Evacuation Plan.

Potential hazards and risks during operation of the project are associated with bushfire, electric and magnetic fields, mine subsidence, aviation safety, interference with telecommunications, and the operational fire or electrical exposure at the potential battery energy storage system at Merotherie Energy Hub. These operational hazards and risks would be primarily managed through continued development of the design of the project in accordance with relevant standards, guidelines and codes, where applicable.

During operation, ignition of bushfires has the potential to occur during maintenance of the project infrastructure and from operation the infrastructure itself such as from lightning strike or electrical fault. Asset protection zones (APZs) with specific vegetation clearing regimes and transmission line easements managed as APZs would be established within the operation area to minimise the risk of ignition from project infrastructure and risk to infrastructure from bushfires. It was noted in a recent Standing Committee on State Development held by the Parliament of NSW on the feasibility of undergrounding the transmission infrastructure for renewable energy projects (Parliament NSW, 2023) that the risk of a bushfire being ignited by high voltage transmission lines is low.

Electric and magnetic fields would be produced by electrical current moving through the project infrastructure. The modelled electric and magnetic fields levels at the boundary of the operation area are compliant with the reference levels within which a person may be exposed without an adverse health effect and with acceptable safety factors. Therefore no mitigation or modifications in regard to electric and magnetic fields are proposed for the project.

Traffic and transport

The road network to be used for the construction and operation of the project reflects the predominately rural nature of the locality. Key roads comprise highways, state roads, regional roads and local roads that connect population centres, mining sites and residential properties with a network of sealed and unsealed roads.

During peak construction periods, the contribution of construction vehicles would bring a noticeable change to local roads that currently carry low volumes of traffic. The volume of construction vehicles on construction routes would vary according to the type and location of construction activity at any given time in the construction period. As these roads have sufficient spare capacity, the project would only have a minor impact on the efficiency and capacity of the road network with most roads continuing to operate with a similar level of service when compared to existing traffic conditions.

Adjustments to four intersections may be required to provide additional turning capacity as a result of increased vehicular movements during construction, being the Neeleys Lane/Ulan Road, Golden Highway/Ulan Road, Merotherie Road/Golden Highway and Spring Ridge Road/Dapper Road intersections. The need for these adjustments would be confirmed during detailed construction planning and based on final workforce numbers. The existing configuration of the Ulan Road/Cope Road intersection is under designed for current traffic volumes. Construction vehicle movements during peak morning and afternoon periods at this location would be minimised to avoid the need to adjust this intersection.

Oversize and over mass (OSOM) movements would be required to deliver certain plant and equipment to the energy hubs and New Wollar Switching Station during construction. Approval for these movements would be obtained from the National Heavy Vehicle Regulator (NHVR) prior to any movements occurring, noting the last sections of the construction routes to energy hubs are not gazetted for OSOM use. These roads and intersections are intended to be upgraded as part of an early works package (subject to separate approvals) and would cater for OSOM deliveries for the project.

The anticipated impact of construction traffic on road pavement conditions is considered to be minor. Heavy vehicles would likely have a larger impact on pavement conditions than light vehicles; however, the impact would depend on the existing pavement condition, and remaining life of the pavement in combination with traffic numbers using the pavement. Pre-condition surveys would be completed before construction, and any required rectifications works would be completed in consultation with the relevant council.

Construction vehicle movements would increase the number of road users on the road network which introduces additional risks associated with movements in/out of multiple construction access points. There is also the potential for driver fatigue given the distances covered by construction routes. These risks would be addressed through physical (such as signage and other traffic management controls) and behavioural measures (such as a Code of Conduct and fatigue management). There would be interaction between construction routes and a section of the Central West Cycle trail, a trail formed by around 400 kilometres of backroads in the region. Approaches would be implemented in liaison with the cyclist group, Mid-Western Regional Council and Warrumbungle Shire Council to manage any interactions with cyclists along these roads.

Impacts to property access would be managed in consultation with affected property owners, and temporary alternative access arrangements provided where required.

During operation, the project would have negligible impacts on the transport network and other road users (such as public and active transport). Routine inspection and/or maintenance of the project by staff and contractors would occur infrequently and would generate minimal traffic.

Waste management

The project has been designed, as far as practicable, to minimise the generation of waste through developing a project design which minimises excavation, an alignment which minimises demolition and a construction methodology which maximises the reuse of materials. Waste generated during construction of the project would mainly consist of spoil (excavated material), vegetation, demolition waste and other construction wastes such as concrete, steel and timber. Waste measures would be implemented under the CEMP for the project, which would include the implementation of waste targets, requirements for waste segregation, and waste mitigation and management measures for the waste types and quantities.

Local waste management facilities closest to the project may have limited or no capacity to accept construction waste from the project. If closer (but generally smaller) local facilities are unable to accept the waste quantities from the project, there may be a requirement to transport the waste generated by construction of the project to larger regional facilities located further away from the construction area. EnergyCo will explore further opportunities with Mid-Western Regional, Dubbo Regional, Warrumbungle Shire and Upper Hunter Shire councils to reduce the demand placed on local waste management facilities as a result of the project.

Minor quantities of waste would be generated during operation of the project due to periodic maintenance activities and would be managed in accordance with established mitigation and management measures.

Other issues

Hydrology, water quality and flooding

The project is located across the Macquarie River and Hunter River catchments. Numerous natural watercourses intersect the project, including perennial and ephemeral watercourses and unnamed drainage lines. Impacts to water quality and flood extents due to construction activities and operation would be minimal and manageable through the implementation of mitigation measures.

Construction water would be obtained from a variety of sources according to a water supply hierarchy, with rainwater harvesting and re-use of treated mine water and construction water being the preferred sources. After these sources, existing unregulated surface water sources would be considered. The availability of water from the Upper and Lower Talbragar Rivers would be limited by the preceding rainfall, and peak demands by the project would impact on the available water supply volumes. Opportunities to use other non-potable water supply options would continue to be explored by the project to lessen this demand.

Soils and contamination

The construction area is mostly used for agricultural purposes and the risk of encountering and disturbing contaminated soils and groundwater is generally low for most of the construction area. The exception is where the project intercepts mining areas and rehabilitation areas at Moolarben Coal Mine and Wilpinjong Coal Mine, respectively which present a low to high contamination risk, and farm dams within the construction area, which present a medium risk for isolated contamination, should they be impacted. Further investigation in medium to high risk contamination areas would be undertaken and relevant mitigation measures implemented prior to disturbance during construction.

There is a general risk for the construction of the project to result in the contamination of soil and/or groundwater due to accidental spills or releases of dangerous goods, hazardous materials and waste material. This risk is considered low and manageable through the implementation of standard environmental management measures as part of the CEMP.

The operation of the project is not likely to result in any significant impact on soils or contamination. Controls would be in place to manage any accidental release of fuels or chemicals, and ongoing operations and maintenance activities are unlikely to involve substantial ground disturbance activities.

Groundwater

In the event surface water availability does not meet the project’s non-potable water requirements during construction, groundwater would be considered as a source in accordance with the water supply hierarchy. New bores established at the Merotherie and Elong Elong energy hubs would potentially supply up to 124 megalitres of water over the four years. This extraction would not exceed the criteria specified for the groundwater source. Groundwater extraction is not proposed during operation.

Construction and operational activities would not result in permanent inflow or take of groundwater. The project is predicted to generally have a limited impact to groundwater, which would be further reduced with the implementation of mitigation measures outlined within the CEMP and the soil and water management sub-plan.

Air quality

Construction of the project would generate dust emissions as a result of earthworks, civil construction activities and movement of construction vehicles along the public road network (referred to as track out). Dust impacts from construction activities such as earthworks were determined to present a negligible to low risk at nearby sensitive receivers prior to mitigation. Construction vehicle movements on paved and unpaved local public roads beyond the immediate vicinity of site access points can also lead to amenity impacts to nearby sensitive receivers due to dust.

During operation, air quality emissions would be associated with maintenance and routine inspections (dust, vehicular/plant emissions), dust emissions from unsealed access tracks and insulating gas emissions from electrical equipment. Any such emissions would be low and not of significance.

Climate change and greenhouse gases

Climate change is projected to result in an increase of extreme weather conditions including of flooding, increased rainfall, extreme heat, droughts, storms and bushfire. The increase of extreme weather conditions has the potential to impact project infrastructure. Project infrastructure would be subjected to low to medium exposure to extreme heat events, low to medium exposure to flooding risk and low to high exposure to bushfire risk. A detailed climate change risk assessment will be carried out during further design development with consideration of climate change adaptation measures.

The greenhouse gas emissions from construction of the project are estimated to be a total of 611,607 tonnes of carbon dioxide equivalent. The embodied emissions within materials that would be produced for the project are estimated to be the largest contributor (94 per cent) during construction. There would also be greenhouse gas emissions during the operation of the project. However, the project would have an overall benefit in reducing greenhouse gas emissions in the wider economy by enabling an increase in the generation of renewable energy in the grid, to replace carbon intensive fossil fuel generation.

Cumulative impacts

Within the Central-West Orana region, a significant number of new developments are proposed, approved or under construction, including more than 30 major renewable energy generation and storage projects (of which 11 would connect to this project), as well as other infrastructure and mining projects. These developments are expected to result in substantial investment, economic benefits and job opportunities in the region, however, would also place pressure on existing communities and services such as accommodation, health services, retail, hospitality and emergency services and waste facilities. Development of these projects would also have the potential for cumulative amenity impacts associated with visual, traffic, noise and air quality impacts during construction and operation.

The most substantial cumulative impacts of this project, in combination with the relevant future projects, are associated with:

- land use, property and agriculture
- landscape character and visual amenity
- biodiversity
- Aboriginal heritage
- socio-economic
- noise and vibration.

The approach taken to the assessment of cumulative impacts acknowledges that each project will be required to mitigate its own impacts to acceptable levels, minimising the overall contribution to cumulative impacts. However, it is also recognised that not all REZ related cumulative impacts can be addressed through a project level approach alone, requiring a more strategic and collaborative approach between EnergyCo, renewable energy developers, councils and government agencies.

Over the last 12 months, EnergyCo has consulted with the community, councils and other government agencies on studies to inform how cumulative impacts in the Central-West Orana REZ will be managed. Given the scale and complexity of the task, work undertaken to date has focussed on data gathering to establish baseline information such as existing levels of service provision (e.g. medical services and waste infrastructure) and identify potential cumulative impacts. This has provided an important evidence base to identify potential measures to manage cumulative impacts and to ensure they are targeted, coordinated and complement existing commitments and policy directions.

The next stage involves the establishment of working groups involving representatives from councils, agencies and EnergyCo to assess and prioritise recommendations, including the identification of funding sources and lead agency responsibilities and implementation timeframes. The outcomes of this next stage will be documented in an Implementation Plan by the end of 2023.

Mitigation and management

EnergyCo will appoint a Network Operator to design, build, operate and maintain the project. The proposed Network Operator would be required to have an environmental management system that is ISO 14000 accredited.

Should the project be approved, the environmental performance of the project would be managed in accordance with:

- the environmental management systems and procedures of the Network Operator
- the design of the project as described in this EIS
- the mitigation measures identified in this EIS
- the conditions of approval and other licences, permits and consents granted for the project
- the CEMP
- an Operational Environmental Management Plan (or equivalent).

Justification and conclusion

A project of this scale and geographical spread would inevitably have impacts on the local environment and community, particularly during construction. The most significant impact to the environment would likely be on biodiversity due to the extent of the vegetation clearing that would be required. The most significant impacts to the community would likely be from changes to existing land use, in particular the loss of agricultural land, and amenity impacts, in particular visual impacts from the introduction of new large scale infrastructure into the landscape.

A range of mitigation measures identified in Chapters 7 to 20 of this EIS would be implemented during construction and operation of the project to manage and minimise the potential impacts of the project. The residual impacts of the project would be outweighed by the benefits, including:

- supporting the transition of the NEM from traditional energy sources to lower emission alternatives based on renewable energy
- facilitating the development of the Central-West Orana REZ to meet current bulk energy demands and enable efficient expansion to meet future demand
- creating job opportunities throughout the project life-cycle with up to 1,800 workers required during construction.

During the continued development of the design and the construction methodology, opportunities to further minimise potential impacts would be sought and ongoing input from stakeholders and the community would be, taken into account. The potential residual construction and operational impacts of the project are considered manageable with the implementation of the proposed mitigation and management measures.

Next steps

This EIS will be publicly exhibited for a minimum of 28 days and during this time government agencies, stakeholders and the community will have the opportunity to make a written submission to the DPE for consideration in its assessment of the project.

To support public exhibition and provide opportunities for the community and stakeholders to ask questions, and find out more information before making a submission, a range of consultation and communication tools will be used by EnergyCo including community information sessions during the exhibition period.

When the public exhibition period of the EIS has closed, DPE will collate and provide EnergyCo with a copy of all submissions received. EnergyCo will consider and take into account these submissions, and then prepare a subsequent report responding to any issues raised. The submissions report will be made publicly available on the DPE Major Projects website.

If required, an amendment report or preferred infrastructure report may also be prepared. If prepared, this will be submitted to DPE alongside the Submissions Report.

1 Introduction

1.1 Renewable Energy Zones (REZs)

New South Wales (NSW) is currently undergoing an energy sector transformation that will change how we generate and use energy. The National Electricity Market (NEM) (managed by the Australian Energy Market Operator (AEMO)) is transitioning from a system dominated by a small number of large coal-fired generators located close to metropolitan centres, to one of diverse renewable energy generation and storage in areas with strong renewable energy resource potential and located close to the existing electricity network.

Renewable Energy Zones (REZs) connect renewable energy generation and energy storage systems to transmission infrastructure via energy hubs, as shown in Figure 1-1. REZs will play a vital role in delivering clean, affordable and reliable electricity for homes, businesses and industry in NSW to help replace the State's existing power stations as they come to their scheduled end of operational life.

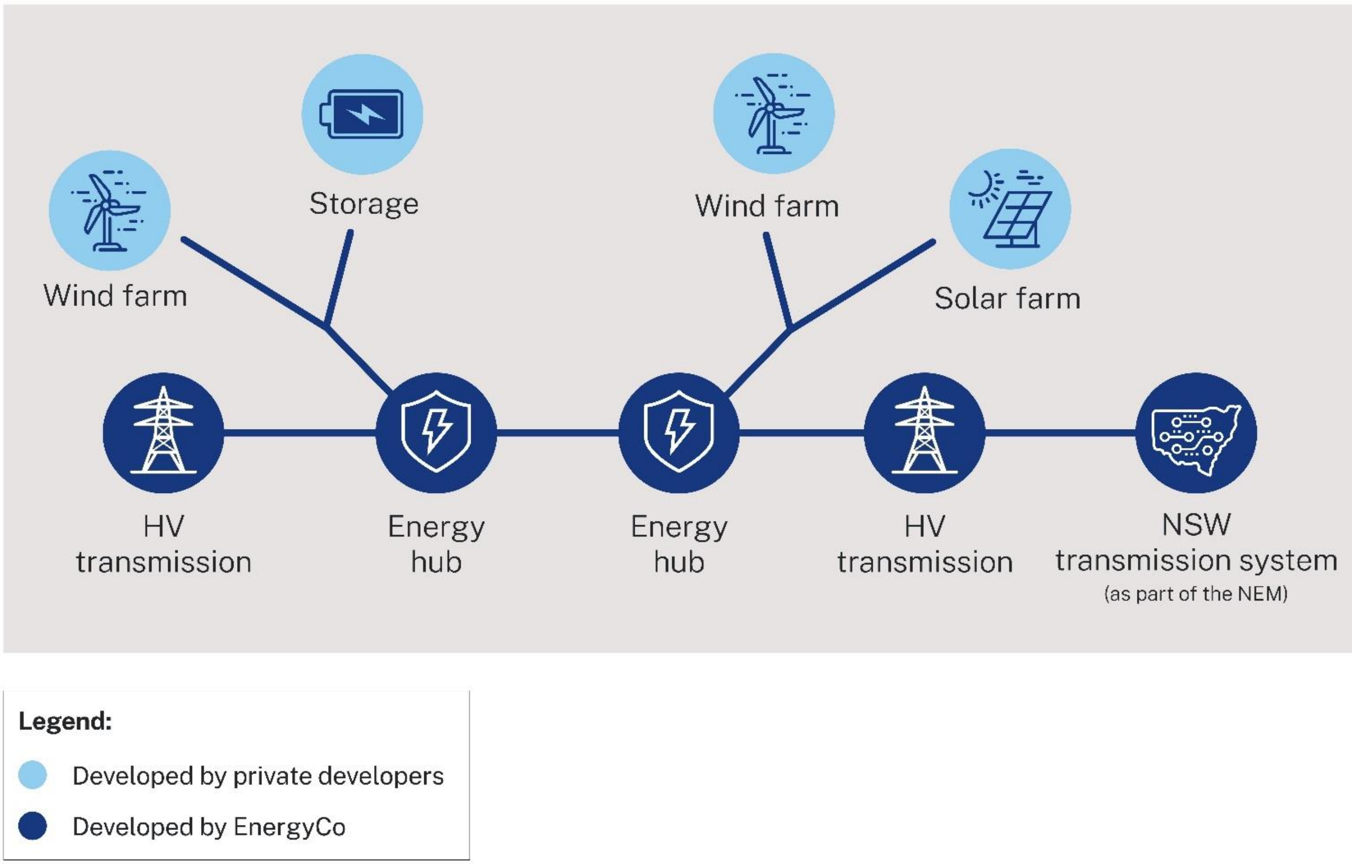


Figure 1-1 Elements of a REZ

Various government strategies, plans and policies such as AEMO's 2022 *Integrated Systems Plan* (ISP) (AEMO, 2022a), the *NSW Transmission Infrastructure Strategy* (Department of Planning and Environment (DPE), 2018a), the NSW Electricity Infrastructure Roadmap (DPE, 2020) and the *NSW Network Infrastructure Strategy* (EnergyCo, 2023a), identify the important role for REZs to provide an effective and economical way to integrate new generation, storage and transmission development. The NSW Electricity Infrastructure Roadmap also identifies five regions prioritised for the development of REZs: the Central-West Orana, South West, New England, Hunter-Central Coast and Illawarra regions of NSW.

The relationship between the project and relevant government strategies is described further in Chapter 2 (Strategic context).

1.2 Central-West Orana REZ

The Central-West Orana REZ was formally declared on 5 November 2021 under the *Electricity Infrastructure Investment Act 2020* (NSW). The declaration sets out the intended network capacity for network infrastructure in the REZ, a map of the specified geographical area and the network infrastructure required for the REZ. Under the declaration, the Energy Corporation of NSW (EnergyCo) has been appointed as the Infrastructure Planner and is responsible for coordination of the development of generation and network infrastructure.

The REZ is approximately 20,000 square kilometres in size and centred on the regional towns of Dubbo and Dunedoo, on the land of the Wiradjuri, Wailwan and Gamilaroi peoples (refer to Figure 1-2). The Central-West Orana region has a strong mix of energy resources and significant investor interest, with more than 27 gigawatts of projects identified in response to a registration of interest (ROI) process in June 2020. The number of responses to the ROI reflects the strong level of interest in the REZ and helps ensure only the most competitive projects will be able to access the new transmission infrastructure through the Consumer Trustee's competitive tender processes.

Figure 1-2 Central-West Orana REZ geographical area (Source: EnergyCo)

As NSW's first REZ, the Central-West Orana REZ will play a pivotal role in underpinning NSW's transition to a clean, affordable and reliable energy sector. The CWO REZ declaration (November 2021) provides for an initial intended network capacity of three gigawatts. The NSW Government is proposing to amend the declaration to increase the intended network capacity to six gigawatts (cwo-rez-proposed-declaration-amendment-consultation.pdf (nsw.gov.au)), which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network.

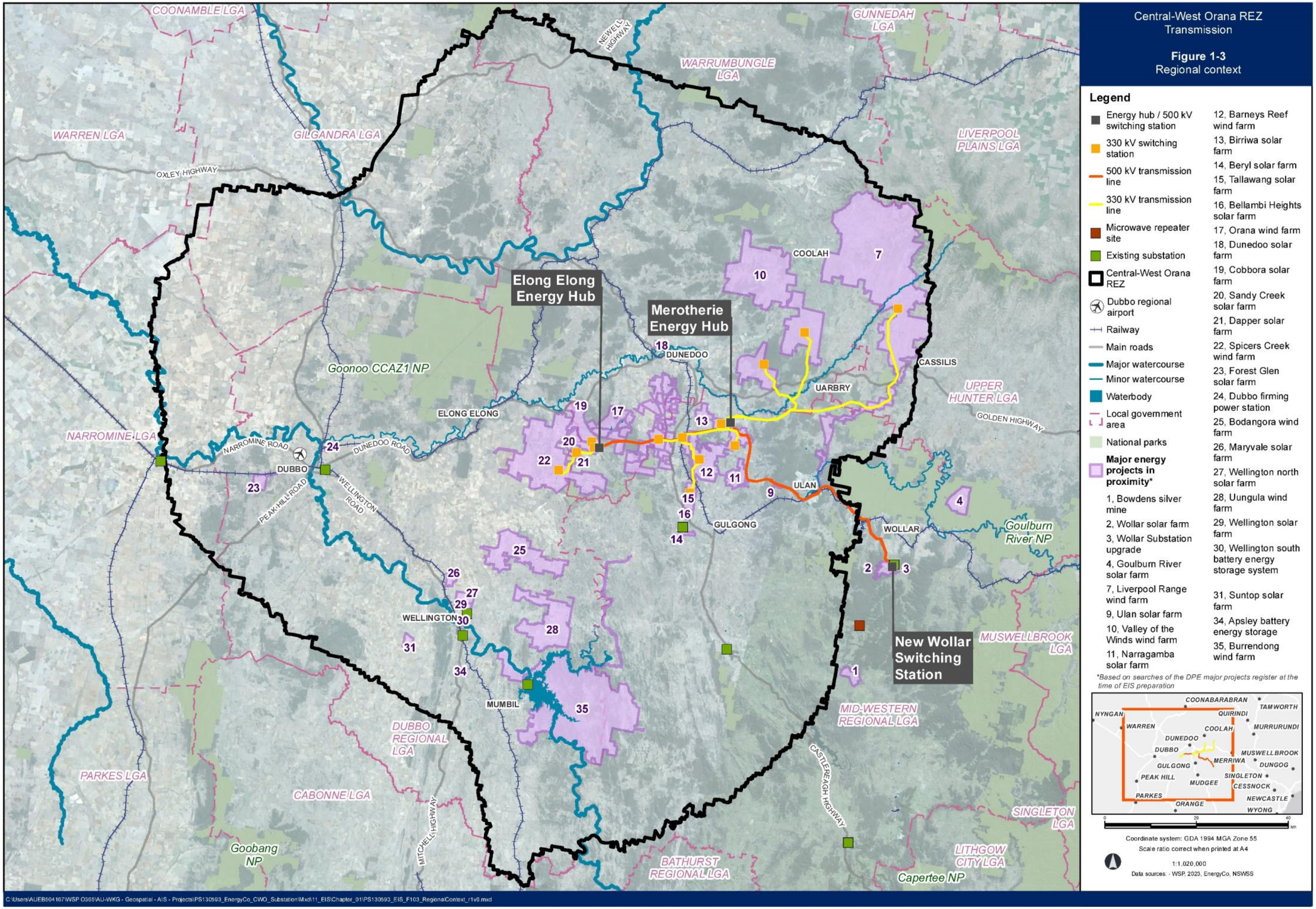
The proposed amendment is consistent with the *Network Infrastructure Strategy* (EnergyCo, 2023) which identifies options to increase network capacity to 4.5 gigawatts initially under Stage 1 and up to six gigawatts by 2038 under Stage 2. The proposed amendment also supports recent modelling by AEMO in its *Draft 2023 Infrastructure Investment Objectives Report* showing more network capacity will be needed to meet NSW's future energy needs as coal-fired power stations progressively retire (refer to Chapter 2 (Strategic context) for more information about project need).

As the existing 330 kilovolt (kV) transmission network in the Central-West Orana region is not capable of transferring the amount of electricity expected to be generated from new renewable energy generation and storage projects in the Central-West Orana REZ, the development of new transmission infrastructure is required to provide additional electricity transfer capacity in the region to connect these projects to the NEM.

1.3 The project

EnergyCo is proposing the construction and operation of electricity transmission infrastructure, energy hubs, switching stations, and other ancillary works required to connect renewable energy generation projects within the Central-West Orana REZ to the existing electricity network (the project) (refer to Figure 1-3). The project is located within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter local government areas (LGAs) and extends generally north to south from Cassilis to Wollar and east to west from Cassilis to Goolma.

The project would enable at 4.5 gigawatts of new network capacity to be unlocked by the mid-2020s and enable renewable energy generators within the Central-West Orana REZ, who are successful in their bids to access the new transmission infrastructure, to export electricity to the rest of the network. Importantly, the development of renewable energy generation projects in the Central-West Orana REZ does not form part of the project and those generation projects are subject to separate planning and environmental approvals.



Central-West Orana REZ Transmission
Figure 1-3
Regional context
Legend
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Microwave repeater site
Existing substation
Central-West Orana REZ
Dubbo regional airport
Railway
Main roads
Major watercourse
Minor watercourse
Waterbody
Local government area
National parks
Major energy projects in proximity*
1, Bowdens silver mine
2, Wollar solar farm
3, Wollar Substation upgrade
4, Goulburn River solar farm
7, Liverpool Range wind farm
9, Ulan solar farm
10, Valley of the Winds wind farm
11, Narragamba solar farm
12, Barneys Reef wind farm
13, Birriwa solar farm
14, Beryl solar farm
15, Tallawang solar farm
16, Bellambi Heights solar farm
17, Orana wind farm
18, Dunedoo solar farm
19, Cobbora solar farm
20, Sandy Creek solar farm
21, Dapper solar farm
22, Spicers Creek wind farm
23, Forest Glen solar farm
24, Dubbo firming power station
25, Bodangora wind farm
26, Maryvale solar farm
27, Wellington north solar farm
28, Uungula wind farm
29, Wellington solar farm
30, Wellington south battery energy storage system
31, Suntop solar farm
34, Apsley battery energy storage
35, Burrendong wind farm
*Based on searches of the DPE major projects register at the time of EIS preparation
Elong Elong Energy Hub
Merotherie Energy Hub
New Wollar Switching Station
COONAMBLE LGA
GUNNEDAH LGA
WARRUMBUNGLE LGA
WARREN LGA
GILGANDRA LGA
LIVERPOOL PLAINS LGA
NARROMINE LGA
UPPER HUNTER LGA
MUSWELLBROOK LGA
MID-WESTERN REGIONAL LGA
DUBBO REGIONAL LGA
PARKES LGA
CABONNE LGA
SINGLETON LGA
BATHURST REGIONAL LGA
LITHGOW CITY LGA
Goonoo CCAZ1 NP
Goulburn River NP
Goobang NP
Capertee NP
NEWELL HIGHWAY
OXLEY HIGHWAY
GOLDEN HIGHWAY
NARROMINE ROAD
DUNEDOO ROAD
WELLINGTON ROAD
PEAK HILL ROAD
MITCHELL HIGHWAY
CASTLEREAGH HIGHWAY
COOLAH
DUNEDOO
CASSILIS
UARBRY
ELONG ELONG
DUBBO
ULAN
GULGONG
WOLLAR
WELLINGTON
MUMBIL
COONABARABRAN
TAMWORTH
NYNGAN
QUIRINDI
WARREN
MURRURUNDI
MUSWELLBROOK
MERRIWA
DUNGOG
SINGLETON
PEAK HILL
MUDGEE
CESSNOCK
PARKES
NEWCASTLE
ORANGE
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An overview of the project is shown in Figure 1-4 and would comprise the following features:

- a new switching station (the New Wollar Switching Station), located at Wollar to connect the project to the existing 500 kV transmission network
- around 90 kilometres of twin double circuit 500 kV transmission lines and associated infrastructure to connect two energy hubs to the existing NSW transmission network via the New Wollar Switching Station
- energy hubs at Merotherie and Elong Elong (including a potential battery storage option at the Merotherie Energy Hub) to connect renewable energy generation projects within the Central-West Orana REZ to the 500 kV network infrastructure
- around 150 kilometres of single circuit, double circuit and twin double circuit 330 kV transmission lines, to connect renewable energy generation projects within the Central-West Orana REZ to the two energy hubs
- thirteen switching stations along the 330 kV network infrastructure at Cassilis, Coolah, Leadville, Merotherie, Tallawang, Dunedoo, Cobbora and Goolma, to transfer the energy generated from the renewable energy generation projects within the Central-West Orana REZ onto the project's 330 kV network infrastructure
- underground fibre optic communication cables along the 330 kV and 500 kV transmission lines between the energy hubs and switching stations
- construction of microwave repeater sites at locations along the alignment, as well as off the alignment at Botobolar, to provide a communications link between the project and the existing electricity transmission and distribution network
- a maintenance facility within the Merotherie Energy Hub to support the operational requirements of the project
- establishment of new, and upgrade of existing access tracks for transmission lines, energy hubs, switching stations and other ancillary works areas within the construction area (such as temporary waterway crossings, laydown and staging areas, earthwork material sites with crushing, grinding and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps)
- property adjustment works to facilitate access to the transmission lines and switching stations. These works include the relocation of existing infrastructure on properties that are impacted by the project
- utility adjustments required for the construction of the transmission network infrastructure, along with other adjustments to existing communications, water and wastewater utilities. This would include adjustments to existing Transgrid and Essential Energy transmission infrastructure. This includes adjustments to Transgrid's 500 kV transmission lines 5A3 (Bayswater to Mount Piper) and 5A5 (Wollar to Mount Piper) to provide a connection to the existing NSW transmission network, including new transmission line towers along the Transgrid network along the frontage of the New Wollar Switching Station, and other locations where there is an interface with Transgrid's network.

Further detail on the key infrastructure components and construction of the project is provided in Chapter 3 (Project description).

It is expected that construction of the project would commence in the second half of 2024 with initial operations commencing by late 2027. Construction site decommissioning and rehabilitation is expected to extend until the first half of 2028.

The project has been developed to avoid impacts on important environmental, land use and social values where practicable, as described in Chapter 2 (Strategic context).

EnergyCo is investigating a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section will be subject to a separate planning approval.

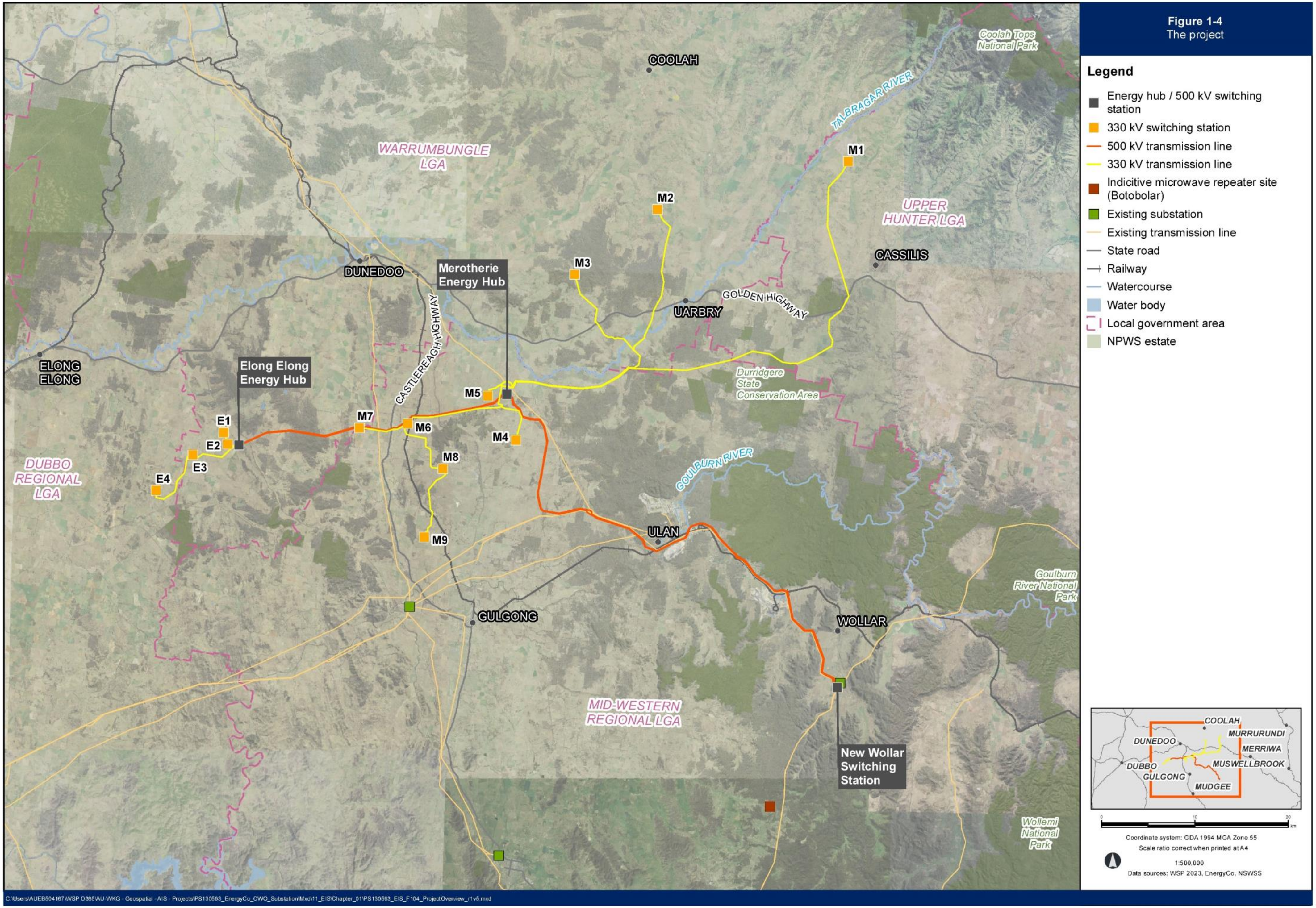

Figure 1-4
The project
Legend
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Indicitive microwave repeater site (Botobolar)
Existing substation
Existing transmission line
State road
Railway
Watercourse
Water body
Local government area
NPWS estate
COOLAH
Coolah Tops National Park
TALBRAGAR RIVER
WARRUMBUNGLE LGA
M1
M2
M3
UPPER HUNTER LGA
CASSILIS
DUNEDOO
Merotherie Energy Hub
CASTLEREAGH HIGHWAY
UARBRY
GOLDEN HIGHWAY
ELONG ELONG
Elong Elong Energy Hub
M5
Durridgere State Conservation Area
M7
M6
M4
E1
E2
E3
E4
M8
DUBBO REGIONAL LGA
GOULBURN RIVER
M9
ULAN
Goulburn River National Park
GULGONG
WOLLAR
MID-WESTERN REGIONAL LGA
New Wollar Switching Station
COOLAH
MURRURUNDI
DUNEDOO
MERRIWA
DUBBO
MUSWELLBROOK
GULGONG
MUDGEE
Wollemi National Park
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Scale ratio correct when printed at A4
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Data sources: WSP 2023, EnergyCo, NSWSS
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1.4 Related development

Related development is development that responds to the opportunities created by the project or which is required as a result of the project. All related development projects are subject to separate planning and approval processes. Further information about these projects is provided in Chapter 20 (Cumulative impacts).

1.4.1 Renewable energy projects

A range of proposed renewable energy generation projects located in the Central-West Orana REZ would connect to the project, subject to the outcomes of the Consumer Trustee's competitive tender process for rights to access the new transmission infrastructure. Where practicable, a number of the project's switching stations have been located with infrastructure from the renewable energy generation projects. Access to the switching stations from the road network would be via access roads to the transmission line easement and access tracks within the transmission line easement. Where the renewable energy generator projects have been approved, there would be an opportunity to utilise the access road network provided by these projects.

1.4.2 Local road upgrades

The following road and intersection upgrades are required to ensure safe access to construction sites and the movement of oversize and overmass (OSOM) equipment for the project:

- Merotherie Road
- Spring Ridge Road
- Spring Ridge Road/Dapper Road intersection
- Golden Highway/Spring Ridge Road intersection
- Neeleys Lane/Ulan Road intersection
- Golden Highway/Ulan Road intersection
- Merotherie Energy Hub Access Road/Merotherie Road intersection
- Merotherie Road/Golden Highway intersection.

The Central-West Orana REZ Transmission project Critical State significant infrastructure (CSSI) declaration was amended in February 2023 to exclude the following development from the declaration:

> *upgrading, relocating or widening existing public roads—*
>
> *(i) carried out on land in the Central-West Orana REZ, and*
>
> *(ii) subject to a determination under the Act, Division 5.1.*

EnergyCo may assess and determine the above road and intersection upgrades under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) to allow these time critical works to be determined and commence construction prior to the determination of the CSSI application. However, the road and intersection upgrades are also included in the EIS so that in the event they are not determined under Division 5.1, they can be determined under the CSSI application.

1.4.3 Port to REZ upgrades

Adjustments and upgrades to public roads are required to facilitate the movement of OSOM equipment between the Port of Newcastle and the REZ. The adjustments and upgrades involve a range of works such as pavement widening and pull over bays, relocation of traffic lights, signs barriers and utilities, and tree and vegetation removal and trimming. These works will be delivered separately and will be subject to separate planning approvals.

1.4.4 Transgrid network upgrades

Upgrade to the existing Transgrid network between Mount Piper and Wallerawang is required to strengthen the grid in the Central Tablelands, helping to ensure that power from the Central-West Orana REZ and other projects can be reliably moved back into the grid and to consumers.

1.5 The proponent

Energy Corporation of NSW (EnergyCo) (ABN 13 495 767 706) is a NSW Government statutory authority established under the *Energy and Utilities Administration Act 1987* (NSW). The role of EnergyCo is to maximise the opportunities created by the transformation of the NSW electricity network by planning REZs across NSW in order to facilitate coordinated investment in transmission and generation.

In November 2021, the NSW Government appointed EnergyCo as the Infrastructure Planner under the *Electricity Infrastructure Investment Act 2020* (NSW), responsible for delivering the Central-West Orana REZ.

As the Infrastructure Planner, EnergyCo is the proponent of the project.

EnergyCo's postal address is GPO Box 5469, Sydney NSW 2001. EnergyCo will coordinate transmission, generation, firming and storage projects for the Central-West Orana REZ to deliver efficient, timely and coordinated investment.

EnergyCo has a number of key functions. Some of those functions will be exercised on behalf of EnergyCo by a Network Operator appointed by EnergyCo. EnergyCo's functions in respect of the project include, but are not limited to:

- working with developers of proposed wind, solar and storage projects to understand their needs and plan for efficient solutions that encourage investment in grid-scale renewable projects and minimise cumulative impacts on the community
- leading community and stakeholder engagement
- developing the scope for the project in consultation with program partners and renewable energy generators
- acquiring land and easements required for the project
- leading the environmental planning approval process
- contributing to strategic planning for the Central-West Orana REZ
- appointing a Network Operator to design, build, operate and maintain the REZ transmission project.

Transgrid will continue to operate and maintain the existing NSW transmission network to connect to the project.

1.6 Purpose and structure of this EIS

The Central-West Orana REZ Transmission project was declared to be CSSI under section 5.13 of the EP&A Act by the (then) NSW Minister for Planning and Public Spaces on 23 November 2020 (see declaration contained in State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP), Schedule 5, clause 23, gazetted 16 December 2020). The scope of the project falls within that CSSI declaration.

This EIS supports an application for approval of the project under Division 5.2, Part 5 of the EP&A Act. It addresses the requirements of Division 5, Part 8 of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation), the Secretary's Environmental Assessment Requirements (SEARs) (refer to Appendix A (SEARS checklist)) issued on 7 October 2022 and the Supplementary SEARs issued on 28 March 2023 (discussed below). It has been prepared having regard to the DPE *State Significant Infrastructure Guidelines* (DPE, 2022i) (the Guidelines).

The project is also a controlled action under the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth (Cth)) (EPBC Act) and requires approval from the Australian Minister for the Environment. Following a referral (EPBC 2022/09353), on 2 March 2023, an authorised representative of the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) determined that the project is a controlled action and that the project will be assessed in accordance with the NSW Assessment Bilateral Agreement.

This EIS has been prepared to address the requirements of both the State and the Commonwealth as set out in the SEARs (refer to Appendix A (SEARs checklist)).

The structure and content of this EIS is outlined in Table 1-1.

Table 1-1 Structure and content of the EIS

Chapter	Description
Chapter 1	**Introduction** Provides a background to the project, an overview of the key features of the project and identifies the proponent for the CSSI application. The chapter also outlines the overall structure and content of the EIS.
Chapter 2	**Strategic context** Provides the following: • an overview of the strategic context and need for the project and a summary of the project objectives • a description of the regional context of the project and Central-West Orana REZ, and the key features of the project site and surrounds that could affect or be affected by the project, including the local and regional community, natural and built environment and key risks or hazards for the project • a summary of the alternatives to the project as a whole and the options considered during development of the reference design and construction methodology for the project, including the approach to avoiding or minimising impacts, the consideration of issues raised during community and stakeholder engagement and the selection of the preferred route and location of supporting infrastructure and sites.
Chapter 3	**Project description** Provides a description of the project features and operation, as well as a description of the construction process, activities and supporting construction facilities. The chapter identifies any uncertainties associated with the project description, including areas that will be subject to potential future design changes, and how these uncertainties will be addressed during further design development.
Chapter 4	**Statutory context** Provides an overview of the statutory requirements relevant to the project that are required for consideration by the approval authority before the determination of the project application.

Chapter	Description
Chapter 5	Community and stakeholder engagement Provides a summary of: • the engagement activities that have occurred during the development of the projects design development and environmental assessment process • the feedback received from engagement activities carried out to-date • how the outcomes of engagement activities have been incorporated into the design and planning of the project • future planned engagement activities for the project that are proposed during public exhibition, detailed design, and delivery.
Chapter 6	Approach to impact assessment Provides a description of the overall approach and methodology used to undertake the environmental assessment of the project, including the avoidance, mitigation and management of impacts and how uncertainties have been addressed.
Chapters 7 to 20	Assessment of impacts Describes the results of the assessments completed to understand the potential impacts of the project, as identified by the SEARs. For each environmental aspect considered in the EIS, the assessment of impacts includes information on the existing environment, potential construction and operational impacts, an identification of key uncertainties associated with the assessment and the proposed approach to the avoidance, mitigation and management of these impacts, including how uncertainties have been resolved.
Chapter 21	Environmental management Provides a description of the proposed approach to environmental management and a compilation of the mitigation measures for the project.
Chapter 22	Environmental risk analysis Provides an environmental risk analysis for the project taking into account the potential impacts identified as part of the assessment of impacts, and the mitigation and management measures to be implemented, as identified in Chapters 7 to 20. The risk analysis identifies the potential environmental and community risks and issues for the project and the residual risk after implementation of the mitigation measures outlined in Chapters 7 to 20.
Chapter 23	Justification and conclusion Provides a summary of, and justification for, the project as a whole, having regard to environmental, economic and social considerations and the principles of ecologically sustainable development.
Chapter 24	References Provides a list of references used to inform the EIS.
Appendices	
Appendix A	Secretary's Environmental Assessment Requirements checklist
Appendix B	Project description mapping
Appendix C	Statutory compliance
Appendix D	Engagement summary
Appendix E	Cumulative impact assessment
Technical papers	
Technical paper 1	Aviation
Technical paper 2	Agriculture
Technical paper 3	Visual and landscape character
Technical paper 4	Biodiversity development assessment report
Technical paper 5	Aboriginal cultural heritage assessment report
Technical paper 6	Non-Aboriginal heritage

Chapter	Description
Technical paper 7	Social
Technical paper 8	Economic
Technical paper 9	Noise and vibration
Technical paper 10	Bushfire
Technical paper 11	Preliminary hazard analysis
Technical paper 12	Electro magnetic field assessment
Technical paper 13	Traffic and transport
Technical paper 14	Hydrology and water quality
Technical paper 15	Flooding
Technical paper 16	Contamination
Technical paper 17	Groundwater
Technical paper 18	Air quality

1.7 Key terminology

The following terms are used throughout this EIS:

- Renewable Energy Zone (REZ): A geographic area identified and declared by the NSW Government as a REZ.
- Central-West Orana REZ: A geographic area of approximately 20,000 square kilometres centred on the regional towns of Dubbo and Dunedoo and extending west to Narromine and east beyond Mudgee and to Wellington in the south and Gilgandra in the north, that will combine renewable energy generation, storage and transmission infrastructure to deliver energy to electricity consumers.
- Consumer Trustee: The *Electricity Infrastructure Investment Act 2020* (NSW) establishes the NSW Consumer Trustee as an independent statutory role with various planning, advisory and procurement functions which must be conducted in the long-term financial interests of NSW electricity customers. AEMO services, as the NSW Consumer Trustee, runs competitive tenders for Long-Term Energy Services Agreements (LTESAs) and REZ Access Rights to support investment, construction and operation of renewable energy generation and long duration storage infrastructure in NSW.
- The project: The Central-West Orana REZ Transmission project as described in this EIS.
- Energy hub: A substation where energy exported from renewable energy generation projects is aggregated, transformed to 500 kV (where required) and exported to the transmission network, and may include battery storage.
- Single circuit transmission lines: typically comprise three conductors along with earthing and communications wires, carried by a single tower set. For 330 kV lines, each conductor typically comprises two conductor cables (six conductor cables in total). The number of conductor cables will be confirmed during detailed design.
- Double circuit transmission lines: typically comprise six conductors along with earthing and communications wires, paired on each phase, carried by a single tower set. For 500 kV lines, each conductor typically comprises four conductor cables (24 conductor cables in total). For 330 kV lines, each conductor typically comprises two conductor cables (12 conductor cables in total). The number of conductors will be confirmed during the detailed design.

- Twin transmission lines: A pair of single or double circuit transmission lines running parallel.
- Substation: A facility used to increase or decrease voltages between incoming and outgoing transmission lines (e.g. 330 kV to 500 kV).
- Switching station: A facility used to connect two or more distinct transmission lines of the same designated voltage.
- Transmission line easement: An area surrounding and including the transmission lines which is a legal ‘right of way’ and allows for ongoing access and maintenance of the transmission lines. Landowners can typically continue to use most of the land within transmission line easements, subject to some restrictions for safety and operational reasons.
- Construction area: The area that would be directly impacted by the construction of the project, including (but not limited to) transmission towers and lines, brake and winch sites, access roads to the switching stations and energy hubs, access tracks to and along the easements, energy hubs, switching stations, communications infrastructure, workforce accommodation camps, construction compounds, laydown and staging areas.
- Operation area: The area that would be occupied by permanent components of the project and/or maintained, including transmission line easements, transmission lines and towers, energy hubs, switching stations, communications infrastructure, access roads to the switching stations and energy hubs, maintenance facilities and permanent access tracks to the easements.

2 Strategic context

This chapter describes the need for the project, including the relevant Australian and New South Wales (NSW) Government policies that support the project. It describes the project objectives and the alternative options considered to address the objectives.

2.1 Project need

2.1.1 Overview

The Australian Government is committed to coordinated global action to reduce greenhouse gas emissions in line with the Paris Agreement and has set targets to reduce emissions by 43 per cent below 2005 levels by 2030, and to net-zero by 2050. Independently, the NSW Government has set a goal to achieve net-zero emissions by 2050 (NSW Department of Planning, Industry and Environment (DPIE), 2020a). Achieving these goals requires transformative low emissions technologies to be deployed at scale across all sectors of the economy.

Electricity generation is currently Australia's largest source of greenhouse gas emissions, accounting for 33 per cent of Australia's total annual emissions in 2020 (Climate Change Authority, 2020). The National Electricity Market (NEM) is an interconnected electricity system, which facilitates the exchange of electricity between generators and retailers. Within the NEM, electricity is generated, bought, sold and transported across Australia's southern and eastern states and territories. The NEM is one of the largest electricity systems in the world, covering about 40,000 kilometres of transmission lines and cables, and delivers around 80 per cent of Australia's electricity consumption.

The NEM, inclusive of the NSW transmission network, needs to be expanded and modernised so that the system can accommodate and respond to changes in electricity generation from traditional energy sources to lower emission alternatives, including renewable energy and batteries, as well as shifting consumer preferences (Australian Government Department of Industry, Science, Energy and Resources (DISER), 2021a).

With the rise in cleaner and lower cost renewable energy generation, coal-fired generation is facing increasing market, financial and operating pressures. Coal-fired electricity generation is withdrawing faster than anticipated (AEMO, 2022a), with large coal-fired power plants, such as the Eraring and Bayswater power stations, closing ahead of originally anticipated retirement dates (Eraring power station to potentially close by 2025 and Bayswater power station to close by 2033), in addition to the recent closure of the Liddell Power Station in April 2023.

Modelling indicates that 14 gigawatts (60 per cent of current coal capacity) may be withdrawn by 2030 and all coal generation could be withdrawn by 2040 (Australian Energy Market Operator (AEMO), 2022a), as competitive and operational pressures intensify with cleaner and lower cost renewable energy generation, as well as gas and coal price volatility in the first half of 2022.

The closure of large coal-fired power stations has the potential to put pressure on the future supply of energy, particularly when considering that electricity consumption in NSW is forecast to increase in the future (AEMO, 2019; AEMO, 2022a). AEMO's *Integrated System Plan 2018* (AEMO, 2018) notes: 'When existing thermal generation reaches the end of its technical life and retires, the most cost-effective replacement of its energy production, based on current cost projections, is a portfolio of utility-scale renewable generation, energy storage, distributed energy resources (DER), flexible thermal capacity including gas-powered generation (GPG), and transmission'. This highlights the urgent need to develop and connect new renewable energy to the NEM (via the NSW transmission network), noting that more renewables are required to replace conventional generators because of their lower capacity factors due to the intermittency of the electricity that they produce (Australian Energy Council, 2017).

The *2022 Integrated System Plan* (ISP) (AEMO, 2022a) estimates that over 125 gigawatts of new grid-scale renewables are needed by 2050, in addition to the current 16 gigawatts capacity, as most of Australia's coal-fired generation will likely retire by 2040. As such, the NSW transmission network (as part of 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 (DISER, 2021a).

2.1.2 Need for additional transmission network capacity

The NEM incorporates around 40,000 kilometres of transmission lines and cables across Queensland, NSW, Australian Capital Territory, Victoria, South Australia and Tasmania. The NEM involves wholesale electricity generation, which is transported via high voltage transmission lines from generators to large industrial energy users and to distribution networks in each region, which deliver energy to homes and businesses.

The existing transmission network was established to transport electricity primarily from generators in fossil-fuel rich areas to load centres, such as residential or industrial areas. As the supply mix evolves, transmission networks need to be reconfigured and expanded to connect regions with high quality renewable energy resources to load centres, and incorporate dispatchable capacity, including energy storage, to keep the NEM stable in the face of potential renewable energy intermittency (renewable energy sources not being able to produce energy at all hours of the day due to environmental, seasonal and daily cycles).

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 able to connect to the network. Furthermore, many areas with high quality renewable energy resources are not well serviced by the existing transmission network. The existing network is estimated to have a connection capacity of 16 gigawatts in areas with favourable renewable resources, which is significantly less than the 125 gigawatts (or more) of new grid-scale renewables required by 2050 (AEMO, 2022a). The transmission grid therefore needs targeted augmentation, including strategically placed large-scale interconnectors and transmission line extensions, to balance resources and unlock Renewable Energy Zones (REZs) in new regions.

The *NSW Transmission Infrastructure Strategy* (NSW Department of Planning and Environment (DPE), 2018a), which is discussed in more detail in Section 2.2, 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 transfer the energy they generate back to the NEM (DPE, 2018b).

As discussed in Chapter 1 (Introduction), the existing transmission network is not capable of transferring the scale of new electricity generation identified for the Central-West Orana REZ. Development of new electricity generation and storage projects in the Central-West Orana REZ will therefore require new high voltage transmission infrastructure in the region.

2.2 Government plans and policies

The Australian and NSW governments have put in place several plans and policies to support the energy market transition. An overview of how the project would be consistent with the aims and objectives of these strategic planning and policy documents is included in Table 2-1 and Table 2-2.

Table 2-1 Relevant Australian Government policy

Australian Government policy	Project alignment with policy
Australia's Nationally Determined Contribution Communication 2022 **(DISER, 2022)** The Australian Government's Nationally Determined Contribution under the Paris Agreement makes a commitment to an emissions reduction target of 43% below 2005 levels by 2030, which is a 15% increase on the upper end of the previous 2030 target (26–28% below 2005 levels).	The project facilitates the longer-term transition to low emission energy sources by connecting renewable energy generators to the NEM. The Central-West Orana REZ declaration (November 2021) provides for an initial intended network capacity of 3 gigawatts (GW) (refer to Section 1.2), enough to power 1.4 million homes. At the time of the preparation of the Environmental Impact Statement (EIS), the NSW Government is proposing to amend the Central-West Orana REZ declaration to increase the intended network capacity to 6 GW, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network (EnergyCo, 2023c) (refer to the NSW Network Infrastructure Strategy below for further information). The proposed amendment is consistent with the Australian Government's current emission reduction commitments under the Paris Agreement.
Australia's Long-Term Emissions Reduction Plan **(DISER, 2021a)** The Long-Term Emissions Reduction Plan is a whole-of-economy plan that aims to achieve net-zero emissions by 2050, based on coordinated actions across four areas: • driving down the cost of low emissions technologies • enabling deployment of low emission technologies at scale • helping regional industries and communities seize economic opportunities in new and traditional markets • working with other countries on the technologies needed to decarbonise the world's economy.	The project would construct new transmission network infrastructure in the Central-West Orana REZ to enable the connection of new utility-scale renewable energy projects to the existing transmission network in NSW and is therefore considered to be consistent with the priorities of the Long-Term Emissions Reduction Plan.
2022 Integrated Systems Plan **(AEMO, 2022a)** The ISP is an actionable roadmap for eastern Australia's power system to optimise consumer benefits through a transition of the energy market. Development in the Central-West Orana REZ was identified in the 2020 ISP (AEMO, 2020) as a Phase 1 project in NSW, as it is development that would meet regional renewable energy targets and other policies, and/or where there is good access to existing network capacity with good system strength. The 2022 ISP identifies 10,000 kilometres of new transmission needed to connect new generation and storage opportunities and deliver renewable energy to consumers through the NEM. The Central-West Orana REZ transmission project is identified as an anticipated project in the 2022 ISP that would contribute to meeting the need for new transmission infrastructure.	The project is identified as a key component of the 2022 ISP and is therefore considered to be consistent with this plan.

Australian Government policy	Project alignment with policy
2021 Infrastructure Investment Objectives Report (AEMO Services Limited, 2021) The Consumer Trustee is an independent statutory role with various planning, advisory and procurement functions to enable the delivery of energy investment in the long-term financial interests of NSW electricity customers. AEMO Services Limited, as the Consumer Trustee under the *Electricity Infrastructure Investment Act 2020* (EII Act), is required to prepare and publish an Infrastructure Investment Objectives Report every two years alongside a 10-year plan for conducting tenders for Long Term Energy Service Agreements to support that infrastructure. The 2021 Infrastructure Investment Objectives Report sets out the NSW Consumer Trustee's 20-year Development Pathway for the construction of electricity infrastructure in NSW to achieve the infrastructure investment objectives included in the EII Act in a practically feasible way. The Development Pathway seeks to support the entry of new generation and long-duration storage infrastructure as soon as practicable, having regard to supply chain constraints and opportunities, and independent of the timing of coal plant withdrawals. This approach ensures that sufficient energy is available in NSW in advance of any unexpectedly early coal plant withdrawal that may occur, and allows for construction to be brought forward if such a withdrawal were to occur. The Development Pathway prioritises construction of renewable energy generation infrastructure that aligns with the development of REZ network infrastructure for the Central-West Orana and New England REZs. The purpose of this is to maximise the utilisation of REZ network infrastructure as soon as it is available.	The project is consistent with the Development Pathway prescribed in the report as it would provide the network infrastructure to connect renewable energy generation projects from the Central-West Orana REZ, providing for the availability of at least 3 GW of energy to the NEM via a connection to the NSW transmission network (noting the NSW Government's intention to amend the Central-West Orana REZ declaration to increase its network capacity to 6 GW, as described in the section on the NSW Network Infrastructure Strategy below).
2022 Infrastructure Investment Objectives Report (AEMO, 2022b) AEMO Services Limited, as the Consumer Trustee under the EII Act, is undertaking a competitive tender for Long Term Energy Services Agreements for firming infrastructure, at the direction of the NSW Minister for Energy. Firming infrastructure generally refers to flexible capacity that is scheduled by AEMO and can be dispatched through AEMO's central dispatch system. Examples of applicable technologies include battery storage, thermal storage and gas peaker plants. The 2022 Infrastructure Investment Objectives Report provides an update to the Development Pathway and 10-Year Plan for competitive tenders from the 2021 Infrastructure Investment Objectives Report (which covered generation and long-duration storage infrastructure). The update includes firming infrastructure (including its location) considered necessary to address a forecast gap in firm capacity required to meet the NSW energy security target from 2025–26 as a result of the earlier than previously scheduled closure of the Eraring Power Station. The Development Pathway for generation and long duration storage infrastructure remains substantially the same in the 2022 Infrastructure Objectives Report as in the 2021 Infrastructure Investment Objectives Report. The 2022 Firming Infrastructure Objectives Report adds an additional 380 megawatts (MW) of firming infrastructure in the Sydney – Newcastle – Wollongong sub-region.	As with the 2021 Infrastructure Investment Objectives Report, the project is consistent with the updated Development Pathway prescribed in the 2022 Infrastructure Investment Objectives Report. The project makes provision for a Battery Energy Storage System (BESS) at the Merotherie Energy Hub and would provide the network infrastructure to connect renewable energy generation projects from the Central-West Orana REZ, some of which include BESS, to the NEM.

Australian Government policy	Project alignment with policy
***2023 Draft Infrastructure Investment Objectives Report* (AEMO, 2023)** The 2023 Draft Infrastructure Investment Objectives Report was published in May 2023 for the purpose of consulting the market, consumer, and other stakeholders. It is intended to be finalised in December 2023. The 2023 Draft Infrastructure Investment Objectives Report leverages updated forecasting assumptions and methodologies to provide a clearer indication of NSW's long term electricity infrastructure needs. The draft Development Pathway seeks to deliver affordable, reliable, secure and sustainable electricity to NSW customers, assuming a scenario that is broadly consistent with the ISP's 'Step Change' scenario. The main changes in the 2023 Draft Infrastructure Investment Objectives Report when compared to the 2022 Infrastructure Investment Objectives Report include: • after 2030, the draft Development Pathway includes significantly more generation to 2043, largely driven by updated demand forecasts, generator retirement announcements and later REZ delivery dates • later timeframes for the delivery of long duration storage, driven by updated assumptions regarding larger lead times for pumped hydro projects • the Draft Development Pathway for firming infrastructure is consistent with the Development Pathway in the 2022 Infrastructure Investment Objectives Report until 2040, when additional firming infrastructure is forecast to be required to meet reliability needs and the cost of long-duration battery storage • updates to the 10-Year Plan to set out more regular-sized tenders for Long Term Energy Services Agreements to provide greater simplicity and certainty to the market, while better reflecting the indicative nature of the tender sizes.	The project is consistent with the Development Pathway prescribed in the report as it would provide the network infrastructure to connect renewable energy generation projects from the Central-West Orana REZ, providing for the availability of at least 3 GW of energy to the NEM via a connection to the NSW transmission network. At the time of writing, the NSW Government is proposing to amend the Central-West Orana REZ declaration to increase the intended network capacity to 6 GW, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network (EnergyCo, 2023c) (refer to the NSW Network Infrastructure Strategy below for further information). The proposed amendment supports modelling in the report showing more network capacity will be needed to meet NSW's future energy needs as coal-fired power stations progressively retire.

Table 2-2 Relevant NSW Government policy

NSW Government policy	Project alignment with policy
***NSW Network Infrastructure Strategy* (EnergyCo, 2023a)** The NSW Network Infrastructure Strategy (NIS) released in May 2023 is a 20-year transmission infrastructure development plan for the coordination of NSW network infrastructure to connect new generation and storage in NSW's five REZs and meet the EII Act objectives, to enable the most cost-effective building of renewable energy generation. The NIS provides further information about the delivery and coordination of NSW REZ transmission network infrastructure, downstream network augmentations and network connections for large scale renewable energy and storage projects. The NIS proposes options that add between 14 GW and 24 GW of network capacity over the next 20 years under the three modelled scenarios of 'Deliver Now', 'Secure Now' and 'Plan for the Future'. This supports recent modelling by AEMO Services Limited (as the Consumer Trustee under the EII Act) in its *2023 Draft Infrastructure Investment Objectives Report* (AEMO, 2023) showing more network capacity will be needed to meet NSW's future energy needs as coal-fired power stations progressively retire.	The Central-West Orana REZ declaration (November 2021) provides for an initial intended network capacity of 3 GW (refer to Section 1.2). It is noted that EnergyCo proposes to initially operate the project between Merotherie and Elong Elong energy hubs at 330 kV rather than 500 kV and stepping up to 500 kV when demand within the REZ is met. Importantly, the proposed infrastructure that EnergyCo is seeking approval for would be designed and constructed to operate at 500 kV between the New Wollar Switching Station, Merotherie Energy Hub and Elong Elong Energy Hub. At the time of EIS preparation, the NSW Government is proposing to amend the Central-West Orana REZ declaration to increase the intended network capacity to 6 GW, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network (EnergyCo, 2023c).

NSW Government policy	Project alignment with policy
As part of the options of the 'Deliver Now' and 'Secure Now' scenarios, the NIS identifies the network capacity of the Central-West Orana REZ could increase from the intended 3 GW (as declared under the EII Act – refer to Section 1.2) to 4.5 GW by 2028 under Stage 1, and to 6.8 GW by 2038 under Stage 2. Stage 1 would be based on the infrastructure proposed in this EIS whereas Stage 2 would require additional infrastructure beyond the scope of this EIS, and would be subject to separate approval.	The project and the proposed amendment is aligned with the NIS as it would provide the transmission infrastructure to meet the network capacity of 4.5 GW by 2028 under the 'Deliver Now' scenario. Other transmission infrastructure beyond the scope of the EIS may be required to provide a network capacity beyond 4.5 GW, and would be subject to separate planning approval.
NSW Transmission Infrastructure Strategy (DPE, 2018a) The NSW Transmission Infrastructure Strategy identifies the NSW Government's plan to unlock private sector investment through priority transmission infrastructure projects, which can keep downward pressure on electricity prices for customers through to 2040 and beyond. The Strategy aims to increase NSW's energy capacity by prioritising REZs in the Central-West Orana, South-West and New England regions of NSW, which will become a driving force to deliver affordable energy into the future.	The project would enable the connection of multiple renewable energy projects in the Central-West Orana REZ to the NEM via a connection to the NSW transmission network, providing certainty to private sector investors and cost savings to energy consumers. The project is consistent with the aims of the Strategy.
NSW Electricity Strategy (DPIE, 2019a) The NSW Electricity Strategy outlines a plan for a reliable, affordable and sustainable electricity system for NSW. It identifies the need to connect new generation projects to the existing transmission network to meet NSW's future energy needs, making it critical to efficiently develop transmission to these new generation projects.	The project would assist in delivering on this commitment and provide regional investment in lower cost, new energy infrastructure to connect the Central-West Orana REZ to the NEM via a connection to the NSW transmission network.
NSW Electricity Infrastructure Roadmap (DPE, 2020) The NSW Electricity Infrastructure Roadmap (the Roadmap) provides a coordinated framework for the delivery of new transmission, generation, long duration storage and firming infrastructure to support low carbon renewable energy and the replacement of coal fired power station capacity scheduled to close in the next two decades. The Roadmap notes the State has committed an initial 12 GW of new transmission capacity and 2 GW of storage capacity by 2030. Key to the transition of the energy sector are five REZs identified at the time, including the Central-West Orana REZ. The REZs will need to be supported by new transmission infrastructure to transfer the expected energy generation efficiently to the major load centres of the Sydney – Wollongong – Newcastle – Hunter Valley area.	The project is aligned with the NSW Electricity Infrastructure Roadmap as it would provide regional investment in lower cost, new energy infrastructure to connect the Central-West Orana REZ to the NEM via a connection to the NSW transmission network. The project would contribute to the Roadmap goal of 12 GW of new transmission capacity by providing 4.5 GW of transmission capacity in the Central-West Orana REZ. At the time of EIS preparation, the NSW Government is proposing to amend the Central-West Orana REZ declaration to increase the intended network capacity of the Central-West Orana REZ to 6 GW, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network (EnergyCo, 2023c) (refer to the NSW Network Infrastructure Strategy above for further information).
State Infrastructure Strategy 2018-2038 (Infrastructure NSW, 2018) The State Infrastructure Strategy 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'.	The project is aligned with the strategic objective for the energy sector within the strategy, as it would provide the increased transmission capacity that is required to encourage private sector investment in low emission energy generation projects within the Central-West Orana REZ in NSW.
NSW Climate Change Policy Framework (Office of Environment and Heritage (OEH), 2016) The NSW Climate Change Policy Framework outlines NSW's long term objectives to achieve net-zero emissions by 2050 and make NSW more resilient to a changing climate.	The project is aligned with this framework, as it would provide a key piece of strategic transmission infrastructure that would enable the transition to a lower emissions economy.

NSW Government policy	Project alignment with policy
Central West and Orana Regional Plan 2041 **(DPE, 2022a)** The Central West and Orana Regional Plan 2041 (the Regional Plan) sets the strategic land use planning framework for the region. The Regional Plan builds on the previous regional plan by recognising and responding to the region's role in supporting NSW's transition to net-zero carbon emissions by 2050 through a broad range of actions, including through enabling the establishment of the Central-West Orana REZ.	The project would enable NSW's transition to net-zero carbon emissions by encouraging private sector investment in new renewable energy. The project is consistent with the objectives of the Regional Plan, as it would stimulate the local and regional economies by facilitating new business and investment activity and create new employment opportunities for local communities (refer to Chapter 13 (Social) and Chapter 14 (Economic)). The project also aligns with the strategies of the Regional Plan as it: • would provide new transmission infrastructure that would ensure the benefits of renewable energy projects in the region to the overall electricity network are fully realised • is designed in consultation with Aboriginal stakeholders and the local community to be compatible with surrounding land use practices and minimise environmental and social impacts (refer to Chapter 5 (Community and stakeholder engagement) and Chapters 7 to 19).

2.3 Regional context

This section provides an overview of the regional context of the Central-West Orana REZ including the natural environment, built environment and the communities in the region. The regional context helps to inform the objectives to be addressed by the project.

2.3.1 Natural environment

The project is located within the Central-West Orana region, which is at the geographic heart of NSW and is the second largest region in NSW. The region includes some of Australia's most important ecosystems which also have significant Aboriginal cultural importance. This includes the RAMSAR-listed (Wetland of international importance) Macquarie Marshes, covering more than 200,000 hectares, the Lachlan Catchment Wetlands which supports 471,011 hectares of wetland with eight nationally significant wetlands, the Greater Blue Mountains World Heritage Area, State forests and more than 149,000 hectares of national parks, including Warrumbungle, Coolah Tops, Blue Mountains, Pilliga and Goulburn River national parks.

The region's landscape includes the highlands, tablelands and slopes in the east with fertile volcanic soils and the plains that dominate the northern and western areas of the region with fertile alluvial soils.

Waterways and water resources in the region, including the Macquarie and Lachlan rivers, underpin the health of the natural environment and are integral parts of the broader Murray–Darling Basin. Rivers of the region connect the varied floodplain wetlands and vegetation communities including the sub-alpine forests in the east to the semi-arid woodland and grasslands in the west. The east and north of the region generally drain to the northwest through the catchments of the Bogan, Macquarie and Castlereagh rivers which join the Barwon Darling in the adjoining Far West region. The southern part of the region drains westerly through the Lachlan River and its tributaries before joining the Murrumbidgee in the Riverina Murray region while parts of the Mid-Western Regional, Lithgow and Oberon local government areas (LGAs) drain to the coast through the Goulburn/Hunter and Hawkesbury–Nepean rivers.

The region also has significant groundwater resources with the Great Artesian Basin and fractured rock aquifers in the north and the shallow alluvial fan aquifers of the Darling River Basin. Many towns in the region rely on groundwater as a primary or alternative source of water, and some industries and landholders rely on groundwater to support their activities, as well as for domestic and stock use.

2.3.2 Community and built environment

The Central-West Orana region consists of 19 LGAs. The region is home to more than 290,000 people, with 29,800 people identifying as Aboriginal or Torres Strait Islander. The population is expected to increase to more than 306,000 people by 2041.

The region's population lives in a diverse network of regional centres, including Dubbo, Mudgee, Wellington, Gulgong and Dunedoo, and smaller towns and rural localities, including Wollar, Ulan, Uarbry, Cassilis and Coolah. Most people live in or around the regional centres. Each regional centre has its own catchment, drawing people from the surrounding communities for employment, services and social networks. The nearest regional population centres to the project are Gulgong and Dunedoo. The nearest towns and villages are Ulan, Wollar and Uarbry, all of which are located within five kilometres from the project.

Land tenure in the region is predominantly freehold, with some areas of Commonwealth land and Crown land, including road reserves, rail corridors, travelling stock reserves, State forests and national parks.

Aboriginal communities in the region retain a strong link with Country and include Traditional Owners and Custodians of the Wiradjuri, Wongaibon, Wailwan (also known as Weilwan and Wayilwan), Gamilaroi (also known as Gamilaraay and Kamilaroi), Ngiyampaa, Dharug and Gundungurra countries that the region sits within. Natural features within the region are important to the cultural heritage of these Aboriginal communities because of their traditions, observances, lore, customs, beliefs and history, and include pre-contact and habitation and usage sites, burial sites, battle sites, and camping, hunting and fishing sites.

The region's broad range of industries, its location and connections to Sydney, Canberra and Newcastle provide a foundation for a diverse regional economy. The top five regional industries, in order of economic contribution, are mining, agriculture, forestry and fishing, health care and social assistance, manufacturing and education and training. Mining and agriculture underpin the region's economy and together create 28 per cent of the region's economic output (DPE, 2022a).

Agricultural production is the primary land use activity and occurs from the vast plains of the Orana in the north and west to the sub-alpine areas of the Central-West in the east, from intensive and irrigated crops, including vegetables, fodder, stone fruits, grapes and cotton, to extensive broadacre cropping, meat and wool production and forestry. Agricultural production supports an extensive value chain including major livestock centres in Dubbo and Blayney, transport, logistics and inter-modal transport hubs, cotton gins, packing and processing, and is a significant employer across all parts of the region.

The protection of regionally significant agricultural land from incompatible land uses is identified as a regional strategic goal. This is reflected in Objective 13 of the *Central West and Orana Regional Plan 2041* (DPE, 2022a). Parts of the region have also been identified as Biophysical Strategic Agricultural Land (BSAL), including areas in and around Dundeoo, Coolah, Dubbo and Wellington. BSAL is land with high quality soil and water resources capable of sustaining high levels of productivity, which have been mapped by the NSW Government to provide increased protection from mining and extraction projects.

The region also has an established mining industry and is rich with high-tech metals and critical mineral resources. The region sits within the Lachlan Orogen geological province which hosts traditional metal resources such as gold, silver and base metals, and a significant proportion of the State's emerging critical mineral resources such as cobalt, scandium, titanium and rare earth elements.

A number of renewable energy projects are proposed, approved or under construction within the Central-West Orana REZ, including the Liverpool Range wind farm, Valley of the Winds wind farm, Birriwa solar farm and Tallawang solar farm. In addition to renewable energy projects, several mining projects in and around Ulan and Wilpinjong are operational and subject to proposed or approved expansions. Potential cumulative impacts that have the potential to arise for the project based on known proposed or approved projects are discussed in Chapter 20 (Cumulative impacts). Key risks and hazards for the project in the region include bushfire risk and mine subsidence risk, as parts of the project study area would be located within Category 1 (highest bushfire risk) and Category 3 (medium bushfire risk) bushfire prone land and/or a mine subsidence district.

2.4 Project objectives

EnergyCo, as the statutory Infrastructure Planner and proponent for the project, is delivering new transmission network infrastructure for the Central-West Orana REZ to ensure efficient aggregation and transfer of renewable energy from renewable energy generators and storage within the REZ to the NSW transmission network (as part of the broader NEM). The project forms part of the NSW Government's broader objective of encouraging and coordinating generation, storage and network investment in the Central-West Orana REZ under the *NSW Electricity Infrastructure Roadmap* (DPE, 2020).

A summary of the project challenges, corresponding objectives and overall project outcomes from a strategic and project design and delivery perspective are shown in Figure 2-1 and Figure 2-2. The objectives respond to the project need and the strategic and regional context identified in the preceding sections.

Strategic

Challenges	Objectives	Outcomes
Ability to meet emission reduction targets set by the NSW Government and the Australian Government	• Support government decarbonisation targets and the transition of the NEM from traditional energy sources to lower emission alternatives based on renewable energy.	• Reduced emissions and a greater mix of renewable energy in the NEM.
Planned closure of aging major coal-fired power generators over the coming decade will create power shortages if this generation capacity is not replaced	• Develop the architecture for the Central-West Orana REZ so that it encourages delivery of, and reduce barriers to the development of viable grid-scale renewable energy projects within the REZ in the near term to deliver a source of affordable and reliable energy. • Deliver the Central-West Orana Transmission Project, a key element of the NSW Electricity Strategy and Electricity Infrastructure Roadmap, by the mid 2020's before the retirement of key coal-fired power stations. • Provide high-capacity connections to mature grid-scale generation projects within the Central-West Orana REZ to enable earlier delivery of bulk power.	• Improved reliability and energy security, by delivering large amounts of new energy supply into the NEM. • Unlock major investment in new renewable energy and regional economies. • Placing downward pressure on customer bills through lower energy generation costs and increased competition.
Increased demand for electricity as technology and industry shifts towards electrification	• Design the Central-West Orana REZ to meet current bulk energy demands and enable efficient expansion to meet future demand as this grows.	• Network infrastructure that will: – meet current and future needs efficiently, reducing ongoing impacts to the community by building it right the first time; and – support ongoing development and investment in renewable energy projects within the REZ to meet growth in demand.
Traditional sources of inertia and stability in the network are lost as fossil fuel generators are retired	• Design the Central-West Orana REZ to address issues of inertia and stability by including equipment and technology within the design of the Central-West Orana REZ to ensure stability and reliability.	• Delivery of a transmission network that can efficiently and reliably deliver bulk power from renewable sources at reliability levels consumers expect of the NEM.

Figure 2-1 Strategic project challenges, objectives and outcomes

Project

Challenges	Objectives	Outcomes
Delivering a project that minimises impacts to local communities along the transmission route during construction and operation	• Engage in open and honest dialogue with the community and stakeholders during the development and delivery of the project, to improve the design and reduce impacts to the community and landowners where reasonable and feasible. • Through corridor development and refinement, avoid large centres of population. • Work with landowners to identify how the project may impact their properties and businesses and develop measures to manage and mitigate those impacts.	• Deliver a project that is supported by the local community and landowners by engaging in an open and transparent consultation process through the development of the projects design, as well as its construction and operation.
Potential for the project to result in conflict with other valued land uses such as agriculture	• Plan for, design and deliver a project that: – Seeks to utilise previously disturbed land to avoid and minimise impacts to other valued land uses. – Minimises the amount of prime agricultural land required for construction and permanent operational infrastructure. – Allows for continued agricultural land uses and farming practices within the Central-West Orana REZ.	• Impacts to agricultural land and farming practices would be avoided and minimised as much as possible throughout construction and operation of the project.
Cumulative impacts of network infrastructure and generation projects	• Plan and deliver transmission and generation projects in a coordinated manner and in consultation with stakeholders, including generators. • Reduce cumulative impacts from construction and operation of the project with other renewable energy projects in the Central-West Orana REZ.	• Efficient and coordinated delivery of network infrastructure and generation projects. • Reduced impacts on local communities during construction and operation.
Potential for the project to result in adverse environmental impacts	• Plan for, design and deliver a project that protects natural and cultural resources, and minimises impacts to: – natural systems, including biodiversity – Aboriginal and non-Aboriginal cultural heritage – visual amenity – water resources and water quality. • Implement strategies to mitigate and offset impacts and to recreate important environmental values in the region.	• Environmental impacts of the project during construction and operation would be avoided and minimised where feasible. • The scale of the project allows new environmental values to be recreated for the benefit of the region. • The project will support the delivery of viable grid-scale renewable energy to reduce the need for fossil fuel generators.

Figure 2-2 Project design and delivery challenges, objectives and outcomes

2.5 Strategic options assessment

The following strategic alternatives have been considered against their ability to deliver on the strategic project objectives:

- Strategic option 1: Base case ('do nothing')
- Strategic option 2: Optimisation and modification of existing transmission infrastructure ('do minimum')
- Strategic option 3: Provision of new transmission capacity to meet known renewable energy demand and allow for future expansion.

2.5.1 Strategic option 1: Base case ('do nothing')

The base case option is to do nothing and to rely on the existing electricity generation and transmission network to meet current and future energy demand. This would involve continued reliance on coal-fired power generation to provide the majority of electricity generation in NSW, supplemented by the current extent of known and planned development of renewable energy projects. As outlined in Section 2.1, coal-fired generation is withdrawing faster than anticipated (AEMO, 2022a), due to large coal-fired power plants closing ahead of originally anticipated retirement dates as competitive and operational pressure on ageing coal fired generators intensify with cleaner and lower cost renewable energy generation becoming available. 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.

The 'do nothing' option would limit investment in renewable energy generation within the Central-West Orana REZ as no additional transmission infrastructure would be provided to collect and transmit energy from renewable energy projects, and the strategic project objectives would not be achieved.

The 'do nothing' option has been rejected as a viable strategic alternative because it would not address the identified project need or adequately satisfy the strategic project objectives to decarbonise the NEM and provide an affordable and reliable source of energy.

2.5.2 Strategic option 2: Optimisation and modification of existing transmission line infrastructure ('do minimum')

The 'do minimum' option would involve the optimisation and modification of existing transmission infrastructure to accept electricity from renewable energy projects in the Central-West Orana REZ. This alternative would be consistent with some of the strategic objectives of the project, as it would connect renewable energy projects to consumers and would contribute to government decarbonisation targets and the transition of the NEM from traditional energy sources to lower emission alternatives, including renewable energy.

However, this option would not provide the increased network capacity needed to encourage the scale of renewable energy investment required to meet government emission reduction targets and to provide an affordable and reliable source of new energy to meet current and future electricity demand. Further, this option would also result in significant construction of transmission assets from the existing Transgrid Transmission Line 79 and Line 72 to connect renewable energy generators to the existing network and would result in significant disruption to existing lines during construction which would affect energy security.

For these reasons, the ‘do minimum’ option has been rejected as a viable strategic alternative for the project.

2.5.3 Strategic option 3: New transmission capacity to meet known renewable energy demand and allow for future expansion

This option would involve the construction and operation of new transmission infrastructure in the Central-West Orana REZ. The transmission infrastructure would include connections from the new transmission infrastructure to renewable energy projects and would be planned so that the transmission alignment considers the location of known renewable energy projects currently under development. In addition, the transmission infrastructure to be provided as part of this option would be designed so that there is sufficient capacity for future renewable energy generators within the Central-West Orana REZ to connect, and there would be flexibility in the project design for it to be expanded and extended in the future to respond to the growing development of renewable energy projects in the Central-West Orana REZ.

This strategic option would align with all the strategic project objectives and is considered to be the preferred strategic option for the project.

2.5.4 Summary

A summary of the strategic project options against the strategic project objectives is provided in Table 2-3.

Table 2-3 Summary of strategic project options against the strategic project objectives

Strategic project objective	Strategic option 1	Strategic option 2	Strategic option 3
Support government decarbonisation targets and the transition of the NEM from traditional energy sources to lower emission alternatives based on renewable energy.	×	✓	✓
Develop the architecture for the Central-West Orana REZ so that it encourages delivery of, and reduce barriers to, the development of viable grid-scale renewable energy projects within the REZ in the near term to deliver a source of affordable and reliable energy.	×	×	✓
Deliver the Central-West Orana Transmission project, a key element of the NSW Electricity Strategy and Electricity Infrastructure Roadmap, by the mid 2020’s before the retirement of key coal-fired power stations.	×	×	✓
Provide high-capacity connections to mature grid-scale generation projects within the Central-West Orana REZ to enable earlier delivery of bulk power.	×	×	✓
Design the Central-West Orana REZ to meet current bulk energy demands and enable efficient expansion to meet future demand as this grows.	×	×	✓
Design the Central-West Orana REZ to address issues of inertia and stability by including equipment and technology within the design of the Central-West Orana REZ to ensure stability and reliability.	×	×	✓

2.6 Project development overview

2.6.1 Summary of project development process

The project has undergone a process of the development and evaluation of alternative transmission corridor options from feasibility to early design development. A summary of the process completed to date is provided in Figure 2-3.

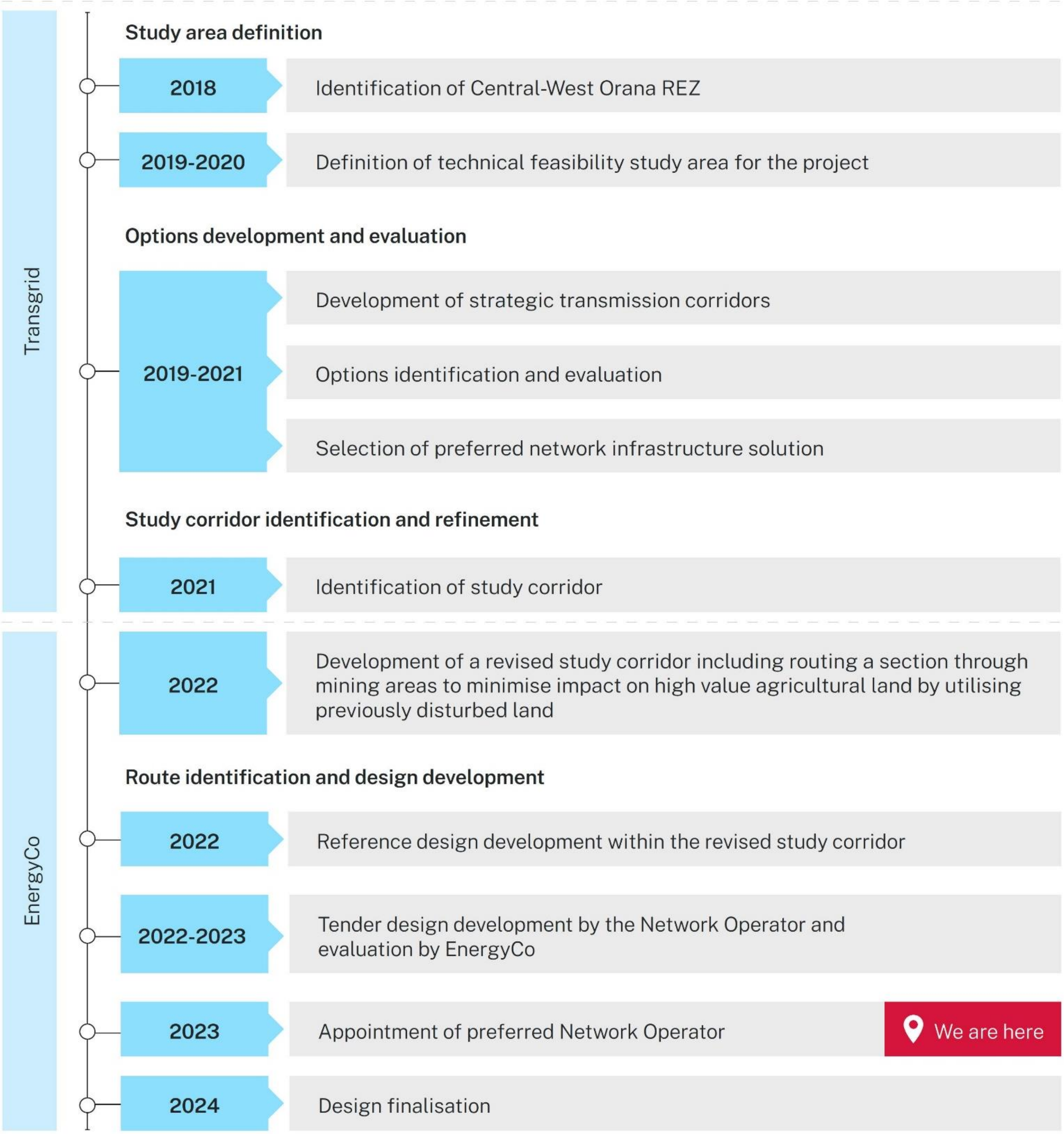

Figure 2-3 Project development process

In 2020, the NSW Government engaged Transgrid, as the operator of NSW's existing transmission network, to carry out early development work to guide the planning of new transmission infrastructure for the Central-West Orana REZ.

Transgrid undertook a multi-step process to identify a study corridor for the transmission project, which included defining a study area, assessing alternatives and technical options, before identifying the preferred network infrastructure solution. Transgrid notes in their *Study Corridor Identification Report* (Transgrid, 2021a), that at each step in the process it sought to avoid or minimise impacts to the environment and community, by considering multiple constraints such as ecology, heritage, land tenure (including agricultural land), bushfire prone land, existing or proposed infrastructure and location of dwellings and townships.

In December 2020, Transgrid released a preliminary study corridor for the project that ran northwest from the existing NSW transmission network near Merriwa, passing south of Dunedoo before connecting to the existing network east of Wellington. The preliminary study corridor developed by Transgrid also included an option to extend the new transmission infrastructure for the Central-West Orana REZ south of Wellington to Lake Burrendong. The preliminary study corridor, and multi-step process outlined above, were published in Transgrid's *Study Corridor Identification Report* (Transgrid, 2021a). Between December 2020 and September 2021, Transgrid carried out community and stakeholder engagement on the preliminary study corridor for the transmission route, which included letters to landowners, community information sessions, community events, social media posts and print advertisements, meetings with landowners, community members, Aboriginal stakeholders, local councils and other stakeholders, and establishment of a dedicated phone number, email address and website to provide project information.

In November 2021, the Central-West Orana REZ was formally declared by the (then) Minister for Energy and Environment (the relevant minister now is the Minister for Energy) and EnergyCo was appointed as the Infrastructure Planner to lead the delivery of REZs in NSW (refer to Section 1.2). At this time, EnergyCo assumed responsibility for planning and design of the transmission corridor and engaging local communities and stakeholders to inform the development of new transmission network infrastructure within the REZ.

2.6.2 Approach to study corridor development

Since EnergyCo's appointment as Infrastructure Planner, the project development process included the following steps:

- reaffirming the project need
- developing the project objectives in response to the need, as described in Section 2.4
- developing, and iteratively refining, a study corridor to identify a preferred transmission alignment based on preferred energy hub locations, proximity to eligible renewable energy generators, landowner and community feedback and site based investigations.

Development and refinement of the study corridor has been broadly undertaken in three key stages, shown in Figure 2-4 and outlined as follows:

- development of a revised study corridor, published by EnergyCo in February 2022. This broad study corridor was about five kilometres wide and included indicative energy hub locations and connection point to the NSW transmission network
- refinement of the revised study corridor to a preliminary project corridor, including reduction in the width from around five kilometres wide to about one kilometre wide, and refinements to energy hubs locations, as depicted in the September 2022 Scoping Report
- further refinement to a project corridor about 220 metres wide, expanding at energy hubs, within which a reference design, including indicative easements, have been prepared.

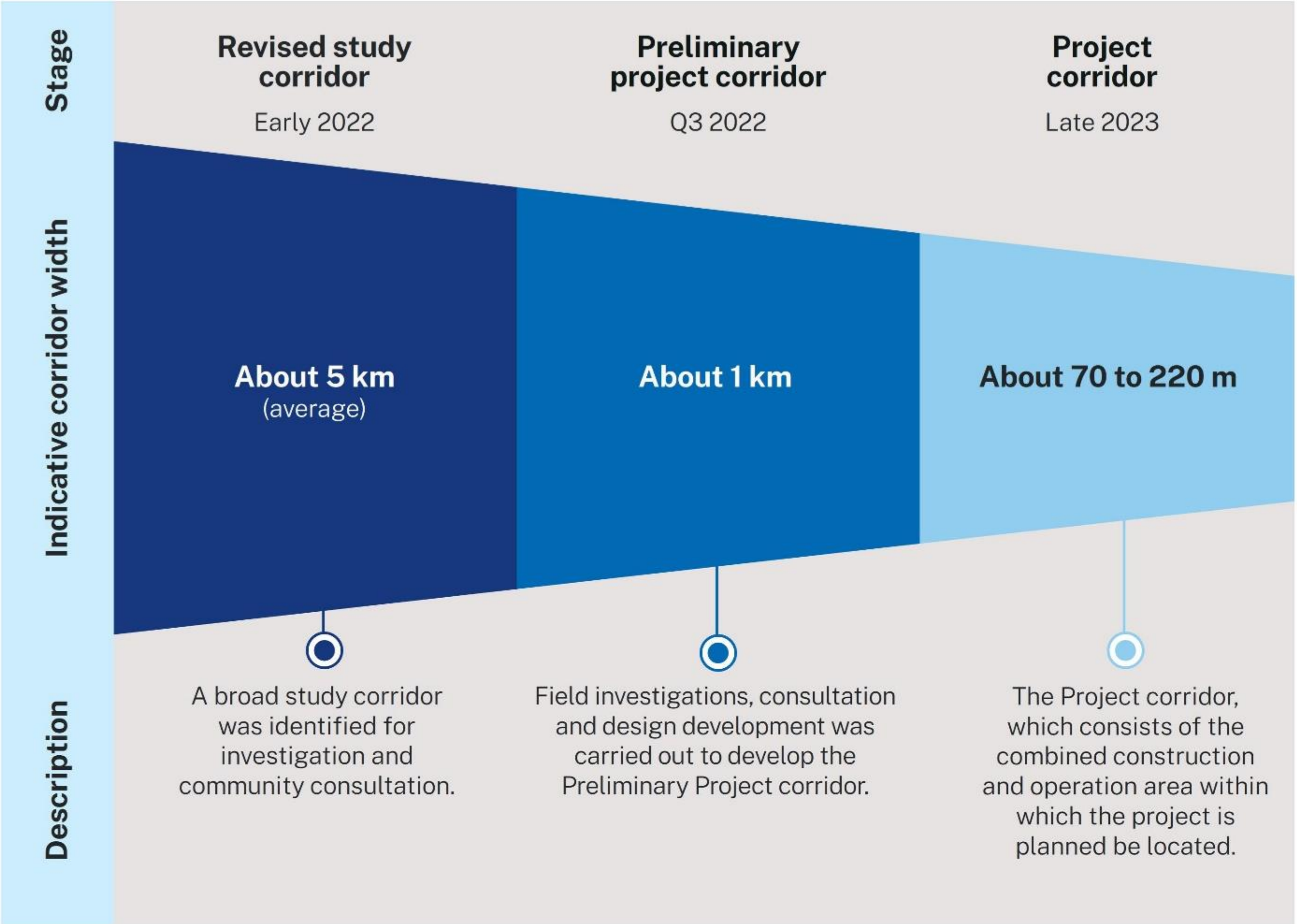

Figure 2-4 Key stages of study corridor development

The framework for developing and refining the study corridor was based upon three tiers of environmental, community and engineering constraints. These constraints were used in combination with the project objectives (as detailed in Section 2.4), to develop the study corridor for the project and the basis for study corridor refinement as the design and environmental assessment of the project has progressed:

- Tier 1: Areas generally considered no-go zones, where locating transmission lines, energy hubs and switching stations would result in a low likelihood of obtaining access, combined with the potential impacts to the environment, community and stakeholders at these locations, presenting a high risk for obtaining planning approval. Examples of potential Tier 1 locations include town centres, areas of concentrated residential settlement, areas of high environmental value such as national parks, national heritage places and sensitive Aboriginal Heritage Information Management System (AHIMS) sites. Although some sections of the revised study corridor and preliminary project corridor included sections of Tier 1 constraints, these have largely been avoided through the design development and refinement process.
- Tier 2: Areas which the project has aimed to avoid wherever practicable because of the added complexity of obtaining site access, obtaining planning approval and the potential impact on community and stakeholder interests at these locations. Examples include areas containing listed threatened species and ecological communities, significant AHIMS sites and high value agricultural land.
- Tier 3: Areas where impacts should be minimised and/or mitigated. In addition to the Tier 2 constraints, examples include areas of Key Fish Habitat, AHIMS sites, agricultural land and private properties.

Corridor planning has also considered opportunities to avoid impacts by routing the corridor through previously disturbed land such as mining areas and existing transmission easements, as well as coordinating transmission connections to renewable energy generation and storage projects to minimise the overall length of generator connections.

2.7 Revised study corridor by EnergyCo

In February 2022, EnergyCo released a revised study corridor for the project which was based on the most appropriate location for a connection to the NSW transmission network (Section 2.7.1), indicative locations for energy hubs (Section 2.7.2), and proximity to eligible renewable energy generators (refer to Section 2.7.2).

The location and configuration of the revised study corridor was largely developed in response to community feedback Transgrid received on their December 2020 preliminary study corridor, in addition to technical and environmental constraints. In particular, the eastern section of the preliminary study corridor, including the proposed connection point to the NSW transmission network near Merriwa, ran in a north-west direction above Goulburn River National Park, through land within Merriwa, Cassilis and Uarbry. As this land comprised large, contiguous areas of BSAL, the community indicated a strong preference for the project to be relocated off the Merriwa Cassilis plateau into areas of existing disturbance or public land.

In response, EnergyCo developed a revised study corridor that incorporated mining areas and existing transmission easements to the south of Goulburn River National Park. Importantly, this section of the study corridor was intentionally narrow due to the presence of Tier 1 constraints, including Goulburn River National Park, Munghorn Gap Nature reserve, mapped Important Regent Honeyeater habitat, and highly sensitive Aboriginal cultural heritage sites. By locating the study corridor in disturbed mining areas and with existing transmission lines, this section of study corridor was able to avoid or minimise impacting these important constraints.

In addition, the revised study corridor incorporated cleared land, and sought to maximise land within eligible renewable energy project footprints to avoid material impacts to high quality ecological values and high value agricultural land while further minimising impacts to private property.

EnergyCo invited the community and stakeholders to provide feedback on the revised study corridor for the project in February and March 2022. A community feedback report was released in June 2022 which outlined the consultation outcomes and next steps in the project development process. Where practicable, this feedback was considered in the development of the one kilometre preliminary project corridor. Further detail about the engagement activities carried out and feedback received is provided in Chapter 5 (Community and stakeholder engagement).

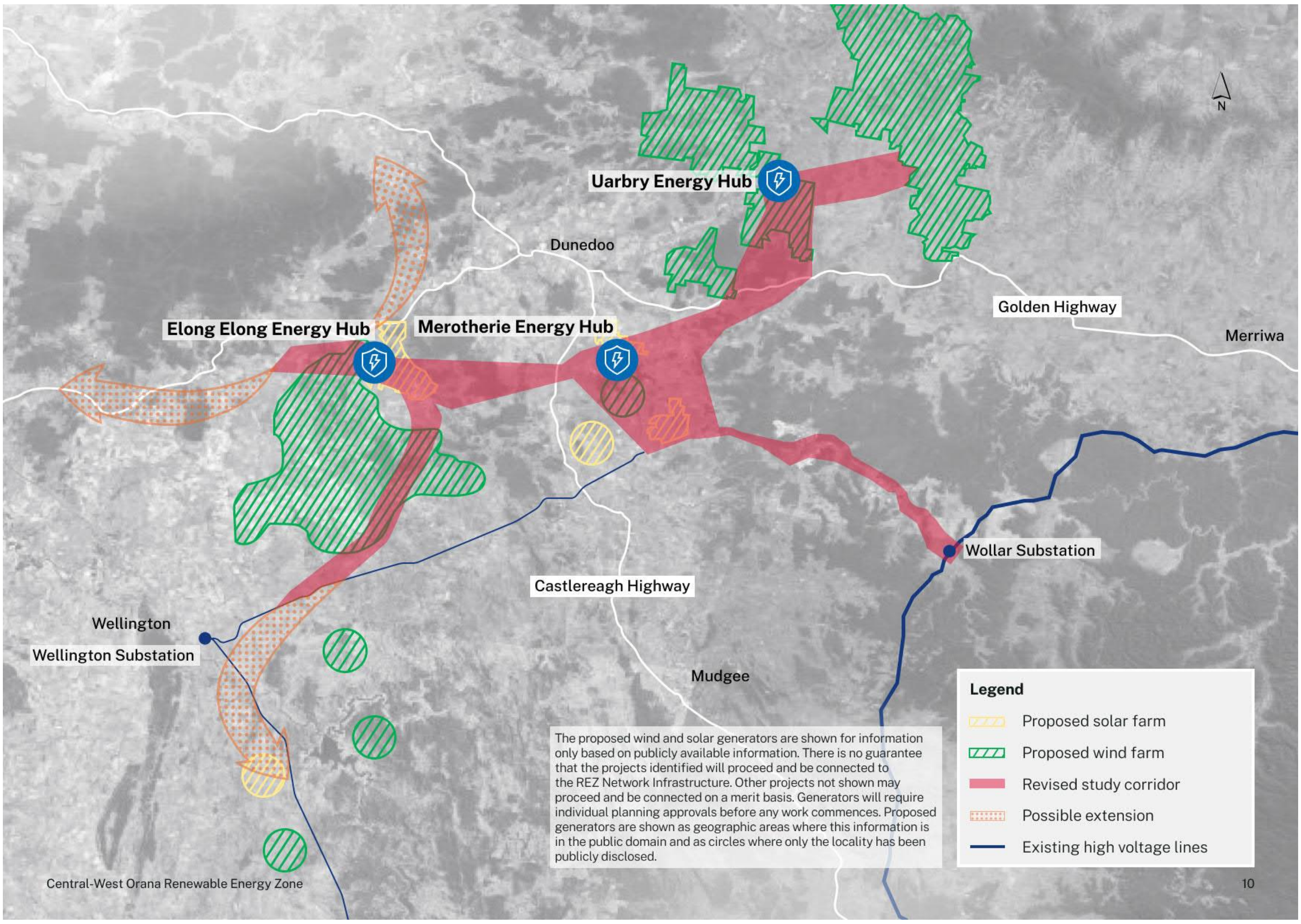

Figure 2-5 February 2022 Revised study corridor (EnergyCo, 2022)

2.7.1 Connection to the NEM

As part of the development of the revised study corridor, EnergyCo initially commenced investigations into technically feasible alternative locations for the project to connect to the NSW transmission network. These investigations considered the entire length of Transmission Line 79 from Wollar to Wellington. It was identified that the most suitable alternative connection points to the NSW transmission network along Transmission Line 79 would be where substation infrastructure exists at Wollar and Wellington.

The existing Transgrid Wellington substation operates at 330 kV, so to provide appropriate capacity to accept and transfer energy generated within the Central-West Orana REZ from renewable energy generation projects, major transmission infrastructure upgrades of lines and substations would be required.

Providing a connection point to the NSW transmission network at Wollar was considered preferrable when compared to Wellington, as it would:

- provide better integration with the existing NSW transmission network as it has an existing connection to the 500 kV network
- result in less visual impacts to surrounding landowners, communities and road users
- enable construction next to the existing Transgrid Wollar 500 kV substation, reducing visual impacts and disruption to the existing transmission network.

2.7.2 Location of energy hubs

Proximity to renewable energy generators

EnergyCo completed an expression of interest process in June 2022 to identify potential renewable energy generation projects in the Central-West Orana REZ that were able to generate at least 250 megawatts alternating current of energy. Through this process, 11 major renewable energy generation projects have been identified as the most likely to progress and are planned to have a future 330 kV transmission connection from the project. The locations of these projects were mapped relative to the revised study corridor to identify potential broad locations for energy hub sites. Preferred locations were identified at or near Uarbry, Merotherie, and Elong Elong as they reflected concentrated areas of renewable energy generation projects in the Central-West Orana REZ and were shown in the February 2022 revised study corridor. The location of the 11 major renewable energy generation projects relative to the revised study corridor is shown on Figure 2-6.

By positioning the energy hubs close to these projects, EnergyCo has been able to rationalise the number and length of transmission line connections to renewable energy generation projects. This has contributed to a reduction in the impact of project infrastructure on the community and the environment, while also providing a cost-effective design solution.

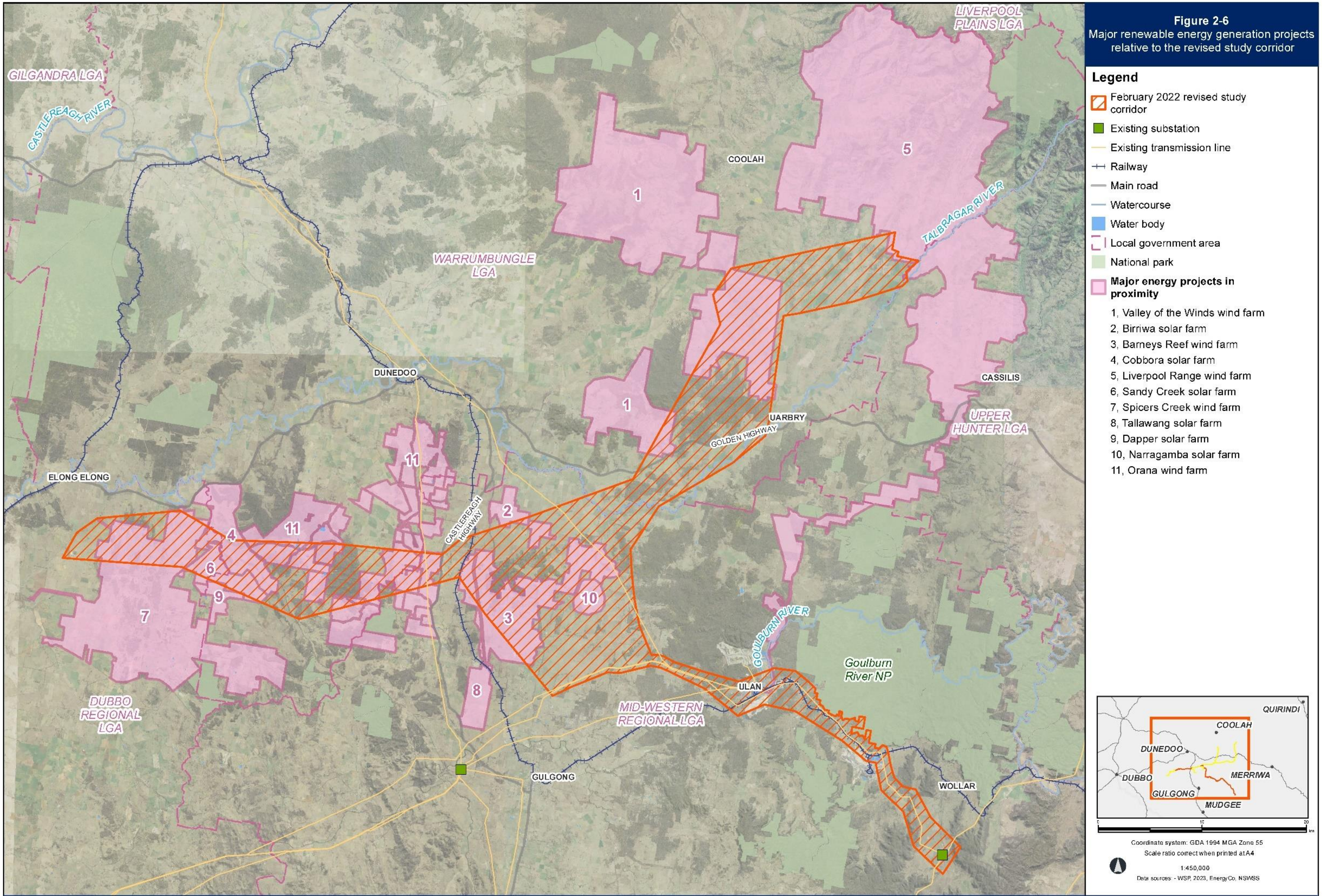

Figure 2-6
Major renewable energy generation projects relative to the revised study corridor

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Energy hub site selection

A site identification and selection process was undertaken for the energy hubs having regard to the tiered constraints outlined above and the following selection criteria:

- proximity of the energy hub to proposed renewable energy generation projects
- availability of predominantly cleared land with sufficient space requirements for an energy hub
- ability to secure land through negotiated agreement (acquisition)
- quality and extent of biodiversity values and heritage sites
- proximity to the existing road network
- ability to secure transmission line easements to the proposed renewable energy generation projects
- visibility of the site from residential properties, and/or surrounding areas
- other site constraints that might affect constructability such as topography, geotechnical conditions and flood immunity.

Merotherie Energy Hub

In considering the site selection criteria, four options were identified for the location of the Merotherie Energy Hub, which are listed below and shown on Figure 2-7.

- Option 1 – Gingers Lane
- Option 2 – Merotherie north
- Option 3 – Merotherie south
- Option 4 – Barneys Reef.

A comparative analysis against the selection criteria was completed and is summarised in Table 2-4. Green indicates that the option met the selection criteria, yellow indicates that the option partially met the selection criteria and red indicates that the option did not meet the selection criteria.

Table 2-4 Merotherie Energy Hub options analysis

Selection criteria	Option 1	Option 2	Option 3	Option 4
Proximity of the energy hub to proposed renewable energy generation projects	🟢	🟢	🟢	🟡
Availability of predominantly cleared land with sufficient space requirements for energy hub	🟡	🔴	🟢	🟢
Ability to secure land through negotiated agreement (acquisition)	🟢	🔴	🟢	🟡
Quality and extent of biodiversity values and heritage sites	🟡	🟡	🟢	🟡
Proximity to the existing road network	🟢	🟡	🟡	🟡
Ability to secure transmission line easements to the proposed renewable energy generation projects	🔴	🟡	🟡	🟡
Visibility of the site from residential properties and/or surrounding areas	🟡	🟡	🟡	🟢
Other site constraints that might affect constructability such as topography, slope and geotechnical conditions and flood immunity	🟢	🟢	🟢	🟡

🟢 : Meets criteria; 🟡 : Partially meets criteria; 🔴 : Does not meet criteria

All site options avoided Tier 1 constraints and contained some Tier 2 constraints, and most site options comprised predominantly cleared land. While each site option contained some areas of vegetation, it was considered feasible to avoid or minimise some of these areas during design development when considering the size and configuration of the land at each option.

Option 2 was not considered a feasible option, as the size and configuration of the site did not meet the functional requirements for an energy hub.

Option 1 was also not considered a feasible option as the site would be located too close to the Elong Elong Energy Hub, which would minimise the benefit of having multiple energy hubs connecting to renewable generators in multiple catchments and increase the length of 330 kV transmission lines needed.

Options 3 and 4 were both identified as feasible options for the location of the Merotherie Energy Hub and rated similarly against the site selection criteria. Construction access to options 3 and 4 would require upgrades to Merotherie Road; however, Option 3 was identified as the preferred location for the energy hub, when compared with Option 4 as:

- the Option 4 site includes land proposed to be occupied by Barneys Reef wind farm, reducing the area available for an energy hub. This option was also located on land with undulating topography, resulting in greater earthworks, impacts to vegetation and impacts to Barneys Reef. Given the proximity to Barney Reef, an energy hub at this location would have made connections from all sides challenging
- the Option 3 site is located more centrally to renewable energy generators that would connect to the Merotherie Energy Hub, meaning there would be less kilometres of transmission line. The option consists of a large site with predominantly cleared land, including areas with little to no native vegetation, provides relatively good access to the Golden Highway via Merotherie Road, and has low flood risk.

A summary of environmental constraints avoided or minimised at this location through the design development process is summarised in Section 2.11.

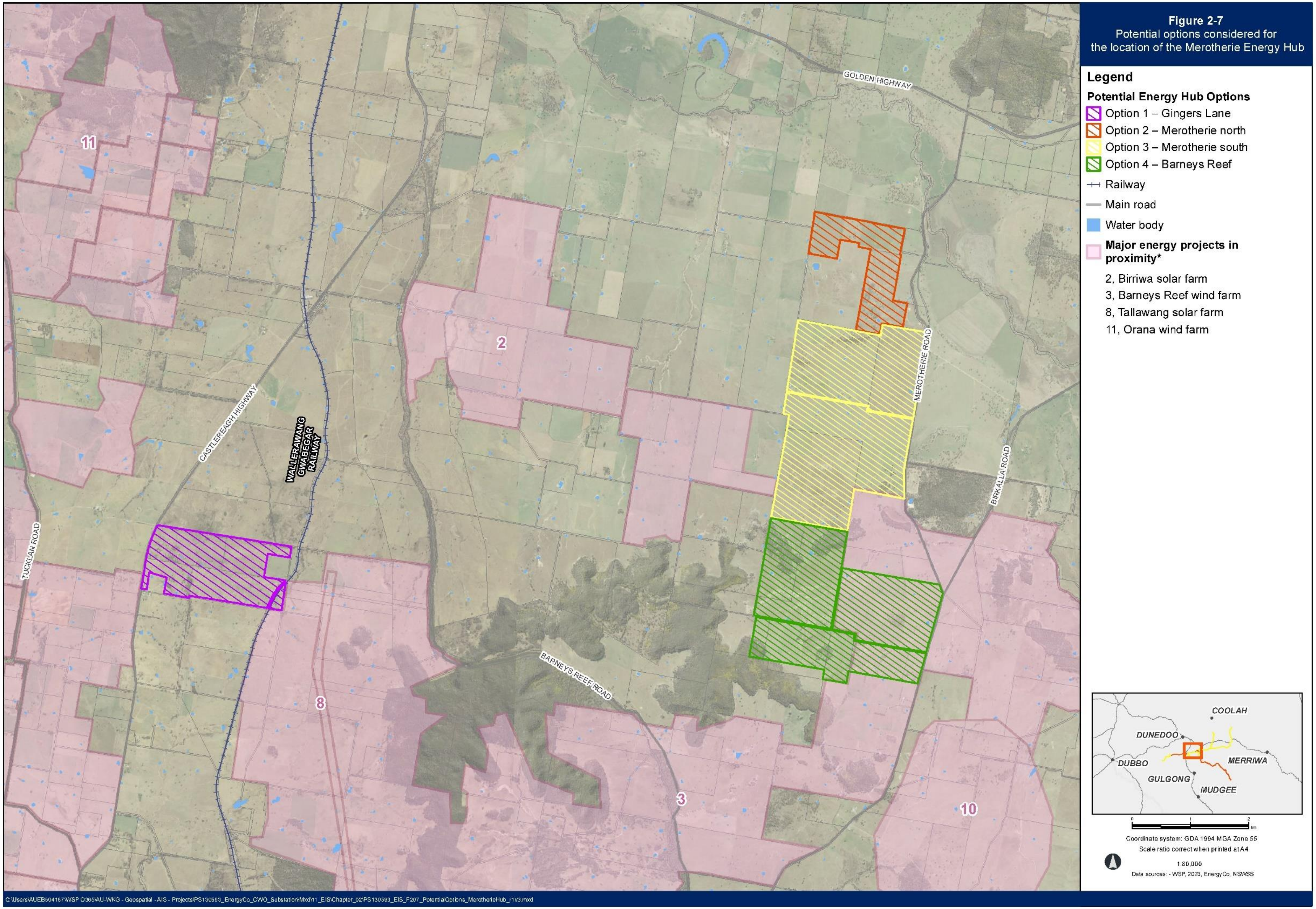


Figure 2-7
Potential options considered for the location of the Merotherie Energy Hub

Elong Elong Energy Hub

Three options were identified for the location of the Elong Elong Energy Hub as outlined below and shown in Figure 2-8:

- Option 1 – Cobbora Road and Saxa Road
- Option 2 – Golden Highway along Sweeneys Lane
- Option 3 – Spring Ridge Road.

During the initial site identification process, EnergyCo took an approach to identify appropriately sized options that would ultimately be sized and acquired based on technical and environment requirements. Commencing with a large site provided opportunities to avoid or minimise environmental constraints.

A comparative analysis against the selection criteria for each option was completed for the energy hub locations and is summarised below in Table 2-5. Green indicates that the option met the selection criteria, yellow indicates that the option partially met the selection criteria and red indicates that the option did not meet the selection criteria.

Table 2-5 Elong Elong Energy Hub options analysis

Selection criteria	Option 1	Option 2	Option 3
Proximity of the energy hub to proposed renewable energy generation projects	🔴	🟢	🟢
Availability of predominantly cleared land with sufficient space requirements for energy hub	🟢	🟢	🟢
Ability to secure land through negotiated agreement (acquisition)	🟡	🟡	🟡
Quality and extent of biodiversity values and heritage sites	🟢	🟢	🟡
Proximity to the existing road network	🟢	🟢	🟢
Ability to secure transmission line easements to the proposed renewable energy generation projects	🔴	🔴	🟢
Visibility of the site from residential properties and/or surrounding areas	🟡	🟡	🟡
Other site constraints that might affect constructability such as topography, slope and geotechnical conditions and flood immunity	🟢	🟢	🟢

🟢 : Meets criteria; 🟡 : Partially meets criteria; 🔴 : Does not meet criteria

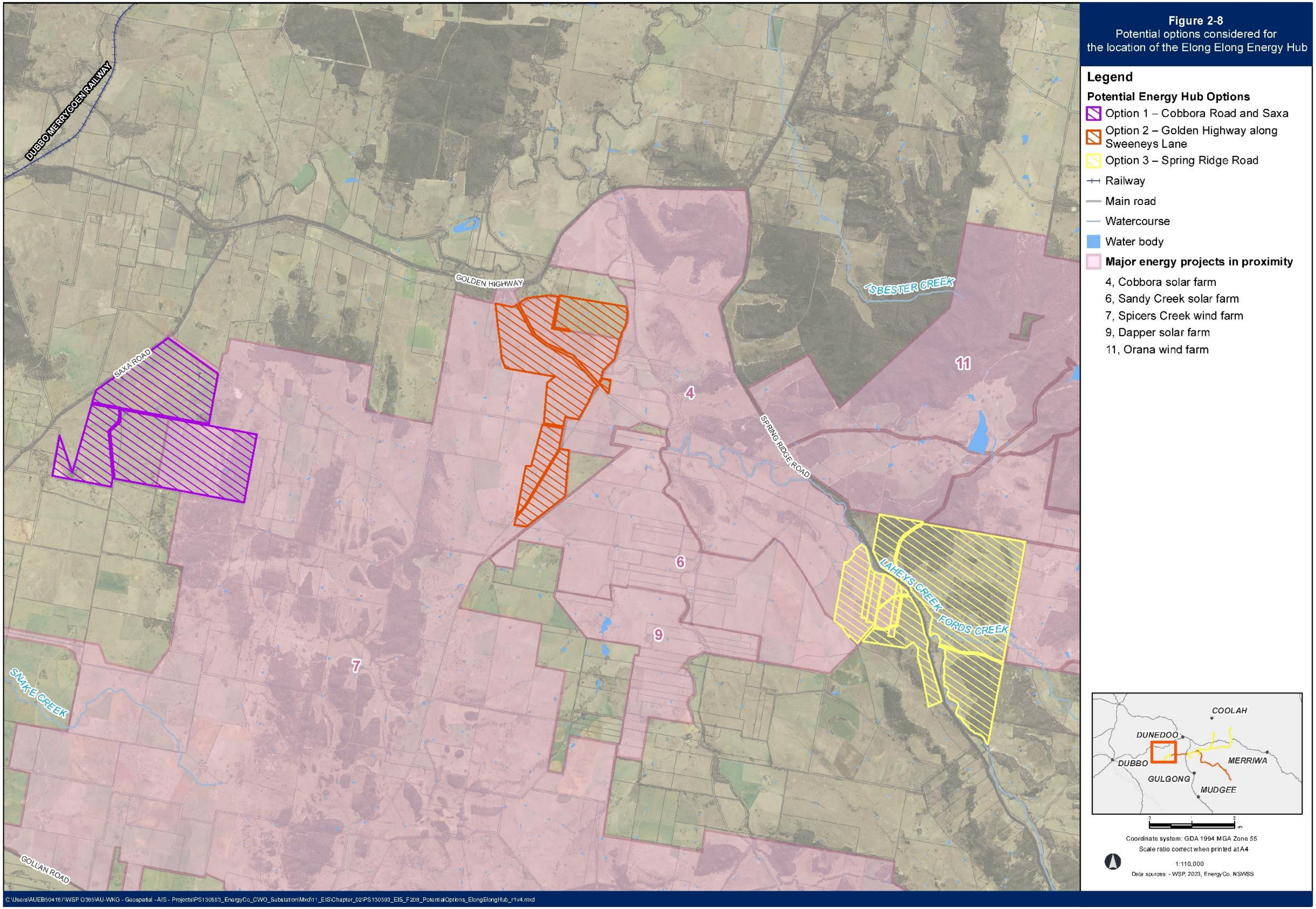


Figure 2-8
Potential options considered for the location of the Elong Elong Energy Hub

While the Option 1 and Option 2 sites contained large areas of land that would meet the functionality requirements of an energy hub, their locations relative to renewable energy generators would require comparatively longer 330 kV and 500 kV transmission lines and associated vegetation clearing. As these options would also have comparatively greater impacts on agricultural land and be located near residential properties, they were not considered feasible options.

Option 3 was selected for further consideration as it best met the selection criteria. Although the Option 3 site contained vegetated areas and threatened ecological communities, the large size of the site meant biodiversity constraints could be avoided or minimised. EnergyCo further refined the energy hub site to utilise land to the west of Spring Ridge Road, thereby removing land to the east of Spring Ridge Road and land to the south of Dapper Road, to avoid vegetated areas.

EnergyCo continued to explore further potential options based on securing land through negotiated agreements. A fourth site option, Option 4 – Sweeneys Lane, was identified given its large size and proximity to renewable energy generators. The location of the Option 4 site relative to the Option 3 site and renewable energy generators is shown on Figure 2-9.

A comparative analysis against the selection criteria for each option was completed and summarised in Table 2-6. Green indicates that the option met the selection criteria and yellow indicates that the option partially met the selection criteria.

Table 2-6 Elong Elong Energy Hub refined options analysis

Selection criteria	Option 3	Option 4
Proximity of the energy hub to proposed renewable energy generation projects	Meets criteria	Meets criteria
Availability of predominantly cleared and land with sufficient space requirements for energy hub	Meets criteria	Partially meets criteria
Ability to secure land through negotiated agreement (acquisition)	Meets criteria	Meets criteria
Quality and extent of biodiversity values and heritage sites	Partially meets criteria	Partially meets criteria
Proximity to the existing road network	Meets criteria	Meets criteria
Ability to secure transmission line easements to the proposed renewable energy generation projects	Meets criteria	Partially meets criteria
Visibility of the site from residential properties and/or surrounding areas	Partially meets criteria	Partially meets criteria
Other site constraints that might affect constructability such as topography, geotechnical conditions and flood immunity	Meets criteria	Partially meets criteria

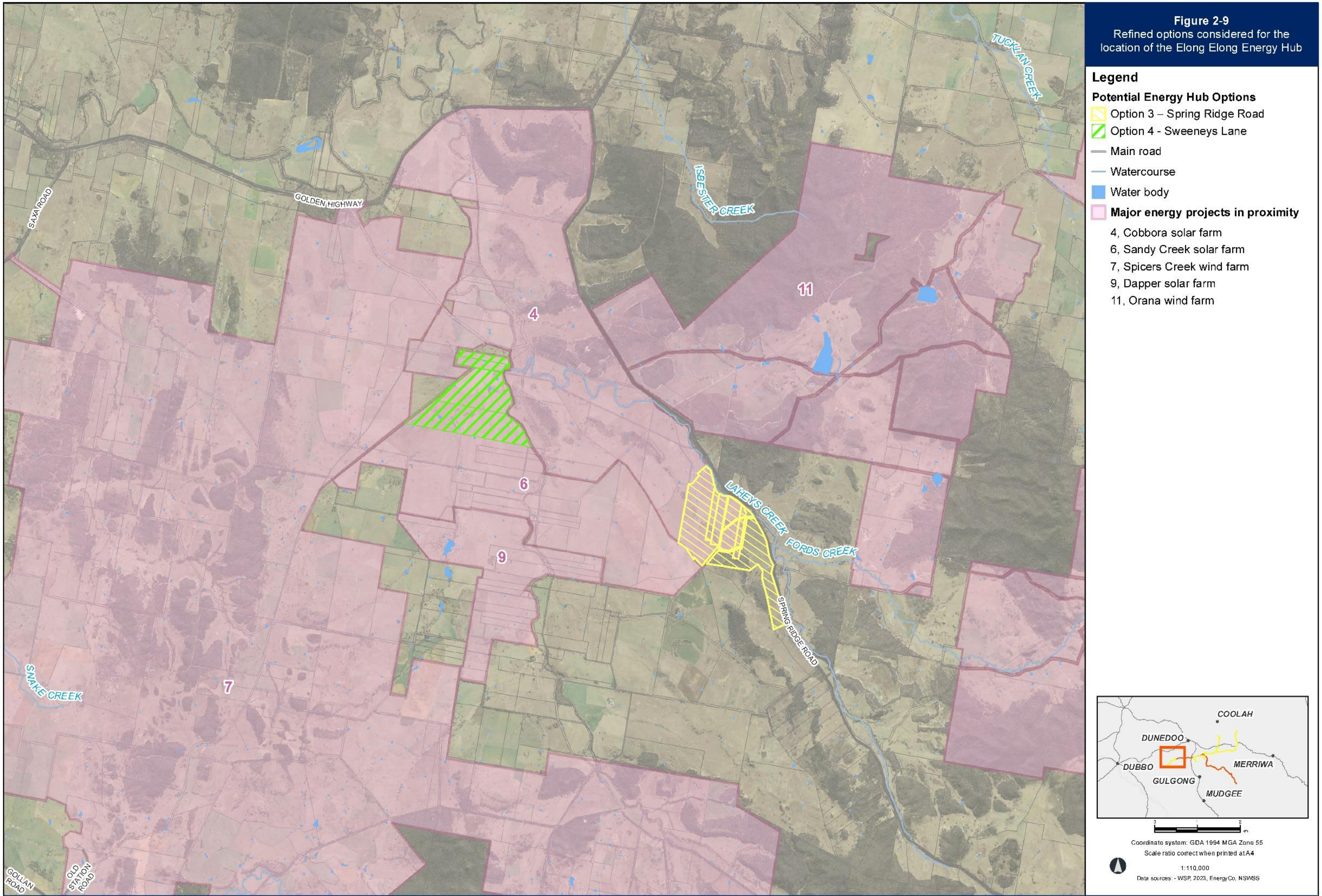
: Meets criteria; : Partially meets criteria

As part of the energy hub selection process, EnergyCo continued to engage with landowners and developers with options over the respective sites, to gauge interest in securing the land via negotiated agreement. Based on these continued discussions, both options 3 and 4 were considered feasible by EnergyCo.

While both options were large and contiguous, a waterway (Broken Leg Creek) traverses the middle of the Option 4 site which reduces the available area of the site and decreases the flexibility to optimise the orientation and location of the energy hub infrastructure. In addition, the area surrounding the waterway was at or below the bed level, indicating the site has the potential to be flood prone which further reduces the available area.

The location of each site option was assessed in relation to developing transmission line easements to Merotherie Energy Hub. The desktop assessment found that the transmission lines for Option 4 would traverse large, vegetated areas located east of Spring Ridge Road, including Tuckland State Forest, and large areas of mapped BSAL. The transmission lines for Option 3 would traverse comparatively less vegetated areas, mapped BSAL and avoided Tuckland State Forest. For these reasons Option 4 was discarded and Option 3 remained the preferred option.

A summary of environmental constraints avoided or minimised at this location through the design development process is summarised in Section 2.11.



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Uarbry Energy Hub

Two options were considered for the location of the Uarbry Energy Hub, located south of Coolah on land partially within the extent of the Girragulang Road cluster of the Valley of the Winds project (Option 1), and on land to the east of the Girragulang Road cluster of the Valley of the Winds project (Option 2). These locations are shown on Figure 2-10.

Option 1 was identified as a feasible option, given its proximity to proposed renewable energy project infrastructure that forms part of the proposed Valley of the Winds project. This option would have required significant earthworks due to the surrounding topography.

Option 2 had two potential configurations, which both required significant earthworks and would present a challenging construction methodology that would likely result in additional vegetation clearance and earthworks.

Both options required transmission infrastructure between the Valley of the Winds and the Liverpool Range projects which meant traversing a wide valley floor (Coolah Valley), undulating ridgelines, Box Gum Woodland in moderate to good condition and BSAL. In addition, both options would have required significant earthworks, long access roads and would have required significant investment for an energy hub at a location with interest from just two renewable energy generators.

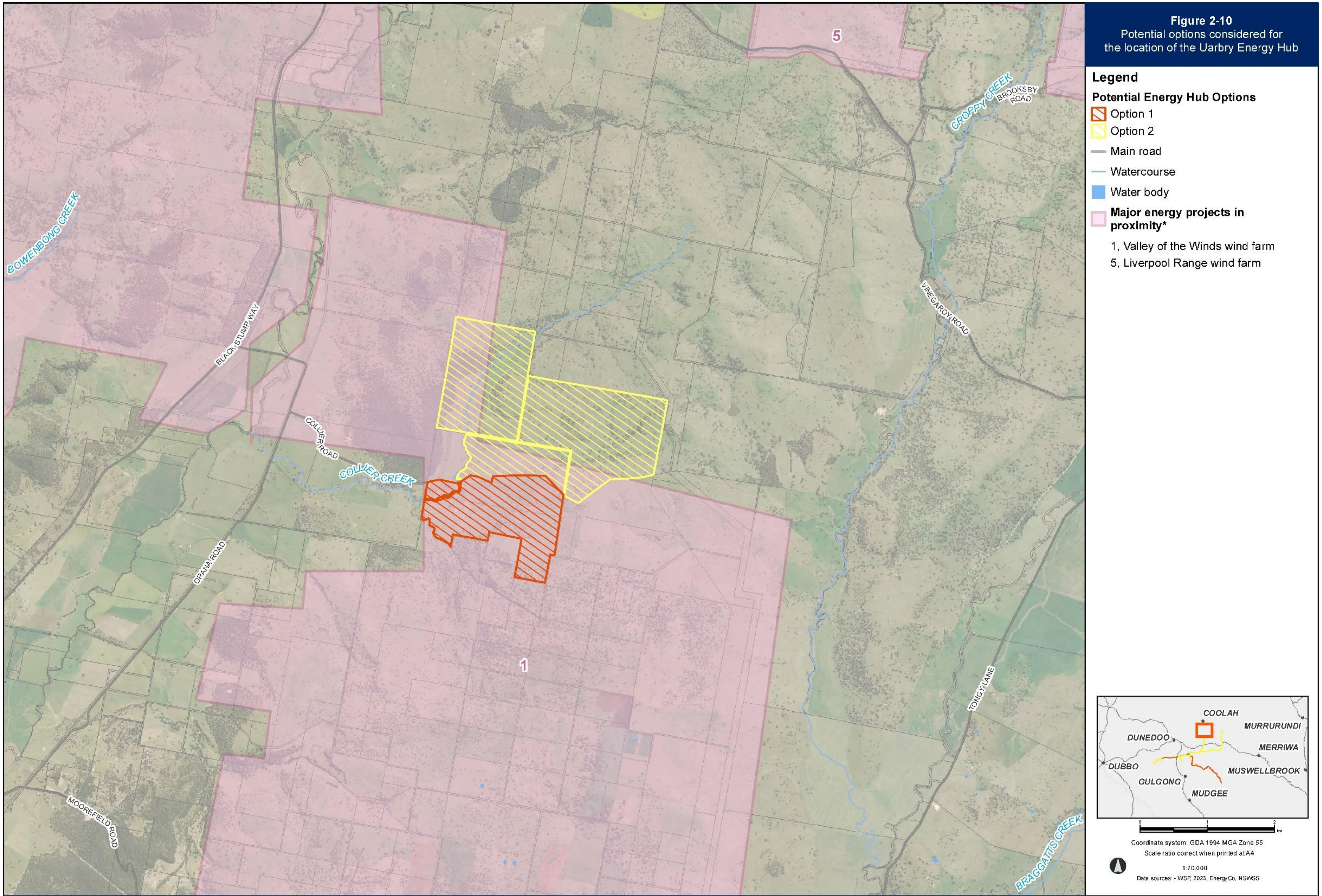
Following publication of the revised study corridor, the local community stated concerns with significant visual impacts to communities and residences at and near Uarbry, particularly when considered in a cumulative context with the Liverpool Range and Valley of the Winds wind farm projects.

Removal of the Uarbry Energy Hub

Considering these engineering, environmental and community constraints, EnergyCo decided to remove the Uarbry Energy Hub from the project scope. This allowed more investment for the Merotherie Energy Hub to service the Valley of the Winds and the Liverpool Range projects via 330 kV transmission infrastructure, including 330 kV switching stations.

Removing the Uarbry Hub was consistent with the project objectives, as it would minimise potential community and environmental impacts from construction and operation and improve the efficiency and cost-effectiveness of the project’s construction.

Figure 2-10
Potential options considered for the location of the Uarbry Energy Hub



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2.7.3 Transmission line design

As part of the development of the project's design, EnergyCo has considered the potential to place the transmission lines underground instead of above ground supported on transmission line towers. Although an underground transmission line would have a more favourable impact in terms of visual amenity, aerial operations and easement width, it would directly impact a larger area of land via ground disturbance, associated with the need to excavate a trench, or multiple parallel trenches where more than one high voltage transmission circuit is required, over the entire length of the alignment.

In addition, reactor switching stations the size of New Wollar Switching Station would be required around every 40 kilometres. A reactor switching station is a facility where underground cables emerge from the ground and are connected to an above ground structure and terminated. They are used to ensure safe voltages and operating conditions are maintained. These have the potential for significant disturbance to agricultural activities, biodiversity and heritage as well as increasing project costs for construction and maintenance, compared to overhead transmission lines.

Placing transmission lines underground would also result in an easement where land use would be more restricted compared to above ground lines (e.g. restrictions on vehicles mass, depths of excavation or ploughing, depths of planted material, placement of fill material).

In addition, the following environmental and engineering constraints would be associated with undergrounding of project transmission infrastructure:

- for 500 kV transmission lines, the number and size of underground cables and the requirement for cable joint bays every one to 1.5 kilometres and additional reactor switching stations at around every 40 kilometres would create significant impacts
- diminished efficiency of energy transmission due to thermal derating (i.e. the voltage and system output are reduced due to a hotter operating temperature underground). Additional cables can be added to compensate for the derating but would require a wider easement and contribute to the hot underground environment. This is further diminished at increasing depths and would require larger cables to transmit the same amount of energy overhead
- should damage or a fault occur to the transmission network infrastructure, specialised skills, plant and equipment would be required and large areas of excavation may be required to identify the fault, resulting in longer repair times and interruptions to energy supply. In particular, the restoration of circuits would take longer due to each 20 kilometre segment of cable requiring a sequential energisation process
- the transition from overhead to underground cables requires cable termination points which are large structures that require sensitive siting
- there may be areas of unsuitable geology and subsidence regions along the transmission easement that would increase the cost of construction as a result of the construction methodology for trenching and excavation works
- the construction methodology for underground transmission lines would result in a longer construction program overall and longer periods of impacting activities, such as excavation and truck movements to transport spoil, at each location
- while undergrounding of transmission infrastructure may provide some additional resilience against major weather events, the transmission structures and lines in NSW are designed to withstand significant weather events, including localised ‘tornado’ wind speeds.

Based on the above factors, locating high voltage transmission lines underground is not considered to be a viable option for this project.

2.8 Preliminary project corridor

In September 2022, EnergyCo submitted a Scoping Report to the NSW Department of Planning and Environment (DPE) for the project to support a State significant infrastructure application, and to assist the Secretary of the DPE in preparing the assessment requirements to be addressed in the EIS (referred to as Secretary's Environmental Assessment Requirements (SEARs)). The Scoping Report included a description of the project, and considered the potential environmental impacts associated with its construction and operation, based on a preliminary project corridor about one kilometre wide within which the project was intended to be located.

The one kilometre wide preliminary project corridor was refined from the revised study corridor and was developed taking into consideration the outcomes of consultation with landowners, the community and government agencies (including local councils) as well as the results of preliminary site investigations and field survey.

The key changes to the revised study corridor and design of the project at this point in the project development process included:

- the removal of an energy hub that was proposed at Uarbry
- the addition of 330 kV network infrastructure to provide a transmission line connection between the energy hubs at Merotherie and Elong Elong and the renewable energy generation projects that were expected to be connected to the project (these connections previously formed part of the scope of the development applications for each renewable energy project but were transferred to the scope of the transmission project application, reflecting EnergyCo’s role in coordinating connections between generators and transmission).

The one kilometre wide preliminary project corridor is shown in Figure 2-11.

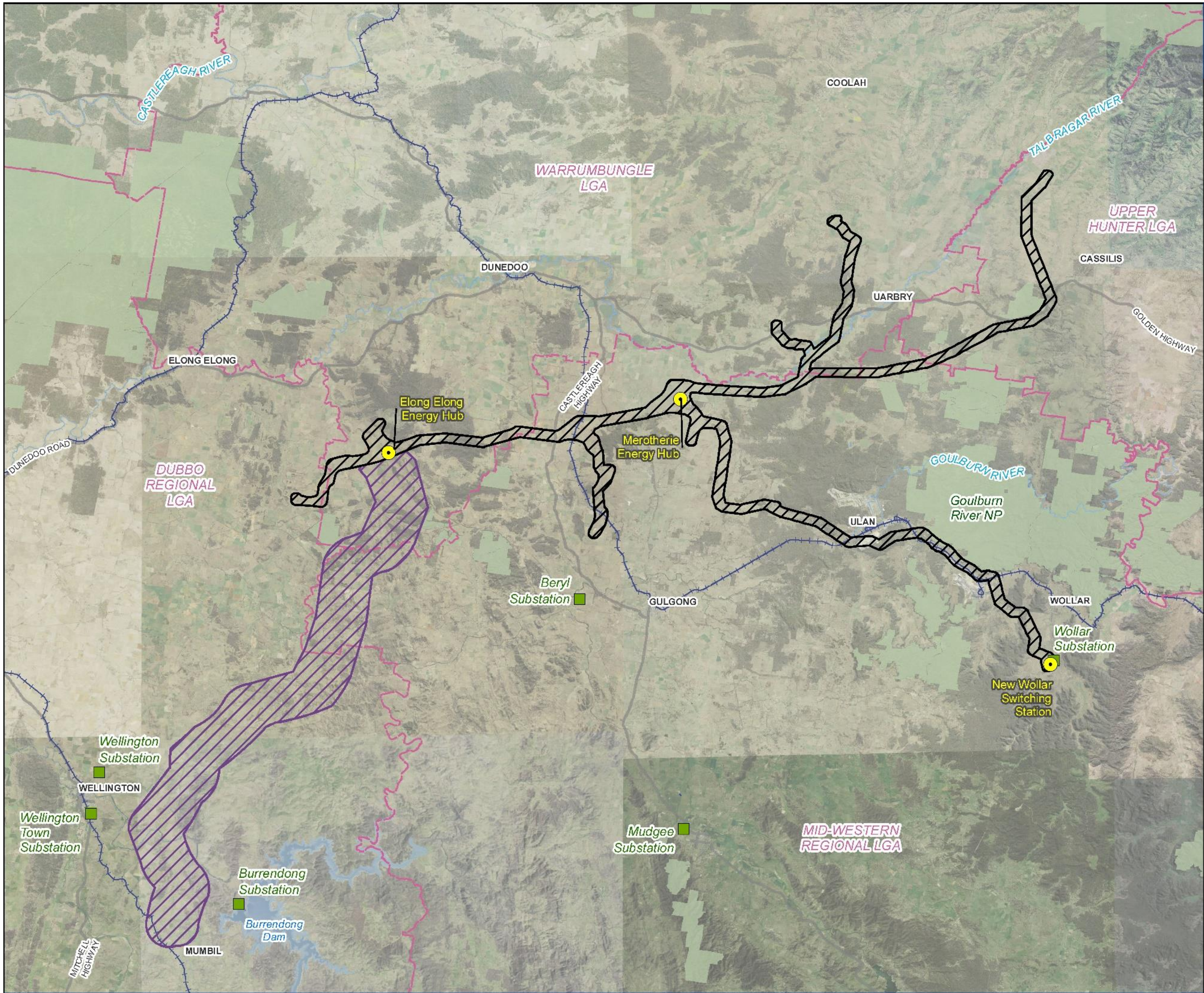
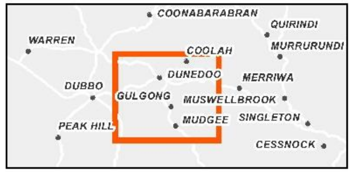


Figure 2-11
September 2022 Scoping Report corridor (EnergyCo, 2022)

Legend

- Energy hub/switching station indicative location
- Existing substation
- Watercourse
- Waterbody
- Railway
- Main roads
- Local government area
- National parks
- Project study area
- *Southern extension

The project includes a southern extension of the transmission network between Elong Elong and Mumbil with a connection to the NSW transmission network. This section is under investigation and will be subject to a separate planning approval.



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Data sources: WSP 2023, EnergyCo, NSWSS

2.8.1 Connections between energy hubs and renewable energy projects

As part of the design refinement process undertaken to develop the project corridor, EnergyCo continued to undertake additional consultation with renewable energy generators that were identified as having the greatest potential to access the new transmission line infrastructure (subject to the Consumer Trustee's competitive tender processes). The key purpose of this consultation was to gain a more comprehensive understanding of each project's design to ensure the transmission project would effectively support the delivery of these projects. As part of this consultation, EnergyCo collected information about the potential designs and development footprints of these projects, including the potential connection points to the project.

Based on the information collected, EnergyCo identified an opportunity to provide transmission line connections from the project's 500 kV network infrastructure to these renewable energy generation projects, helping fulfil its obligation as Infrastructure Planner to provide a coordinated approach to renewable energy generation within the Central-West Orana REZ. This resulted in the addition of 330 kV network infrastructure to the project, rather than this being the responsibility of individual generator projects, including transmission lines between the energy hubs at Merotherie and Elong Elong, and switching stations at 13 locations, which provide a direct connection from the renewable energy generation projects to the project.

By developing these connections as part of this project, EnergyCo was able to provide an optimised transmission network solution between energy hubs and renewable energy projects that would reduce both the number and length of transmission lines in the network by providing a coordinated approach to their development, thereby minimising potential environmental impacts associated with this infrastructure while also providing a more cost-effective solution.

The development of the 330 kV network infrastructure alignments to the renewable energy generation projects followed a corridor planning process consistent with that identified in Section 2.6.2 of this chapter, which uses a tiered constraints approach, before micro-siting the alignment within a preferred corridor to avoid constraints as far as practicable.

2.9 Project corridor

The project corridor consists of the combined indicative construction and operation areas, assessed as part of this EIS. The project corridor evolved from the one kilometre preliminary project corridor to be more reflective of the actual footprint required to facilitate construction of the project, as well as the ongoing area required for the project's operation. While the preliminary project corridor was generally about one kilometre wide, the project corridor is typically about 220 metres wide along the length of the transmission line easement with larger footprints to take into account energy hub sites and switching station sites. At locations where the project corridor includes multiple transmission lines, the project corridor has been widened.

During development of this EIS, continued community, landowner and agency consultation has been undertaken, as well as detailed site investigations and field surveys. The information collected as part of this process, combined with continued development of the project's design and construction methodology, has resulted in some adjustments to the project's construction and operation areas. Changes to the preliminary project corridor that have been incorporated into the project corridor have included:

- modifying the Cassilis connection (between the Merotherie Energy Hub and Liverpool Range wind farm) to follow the transmission line alignment through the Durridgere State Conservation Area (SCA), consistent with the approved Liverpool Range wind farm project as far as practicable. The alignment was revised at this location to better align with the approved Liverpool Range project to provide continuity and certainty to hosting landowners of both projects. In this regard, the transmission line alignment from switching station M1 to a point within the Durridgere SCA is consistent with the approved Liverpool Range project. At the point of divergence within Durridgere SCA, the approved Liverpool Range transmission alignment continues southwest and the EnergyCo alignment continues west towards the Merotherie Energy Hub. However, it must be noted that only one transmission line would be constructed. Accordingly, in the event Tilt Renewables is successful in the Consumer Trustee's competitive tender process for rights to access the new transmission infrastructure, and becomes an access right holder, they would not construct their external transmission line and connection infrastructure, instead utilising EnergyCo's transmission line. This approach is consistent with Tilt Renewables modification assessment report (SSD 6696) and would result in a net reduction to an easement length within Durridgere SCA by 4.15 kilometres. Conversely, if Tilt Renewables is not successful in the tender process, they would proceed with the approved transmission line alignment. In addition, EnergyCo would not construct the transmission line from switching station M1 to a point near the Merotherie Energy Hub on the basis there would be no renewable energy development to connect to at this location

- modifying the transmission line alignment along the Goolma connection to avoid the Dapper homestead (heritage item HH01) and the Dapper hut and shed (heritage item HH02), both assessed as having local heritage significance
- modifying the transmission line tower design along the Cassilis connection to include monopoles instead of steel lattice towers at some locations, to be consistent with the approved Liverpool Range wind farm project
- modifying the alignment through the Moolarben and Wilpinjong coal mines, to avoid areas of active and planned future mining activities, in consultation with the mine operators. In the case of the realignment in Moolarben this reduced the area of impact to the important habitat of the Regent Honeyeater but increased the area of impact to a mining offset area
- where practicable, undertaking adjustments to the transmission line alignments (both 500 kV and 330 kV) to locate as much of the project within land to be used for renewable energy generation projects, to avoid impacts to private property (where practicable) while also complementing the design of these projects
- where locating the transmission line alignment on private property could not be avoided, adjustments to the alignment were made (where practicable) in response to landowner feedback and a greater understanding of how landowners utilise their property
- in consultation with the developers of the Liverpool Range and Valley of the Winds wind farms, a reduction in the extent of the 330 kV network infrastructure along the Cassilis, Coolah and Leadville connections
- modifying the transmission line in response to additional information gained from field surveys.

It is recognised that landowners hosting critical project infrastructure play an important role in supporting the delivery of the project and the NSW Government's renewable energy transition. Accordingly, the NSW Government has established the Strategic Benefit Payments Scheme for new major transmission projects. Under this scheme, landowners hosting new transmission infrastructure will be paid a set rate of $200,00 per kilometre of transmission line in annual instalments over 20 years. The payments are separate, and in addition to any compensation that is paid to landowners for transmission easements in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991.*

2.10 Future project development

It is expected that further refinement of the project's design and construction methodology would continue through the environmental approvals process and construction.

During public exhibition of this EIS, EnergyCo will undertake communication and consultation activities and the community, landowners, government agencies and other interested parties may make written submissions on the project to the Secretary of the DPE for consideration in the assessment of the project.

Following the public exhibition period, DPE will provide EnergyCo with a copy of all submissions received. EnergyCo will then consider the feedback received in these submissions and may potentially (subject to the corridor planning and project development process) consider adjustments to the project alignment and/or construction methodology. Any changes to the project in response to submissions received on the EIS would be documented where relevant, in a Response to Submissions Report and if required, an Amendment Report.

Continued design development and detailed construction planning would be undertaken at the same time as the above environmental assessment process as more detailed technical, design, constructability and environmental information becomes available. Any changes to the project design and/or construction methodology that arise due to this process would also be made available as part of an Amendment Report.

Any future project development and refinement would generally be undertaken in consideration of the tiered constraints approach that has been applied to the project development process to date.

2.11 Avoidance and minimisation of impacts

The design development of the project from the identification of the revised study corridor through to the current EIS study corridor has aimed to avoid or minimise potential impacts. Continuous refinement at each stage of project development has included identification of significant environmental constraints that would be desirable to avoid or impact minimally.

Broadscale environmental constraints criteria that have been generally applied throughout the project development process have included:

- minimising direct impacts to areas of high value biodiversity, such as listed threatened ecological communities, species and habitats
- where practicable, locating the alignment:
  - outside of areas of high value agricultural land, such as BSAL
  - at least 500 metres from existing dwellings to minimise impacts to visual amenity
  - where the alignment traverses through private property, the design has been developed with the aim of positioning infrastructure in areas that align with the current land use activities of these properties (in consultation with landowners where practicable) to minimise impacts to property and land use
  - outside of waterways
  - away from town centres and areas of higher-density residential development
  - in consideration of landowner feedback, willingness of landowners to host permanent project infrastructure within an easement on their property

- where practicable, avoiding areas identified through desktop research and field surveys containing:
  - land subject to Native Title claim (determined and unresolved)
  - Aboriginal and non-Aboriginal heritage items identified through desktop research and database searches
  - non-Aboriginal heritage items and areas of interest identified as part of field surveys
  - items and areas of Aboriginal cultural value identified as part of field surveys
  - areas of higher Aboriginal cultural heritage potential, determined through the development of a landscape-based predictive model of the archaeological resource
  - engineering and constructability constraints, such as flood prone land, high bushfire risk and steep slopes
- maximise the use of already disturbed land, used for activities such as mining land, industrial land and existing transmission line easements.

It is acknowledged that in some locations along the project alignment, a number of competing environmental and technical constraints are present which requires adopting a balanced approach to corridor planning to determine the most appropriate project alignment. Measures to avoid any residual environmental constraints that are present within the project corridor would continue through ongoing design development and detailed construction planning. Any unavoidable environmental impacts identified within the EIS study corridor have been subject to assessment as part of this EIS.

3 Project description

3.1 Overview

A summary of the project is provided in Table 3-1 and shown on Figure 3-1. Section 3.2 provides a greater level of detail about each of the key components of the project and Section 3.3 describes the operational and maintenance aspects of the project. Land access and acquisition requirements for the project are discussed in Section 3.4, and an overview of the key construction features and construction activities of the project is provided in Section 3.5.

Table 3-1 Project summary – operation

Project element	Summary	Figure reference
Project location	The project is located within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter local government areas (LGAs) and generally extends north to south from Cassilis to Wollar and east to west from Cassilis to Goolma.	Figure 3-1
Operation area	The operation area of the project would comprise the following permanent infrastructure: • a transmission line easement which would provide a right of access to maintain and operate the 500 kilovolts (kV) and 330 kV transmission lines and other operational assets • an operation area for the energy hubs at Merotherie (incorporating a maintenance facility next to the Merotherie Energy Hub) and Elong Elong • an operation area for the New Wollar Switching Station • an operation area for the 330 kV switching stations at Cassilis, Coolah, Leadville, Merotherie, Tallawang, Dunedoo, Cobbora and Goolma • access tracks along and to the transmission line easements. The operation area of the project is around 2,700 hectares, but is subject to ongoing investigation and refinement and would be finalised as part of continued design development. In particular, the operation area is expected to increase at the Elong Elong Energy Hub due to the configuration of the initial 330 kV operation.	Figure 3-2
Transmission lines	The transmission line network infrastructure that would be provided as part of the project would include: • twin double circuit 500 kV transmission lines and towers, which extend for around 90 kilometres, to connect the Merotherie and Elong Elong energy hubs to the National Electricity Market (NEM) via the New Wollar Switching Station. The Merotherie Energy Hub — Elong Elong Energy Hub connection would be built as part of this project to operate at 500 kV; however, would initially operate at 330 kV until a time when 500 kV operations at the Elong Elong Energy Hub commence • 330 kV network infrastructure around 150 kilometres in length, connecting selected renewable energy generation projects within the Central-West Orana Renewable Energy Zone (REZ) to the Merotherie Energy Hub and Elong Elong Energy Hub. This includes single circuit and double circuit 330 kV transmission lines and towers, extending from the Merotherie and Elong Elong energy hubs to nearby renewable energy generation projects • access tracks along and to the transmission line easements. These would be established initially to facilitate construction and retained for operational purposes. In some locations the 500 kV network would run alongside the 330 kV network.	Figure 3-2, Figure 3-3, Figure 3-4 and Figure 3-10

Project element	Summary	Figure reference
Energy hubs	Energy hubs are proposed at Merotherie and Elong Elong to connect 330 kV transmission lines from selected renewable energy generation projects within the Central-West Orana REZ to the project's 500 kV network infrastructure. An energy hub operating at 500 kV would typically comprise 330 kV and 500 kV switchyards, with power transformers, synchronous condensers, battery storage and maintenance facility (at Merotherie only), and other supporting equipment and infrastructure including access roads, fencing and lighting. At Elong Elong, all of the earthworks, pads, foundations and access roads would be constructed to facilitate operation at both 330 kV and 500 kV, though initially, the energy hub would only be fitted out for 330 kV operation. The configuration for the initial 330 kV operation is expected to increase the operational area at the energy hub as shown in Figure 3-2 and Appendix B. Fit out of the 500 kV switchyard would only occur when demand within the Central-West Orana REZ is met. The Merotherie Energy Hub would operate at 500 kV but not all 500 kV infrastructure would be constructed and operated until demand within the REZ is met. All earthworks, pads, foundations and access roads would be constructed to facilitate operation of the Merotherie Energy Hub at full capacity. The operation of both the temporary and full-build configurations of the energy hubs form part of this project.	Figure 3-2 and Figure 3-6 to Figure 3-7
Switching stations	Fourteen switching stations located along the 500 kV and 330 kV network infrastructure comprising: • a new 500 kV switching station at Wollar (the New Wollar Switching Station) to connect the project to the existing 500 kV electricity network • thirteen 330 kV switching stations along the 330 kV network infrastructure at Cassilis, Coolah, Leadville, Merotherie, Tallawang, Dunedoo, Cobbora and Goolma. These switching stations would transfer the energy generated from renewable energy generation projects within the Central-West Orana REZ onto the project's 330 kV network infrastructure. The switching stations along the 330 kV network may in some cases allow multiple renewable energy generation projects to have an aggregated connection to the 330 kV network infrastructure, reducing the overall length of generator connections, and would also allow for potential future connections to additional renewable energy generation projects within the Central-West Orana REZ (subject to the outcomes of the Consumer Trustee's competitive tender process for rights to access the new transmission infrastructure). Each switching station site would typically comprise a switchyard and other support equipment and infrastructure, including auxiliary service buildings, roads, drainage, fencing and lighting.	Figure 3-2, Figure 3-5 and Figure 3-8
Communications infrastructure	Underground fibre optic communications cables would be provided to monitor and control the network infrastructure and generator performance, and would generally be located within the transmission line easement between: • the New Wollar Switching Station and the existing Transgrid Wollar Substation • the New Wollar Switching Station and energy hubs • the energy hubs and renewable energy generation projects, including the connecting switching stations and the 330 kV network infrastructure. • microwave repeater structures at locations along the alignment, as well as one repeater structure off the alignment at Botobolar, to provide a communications link between the project and the existing transmission and distribution network.	Figure 3-9
Watercourse crossings	Communications infrastructure would cross around 29 watercourses through conduits installed below the watercourses. The project would not require any permanent watercourse crossings for access roads or access tracks. Temporary watercourse crossings may be required during construction where alternative vehicle access routes are impractical.	N/A

Project element	Summary	Figure reference
Operational maintenance facility	A maintenance facility would be located at the Merotherie Energy Hub to support the operational requirements of the project. The maintenance facility would be used as a base for the operation of the project and would include an office building, stores, workshop facilities, parking areas, water storage tanks, fire fighting equipment and septic tank.	Figure 3-6
Commencement of operation	Initial operations are projected to commence in late 2027 (subject to approvals and other factors).	N/A
Operational workforce	Variable with a peak operational workforce of up to 60 personnel, comprising a combination of office- and site-based roles.	N/A

The project would continue to be refined as part of continued design development. An overview of the project is shown in Figure 3-1.

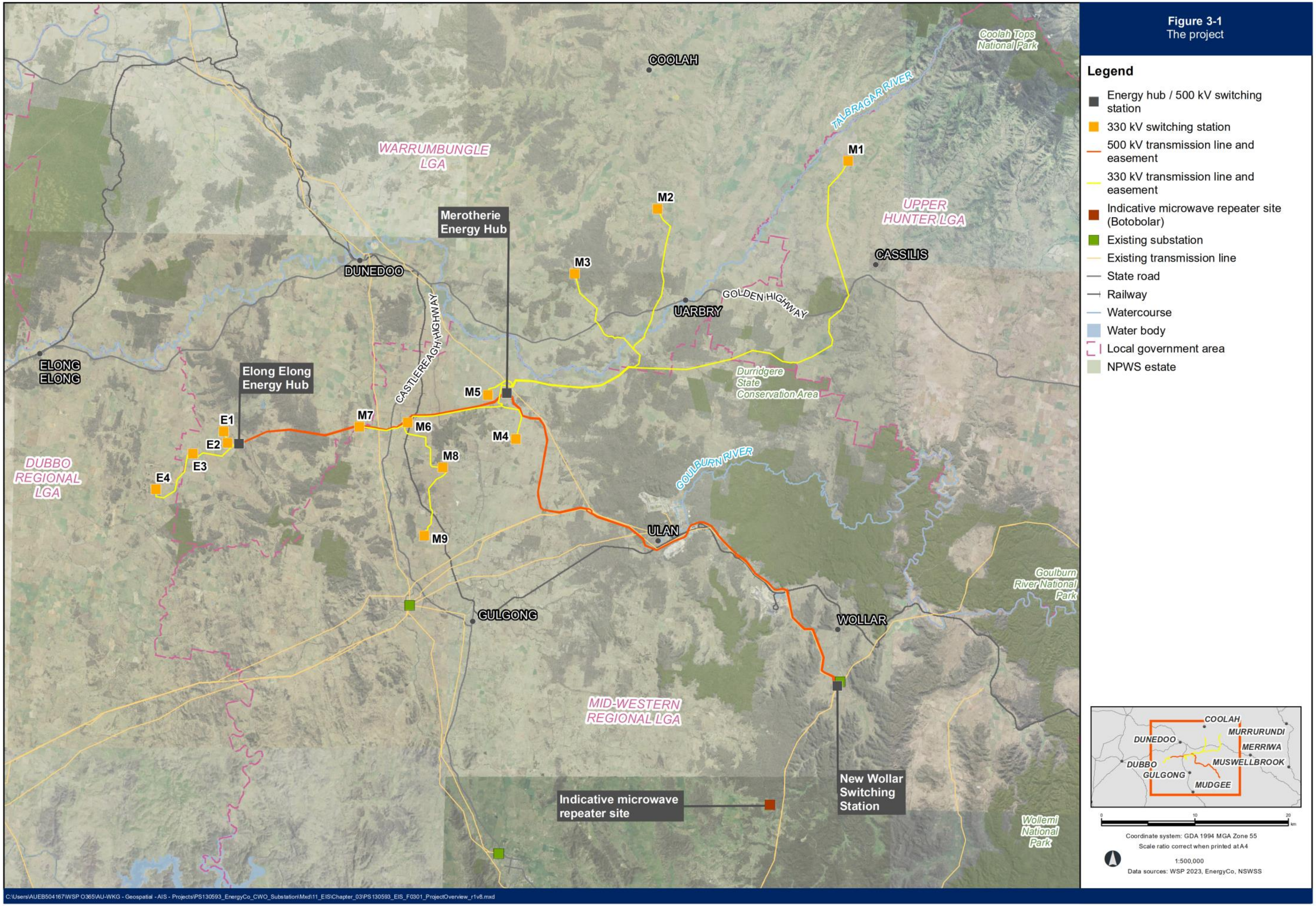

Figure 3-1
The project

3.2 Components of the project

The project would require the construction and operation of a series of double and single circuit transmission lines, energy hubs and switching stations to collect and transform power for transmission on to the existing electricity network. The permanent infrastructure of the project is described in detail in Section 3.2.1 to Section 3.2.5.

3.2.1 Transmission line alignment

The project includes a series of transmission lines, referred to as the 500 kV network infrastructure and the 330 kV network infrastructure.

The alignment of the transmission lines has been developed to avoid and/or minimise impacts on important environmental, land use and social values, where practical to do so (refer to Chapter 2 (Strategic context) for more information on project development). This has resulted in the selection of an alignment which, is located next to existing transmission line easements and travels through as much previously disturbed land where practicable, including co-locating project infrastructure with areas used for mining. A coordinated approach to transmission line connections has been adopted to minimise the number of transmission line easements between the project and renewable energy generation projects, where practicable.

An overview of the proposed transmission line alignment is shown in Figure 3-2. Additional project mapping is also provided in Appendix B (Project description mapping).

500 kV network infrastructure

The 500 kV network infrastructure would comprise twin double circuit 500 kV transmission lines that would form a transmission backbone. The 500 kV network infrastructure would connect to the existing transmission network (as part of the NEM) at Wollar via the New Wollar Switching Station. Two energy hubs along the 500 kV network infrastructure at Merotherie and Elong Elong would connect renewable energy generation projects within the Central-West Orana REZ to the 500 kV network infrastructure. The nominal length of the 500 kV network infrastructure would be around 90 kilometres and the alignment would include:

- Twin double circuit 500 kV transmission lines between the New Wollar Switching Station and the Merotherie Energy Hub (the New Wollar Switching Station — Merotherie Energy Hub connection). These transmission lines would extend from the New Wollar Switching Station for around 60 kilometres in a northwesterly direction, passing along the western edge of the Goulburn River National Park, as well as traversing the Wilpinjong, Moolarben and Ulan coal mining operations and the Sandy Hollow/Gulgong Railway. North of the mining operations, the New Wollar Switching Station to the Merotherie Energy Hub connection would mainly pass though cleared agricultural lands. The transmission lines would generally be located parallel to Transgrid's existing 330 kV transmission line (Transmission Line 79) from the existing Wollar Substation, for a distance of around 40 kilometres.
- Twin double circuit 500 kV transmission lines from the Merotherie Energy Hub to the Elong Elong Energy Hub (the Merotherie Energy Hub — Elong Elong Energy Hub connection). The Merotherie Energy Hub – Elong Elong Energy Hub connection would extend for around 30 kilometres in a westerly direction from Merotherie passing predominantly though cleared agricultural lands midway between the towns of Gulgong and Dunedoo. This section of the 500 kV transmission line alignment would cross a number of local roads, the Castlereagh Highway, and the Wallerawang – Gwabegar Railway Line. It would also extend through an area of bushland adjacent to the Tuckland State Forest on its approach to the Elong Elong Energy Hub. This portion of the 500 kV network infrastructure would initially operate at 330 kV, and would ultimately operate at 500 kV when generation from renewable energy generation projects requires it.

330 kV network infrastructure

The project would include around 150 kilometres of 330 kV network infrastructure, and would comprise a combination of single, double circuit and twin double circuit 330 kV transmission lines. The 330 kV network infrastructure would provide a connection between the energy hubs and 330 kV switching stations. The switching stations along the 330 kV network infrastructure would be designed to connect and aggregate the energy generated from renewable energy generation projects onto the 330 kV transmission line network.

The 330 kV network infrastructure from the Merotherie Energy Hub would include:

- 330 kV transmission lines extending for around 90 kilometres to the northeast to provide connections to the proposed Valley of the Winds wind farm and approved Liverpool Range wind farm. The transmission lines would initially extend in an easterly direction as twin transmission lines for around 14 kilometres before deviating to form the following connections:
  - a 330 kV transmission line extending for around 44 kilometres (referred to as the Cassilis connection), terminating at switching station M1
  - a 330 kV transmission line extending for around 20 kilometres (referred to as the Coolah connection), terminating at switching station M2
  - a 330 kV transmission line extending for around 12 kilometres (referred to as the Leadville connection), terminating at switching station M3
- a 330 kV transmission line extending for around five kilometres in a southerly direction (referred to as the Merotherie south connection) to connect to switching station M4. This would initially provide a connection to the proposed Narragamba solar farm
- a 330 kV transmission line extending to the northwest and west of the Merotherie Energy Hub for around four kilometres (referred to as the Merotherie west connection) to connect to switching station M5. This would initially provide a connection to the proposed Birriwa solar farm
- 330 kV transmission lines extending around 16 kilometres to the west of the Merotherie Energy Hub (referred to as the Tallawang west connection). The Tallawang west connection would extend west for around 11 kilometres to switching station M6 in Tallawang before continuing to switching station M7 further west. This would initially provide a connection to the proposed Orana wind farm. The majority of the Tallawang west connection would be located alongside the project's 500 kV network infrastructure
- a 330 kV transmission line extending around 17 kilometres south from switching station M6 at Tallawang (referred to as the Tallawang south connection). The connection would extend for around eight kilometres to switching station M8 to provide a connection to the proposed Barneys Reef wind farm. From switching station M8, the Tallawang south connection would continue further south to switching station M9 to provide a connection to the proposed Tallawang solar farm.

The 330 kV network infrastructure from the Elong Elong Energy Hub would include:

- a 330 kV transmission line extending for around two kilometres to the north (referred to as the Cobbora north connection) to switching station E1, to provide a connection to the proposed Cobbora solar farm
- a 330 kV transmission line extending for around 760 metres in a northwesterly direction (referred to as the Cobbora west connection) to switching station E2, to provide a connection to the proposed Sandy Creek solar farm
- a 330 kV transmission line extending for around 13 kilometres in a southwesterly direction (referred to as the Goolma connection). The connection would extend for around five kilometres to switching station E3, to provide a connection to the proposed Dapper solar farm. From switching station E3, the Goolma connection would continue southwest to switching station E4, to provide a connection to the proposed Spicers Creek wind farm.

Figure 3-2
Operational features of the project

Legend

- Operation area (including access roads and access tracks)
- Energy hub / 500 kV switching station
- 500 kV transmission line and easement
- Existing transmission line
- Road
- Railway
- Watercourse
- Water body

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:160,000
Data sources: WSP 2023, EnergyCo, NSWSS

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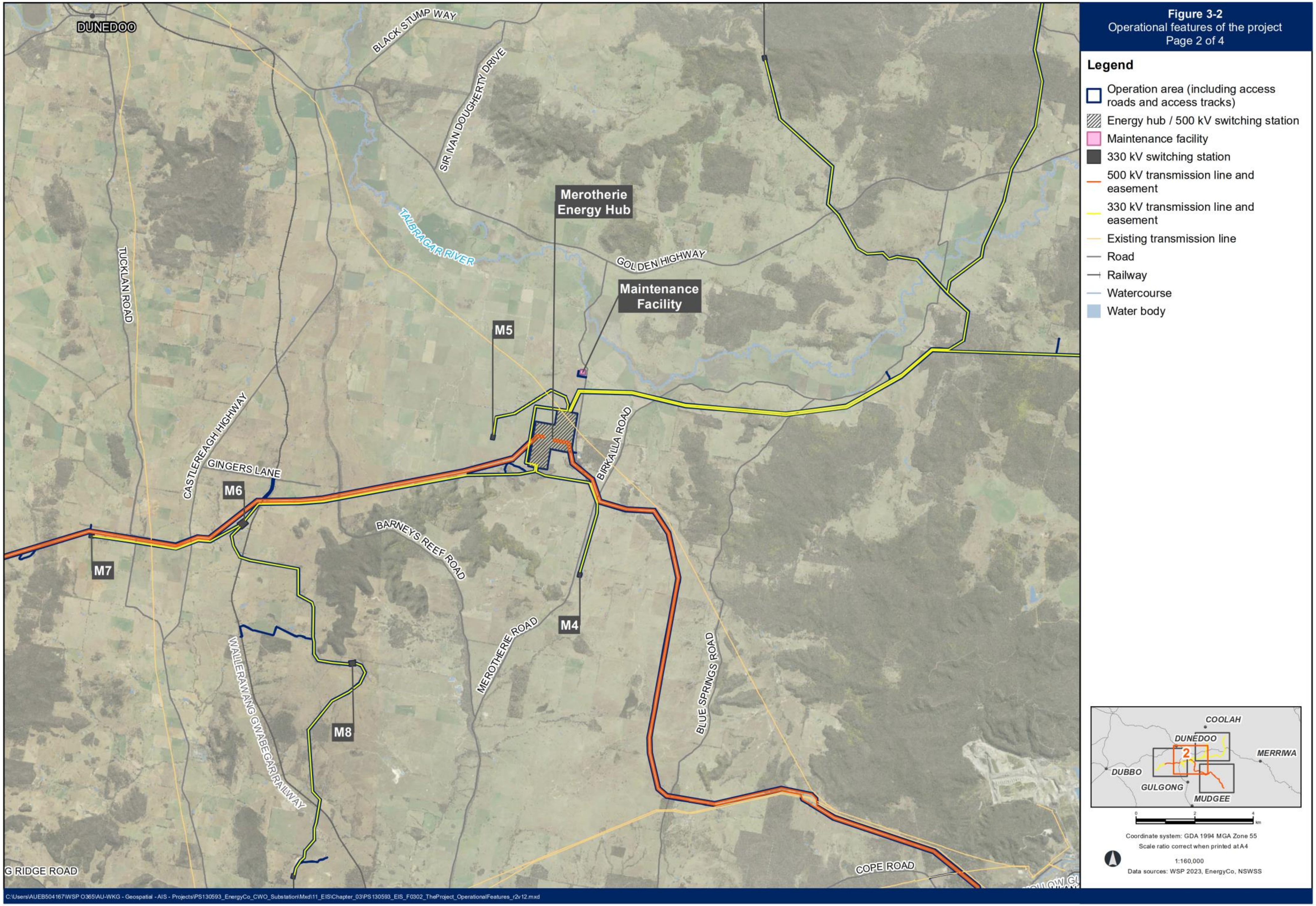
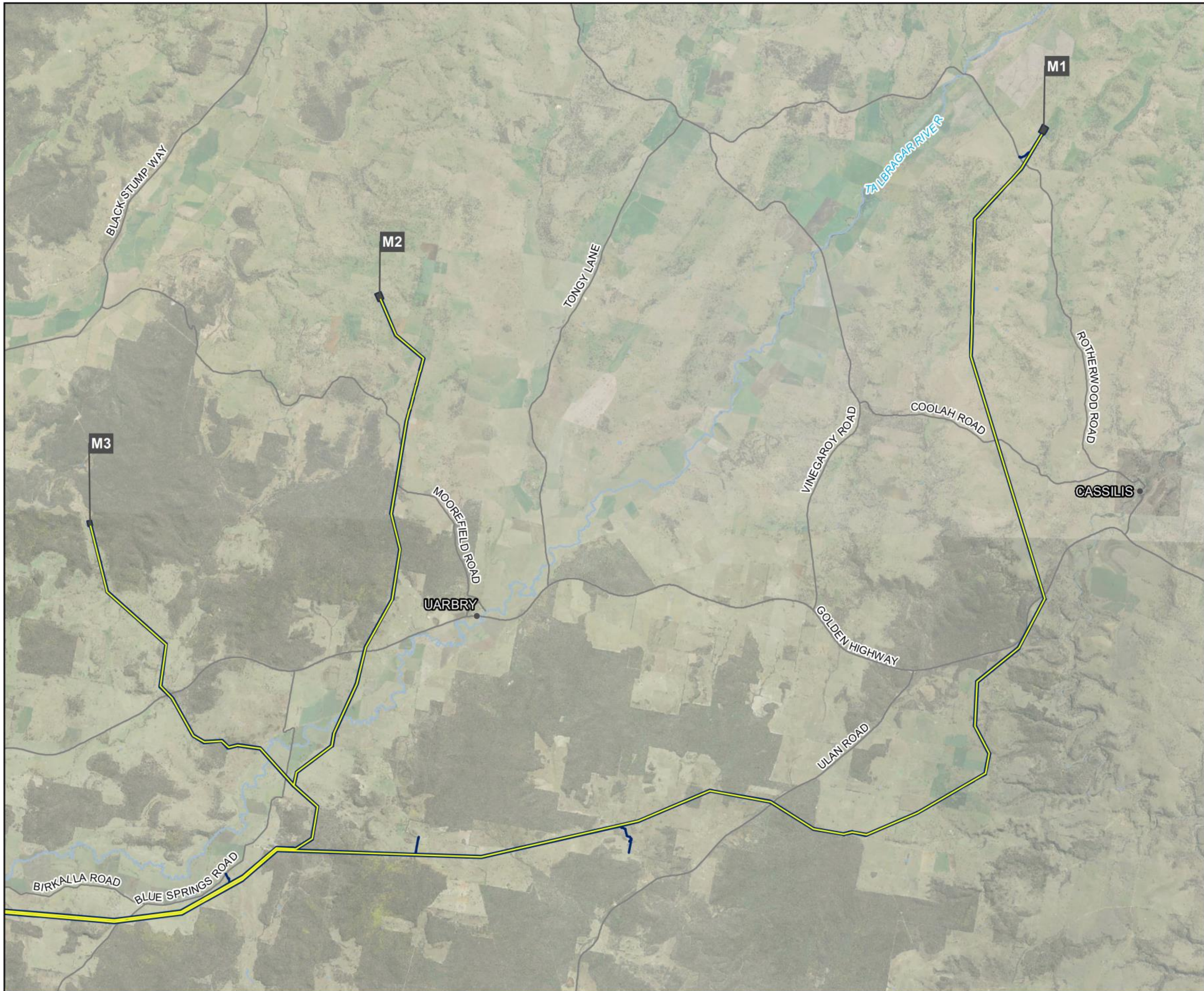


Figure 3-2
Operational features of the project
Page 2 of 4

Figure 3-2
Operational features of the project
Page 3 of 4



Legend

- Operation area (including access roads and access tracks)
- 330 kV switching station
- 330 kV transmission line and easement
- Road
- Watercourse
- Water body

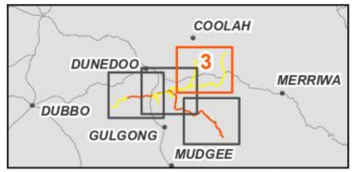


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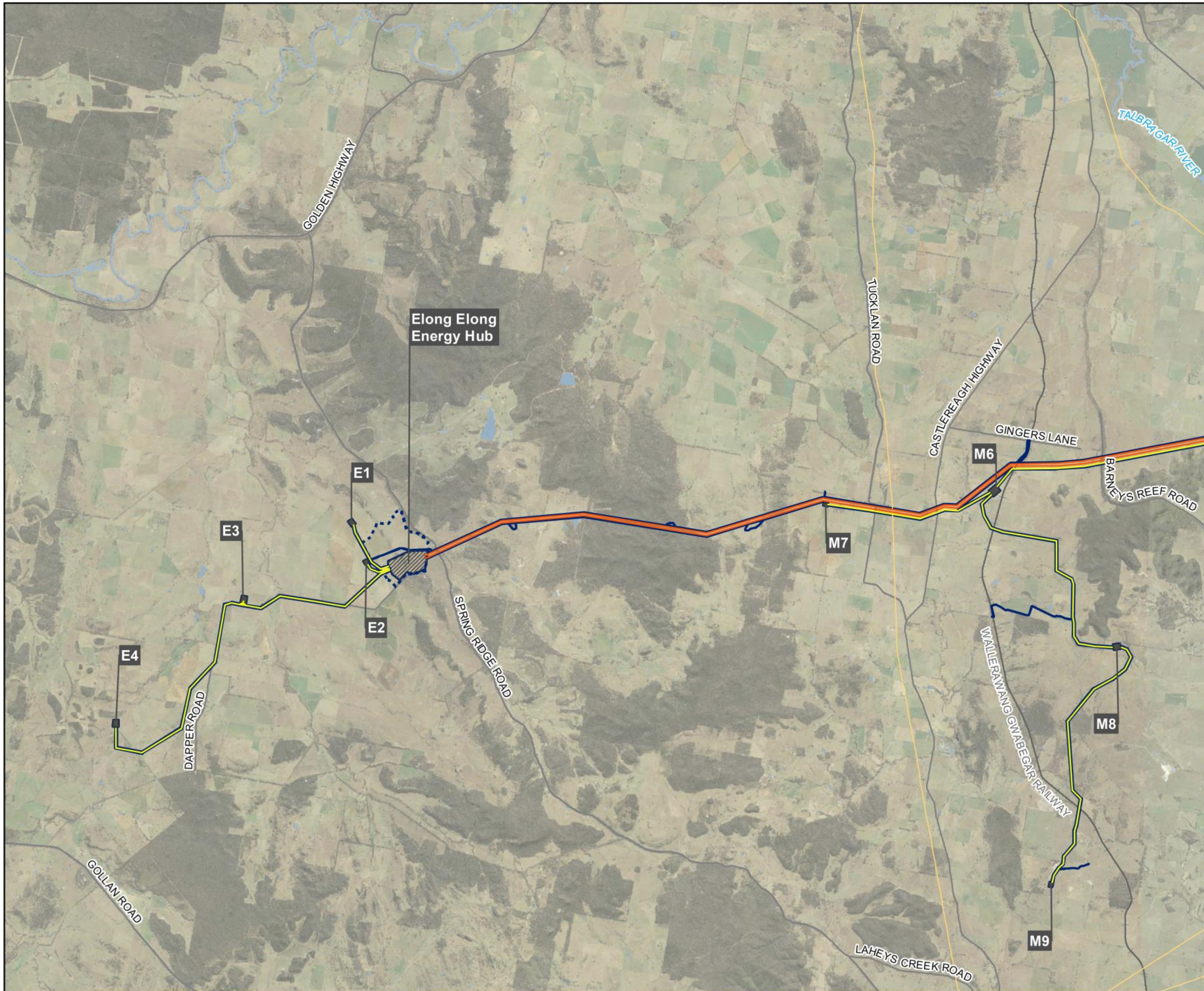
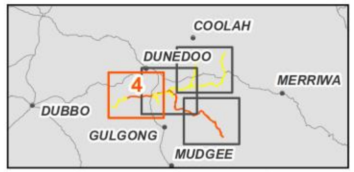
Figure 3-2
Operational features of the project
Page 4 of 4



Legend
- Operation area (including access roads and access tracks)
- Energy hub / 500 kV switching station
- Potential future expansion
- 330 kV switching station
- 500 kV transmission line and easement
- 330 kV transmission line and easement
- Existing transmission line
- Road
- Railway
- Watercourse
- Water body



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Data sources: WSP 2023, EnergyCo, NSWSS

Connections to the switching stations would be provided to renewable energy generation projects in the Central-West Orana REZ who are successful in their bids to access the transmission infrastructure through the Consumer Trustee's competitive tender process. The development of renewable energy generation projects in the Central-West Orana REZ does not form part of the project and those generation projects are subject to separate planning and environmental approvals (refer to Section 1.4). Renewable energy generators are responsible for connecting their projects to the closest switching station in accordance with their own planning approvals.

3.2.2 Transmission line towers

The 500 kV and 330 kV transmission lines would be supported on a series of transmission line towers, except for a section of the 330 kV transmission line along the Cassilis connection. This section would be supported by a combination of towers and poles, to be as consistent as practicable with the transmission line design proposed at this location when it formed part of the approved Liverpool Range wind farm project.

The final location and specification of each transmission line tower would be dependent on a range of factors such as distance between each structure, structure loading, required ground clearances, transmission line voltage, changes in direction of the transmission line route, local geotechnical conditions, topography and local environmental constraints (such as the need to avoid specific areas of biodiversity value or to span watercourses).

The type and arrangement of the transmission line towers would continue to be refined as part of the finalisation of the project design, with a view to further minimising environmental impacts within the identified transmission line easement, wherever practicable.

The transmission line tower type for the 500 kV network infrastructure would consist of free-standing steel lattice towers, comprising:

- suspension towers. This tower type is typically used for straight sections of the transmission line. It would have a typical permanent base footprint area of around 20 metres by 20 metres (or around 400 square metres).
- tension towers. This tower type is typically used where there is a change in direction along the transmission line alignment but can also be used between long runs of suspension towers. These towers typically have a wider base than suspension towers, with a base footprint of around 25 metres by 25 metres (or around 625 square metres).

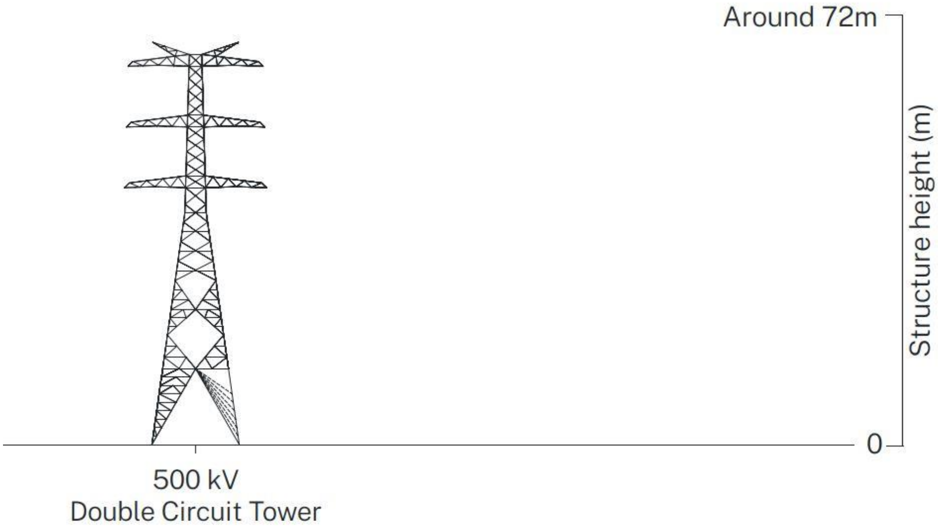
Transmission line towers for the 330 kV network infrastructure would be similar to those for the 500 kV network infrastructure, though they would have a slightly smaller footprint. Suspension towers would have a permanent base footprint of around 15 metres by 15 metres (or around 225 square metres), with the tension towers around 20 metres by 20 metres (or around 400 square metres). The final permanent base footprint would be confirmed as part of continued design development. Where poles are used along the 330 kV network infrastructure, these would typically be monopoles with a similar height to lattice towers but with a reduced base footprint of around three metres diameter. An 80 metre by 80 metre area around each transmission line tower (around 6,400 square metres) would be permanently cleared of vegetation.

Depending on local circumstances, the height of the transmission line towers would be up to around 70 metres for the 500 kV network infrastructure and up to around 65 metres for the 330 kV network infrastructure. The transmission line towers would be typically spaced at around 450 metres to 550 metres apart for the 500 kV network infrastructure and 250 metres to 450 metres apart for the 330 kV network infrastructure, though this would increase or decrease depending on constraints present along the corridor.

The number, location and type(s) of tower required would be confirmed as part of the continued development of the project design.

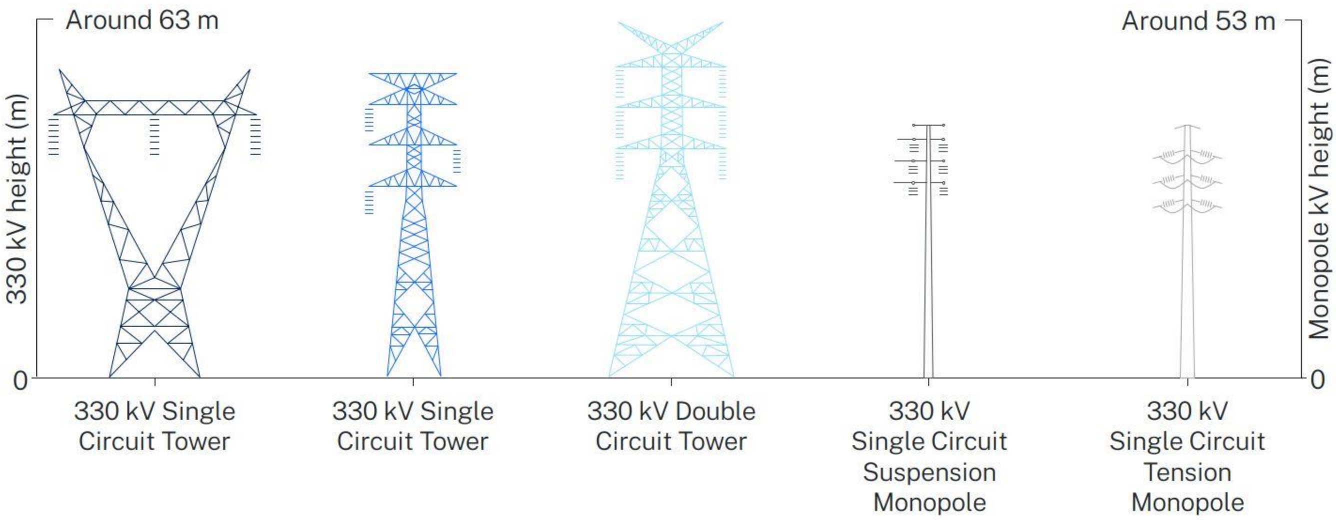
Transmission line towers will also include communications infrastructure, including optical ground wires.

The indicative concept designs for the 500 kV and 330 kV transmission line towers are shown in Figure 3-3 and Figure 3-4 respectively.



Note: Figure not to scale. Typical widths only, may vary on a case by case basis.

Figure 3-3 Indicative concept design for the 500 kV transmission line towers



Note: Figure not to scale. Typical widths only, may vary on a case by case basis.

Figure 3-4 Indicative concept design for the 330 kV transmission line towers

3.2.3 Transmission line access

Access to the proposed transmission line easements for operational maintenance would be via access tracks, running to and along the easements, and existing public and private roads.

Improvements to existing access tracks and new access tracks would be required to provide appropriate access to construction areas, and would be retained for operational purposes. Access tracks would be used by a range of heavy and light vehicles. Access tracks proposed for the project are shown in Figure B-2 in Appendix B (Project description mapping).

Existing access tracks would be used, where practicable, in order to minimise vegetation clearing and construction works (i.e. widening or grading). 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 practicable, to one route.

New access tracks and improvements to existing access tracks would be required in areas where there are no existing access tracks that are fit for purpose, or where existing conditions (such as terrain) prevents continuous access along the transmission line easement between road crossings.

Improved or new access tracks would typically be between four to eight metres wide and would generally follow the natural contour of the land as far as practicable to minimise the amount of cut and fill material and soil disturbance. New constructed access tracks would be sited to minimise vegetation clearance as far as practicable. In the case of cultivated land, it may be necessary to position new access tracks along existing fence lines or otherwise in accordance with landowner requirements.

The project would not require any permanent watercourse crossings for access tracks. Temporary watercourse crossings in the form of culverts, causeway, bridges or fords may be required during construction where alternative vehicle access routes are impractical. All watercourse crossings would be designed and installed in accordance with relevant Department of Primary Industries (DPI) guidelines for watercourse crossings including:

- *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (NSW DPI, 2003)
- *Guidelines for Controlled Activities on Waterfront Land* (NSW DPI, 2012)
- *Policy and Guidelines for Fish Habitat and Conservation and Management* (NSW DPI, 2013).

Access points to access tracks would be established along public roads, where required, and retained for the duration of construction and operation. These are shown on Figure B-2 in Appendix B (Project description mapping).

3.2.4 Energy hubs and switching stations

The project would include two energy hubs and 14 switching stations. An energy hub is a substation where energy exported from renewable energy generation projects is aggregated, transformed to 500 kV (where required), and exported to the transmission network. A switching station is a facility used to connect two or more distinct transmission lines of the same designated voltage.

A 500 kV switching station at Wollar (the New Wollar Switching Station) would transfer electricity from the project onto the existing transmission network (as part of the NEM).

Energy hubs along the 500 kV transmission network would connect the project’s 330 kV transmission lines from renewable energy generation projects within the Central-West Orana REZ to the project’s 500 kV network infrastructure.

Thirteen 330 kV switching stations would connect and aggregate the energy generated from the renewable energy generation projects onto the 330 kV transmission line network.

The locations of the energy hubs and switching stations are described in Table 3-2 and shown in Figure 3-1. Indicative layouts of the energy hubs and switching stations are shown in Figure 3-5 to Figure 3-8.

Table 3-2 Location and details of energy hubs and switching stations

Energy hub/ switching station	Description
New Wollar Switching Station (refer to Figure 3-5)	A new switching station along the 500 kV network, located around six kilometres south of the township of Wollar, and 320 metres southwest of the existing Transgrid Wollar Substation off Barigan Road. It is located in the Mid-Western Regional LGA. The New Wollar Switching Station would provide a connection point between the project and the existing transmission network.
Merotherie Energy Hub (refer to Figure 3-6)	The Merotherie Energy Hub is located next to Merotherie Road, Merotherie in the Mid-Western Regional LGA. The nearest town is Dunedoo, located around 17 kilometres to the northwest of the energy hub. The energy hub would provide a connection between the 330 kV network infrastructure from renewable energy generation projects in the Central-West Orana REZ to the project's 500 kV network infrastructure.
Elong Elong Energy Hub (refer to Figure 3-7)	The Elong Elong Energy Hub is located next to Dapper Road, Cobbora in the Warrumbungle LGA. The nearest town is Dunedoo, around 22 kilometres to the northeast. The energy hub would provide a connection between the 330 kV network infrastructure from renewable energy generation projects in the Central-West Orana REZ to the project's 500 kV network infrastructure.
330 kV switching stations (refer to Figure 3-8)	Switching stations along the 330 kV network infrastructure would connect and aggregate the energy generated from the renewable energy generation projects onto the 330 kV transmission line network. Switching stations would be located along and at the end of 330 kV transmission lines at the following locations: • Cassilis (M1) • Coolah (M2) • Leadville (M3) • Merotherie (M4, M5) • Tallawang (M6, M7, M8 and M9) • Cobbora (E1, E2 and E3) • Goolma (E4). The connection from the renewable energy generation projects to the switching station is the responsibility of each generator, and would form part of a separate planning approval(s).

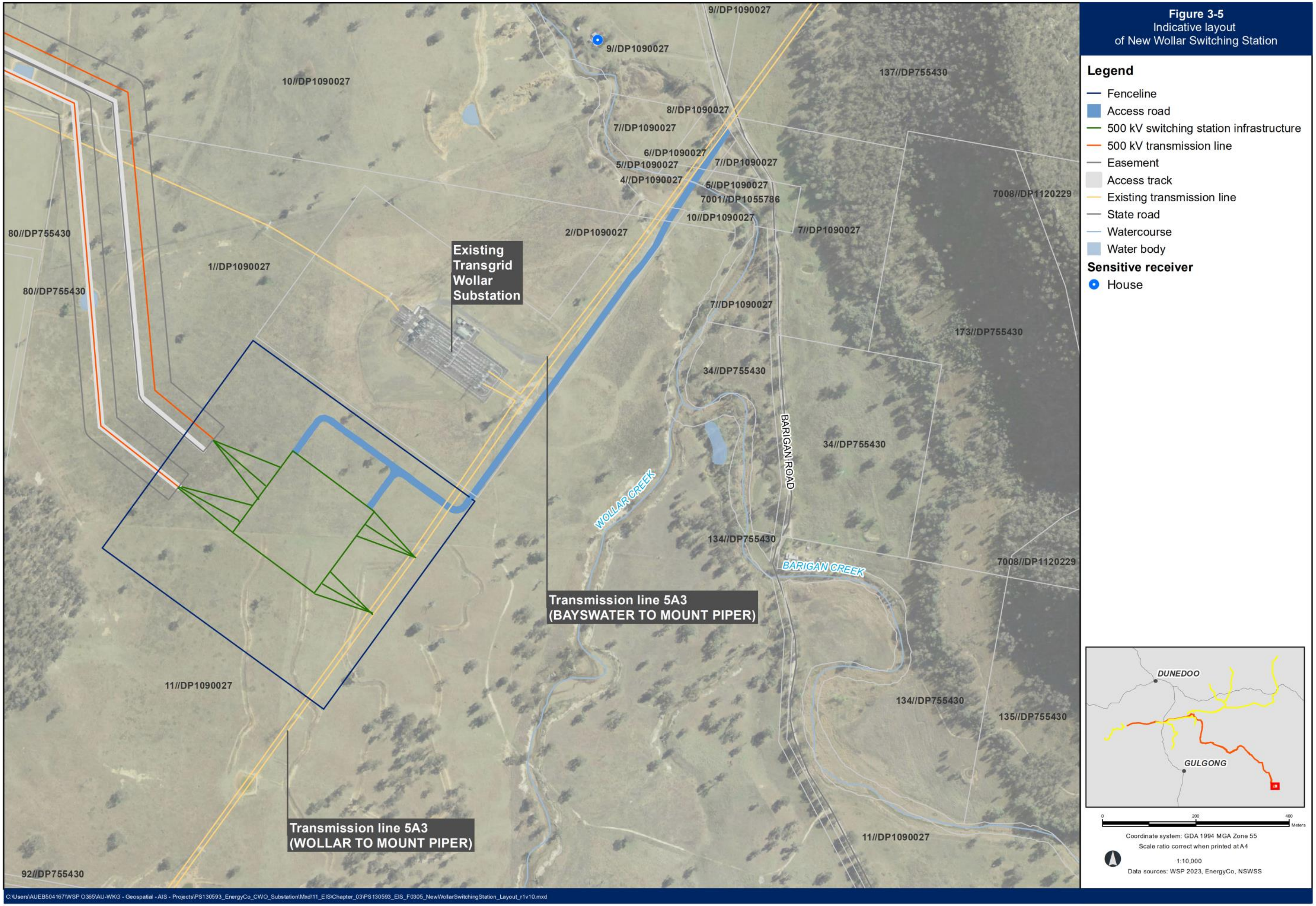


Figure 3-5
Indicative layout
of New Wollar Switching Station
Legend
Fenceline
Access road
500 kV switching station infrastructure
500 kV transmission line
Easement
Access track
Existing transmission line
State road
Watercourse
Water body
Sensitive receiver
House
Existing Transgrid Wollar Substation
Transmission line 5A3 (BAYSWATER TO MOUNT PIPER)
Transmission line 5A3 (WOLLAR TO MOUNT PIPER)
WOLLAR CREEK
BARIGAN CREEK
BARIGAN ROAD
9//DP1090027
10//DP1090027
137//DP755430
8//DP1090027
7//DP1090027
6//DP1090027
5//DP1090027
4//DP1090027
7001//DP1055786
10//DP1090027
2//DP1090027
1//DP1090027
80//DP755430
7008//DP1120229
173//DP755430
34//DP755430
134//DP755430
135//DP755430
11//DP1090027
92//DP755430
DUNEDOO
GULGONG
0
200
400
Meters
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:10,000
Data sources: WSP 2023, EnergyCo, NSWSS
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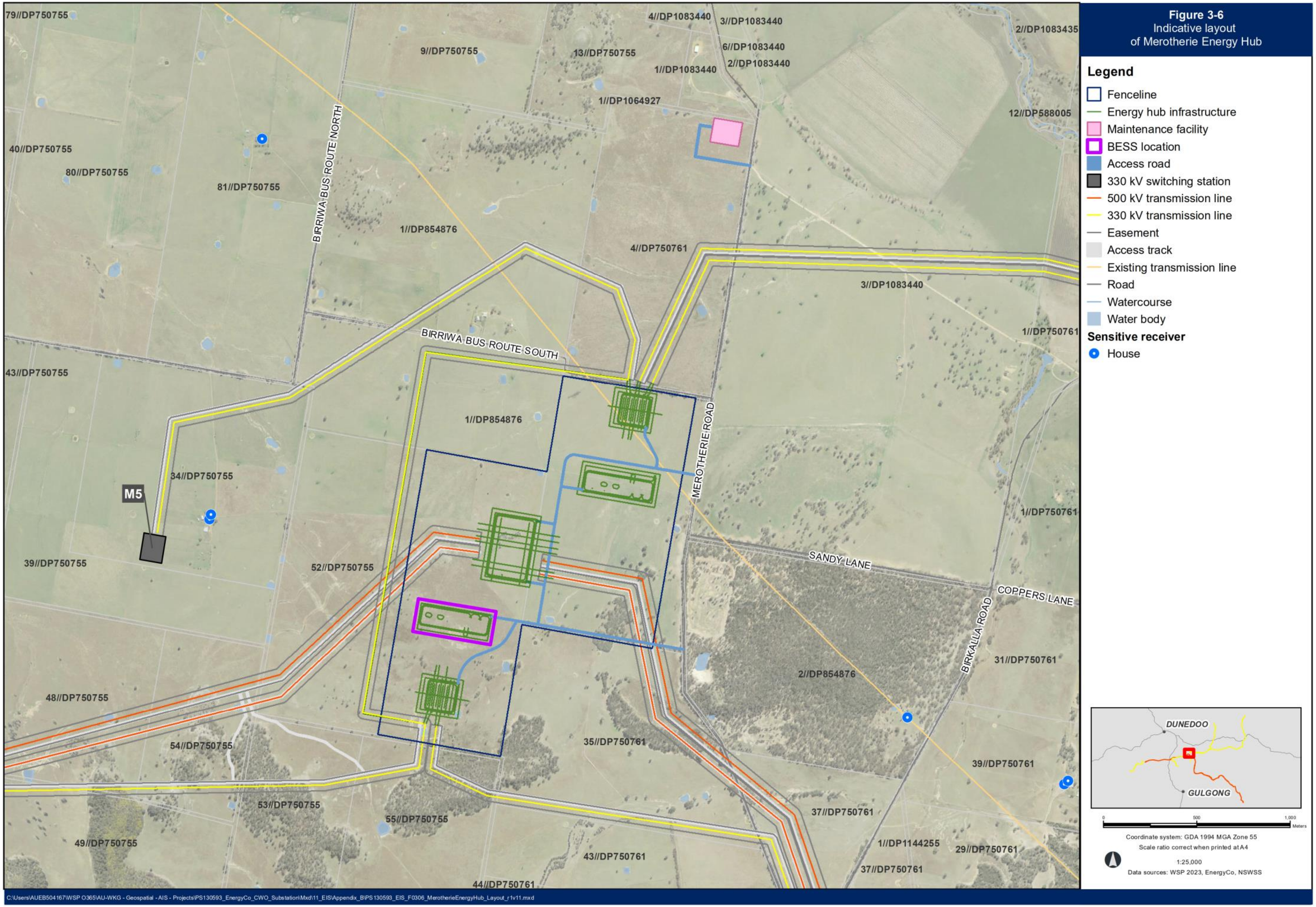
Figure 3-6
Indicative layout of Merotherie Energy Hub
Legend
Fenceline
Energy hub infrastructure
Maintenance facility
BESS location
Access road
330 kV switching station
500 kV transmission line
330 kV transmission line
Easement
Access track
Existing transmission line
Road
Watercourse
Water body
Sensitive receiver
House
M5
BIRRIWA BUS ROUTE NORTH
BIRRIWA BUS ROUTE SOUTH
MEROTHERIE ROAD
SANDY LANE
COPPERS LANE
BIRKALLA ROAD
79//DP750755
9//DP750755
13//DP750755
4//DP1083440
3//DP1083440
6//DP1083440
2//DP1083440
1//DP1083440
1//DP1064927
2//DP1083435
12//DP588005
40//DP750755
80//DP750755
81//DP750755
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1//DP750761
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52//DP750755
1//DP750761
31//DP750761
2//DP854876
48//DP750755
54//DP750755
35//DP750761
39//DP750761
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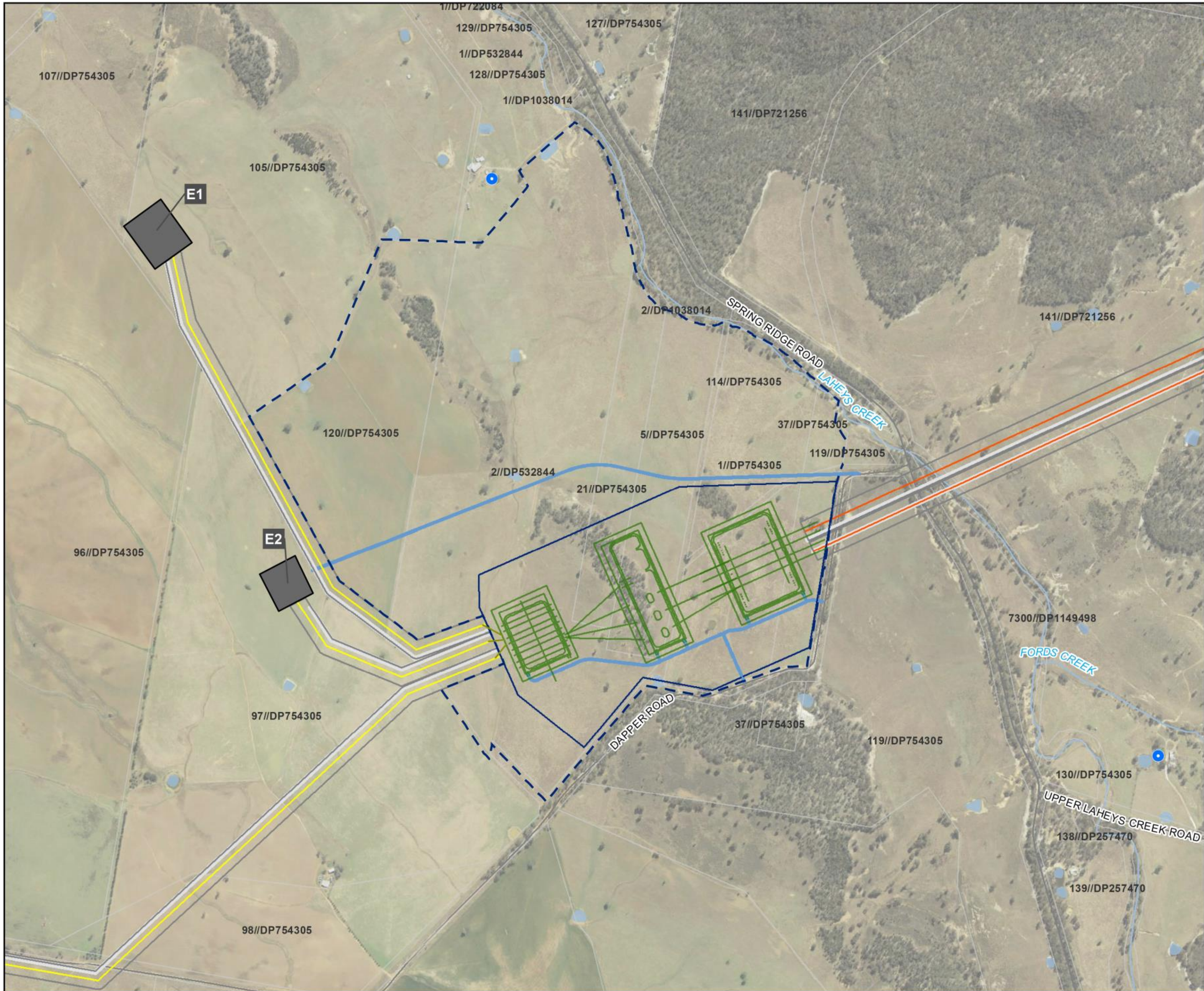
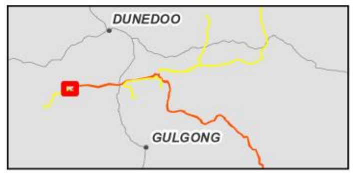
55//DP750755
37//DP750761
49//DP750755
43//DP750761
1//DP1144255
29//DP750761
37//DP750761
44//DP750761
DUNEDOO
GULGONG
0
500
1,000
Meters
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:25,000
Data sources: WSP 2023, EnergyCo, NSWSS
C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\11_EIS\Appendix_B\PS130593_EIS_F0306_MerotherieEnergyHub_Layout_r1v11.mxd

Figure 3-7
Indicative layout
of Elong Elong Energy Hub





0 250 500 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:18,000
Data sources: WSP 2023, EnergyCo, NSWSS

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Figure 3-8
Indicative layout of a typical 330 kV switching station

Key components

New Wollar Switching Station

The New Wollar Switching Station would occupy an area of around 35 hectares (inclusive of the required bushfire asset protection zone (APZ) buffer and access road) (refer to Figure 3-5). The typical infrastructure and equipment that would be installed would include:

- a 500 kV switchyard that would provide connections to:
  - the Merotherie Energy Hub via the 500 kV network infrastructure
  - Transgrid's existing Wollar Substation via the existing Transgrid 500 kV transmission lines 5A3 and 5A5 and underground fibre optic communications cabling
- auxiliary transformers that would provide low voltage alternating current for auxiliary loads for equipment within the switching station
- a range of supporting electrical components including circuit breakers, overhead conductors, busbars and gantries
- noise mitigation structures, including buildings and noise walls, if required
- control and protection systems (including relays, metering and disturbance recorder)
- control buildings to accommodate protection for switchgear and fixed portions of secondary systems (such as fire protection, security system, and air conditioning)
- oil containment system (including bunding and containment tank)
- water supply, drainage and sewer infrastructure
- a parking area.

An underground fibre optic communications connection between the New Wollar Switching Station and the existing Transgrid Wollar 500 kV Substation would be provided to support communication requirements.

The building pads that would be constructed at the New Wollar Switching Station would allow for additional switchyard infrastructure and connections for two additional 500 kV transmission lines in the future. The construction and operation of any additional 500 kV transmission network infrastructure would be subject to separate environmental assessment and approval.

Energy hubs

The energy hubs at Merotherie and Elong Elong would occupy an area of around 200 hectares and 75 hectares respectively, inclusive of the required APZ buffers, but excluding the maintenance facility at the Merotherie Energy Hub. As discussed in Section 3.1, the Elong Elong energy hub would initially be fitted out in a temporary arrangement to reflect the initial operation of the Elong Elong – Merotherie connection at 330 kV. Fit out and operation of 500 kV switchyard infrastructure at Elong Elong would occur when demand within the REZ network has been met (refer to Section 3.5.3). The operational area at the Elong Elong energy hub is expected to increase due to the configuration of the initial 330 kV operation. The operation area of the project more generally is subject to ongoing refinement and would be finalised as part of continued design development.

The construction and operation of both the temporary and full-build configurations of the Elong Elong and Merotherie energy hubs form part of this project.

The key electrical components of the Merotherie Energy Hub at full-build include:

- one 500 kV switchyard that would provide connections to the New Wollar Switching Station and Elong Elong Energy Hub (when operated at 500 kV), via the 500 kV network infrastructure
- two 330 kV switchyards that would provide connections between the energy hub and switching stations via the project 330 kV network infrastructure
- two equipment yards containing the power transformers and synchronous condensers
- four synchronous condensers, which would provide system stability and regulation of the energy collected at the energy hubs
- four transformers. The transformers would also provide connection for auxiliary transformers which would provide low voltage alternating current for auxiliary loads for equipment within the energy hub
- an option to have one 200 megawatts/400 megawatts per hour battery energy storage system (BESS)which could replace one synchronous condenser (subject to continued development of the project design and feasibility investigations). The BESS would consist of a series of containerised or stacked Lithium-ion or Lithium-ion phosphate type battery cells located within enclosures (or units) together with associated control systems. An indicative location for the BESS is shown in Figure 3-6. The design and layout of the battery would be subject to further design development and impact assessment.

The final number and configuration of each of the components would be confirmed during the detailed design phase.

The key electrical components of the Elong Elong Energy Hub at full-build include:

- one 500 kV switchyard that would provide a connection to the Merotherie Energy Hub when operating at 500 kV
- one 330 kV switchyard that would provide connections between the energy hub and switching stations via the project 330 kV network infrastructure, as well as the Merotherie Energy Hub when operating at 330 kV
- one equipment yard, containing power transformers and synchronous condensers
- three transformers. The transformers would also provide connection for auxiliary transformers which would provide low voltage alternating current for auxiliary loads for equipment within the energy hub
- three synchronous condensers, which would provide system stability and regulation of the energy collected at the energy hubs.

The final number and configuration of each of the component types would be confirmed during the detailed design phase.

The typical infrastructure and equipment that would be installed at each energy hub would include:

- a range of supporting electrical components including shunt reactors, circuit breakers, overhead conductors, busbars and gantries
- noise mitigation structures, including noise insulated buildings to enclose the synchronous condensers
- control and protection systems (including relays, metering and disturbance recorder)
- communications equipment, including microwave infrastructure
- auxiliary services and control buildings to accommodate protection for switchgear and fixed portions of secondary system (such as fire protection, security system and air conditioning)
- a backup diesel powered generator to charge batteries for the control systems
- oil containment system (including bunding and containment tank) and oil water separation facility

- water supply, drainage and sewer infrastructure
- amenities for maintenance and operational personnel
- laydown area
- workshop area
- storage for spare equipment
- a parking area.

The energy hub building pads that would be constructed as part of the project would allow for additional switchyard, transformers and/or synchronous condensers infrastructure should they be required in the future to provide additional capacity or resilience within the network. The construction and operation of the additional infrastructure would be subject to separate approvals.

Both the temporary and full-build configurations of the Elong Elong Energy Hub and Merotherie Energy Hub form part of this project.

The internal configuration of each energy hub differs according to local conditions and the type and size of renewable energy generation projects proposed to be connected to the project (refer to Figure 3-6 and Figure 3-7). The final configuration would be confirmed during detailed design.

Maintenance facility

A maintenance facility would be established near the Merotherie Energy Hub (refer to Figure 3-6), which would support the operation and maintenance of the transmission lines, switching stations and energy hubs (refer to Section 3.3) during operation of the project. Maintenance staff and personnel would be based at this maintenance facility. The single storey maintenance facility would occupy an area of around two hectares and include:

- an office, which would accommodate maintenance personnel, staff amenities, training and first aid rooms
- storage facilities, including a climate controlled electronic storeroom and storage facilities for spare parts, equipment, fleet and plant
- workshop facilities
- parking areas
- water storage tanks (including for fire fighting purposes)
- fire fighting equipment
- septic tank.

The Elong Elong Energy Hub would also include containerised workshop and storage that would be used for maintenance works and breakdown activities.

Generally, the maintenance facility would be used during standard working hours; however, 24 hour access would be provided to allow for the use of the facility during an emergency event or incident. Parking would be provided at the maintenance facility for operational personnel, and no additional off-site parking would be required.

The built form of the maintenance facility building is currently under development, however more information will be provided prior to the assessment and determination of the application. Wastewater from the maintenance facility would be stored in a septic tank and collected and transported to a council wastewater treatment plant as required.

330 kV switching stations

Thirteen switching stations would be installed along the 330 kV network infrastructure and would range in size from about four hectares to 12 hectares, (inclusive of the required APZ buffer surrounding the switching stations), depending on the size and generation capacity of the renewable energy generation projects they connect to. A typical arrangement is provided in Figure 3-8. The typical infrastructure and equipment that would be installed at each switching station would include:

- one 330 kV switchyard that would provide connection(s) to the 330 kV transmission line(s)
- auxiliary transformers that would provide low voltage alternating current for auxiliary loads for equipment within the switching station
- a range of supporting electrical components including circuit breakers, overhead conductors, busbars and gantries
- control and protection systems (including relays, metering and disturbance recorder)
- communication equipment, including microwave infrastructure
- auxiliary services and control buildings to accommodate protection for switchgear and fixed portions of secondary systems (such as fire protection, security system and air conditioning)
- a backup diesel powered generator to charge batteries for the control systems
- amenities for maintenance and operational personnel
- water supply, drainage and sewer infrastructure
- storage for spare equipment.

Auxiliary power

Auxiliary power for the energy hubs and switching stations would be accessed from Essential Energy’s existing electrical distribution network. This would be supplied to the energy hub and switching station sites from connection points on the existing 66 kV (or below) network, for which approval is sought under the CSSI application, and which would be delivered as part of the project.

The exact connection points would be determined following detailed studies undertaken by the electricity service provider. It would involve the potential construction of an above ground transmission line (poles and wires) or underground transmission line to accommodate the connection. The final routes for auxiliary power connections would be subject to detailed construction planning and determined in consultation with Essential Energy. Where practicable, the new transmission lines would be located within Essential Energy’s existing easement. It is also anticipated that some augmentation works would be required to the distribution line in accordance with the information included in the ‘Adjustments and augmentation to existing transmission infrastructure’ section below.

Safety and security

Security fencing would be installed at the energy hubs, maintenance facility and switching stations. At relevant locations within the operation area, the following safety equipment would be provided:

- closed-circuit television security cameras
- motion sensors
- temperature monitors
- outdoor lighting
- anti-climbing barriers to all transmission towers
- safety and public information signage at energy hubs, switching stations, maintenance facility and transmission line towers.

To manage the risk of fire to and from the energy hub and switching station sites and maintenance facility, a bushfire APZ would be implemented and maintained around each site (refer to Chapter 16 (Hazard and risk) and Technical paper 10 – Bushfire, for further detail on the APZ).

Lighting

Operational lighting would be provided at the energy hubs, maintenance facility and switching stations for site security and worker safety. Lighting would operate from dusk until dawn, seven days a week. The external lighting would be installed to maintain an even distribution across the sites. The lighting would be designed to minimise light spill to areas beyond the site boundary, including potential light spill on passing traffic along local roadways, sensitive receivers and local fauna. Lights would incorporate Light Emitting Diode (LED) technology, mounted on poles or buildings and would be controlled via a daylight sensor.

Exterior lighting would primarily be designed in consideration of the *Dark Sky Planning Guidelines* (NSW DPE, 2023a) and *Australian and New Zealand Standard AS/NZS 4282:19 Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019a). Other guidelines that would inform exterior lighting design include the *Australian Standard AS1158.3.1:2005 Lighting for roads and public spaces* (Standards Australia, 2005) and *Australian Standard AS2067:2016 Substations and high voltage installations exceeding 1 kV a.c* (Standards Australia, 2016).

A lighting study would be completed as part of continued design development to determine the most appropriate outdoor lighting design at energy hubs and switching stations.

The following general specifications have been assumed and are subject to further design development:

- lighting masts typically at a height of 15 metres with standard flood lights fitted to each mast, comprising a LED light of about 300 watts that would emit 52,000 lumens
- 20 lux for lighting around cubicles and marshalling boxes/kiosks, in proximity of all operating points and around the areas of control buildings
- 10 lux along access roads
- 2.5 lux within general open areas where lighting would be required.

Access roads and tracks

Access to the energy hubs, maintenance facility and switching stations would be via new and/or upgraded access roads or access tracks from private access points from the nearest public road. Access roads are private roads to provide access to the energy hubs at Merotherie and Elong Elong, the maintenance facility at Merotherie, New Wollar Switching Station and switching station E2 from the nearest public road.

The existing access road to the existing Transgrid Wollar Substation would be upgraded and extended to provide access to the New Wollar Switching Station.

Access roads would be sealed and designed to accommodate the expected vehicle movements along these roads during both construction and operation. All access roads would generally be wide enough to accommodate a traffic lane in each direction, with lanes typically between 2.5 and 3.5 metres in width.

Road drainage provisions to cater for run-off from the road surface and the immediate road corridor areas would be designed for up to a 10 per cent Annual Exceedance Probability (AEP) flood event, where practicable.

The project would not require any new permanent watercourse crossings for access roads or access tracks. Temporary watercourse crossings in the form of culverts, causeway, bridges or fords may be required during construction where alternative vehicle access routes are impractical. All watercourse crossings would be designed and installed in accordance with relevant DPI guidelines, as discussed in Section 3.2.3. Where practicable, the switching stations have been located with infrastructure from the renewable energy generation projects and, where suitable, the access road network provided under these projects would be utilised. Alternatively, switching stations would be accessed via access tracks from the access points, that run mostly within the transmission line easements, as described in Section 3.2.3.

Access points for the switching station sites (except switching station E2) would not require any adjustments to the public roads. Access points for the energy hub sites and maintenance facility would require upgrades to public roads, bridges and intersections which are intended to be assessed and determined through separate planning and approval processes (refer to Section 1.4 for more information on related development). EnergyCo intends to assess and determine these public road, bridge and intersection upgrades under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act), to allow these time critical works to be determined and commence construction prior to the determination of the critical State significant infrastructure (CSSI) application. However, the road, bridge and intersection upgrades are also included in the Environmental Impact Statement (EIS) so that in the event they are not determined under a separate planning and approval process, they can be determined as part of this project under the CSSI application.

Site access points for the New Wollar Switching Station, the energy hubs at Merotherie and Elong Elong and the maintenance facility at the Merotherie Energy Hub are summarised in Table 3-3.

Table 3-3 Site access points

Site	Site access point
New Wollar Switching Station	The switching station would be accessed from Barigan Road via a new extension and an upgrade of the existing Transgrid Wollar Substation access road (refer to Figure B-1 in Appendix B (Project description mapping)).
Merotherie Energy Hub and maintenance facility	Access to the Merotherie Energy Hub and maintenance facility would be via three new private site access points off Merotherie Road (refer to Figure B-1 in Appendix B (Project description mapping)).
Elong Elong Energy Hub	Access to the Elong Elong Energy Hub would be via two new access points off Dapper Road (refer to Figure B-1 in Appendix B (Project description mapping)).

Parking

The energy hubs, switching stations and access roads would be configured to provide adequate parking areas for workforce personnel during construction and operation of the project.

Water supply

Refer to Section 3.3.4 for a discussion on water supply to the energy hubs and switching stations.

Stormwater and drainage

Drainage infrastructure would be installed along the perimeter of each energy hub and switching station site and the maintenance facility to capture and divert runoff from the surrounding catchment away from the project infrastructure. Intercepted runoff would be diverted to existing natural watercourses or overland flow paths using appropriate dispersion/dissipation structures or drainage systems.

At energy hubs a system of kerb and guttering and drains and stormwater pits and pipes would collect and discharge stormwater. On-site detention basins may be provided where required to provide slow controlled release to the nearest watercourse, and to maintain the water quality objectives established during construction as part of the construction water quality monitoring program (refer to Section 19.1 (Hydrology, flooding and water quality)). The bench drainage system would cater for runoff from the bench surface, including switchyard and access road areas. Drainage would be provided in the bench grading to prevent inundation of the switchyard areas under a one per cent AEP flood event.

Energy hubs and switching stations would be placed on an impervious surface and would include a bunded oil containment system around transformer yards. Oil containment systems would be isolated from the stormwater drainage collection system to prevent cross-contamination and have a capacity of at least 130 per cent of the largest oil volume within the oil containment system or provide a minimum of 54 kilolitres storage (whichever is greater).

Adjustments and augmentation to existing transmission infrastructure

The project would require the adjustment and augmentation of existing Transgrid and Essential Energy transmission and distribution lines at crossing points with the new 500 kV and 330 kV transmission lines. Adjustments and augmentation would include changes to tower pole heights at locations along the following transmission and distribution lines:

- Transmission Line 5A3 (Bayswater to Mount Piper) and Transmission Line 5A5 (Wollar to Mount Piper) (Transgrid 500 kV)
- Multiple 12.7 kV, 22 kV and 66 kV distribution lines (Essential Energy)
- Transgrid Transmission Line 79 (Wollar to Wellington).

Details of the adjustments will be confirmed through detailed design in consultation with the individual asset owners.

Transgrid transmission lines 5A3 (Bayswater to Mount Piper) and 5A5 (Wollar to Mount Piper)

Transgrid's 500 kV transmission lines 5A3 (Bayswater to Mount Piper) and 5A5 (Wollar to Mount Piper) would be adjusted to provide a connection between the New Wollar Switching Station and the existing transmission network. This would require a 500 kV suspension transmission line tower and four 500 kV tension transmission line towers to connect to the Transgrid network along the eastern frontage of the New Wollar Switching Station. Two existing towers that form part of the Transgrid network would be removed. The configuration of the transmission line towers would cater for additional future twin 500 kV transmission lines to connect to the New Wollar Switching Station (refer to the New Wollar Switching Station section above).

Essential Energy 12.7 kV, 22 kV and 66 kV distribution lines

The project alignment would intersect the easements of a number of existing 12.7 kV, 22 kV and 66 kV distribution lines that form part of the Essential Energy network. At these locations, the Essential Energy distribution lines may have to be relocated above ground or below ground, to maintain minimum vertical and horizontal clearances from the proposed transmission lines. In addition, the Essential Energy network would be augmented or extended to provide auxiliary power connections to the energy hubs and switching stations. These connections are discussed in the 'Auxiliary power' section above.

3.2.5 Communications infrastructure

Fibre optic cabling

Underground fibre optic communication cables would be provided to monitor and control the network infrastructure and generator performance. The communication cables would be installed along the entire 500 kV and 330 kV transmission line easement, where practicable.

Microwave repeaters

A new microwave network would be established as part of the project to provide a secondary communications link between the project and the existing electricity transmission and distribution network. It would provide a connection to an existing microwave network that has been established by other electricity distribution providers. A new antenna pole would be established outside of the operation area at a location that would provide line-of-sight access between the New Wollar Switching Station and existing microwave towers in the vicinity of the project. Investigations are currently being undertaken to identify an appropriate location for this tower. It is anticipated that it would be located on Crown Land near Botobolar, about 14 kilometres southwest of the operation area at its closest point, near Wollar (refer to Figure 3-9). An additional tower would also be required along the alignment within the operation area, between the Merotherie Energy Hub and New Wollar Switching Station.

The new microwave towers would comprise an antenna pole, around 40 metres in height (dependent on line-of-sight requirements). The antenna would be powered by a new solar site which would be established around the base of the tower.

The preliminary locations and details of the microwave repeater sites are subject to further design development.

Figure 3-9
Microwave repeater site – Botobolar

3.3 Operation

Operation of the project would provide for the transmission of electricity generated from renewable energy generation projects within the Central-West Orana REZ onto the existing transmission network.

During operation, the transmission lines and towers, energy hubs and switching stations would be inspected by field staff and contractors on a regular basis and subject to maintenance activities. Other operational activities in the event of an emergency would also occur as required. These activities would be completed by the future Network Operator.

3.3.1 Energy transmission

Operation of the project would provide for the transmission of electricity generated from renewable energy generation projects within the Central-West Orana REZ onto the existing transmission network.

It is anticipated that electricity generation within the Central-West Orana REZ would gradually ramp up to the intended network capacity over time as generators gain access to the network and deliver their projects (subject to the outcomes of the Consumer Trustee's competitive tender process for rights to access the new transmission infrastructure). Because of this, the operation of the Elong Elong – Merotherie connection and the Elong Elong Energy Hub would commence at 330 kV, rather than 500 kV, up until a point when the demand within the REZ requires this portion of the project to operate at 500 kV. Further, the Merotherie Energy Hub would operate at 500 kV but not all 500 kV infrastructure would be required until demand within the REZ is met.

There is therefore the potential that some project infrastructure would initially be constructed in a temporary arrangement to suit 330 kV operation, and then augmented at a point when the demand with the Central-West Orana REZ requires 500 kV operations.

3.3.2 Transmission line maintenance

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

- regular inspection and maintenance of all network infrastructure (ground and aerial), including transmission lines, towers and poles, that would typically involve:
  - annual aerial inspection of the transmission lines, easements, vegetation and access tracks as part of seasonal bushfire prevention surveys
  - ground based light detection and ranging (LiDAR) and thermographic inspection of lines
  - vehicle-based patrol of access tracks and roads
  - ground based asset inspection including foundation inspections. This would typically involve two to three maintenance crews driving light vehicles along the easement (accessed from public roads and access tracks), inspecting each transmission line tower from the ground and by personnel climbing the tower
  - maintenance of transmission lines to address defects identified from inspections, using a light vehicle(s), an elevated work platform and a medium sized truck involving multiple maintenance crews to rectify any defects found from routine inspections
  - earth testing at each line structure
  - vegetation removal required to maintain appropriate electrical safety clearances to the transmission lines

- an aerial inspection and LiDAR data gathering exercise of transmission
- fault and emergency response (unplanned maintenance), that would typically involve 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 number of maintenance personnel and/or crews required to repair any damaged infrastructure would depend on the extent of repairs required.

Vegetation management

Vegetation within the operation area with growth heights of two metres and above (largely trees and shrubs) would be removed prior to and during operation, whereas native vegetation (including Derived Native Grasses and Derived Native Shrublands) with growth heights less than two metres would be retained. Where practicable, native vegetation would be retained throughout the operation area in accordance with project operational safety requirements (including bushfire risk management).

Hazard/high risk trees located inside and outside the transmission line easement would be removed. Hazard/high risk trees are defined as 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 would be confirmed based on the final 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 would be removed. To enable adequate assessment of future potential impacts on hazard/high risk trees beyond the easement the following parameters have been established for both the 330 kV and 500 kV transmission lines:

- 330 kV transmission line – hazard/high risk tree height is greater than 30 metres at the outer edge of the easement and 39.7 metres at 10 metres beyond
- 500 kV transmission line – hazard/high risk tree height is greater than 20 metres at the outer edge of the easement and 29 metres at 10 metres beyond.

Trees located outside the easement that exceed or have potential to exceed these defined hazard/high risk tree parameters include trees occurring in certain taller growing vegetation communities as defined in Section 4.2 of Technical paper 4 – Biodiversity development assessment report.

3.3.3 Energy hub and switching station maintenance

Likely operational maintenance activities at the energy hub and switching station sites would include:

- ground and vegetation management, weed spraying and inspections of fire systems and synchronous condensers
- vermin management
- inspections of switchyards and buildings, power transformers and oil filled equipment, oil water separator, protection of secondary system assets (including supervisory control and data acquisitions systems) and thermographic survey of electrical equipment
- operational exercise for electrical equipment function and minor service of 50 and 120 volts battery systems
- minor service of electrical equipment
- major service of 50 and 120 volts battery systems
- maintenance of equipment protection and control systems
- major service of electrical equipment
- ad hoc attendance by switching operators to undertake switching of infrastructure for planned and unplanned works and fault and emergency personnel to respond to equipment status alarms.

Routine infrastructure inspection activities would require around two to four personnel, and routine/planned maintenance would require around four to 12 maintenance personnel.

Ad hoc maintenance may also arise from fault and emergency works (for example through a weather event or unexpected failure of an asset). This maintenance would occur as required. The number of maintenance personnel and/or crew required to repair any damaged infrastructure would depend on the extent of repairs required.

These activities are likely to require access via light vehicles or small to medium sized plant. Any waste generated during operation would be minimal and disposed of on an 'as needed' basis to a licensed waste facility by the attending maintenance personnel.

The energy hubs would include laydown areas which would support the maintenance operations.

Equipment is expected to have a service life of around 40 to 50 years. Maintenance would be undertaken regularly 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 sites to be extended.

3.3.4 Resource use

Materials expected to be required for the operation of the project would be limited to those necessary for ongoing maintenance activities, and the operation of the energy hubs and switching stations. Resources used during operations would be associated with:

- replacement materials for electrical components at the energy hubs and switching stations such as inverters, transformers and electric cabling as required
- maintenance of access tracks and roads
- maintenance activities and use of machinery and vehicles (e.g. fuels, lubricants and metals)
- potable and non-potable water requirements
- electricity for the operation of the energy hubs, switching stations and communications facilities.

Materials

The materials described in Table 3-4 are expected to be required annually as part of continued operation and maintenance of the project. Other materials may also be required to aid in general operation and maintenance activities, and these would be confirmed as part of continued development of the project's operational requirements.

Table 3-4 Annual operational materials requirements

Material	Description/activity	Tonnes per year
Road base	Access track/road maintenance	50
Crushed sandstone (or similar)	Access track/road maintenance	50
Blue metal	Substation	15
Transformer mineral oil	Maintenance	2.5
Silica gel	Transformer/oil breather	0.1

Water

During operation of the project, about 1.7 megalitres of water per year would be required for maintenance activities, on-site staff facilities and testing of fire fighting systems and services, comprising:

- around 430 kilolitres for on-site staff facilities and maintenance activities at the energy hubs (potable water)
- around 1,100 kilolitres for vegetation management (potable or non-potable water), subject to development of a detailed vegetation management plan for the project as part of continued design development
- around 170 kilolitres for fire systems testing and fire services training (potable or non-potable water).

Measures to minimise water use, particularly of potable water, would be investigated during detailed design.

Potable water would preferentially be sourced from council owned potable water supplies in Dunedoo and Coolah (in the Warrumbungle LGA) and Gulgong (in the Mid-Western Regional LGA). Other sources would be investigated If these council owned supplies are not able to supply water to the project. Non-potable water would be sourced from rainwater harvesting and existing unregulated surface water sources, including the Upper Talbragar River Water Source, Lower Talbragar River Water Source and Upper Goulburn River Water Source, under water access licences for the project. The available water in each water source is dependent on conditions in each water source, which are dependent on the climate.

Water would be purchased and transported to the energy hubs, maintenance facility and switching stations as required, where it would be stored in water tanks.

3.4 Land requirements

The project has been designed and developed to minimise impacts on private landowners, however private land is required for the following purposes:

- temporary use of land during construction
- permanent acquisition of freehold land for the energy hubs, switching stations, maintenance facility and temporary workforce accommodation camps
- easements for transmission lines infrastructure.

Acquisitions of all interests in land would be carried out in consultation with the relevant landowner in accordance with the requirements of the *Land Acquisition (Just Terms Compensation) Act* 1991 (NSW) (Just Terms Act) and preferably resolved by negotiated agreement.

To the extent that subdivisions are required to facilitate acquisitions of part-lots, the project would also incorporate subdivisions.

Additional detail about potential impacts of the project on property during construction and operation are included in Chapter 7 (Land use and property).

3.4.1 Freehold land access and acquisition arrangements

Freehold interests in land would be permanently acquired for the energy hubs (including the maintenance facility at the Merotherie Energy Hub) and the New Wollar Switching Station, prior to construction commencing.

Land for the temporary workforce accommodation camp at Neeleys Lane, Turill has been acquired by EnergyCo.

Freehold interests in land required for the 330 kV switching stations would be temporarily leased for the duration of construction, before the land is permanently acquired for operation, based on the final footprint of the constructed infrastructure.

EnergyCo has commenced the acquisition process to acquire any construction leases, together with the underlying land required for the project, in accordance with the Just Terms Act.

The freehold land that would be permanently acquired for the project is listed in Table 3-5. The need for any further freehold land would be determined during finalisation of the project design and in consultation with relevant landowners (as required).

The proposed microwave repeater site at Botobolar is on Crown Land.

Table 3-5 Freehold land requirements

Project component	Lot/DP		Partial/full acquisition
New Wollar Switching Station	Lot 11 DP 1090027		Partial
Merotherie Energy Hub and maintenance facility	Lot 1 DP 854876 Lot 52 DP 750755 Lot 4 DP 750761 Lot 1 DP1064927		Full
Elong Elong Energy Hub	Lot 1 DP 754305 Lot 5 DP 754305 Lot 21 DP 754305	Lot 37 DP 754305 Lot 120 DP 754305 Lot 2 DP 532844	Full
330 kV switching stations	Lot 5 DP 883170 (M1) Lot 85 DP 750745 (M2) Lot 32 DP750745 (M2) Lot 12 DP 750768 (M3) Lot 47 DP 750761 (M4) Lot 34 DP 750755 (M5) Lot 51 DP 1215895 (M6) Lot 33 DP 750764 (M7)	Lot 47 DP 750767 (M8) Lot 148 DP 750762 (M9) Lot 105 DP 754305 (E1) Lot 97 DP 754305 (E2) Lot 15 DP 753405 (E3) Lot 17 DP 753405 (E3) Lot 1 DP 134329 (E3) Lot 33 DP 754302 (E4)	Partial
Neeleys Lane temporary workforce accommodation camp	Lot 61 DP 750771 Lot 62 DP 750771 Lot 72 DP 750771		Full

3.4.2 Easements

The project would require access to land for the construction and permanent operation of transmission lines. Where the transmission alignment traverses private land, access would predominately be achieved by:

- a construction easement, including temporary access and brake and winch sites
- an easement for the permanent alignment of the transmission lines, together with any accesses required to support operations.

The easements would set out how each party use the land affected by the relevant easement. The terms of the easement would, among other things, allow ongoing access and maintenance of the transmission lines to authorised entities. Landowners can typically continue to use most of the land within transmission line easements, subject to some restrictions for safety and operational reasons.

The project would also require an easement through the Durridgere State Conservation Area which would be secured in accordance with the requirements of the *National Parks and Wildlife Act 1974*.

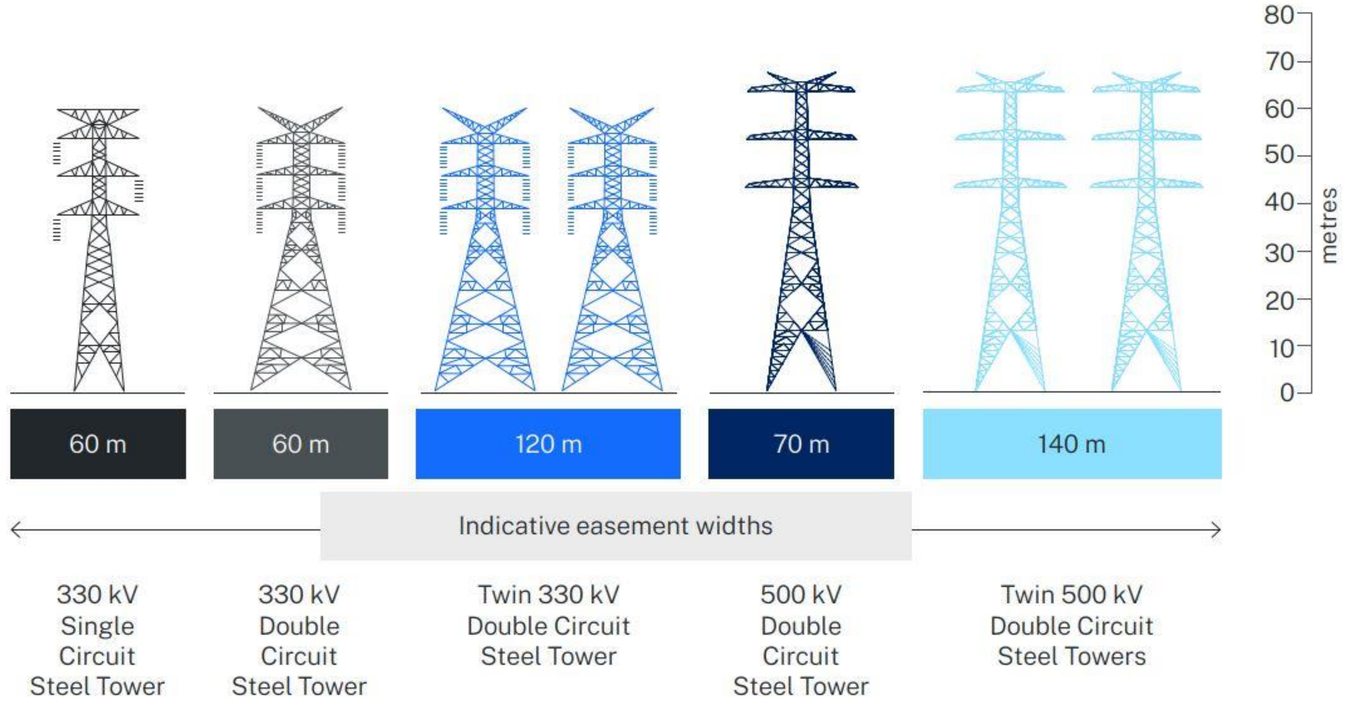
Typical permanent easement widths include:

- 70 metres for a single 500 kV transmission line
- 60 metres for a single 330 kV transmission line.

Where the 500 kV and 330 kV networks are located in the same easement, or immediately next to each other, a permanent easement width of up to around 240 metres would be required. This is expected to occur for two sections about seven and four kilometres between the Merotherie and Elong Elong energy hubs.

Figure 3-10 shows typical permanent transmission line easements for the 500 kV and 330 kV network infrastructure.

Easements on land would be established and acquired in accordance with the Just Terms Act.



Note: figure not to scale and represents indicative maximum heights and minimum easement widths. A maximum easement width of around 240 metres would occur where a 330 kV easement (60 metres) is located alongside a twin 500 kV transmission line easement (140 metres) and include gaps between the 330 kV and 500 kV networks.

Figure 3-10 Typical transmission line easements for the 330 kV and 500 kV network infrastructure

3.4.3 Operational access requirements

Access to the transmission line easement during operation would be via existing public and private roads and access tracks, and access tracks established as part of the project during construction.

In some cases, access easements may be required to allow operational access to the transmission line easement from the nearest public road. These access easements would be negotiated with landowners as necessary. Where access arrangements are in place, the future Network Operator may install lockable and signed access gates should the landowner not have a suitable nearby access gate.

3.5 Construction of the project

3.5.1 Construction overview

Key construction activities for the project would occur in the following stages:

- enabling works, being activities that occur early in the overall construction program and prior to the approval of the Construction Environmental Management Plan
- construction works associated with the energy hubs and switching station sites
- construction works associated with the transmission lines
- pre-commissioning and commissioning of the project
- demobilisation and rehabilitation of areas disturbed by construction activities.

These key stages would not necessarily take place in the order stated above and some stages may take place concurrently. The key stages are further discussed in Section 3.5.6. An overview of project construction is provided in Table 3-6, with key features shown in Figure 3-11.

Table 3-6 Project summary – construction

Project element	Summary	Figure reference
Construction		
Construction area	Around 4,000 hectares comprising the area that would be directly impacted by the construction of the project, including all project infrastructure elements (including, but not limited to, the transmission lines and towers, energy hubs, switching stations, access roads to switching stations and energy hubs, access tracks to and along easements, communications infrastructure, workforce accommodation camps, construction compounds, brake and winch sites and laydown and staging areas).	Figure 3-11
Construction program	Anticipated to commence in the second half of 2024 and be completed in the first half of 2028 (subject to approvals and other factors).	Figure 3-12
Construction workforce	Variable with a peak construction workforce of up to around 1,800 personnel.	N/A

Project element	Summary	Figure reference
Construction compounds	Construction compounds to support the construction of the project would be located at: • New Wollar Switching Station • Merotherie Energy Hub • Elong Elong Energy Hub. The construction compounds would accommodate a range of facilities including (but not limited to) staging and laydown areas, concrete batching plant and cement silo, aggregate storage, crushing, grinding and screening plant, parking areas, equipment and materials storage, maintenance sheds, generators, chemical and fuel stores, firefighting equipment, waste bins and stockpile areas, potable water tanks, wastewater treatment plants, staff facilities (office, lunch room and amenities), and helicopter landing pad and support facilities, including refuelling tanks.	Figure 3-17, Figure 3-18 and Figure 3-19
Workforce accommodation camps	Workforce accommodation camps to cater for the construction workforce would be located at: • Merotherie Road, Merotherie • Neeleys Lane, Turill. The workforce accommodation camps would provide accommodation for up to around 1,800 staff. Each workforce accommodation camp would include (but not limited to) demountable accommodation and office buildings, workforce amenities, utilities, refuelling tank, parking area and bus stop, equipment, materials and gas storage, generators, firefighting equipment and wastewater treatment plant.	Figure 3-18 and Figure 3-20
Other ancillary construction support facilities	The following ancillary construction support facilities would be required at the switching stations: • staging and laydown areas • vehicle, equipment and materials storage, maintenance sheds, generators, chemical and fuel stores, firefighting equipment, waste bins and potential stockpile areas • staff facilities (office and amenities) • parking areas • potable water tanks. Workforce amenities (including temporary bathroom facilities) would also be located within the construction area, typically along the transmission line alignment. Staging and laydown areas would be located along the transmission line and at each transmission line tower site to minimise vehicle movements to and from the construction compounds, where practicable.	N/A
Water management	Construction of the project would require a total demand of around 700 megalitres of water across the construction period, comprising of a mix of potable and non-potable water required for: • workforce accommodation camps and ancillary facilities • construction activities (such as concrete batching, dust suppression, vehicle washdown, earthworks and pavement compaction and landscaping). Non-potable water is proposed to be sourced from rainwater harvesting, reuse of construction water, treated water sources (including wastewater from the workforce accommodation camps and mine water (subject to further investigations during continued design development), existing unregulated surface water sources or regulated groundwater sources (from two new groundwater bores located at the Merotherie and Elong Elong construction compounds). Potable water is proposed to be sourced from existing regulated and unregulated surface water sources. Wastewater treatment plants would be provided at the workforce accommodation camps.	Figure B-1 in Appendix B (Project description mapping)

Project element	Summary	Figure reference
Construction routes	Construction routes to and from construction work areas, energy hubs, switching stations and workforce accommodation camps would use the public road network. These are depicted in Appendix B (Project description mapping) and discussed in Section 3.5.10. Non-standard or oversized loads would be transported from the Port of Newcastle (Newcastle) via gazetted oversize and overmass (OSOM) routes. Some material deliveries (excluding OSOM) may also be delivered to the construction area via the Sandy Hollow/Gulgong Railway (to Gulgong), subject to additional feasibility investigations. Upgrades to certain local roads, bridges and intersections may be required to enable access to construction compounds. Where road, bridge and intersection upgrade works are required, these would be addressed through separate planning and approval processes (refer to Section 1.4).	Figure B-1 and Figure B-3 in Appendix B (Project description mapping)
Aerial stringing	Helicopters and/or drones (if available and practicable) would be used for stringing of the transmission lines where ground pulled draw wire cannot be used in ecologically sensitive areas or areas with access constraints. Helicopter landing pads and support facilities, including refuelling tanks, would be located at each of the three main construction compounds at the Elong Elong Energy Hub, Merotherie Energy Hub and New Wollar Switching Station. Refuelling tanks would also be located at laydown areas along the transmission line easement.	N/A
Utility adjustments	Adjustments to existing utilities would be required where new infrastructure would interface with existing utilities. This would include protection or relocation works to utilities including communications, gas mains and energy transmission.	N/A

Figure 3-11
Overview of the project construction
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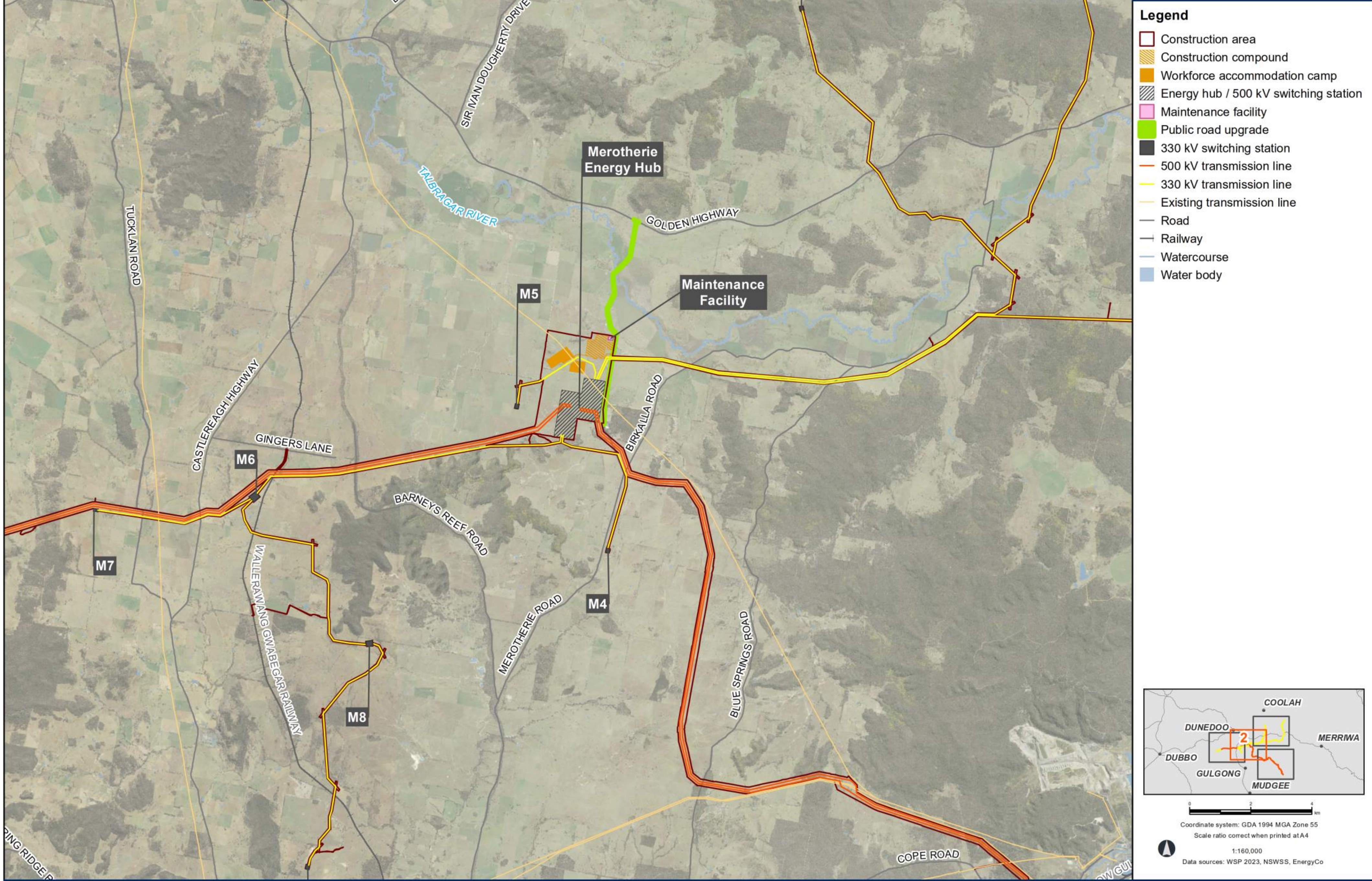
Figure 3-11
Overview of the project construction
Page 2 of 4



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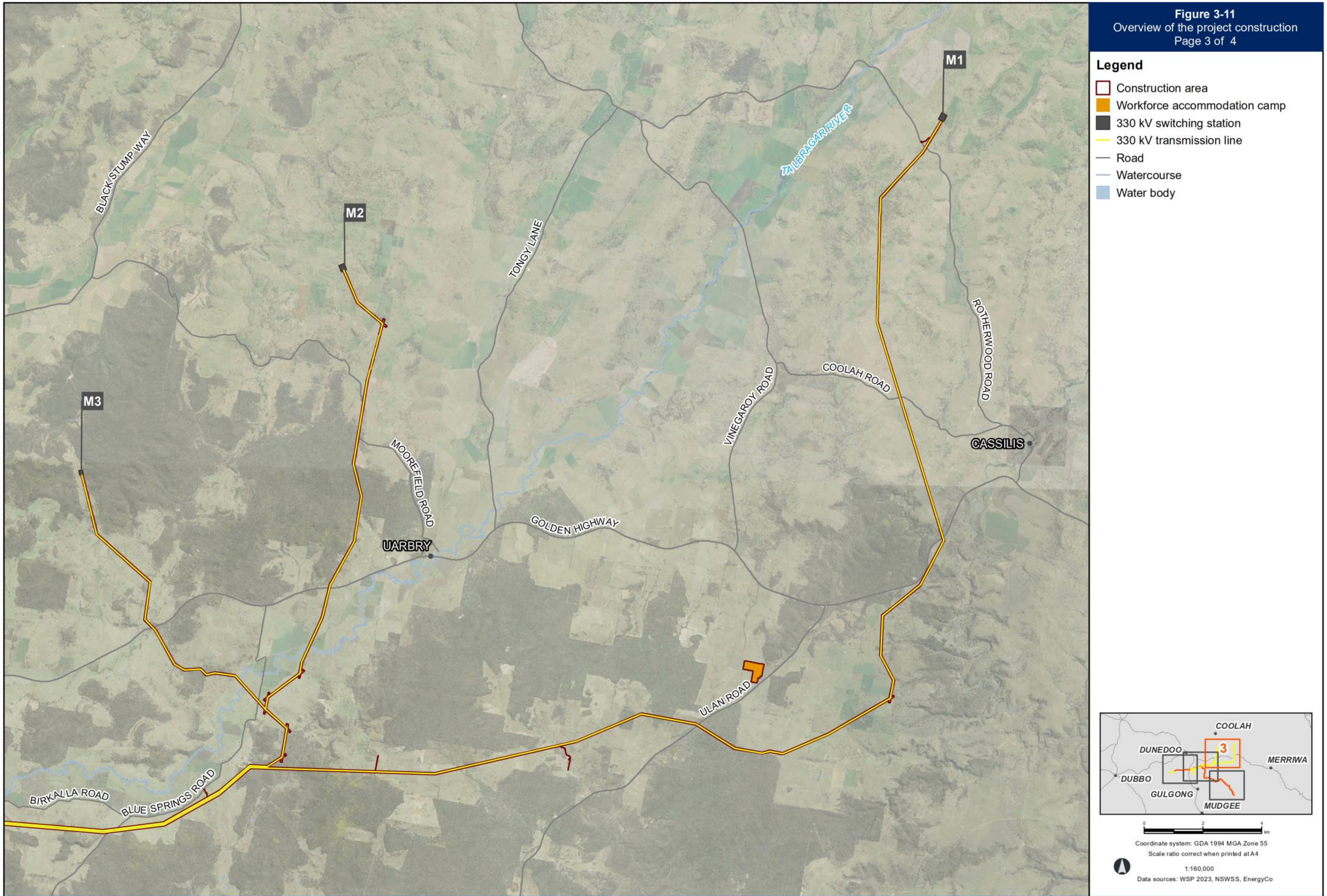

Figure 3-11
Overview of the project construction
Page 3 of 4

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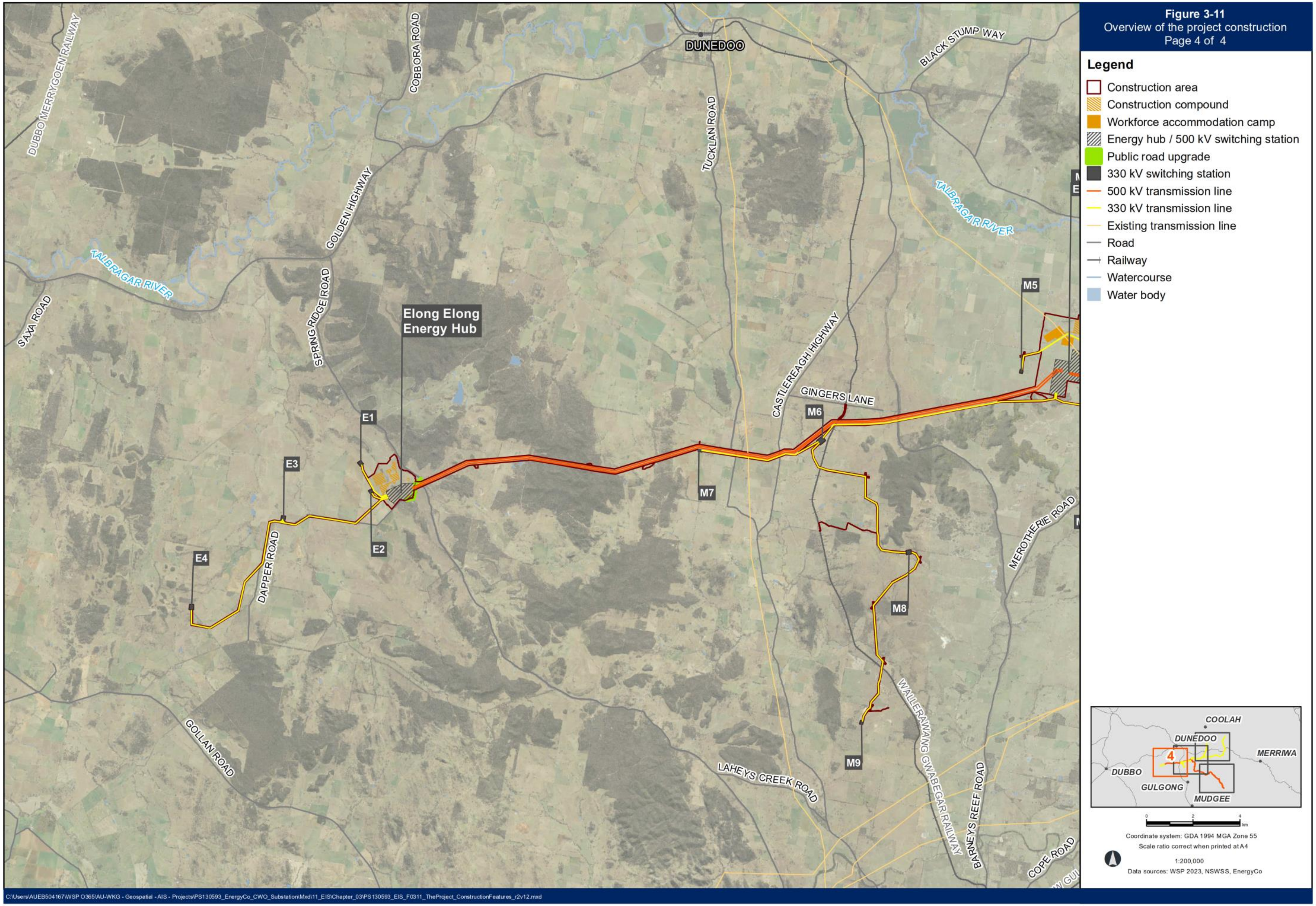

Figure 3-11
Overview of the project construction
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3.5.2 Indicative construction program

The indicative timeframe for the project is for construction to commence in the second half of 2024, for a period of around four years, with initial operations to commence by late-2027, subject to NSW Government and Commonwealth planning approvals. Construction site decommissioning and rehabilitation is expected to extend until the first half of 2028 (refer to Figure 3-12).

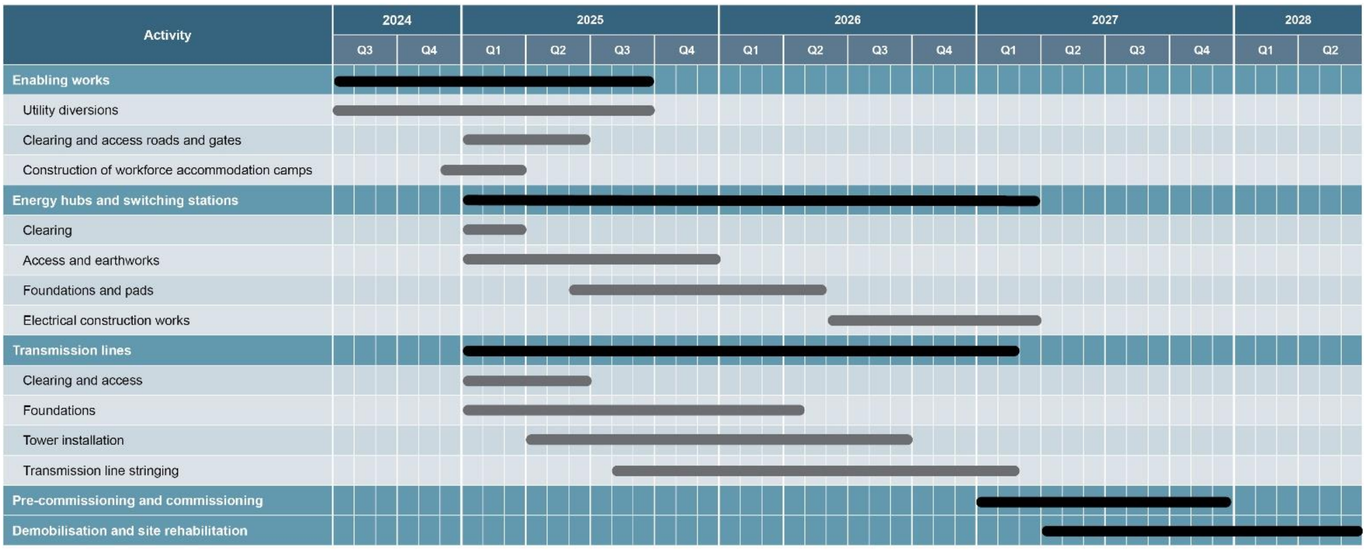


Figure 3-12 Indicative construction program

3.5.3 Construction staging

Construction of the project is planned to occur in stages and across multiple work fronts. This would mean that at any one time, construction activities are likely to be occurring at several locations within the construction area at the same time. The sequencing of construction activities and phases would be confirmed as part of detailed construction planning.

As detailed in Section 3.2, the Elong Elong Energy Hub and the Merotherie Energy Hub — Elong Elong Energy Hub connection would initially operate at 330 kV. However, as more demand is placed on this portion of the transmission line infrastructure, it is envisaged that both the Elong Elong Energy Hub and the Merotherie Energy Hub — Elong Elong Energy Hub connection would operate at 500 kV.

To facilitate this, the following staging of the project's construction is planned to occur:

- Initially, all foundations, pads and hardstand areas required for 500 kV operation of the Elong Elong Energy Hub would be constructed within the energy hub site; however, only the equipment in the two 330 kV switchyards would be fitted out with equipment. At a later date, the 500 kV switchyard within the energy hub would be fitted out with equipment. It is anticipated that the 500 kV switchyard would be fitted out with equipment and be operational to align with the timing of when the demand on the REZ network reaches a point where 500 kV operation of the energy hub is required.
- Initially, all foundations and hardstand areas required for 500 kV operation of the Elong Elong – Merotherie connection would be constructed within the Merotherie Energy Hub site; however, only the equipment for 330 kV operation would be installed, except for the infrastructure that connects to the New Wollar Switching Station — Merotherie Energy Hub connection. It is anticipated that these works would be constructed and operational to align with the timing of when the demand on the REZ network reaches a point where 500 kV operation of the Elong Elong Energy Hub is required.

- The Merotherie Energy Hub — Elong Elong Energy Hub connection would be constructed to the specifications required for 500 kV operation; however, would be operated at 330 kV until a time when 500 kV operations commence. No augmentations of this transmission line are expected as part of the transition of operations from 330 kV to 500 kV, except within the Merotherie and Elong Elong energy hub sites, where the transmission lines would need to be adjusted.

3.5.4 Construction phases

Enabling work

Enabling works are activities that occur early in the overall construction program and prior to the approval of the Construction Environmental Management Plan (and incorporating investigations and other works that can be undertaken prior to CSSI approval) to:

- facilitate the commencement of substantial construction works
- to manage specific feature or issues
- collect additional information required to finalise aspects of the design and construction methodology.

To be considered enabling works, these works must be considered of minor or low impact, and typically must not involve impact on features of high environmental or heritage conservation significance, or significant amenity impacts to nearby receivers.

Enabling works for the project would include:

- installation of fencing, gates, barricades, exclusion zones and other access controls
- property adjustment work, including adjustments to existing property fencing. Any property adjustment work would occur in consultation with the affected landowner and in accordance with the Property Management Plan for that property
- establishment of permanent and temporary environmental controls and monitoring equipment, where required
- minor clearance of vegetation (excluding threatened species and ecological communities) to facilitate other enabling works, and the relocation of salvaged habitat features
- establishment of construction compounds, interim workforce accommodation camps and laydown areas, including:
  - surface preparation required to establish construction compounds, interim workforce accommodation camps (which would be at the same location as the workforce accommodation camps) and laydown areas
  - installation/erection of site sheds, storage containers, interim workforce accommodation camps, office and associated amenities facilities. The interim workforce accommodation camps would be required to temporarily house the construction workforce (particularly early work contractors) to carry out the establishment of the final workforce accommodation camps, pre-construction works activities and early work activities. These camps would be located within the same areas identified for the construction compounds and final workforce accommodation camps (refer to Figure 3-11) and would be supported by temporary infrastructure such as portable generators, toilets and ablutions and water trucks for potable water
  - establishment of concrete batching plants
- biodiversity, heritage and other investigations, including test excavation (as required), protection, salvage, environmental monitoring and recordings
- establishment of new access tracks and upgrades to existing access tracks where required, including widening and/or grading of existing access tracks

- utility works, connections, adjustments, augmentations, relocations, and protection. This includes connections to construction compounds and/or workforce accommodation camps, where practicable
- delivery of construction plant and equipment to site and delivery of materials at laydown areas
- additional geotechnical and contamination investigations
- 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
- removal of waste from the construction area and remediation of contaminated land (if present and required)
- works to enable installation of microwave communication towers.

Transmission line construction

Construction of the transmission lines, including the towers and stringing activities, would take place within a temporary easement typically about 220 metres wide, but around 260 metres wide where the 500 kV and 330 kV networks are located immediately next to each other. This easement would then be permanently reduced for operation of the project in accordance with the widths described in Section 3.4.2. Construction of each transmission line tower would include the following key steps:

- site preparation, including survey, access, vegetation clearance and earthworks
- construction of transmission line tower foundations and earthing grids
- transmission line tower assembly and installation
- stringing.

Based on the final construction staging of the multiple crews working across multiple work fronts, there may be periods of inactivity between the abovementioned key construction activities for each transmission line tower.

Energy hub, maintenance facility and switching station site construction

Following a period of enabling and site establishment works, as described above, the construction methodology for the energy hub, maintenance facility and switching station sites would typically consist of the following key activities (depending on the site specific electrical infrastructure requirements):

- establishment of suitable access
- earthworks and site preparation, including:
  - removal of vegetation and topsoil
  - bulk earthworks to form the energy hub, maintenance facility or switching station pad, including excavation, and leveling of the site, placement and compaction of fill, and preparation of the site for concrete foundations
  - blasting, depending on geotechnical conditions (to be confirmed as part of continued design development, and subject to further assessment)
- civil construction works, including:
  - construction of hardstand areas
  - construction of access roads
  - installation of reinforced concrete and piled foundations for the electrical equipment
  - installation of protective walls around transformer areas

- — trenching of electrical equipment conduits and general site drainage works
  - — bund construction
  - — construction of prefabricated ancillary buildings, equipment control buildings and acoustic sheds, as required
- mechanical and electrical fitout, including:
  - — erection of galvanised steel towers to support electrical equipment, using cranes
  - — installation of electrical equipment on foundations, including transformers and synchronous condensers (at energy hubs)
  - — installation of site wiring and electrical control equipment within the control buildings
  - — installation of trenches and cabling
  - — at New Wollar Switching Station, installation of an underground communications cable between the new switching station and the existing Transgrid Wollar 500 kV Substation
- finishing works, including:
  - — erection of the boundary security fence, including site access gates
  - — surfacing and stabilising works for access roads
- commissioning.

Pre-commissioning

The pre-commissioning process would commence in the final stages of construction. Pre-commissioning is required to ensure construction has been undertaken in accordance with the design and statutory requirements and is safe to operate.

Key activities undertaken during pre-commissioning include:

- testing and commissioning of the equipment at the energy hubs, maintenance facility and switching stations
- point to point testing of the connections of the transmission lines, energy hubs, maintenance facility and switching stations
- earthing testing
- high voltage testing
- high voltage equipment operational checks
- connection to the existing NSW transmission network
- protection, control, and metering system and communication system testing
- operational readiness and safety checks.

Commissioning

Following all testing, operational readiness checks and connection of the New Wollar Switching Station to the existing NSW transmission network, the commissioning of the project would commence. Commissioning is planned to start a year prior to the commencement of operation and would be a staged process. This would include:

- connecting the New Wollar Switching Station to the existing NSW transmission network
- commissioning of the New Wollar Switching Station
- energisation of the New Wollar Switching Station — Merotherie Energy Hub connection 500 kV transmission lines
- progressive commissioning of the Merotherie Energy Hub

- progressive commissioning of the 330 kV network infrastructure connecting Merotherie Energy Hub to the surrounding renewable energy generation projects
- energisation of the Merotherie Energy Hub — Elong Elong Energy Hub connection 500 kV transmission lines (operating at 330 kV initially)
- progressive commissioning of the Elong Elong Energy Hub
- progressive commissioning of the 330 kV network infrastructure connecting Elong Elong Energy Hub to the surrounding renewable energy generation projects
- supporting the connected renewable energy generation projects to undertake their own test and commissioning activities
- end to end testing of communication and control systems between the Central-West Orana REZ and the REZ control room, AEMO control room and Transgrid control rooms
- audible noise, thermographic imaging and electric and magnetic field (EMF) testing.

Demobilisation and construction site rehabilitation

Following infrastructure completion, demobilisation and construction site rehabilitation would be carried out progressively along sections of the transmission lines, including tower locations, and at energy hubs, the maintenance facility and switching stations. This phase of work would include:

- removal of all construction plant and equipment, and all materials not required during operation, including any remaining waste material
- removal and/or handover of construction compounds and workforce accommodation camp sites to EnergyCo
- removal of any temporary site buildings and temporary environmental controls
- rehabilitation works, including rehabilitation of construction areas, compounds and workforce accommodation camps, irrigation and water infrastructure facilities, natural drainage in areas where temporary facilities were provided, fences, gates and other agricultural infrastructure which may have been damaged during construction. Land subject to a temporary lease agreement would be rehabilitated to its pre-existing condition where feasible and reasonable
- in other non-operational locations, site restoration would be undertaken to make good any disturbances caused during project activities.

3.5.5 Construction hours and workforce

Construction of the project would be generally be carried out during recommended standard hours as defined by the *Interim Construction Noise Guideline* (NSW Department of Environment and Climate Change (DECC), 2009) (ICNG):

- Monday to Friday between 7 am and 6 pm
- Saturday between 8 am and 1 pm
- no work on Sundays or public holidays.

Construction of the project would also be undertaken outside of the recommended standard hours (out of hours work), as detailed below.

Out of hours work

Due to the remote nature of the work, and the requirement to accommodate a rostered fly-in fly-out and drive-in drive-out workforce, construction hours would occasionally be extended across a seven-day work week between 7 am and 7 pm. To support construction activities during these extended hours, operation of the main construction compounds would also be required.

Where sensitive receivers are noise affected during extended construction hours (that is, where construction noise is above the noise management level (refer to Chapter 15 (Noise and vibration)), and the works cannot be undertaken during standard work hours, mitigation measures would be implemented through an out of hours work protocol.

The workforce accommodation camps would be operational 24 hours a day, seven days a week to provide accommodation for the workforce.

In addition, the following out of hours work would be required at certain locations within the construction area to satisfy third party or safety requirements or to accommodate specific long lead items:

- stringing of transmission lines across a main road or railway
- transmission line construction within areas currently forming part of mining operations, to coordinate works with 24/7 mining operations
- where road occupancy licences are required
- transmission line cutover or commissioning
- the delivery of equipment or materials as requested by police or other authorities for safety reasons (such as the delivery of transformer units)
- oil filling of the transformers at energy hubs
- 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 am for early pours)
- any works that do not exceed the applicable noise management levels in accordance with the ICNG.

During detailed construction planning, a program would be developed to identify the required night work periods (including dates and durations). Except for emergencies, out of hours works would be carried out in accordance with an out of hours protocol and would not take place outside construction hours without prior notification in line with that protocol (refer to Chapter 15 (Noise and vibration)).

Construction workforce

The construction workforce would vary depending on the stage of construction and associated activities. During the peak construction period, it is expected around 1,800 full time equivalent construction workers would be employed. The peak construction workforce is expected to occur in the second half of 2025. This is attributed to concurrent construction works being completed for civil construction and electrical construction works across three key construction phases (the enabling works, energy hubs and switching stations, and transmission line construction activities).

3.5.6 Construction methods

Site preparation

Site preparation works would be required at the energy hub, maintenance facility and switching station sites and at each transmission line tower site. Typically, site preparation activities would include:

- vegetation clearing and mulching, where required
- earthworks (including blasting, if required) for levelling of the ground surface, bench sites (including the laydown and storage area), drainage and/or grading and construction of access tracks from public roads to the easements (where required). Earthworks activities would also include placement and compaction of fill, and preparation of the site for concrete foundations.

Vegetation clearance

The approach to vegetation clearance within the construction area has been adopted to provide as realistic an assessment as possible and avoid a ‘worst case’ approach, as doing so for this environmental aspect would result in a substantial overestimation of the likely biodiversity impacts of the project. The approach to the assessment of potential biodiversity impacts and a detailed description of the vegetation clearance strategy that has been applied to the project is provided in Chapter 6 (Approach to impact assessment).

Vegetation clearance within the construction area would be confirmed during finalisation of the project design and construction methodology and would be developed with the aim of avoidance and minimisation of potential impacts to biodiversity, where practicable.

Earthworks

Excavation and the establishment of hardstand areas would be required to provide a level platform for equipment setup, and/or the erection of the tower and other construction activities. This would require the use of earth moving equipment such as graders, excavators, dozers, dump trucks and rollers.

Where excavation is required for hardstands, pads and access roads, excavations would typically be up to around 1.5 metres below ground level (bgl) (subject to site topography and geotechnical conditions). In areas where groundwater is shallow, alternative construction methodologies and designs may be implemented to limit interaction with groundwater during excavation and to avoid or minimise the need to dewater. If groundwater is encountered during excavation, dewatering would be undertaken and managed as appropriate.

The construction area traverses land within the Wilpinjong Coal Mine (owned by Peabody), including an area known as Pit 4. Pit 4 has been previously mined and backfilled with materials potentially containing high carbon material (HCM), and low-level coal, which carries a risk of spontaneous combustion if not handled appropriately. HCM is likely to be encountered at a depth of greater than one metre below the ground surface. Once excavated, HCM cannot be used as surface fill material and cannot be capped with topsoil and rehabilitated. It must be buried within the mine within specific areas in accordance with the Spontaneous combustion management plan for the Wilpinjong Coal Mine (refer to Section 19.2 (Soils and contamination)). Prior to excavation in these areas, soil testing would be carried out to confirm the presence of HCM. Appropriate safeguards and management measures as outlined in Chapter 21 (Environmental management) would be implemented to ensure the appropriate handling and treatment of HCM on-site.

Excavated material that does not contain HCM would be stockpiled and tested to determine its waste classification and potential beneficial reuse. Excavated material suitable for reuse would 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 rehabilitation. 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 its waste classification.

Blasting

Controlled blasting may be required in areas of shallow bedrock or hard geological conditions, to loosen and break up existing rock. There is the potential for this to be required at the Merotherie and Elong Elong energy hubs, switching stations and small areas along the transmission line alignment. This would most likely include the Cassilis, Coolah, Leadville and Merotherie Energy Hub — Elong Elong Energy Hub connections, based on the current understanding of geotechnical conditions. Areas requiring blasting would be confirmed during detailed construction planning.

Controlled blasting typically involves pre-drilling a series of closely spaced holes which are loaded with a small amount of explosives that are then detonated to break the rock into removable pieces. Following controlled blasting, rock material would be excavated using standard construction plant and equipment. The controlled blasting technique to be used would be confirmed during detailed construction planning and may be adjusted during construction, depending on the success of the initial blasting activities.

Where practicable, the excavated material from blasting would be reused to construct the pads for the energy hubs, maintenance facility, switching stations, transmission tower foundations or aggregates road base to be used on the project, to minimise the volume of imported fill material required.

Construction of transmission line tower foundations

Transmission line tower foundations would typically consist of pile foundations along the transmission line alignment. Alternative foundation designs would be required at some locations due to the anticipated geotechnical conditions. An example of this would include the foundation for a tower base in a rehabilitated open cut mining area, comprising uncontrolled backfill.

Transmission line tower piles would typically consist of bored, cast in situ piles with reinforced concrete. Pile depth would typically range from between five metres bgl to 20 metres bgl, though this would vary significantly based on the depth at which rock is encountered. Piles would typically range in diameter between 600 millimetres and 1,800 millimetres, though this would depend on the type of tower and the geotechnical conditions encountered (e.g., greater piling depths would be required where soft soil types are present), and the type of transmission tower required.

Monopole foundations would generally comprise bored piles, up to four metres in diameter, which would be socketed into rock, depending on geotechnical conditions. Where rock is encountered at shallow depths, alternative foundation designs may be utilised that include rock and strand anchors.

If groundwater is encountered during piling, dewatering would be undertaken and managed as appropriate. Dewatering may also be required during the concrete pour process. Concrete would be poured into the excavated pile, and water removed from the pile as it is displaced by the concrete.

Tower foundations in mining rehabilitation and mine subsidence areas

The New Wollar Switching Station — Merotherie Energy Hub connection that forms part of the 500 kV network infrastructure would require the construction of tower foundations within the three mining areas, including rehabilitated areas as well as areas of potential mine subsidence within the Mudgee Mine Subsidence District. The transmission line easement would be outside of mining operational areas, except at the Moolarben Coal Mine.

An assessment of predicted subsidence has been completed for the areas of the project that traverse the Mudgee Mine Subsidence District. This assessment has indicated that subsidence within the Mudgee Mine Subsidence District is not expected to impact or affect the project's infrastructure during construction and/or operation. Consultation with the Subsidence Advisory NSW has been undertaken as part of this process. Consultation with Subsidence Advisory NSW will continue throughout the detailed design and construction phases if any significant design changes are proposed for the portion of the alignment through the Mudgee Mine Subsidence District.

The main issues associated with transmission tower foundations on infilled pits in rehabilitated mining areas relate to differential settlement and constructability, as pits are typically filled with highly variable soil and rock materials derived from mining. These materials are generally not placed or compacted in a controlled manner and may contain voids and boulders. In addition, some areas may have also been used as tailings dams.

Within the rehabilitated open cut mining areas, the design of the project has considered the potential impacts of settlement on project infrastructure. For towers over areas previously subject to mining it is possible that cruciform foundations may be adopted in some areas rather than piles (refer to Figure 3-13). This would be further investigated and confirmed as part of continued design development The design of project infrastructure within these areas would continue to be refined as part of continued design development. The location of the 500 kV network infrastructure relative to the Mudgee Mine Subsidence District and areas of mine subsidence risk associated with the Moolarben, Ulan and Wilpinjong mining operations are shown in Figure 3-14.

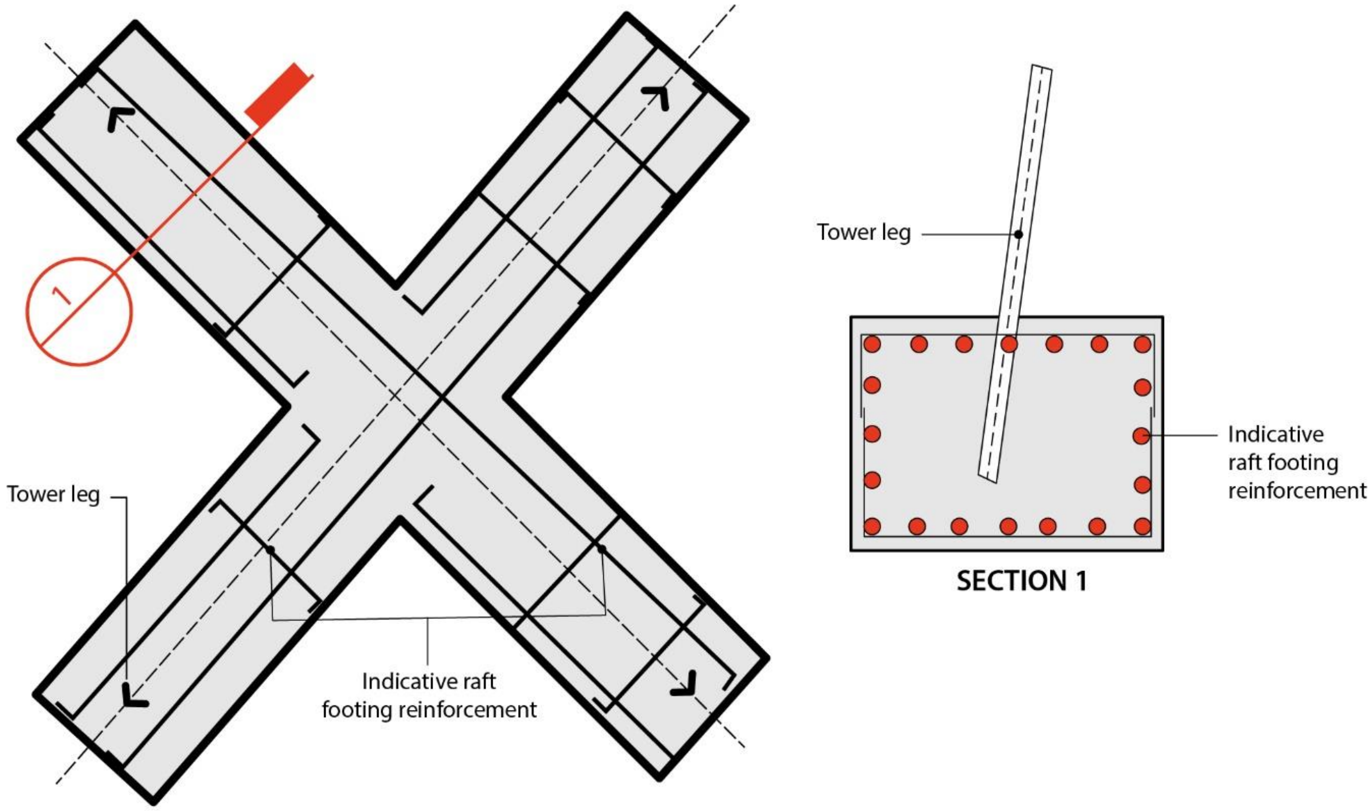
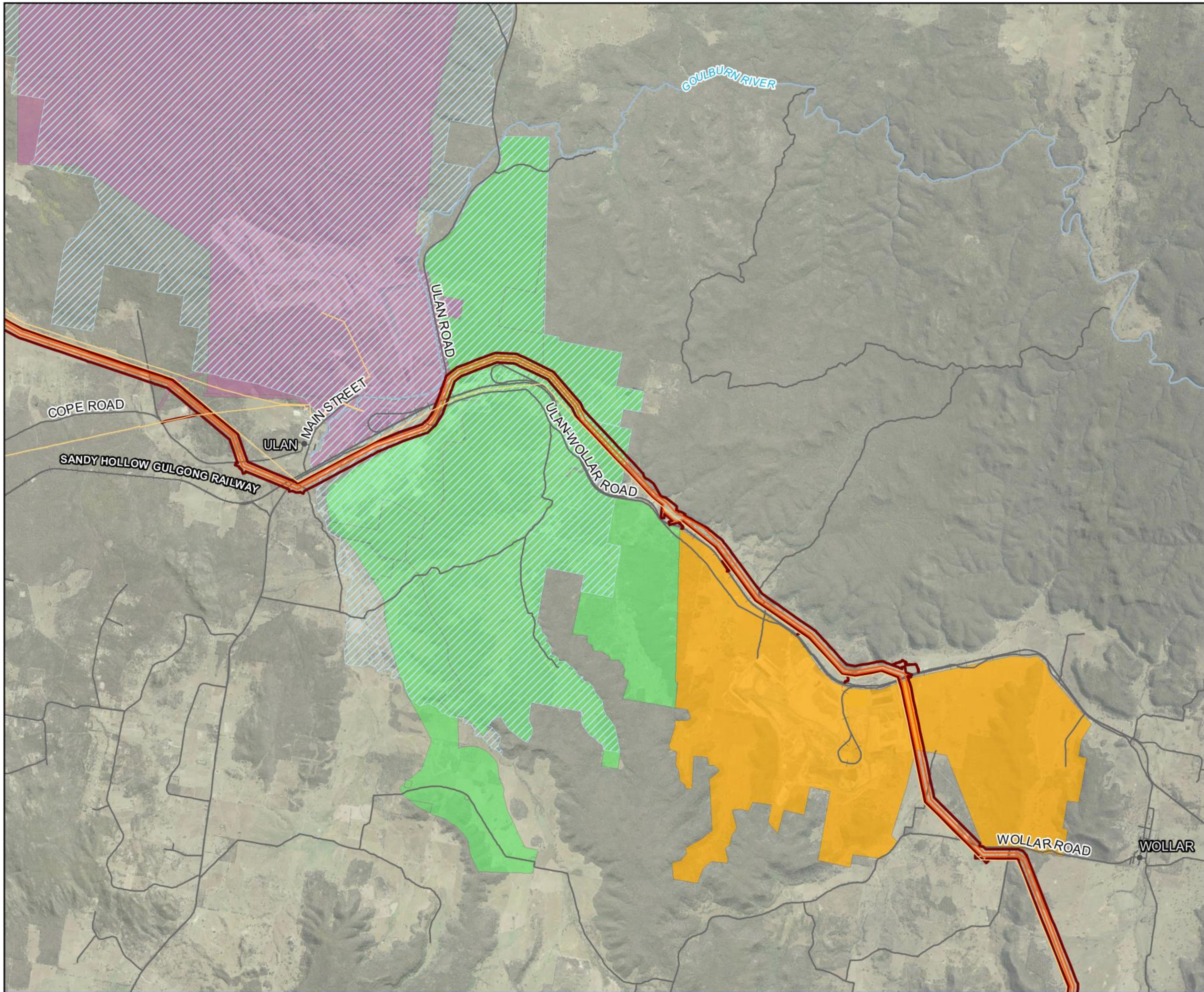


Figure 3-13 Cruciform foundation design for rehabilitated open cut mining areas

Figure 3-14
Mine subsidence district areas in the vicinity of the project



Legend

- Construction area
- 500 kV transmission line
- Existing transmission line
- Mudgee Mine Subsidence District

Mining lease area

- Wilpinjoing mine
- Moolarben mine
- Ulan mine
- Railway
- Road
- Watercourse

0 1,000 2,000 3,000 4,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:120,000
Data sources: WSP 2023

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Assembly of transmission line towers

Transmission line towers are typically erected by assembling them in sections on the ground and hoisting or lifting successive sections into place using cranes. Assembly of towers on the ground is generally done using Franna cranes or similar, and once a transmission line tower section is of sufficient size, it's lifted into place using a larger crane, though this varies depending on specific site constraints.

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 earth wires and insulators.

Construction of each transmission line tower would require access for tower assembly and stringing works. Crane pads may be required for erecting each tower, depending on geotechnical conditions. At a typical site, this would include a temporary area of around 80 metres by 80 metres for the 330 kV and 500 kV transmission line towers. These sizes are indicative only and would vary depending on specific constraints at each tower location.

Stringing of the transmission lines

Insulators would be pre-assembled at each transmission line tower site and installed on the transmission line towers using winches before stringing commences.

Rollers would be installed at the peak of the towers for stringing overhead earth wire and optical ground wire.

In locations where the transmission line alignment includes a direction change, a larger area would be required to allow for brake and winch sites. A brake and winch site would be temporarily cleared to provide an area for plant and equipment to be located, and for the purposes of spooling and winching a conductor into place on an erected transmission line tower. Brake and winch sites would generally be around 150 metres in length and 70 metres wide, though they vary significantly based on the height of the adjacent tower and the existing topography.

Use of drones/helicopters

In ecologically sensitive areas or areas with access constraints, the stringing of transmission lines would use aerial methods, such as a line stringing drone or a helicopter, to pull the draw wire if available and practicable, and subject to noise impact restrictions and weather conditions (refer to Figure 3-15). This method is expected to minimise disturbance and vegetation clearance, and reduce assembly, erection and stringing timeframes.

The coordination of aerial activities would be completed in consultation with local landowners, Airservices Australia and Civil Aviation Safety Authority to minimise any potential air traffic conflicts, as required.

Use of ground pulled draw wire

When the use of drones or helicopters to string transmission lines is not practicable (due to inclement weather, not being available or due to noise restrictions), a small bulldozer would be used to ground pull the draw wire (refer to Figure 3-16).

Stringing would be completed in sections along the alignment. The method utilised for the installation of the draw wire would depend on a number of site specific constraints including topography and the length of the pull.

At each tower, the draw wire would be pulled over a pulley assembly which would be pre-installed on the tower. The draw wire is then connected to a winch set up at the end of the stringing route. Tensioners would be set up in the brake site, between the first tower and cable drum, with the conductors winched into position. When the end of the conductor drum is reached, the conductor would be clamped in place after tensioning, and a new drum set up and fed through the tensioner. The ends of the conductor would be jointed and the pull restarted until the full length of the run has been achieved.

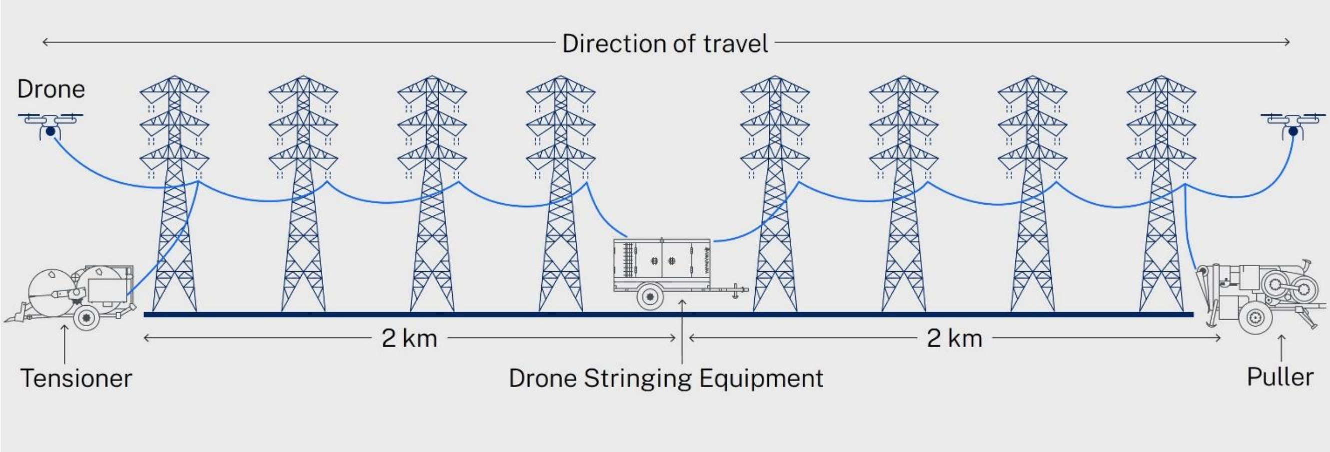


Figure 3-15 Diagram of how conductor stringing operations could occur using a drone

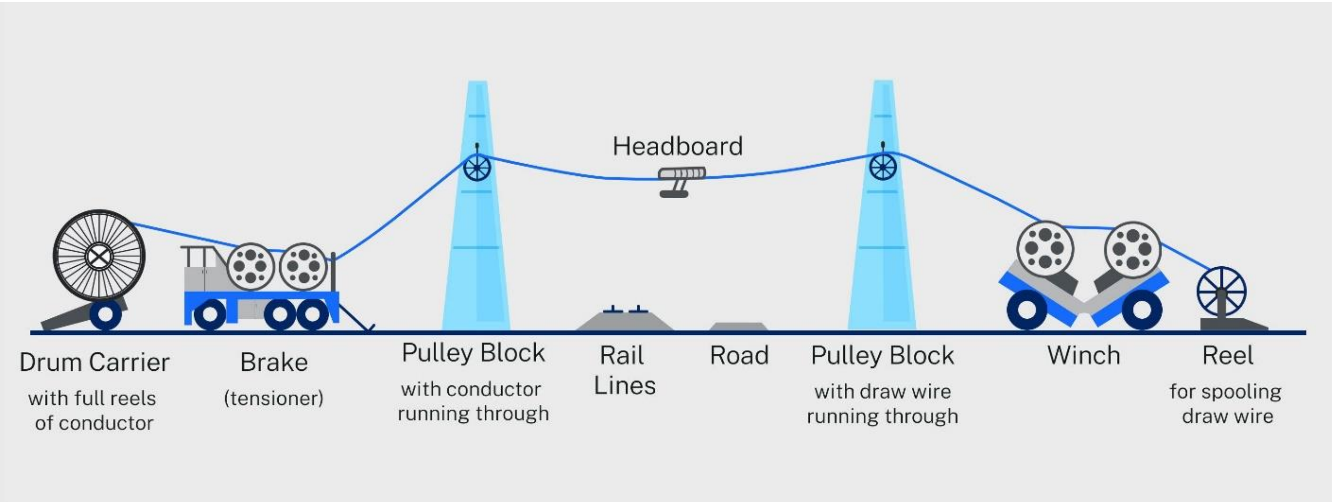


Figure 3-16 Diagram of how conductor stringing operations could occur using a ground pulled draw wire

Transmission line crossing points

Watercourse crossings

The transmission lines (both 500 kV and 330 kV network infrastructure) would require spanning of a series of watercourses, including the Talbragar River and smaller ephemeral watercourses.

Generally, to limit the potential for impacts to and disturbance of these watercourses, the design of the transmission lines would include a transmission line tower on either side of the watercourse, located as far away as practicable from the watercourse. In instances where a temporary watercourse crossing cannot be used (refer to Section 3.2.3), a drone or helicopter would be used to take the draw wire over the watercourse during stringing to allow cables to then be pulled and strung tower to tower. In some circumstances it may be impractical to use a drone or helicopter, and in such cases alternative methods, such as the use of watercraft, would be investigated.

There would be some temporary works at the base of the transmission line tower on both sides of the watercourse to allow for the construction of the transmission line tower foundations and tower assembly, however it is likely that these would be located as far as practicable from the bank of the watercourse with appropriate environmental controls (such as erosion and sediment controls) implemented.

Road, rail and other infrastructure crossings

The project would cross a number of roads, railways lines, existing transmission lines, and existing mining infrastructure.

Key roads that would be crossed by the project include:

- Upper Cumbo Road
- Wollar Road
- Wipinjong Road
- Ulan-Wollar Road
- Ulan Road
- Cope Road
- Blue Springs Road
- Birkalla Road
- Castlereagh Highway (B55)
- Birriwa Bus Route South
- Merotherie Road
- Ross Crossing South Road
- Golden Highway (B84)
- Moorefield Road
- Cliffdale Road
- Turill Bus Route Road
- Summerhill Road
- Coolah Road
- Rotherwood Road
- Tucklan Road
- Barneys Reef Road
- Puggoon Road
- Upper Laheys Creek Road
- Spring Ridge Road
- Dapper Road
- Sandy Creek Road.

Key railway line crossings would include:

- three crossings of the Sandy Hollow/Gulgong Railway, which is operated by the Australian Rail Track Corporation and is referred to as the Ulan Line. The crossings are located along Ulan Road and the Ulan-Wollar Road adjacent to the existing mining operations
- three crossings of the Wallerawang/Gwabegar Railway, two crossings around five and seven kilometres south of the rail line's intersection with the Castlereagh Highway and one crossing around two kilometres northeast of switching station M9.

Key crossings of existing transmission network and other infrastructure crossings would include:

- Transgrid Transmission Line 79 at a number of locations between the New Wollar Switching Station and Merotherie Energy Hub
- 12.7 kV, 22 kV, 66 kV and 132 kV Essential Energy distribution lines near the Merotherie and Elong Elong energy hubs and Moolarben, Ulan and Wilpinjong coal mines.

Where the new transmission lines cross above the 12.7 kV, 22 kV and 66 kV Essential Energy distribution lines, undergrounding or relocation of these utilities may be required.

Where undergrounding is not required, including at locations where the transmission lines would cross Transgrid Transmission Line 79 and other infrastructure, temporary hurdles with netting may be required. The hurdles and netting would be installed above the existing infrastructure and act as protection during the stringing operation. These hurdles with netting would protect the existing infrastructure, allowing continued use during the stringing operation. A similar approach may be adopted for road and railway crossings.

Communications infrastructure

The fibre optic communication cables would be installed alongside access tracks within the transmission line easements. The communication cables would be laid within conduits or direct buried in trenches around 600 millimetres wide and 1,000 millimetres deep within the transmission line easement.

Horizontal directional drilling would be used (where feasible) to install communications infrastructure across watercourses to avoid channel disturbance, the creation of in-stream barriers and impacts on water quality and aquatic fauna and flora. Detailed hydrogeological information (e.g. bore data) will be used to inform the most suitable underboring construction method that would minimise the need for dewatering.

Directional drilling would require a launch pit for the drill entry and a receival pit. A vertical borehole would be drilled at the launch pit to the target depth below the ground surface, from where horizontal drilling would proceed.

Drilling fluids would be circulated and then recovered to remove cuttings and provide formation stability and to lubricate the drilling rod and head. Management of excess drilling mud would either be on-site through beneficial reuse in accordance with the Environment Protection Authority general exemption for treated drilling mud or disposed at an appropriately licenced facility.

Crushing, grinding and screening

Crushing, grinding and screening plant would be located at the New Wollar Switching Station, Merotherie Energy Hub and Elong Elong Energy Hub construction compounds to process material extracted from these sites (refer to Section 3.5.7). The final quantity of material that would be subject to crushing, grinding and screening activities would be confirmed as part of detailed construction planning; however, at this stage, the amount of material is not expected to exceed the threshold quantities that would trigger the need for an Environment Protection Licence (EPL) for this activity.

3.5.7 Construction facilities

Construction compounds

To support the construction of the project, three main construction compounds would be required, one at each of the energy hubs and one at the New Wollar Switching Station. The main construction compounds would be established as enabling work and demobilised at the completion of construction. Construction compounds would include the following:

- staging and laydown areas
- concrete batching plant
- cement silo
- crushing, grinding and screening plant
- aggregate bins
- staff facilities (office, lunch room and amenities)
- parking areas
- construction support facilities including vehicle, equipment and materials storage, maintenance sheds, generators, chemical and fuel stores (such as petroleum, diesel, liquefied natural gas, herbicide, pesticide and mineral oils), firefighting equipment, waste bins and stockpile areas. Hazardous and dangerous good storage would be secured in purpose-built bunded and secure areas
- helicopter landing pad and support facilities
- testing laboratory
- potable water tanks
- wastewater treatment plant. If a wastewater treatment plant is not established, wastewater would be transported to a licenced treatment facility.

Upon completion of works, the construction compounds would be cleared of any temporary infrastructure and equipment, and rehabilitated.

New Wollar Switching Station

The construction compound at the New Wollar Switching Station would be located along the southwestern boundary of the switching station and accessed via Barigan Road. Access to the construction compound would be via the existing access road for the Transgrid Wollar Substation and an extension of this access road to the construction compound.

The construction compound would provide primary support for the construction of the New Wollar Switching Station and the New Wollar Switching Station — Merotherie Energy Hub connection.

An indicative location for the construction compound is shown in Figure 3-17. The layout of the site would be determined prior to commencement of construction.

Merotherie Energy Hub

The construction compound at the Merotherie Energy Hub would be located to the north of the energy hub and accessed via the Golden Highway, Merotherie Road and Birriwa Bus Route South (that runs east-west through the Merotherie Energy Hub site). Access to the construction compound would be via Merotherie Road.

The construction compound would provide primary support for the construction of the Cassilis connection, Coolah connection, Leadville connection, Merotherie south connection, Merotherie west connection, Merotherie Energy Hub — Elong Elong Energy Hub connection, Tallawang west connection and Tallawang south connection.

An indicative location for the construction compound is shown in Figure 3-18. The layout of the site would be determined prior to commencement of construction.

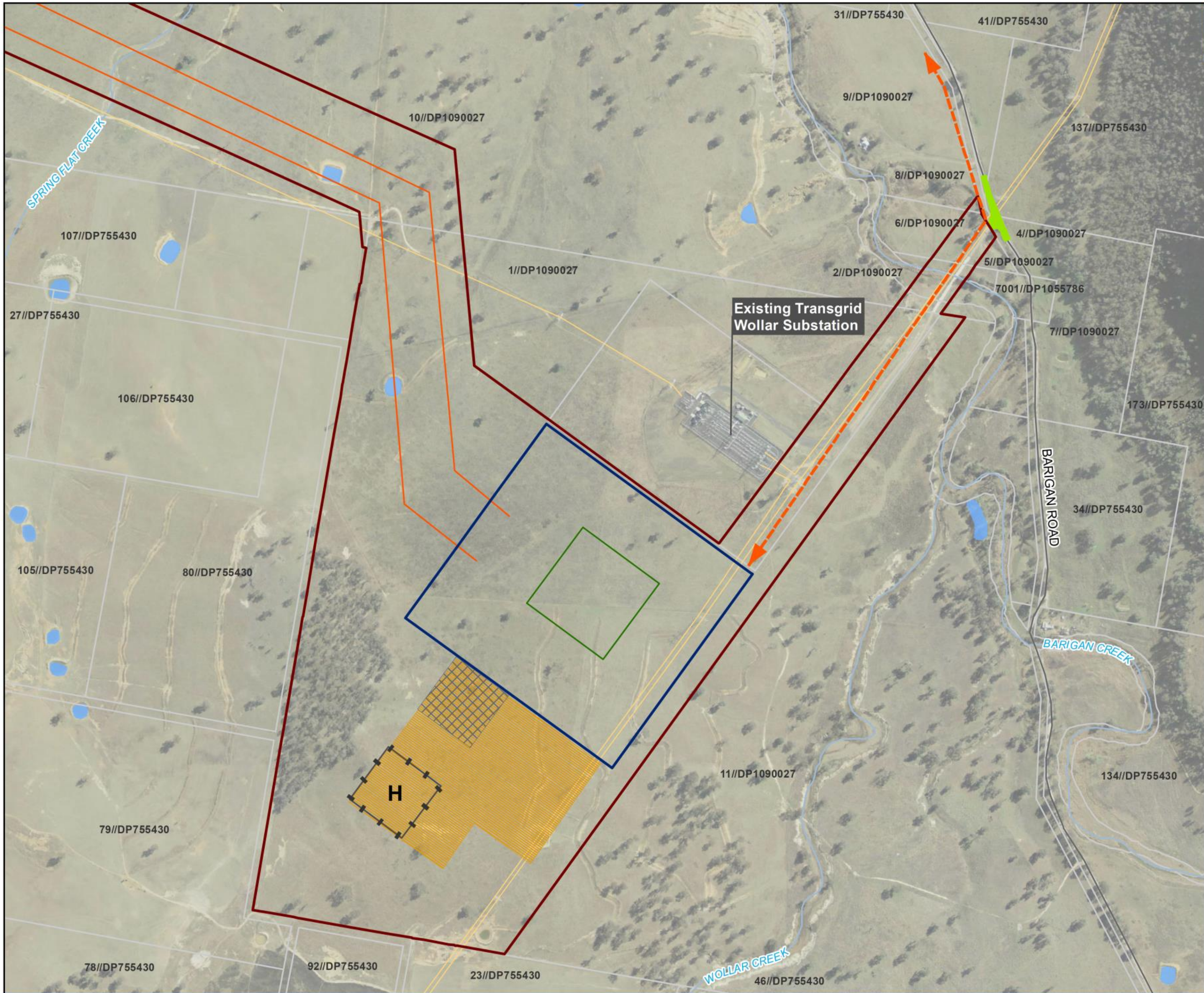
Elong Elong Energy Hub

The construction compound at the Elong Elong Energy Hub would be located along the northern boundary of the energy hub and accessed via the Golden Highway, Spring Ridge Road and Dapper Road. Access to the construction compound would be via Dapper Road.

The construction compound would provide primary support for the construction of the Elong Elong Energy Hub, Merotherie Energy Hub – Elong Elong Energy Hub connection, Cobbora north connection, Cobbora west connection and Goolma connection.

An indicative location for the construction compound is shown in Figure 3-19. The layout of the site would be determined prior to commencement of construction.

Figure 3-17
Indicative construction layout at New Wollar Switching Station



Legend

Construction
- Construction area
- Construction compound
- Helipad
- Concrete batch plant
- Public road upgrade
- Access in/out

Note: Location of construction features are indicative and would be confirmed during detailed design

Operation
- 500 kV switching station
- 500 kV transmission line

Other features
- Existing transmission line
- Road
- Watercourse
- Water body

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:12,000
Data sources: WSP 2023

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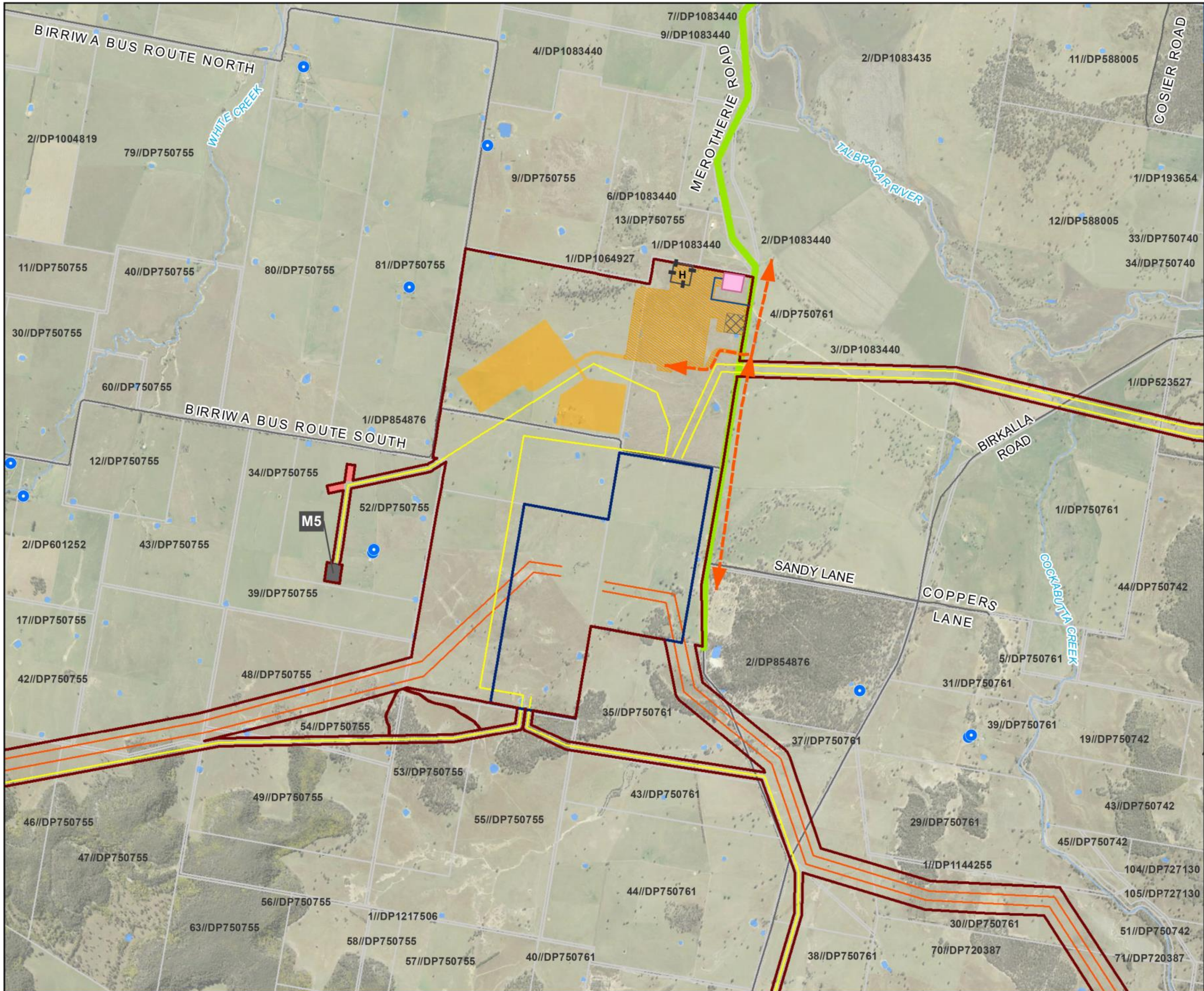
Figure 3-18
Indicative construction layout at Merotherie Energy Hub



Legend

Construction
- Construction area
- Brake and winch site
- Construction compound
- Workforce accommodation camp
- Helipad
- Concrete batch plant
- Public road upgrade
- Access in/out

Note: Location of construction features are indicative and would be confirmed during detailed design

Operation
- 500 kV energy hub
- Maintenance facility
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line

Other features
- Road
- Watercourse
- Water body

Sensitive receiver
- House

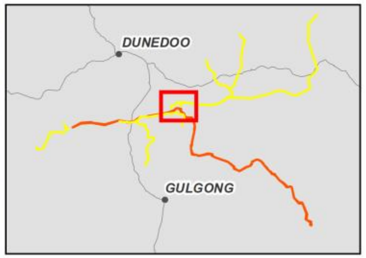


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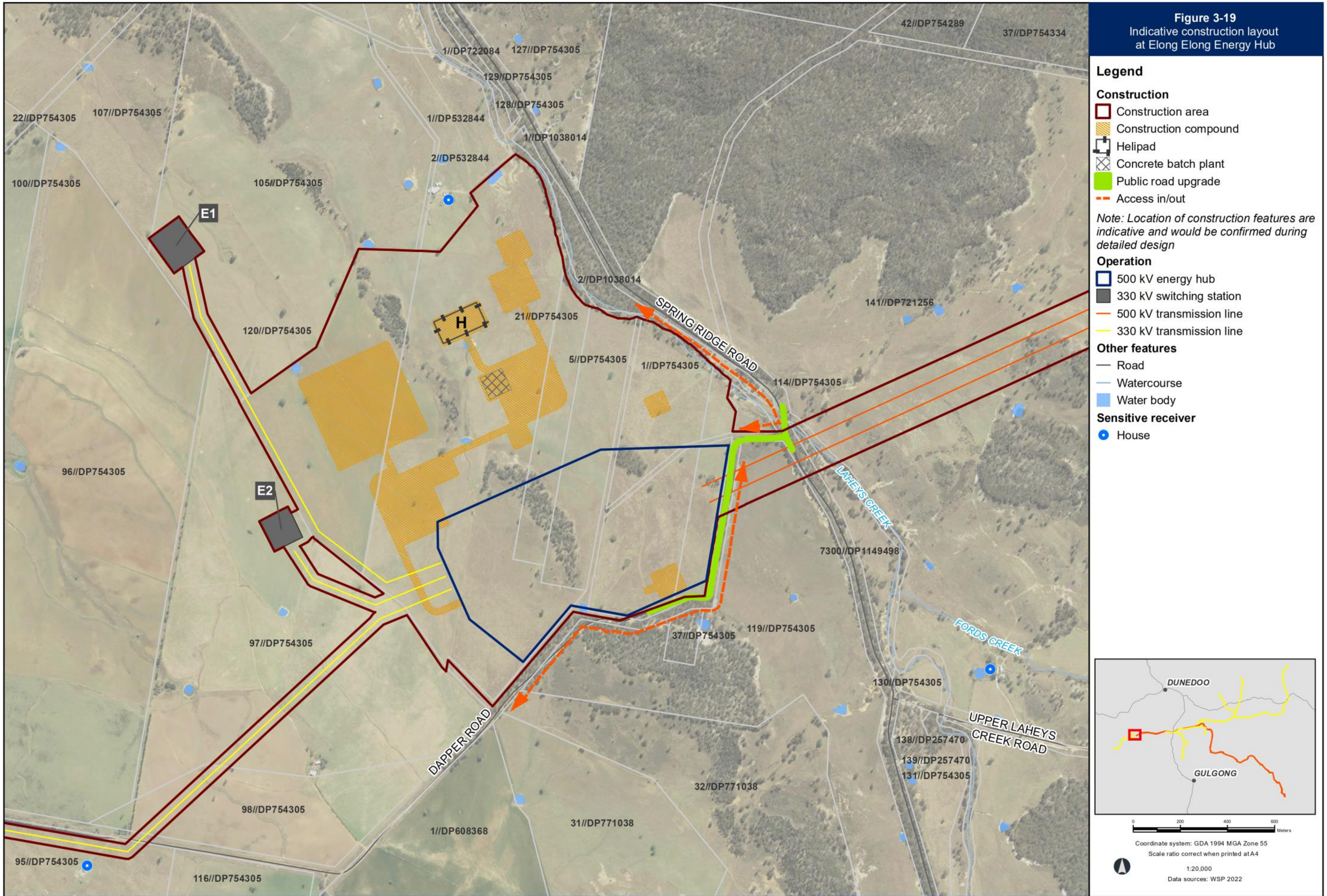
Figure 3-19
Indicative construction layout at Elong Elong Energy Hub



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Other ancillary construction support facilities

In addition to the proposed main construction compounds, ancillary construction support facilities would be required at the 330 kV switching station sites, along the transmission line easement (including at each transmission line tower site), and at the Neeleys Lane workforce accommodation camp.

The 330 kV switching station sites would include the following construction support facilities:

- staging and laydown areas
- construction support facilities including vehicle, equipment and materials storage, maintenance sheds, generators, chemical and fuel stores (such as petroleum, diesel, liquefied natural gas, herbicide, pesticide and mineral oils), firefighting equipment, waste bins and potential stockpile areas. Hazardous and dangerous good storage would be secured in purpose-built bunded and secure areas
- staff facilities (office and amenities)
- parking areas
- potable water tanks.

Workforce amenities (including meal and bathroom facilities) would also be located within the construction area, typically along the transmission line alignment.

Staging and laydown areas would be located along the transmission line and at each transmission line tower site for the temporary storage of materials, plant and equipment required to construct the various elements of the project, and to facilitate assembly of the transmission line towers and stringing of the conductors.

Although every endeavour has been made to identify the land areas likely to be required for construction, the construction contractor(s) may require additional compounds and/or support facilities. Alternative or additional sites (if required outside the construction area) may be added, and would be subject to further assessment and approval.

The following criteria would be considered for any additional compounds and/or support facilities:

- ready access to the road network – located to minimise the need for heavy vehicles to travel on local roads
- located on relatively level land
- separated from the nearest residences by at least 200 metres, unless feasible and reasonable noise and light spill mitigation measures are implemented
- not requiring native vegetation clearing beyond that already required
- minimise impacts (e.g. noise and dust) on any adjacent properties, in particular residential dwellings
- above the 20 year average recurrence interval flood level, unless a contingency plan to manage flooding is prepared and implemented
- sufficient space to store construction materials to minimise the number of deliveries required.

Workforce accommodation camps

Two temporary workforce accommodation camps would be required to cater for the construction workforce The workforce accommodation camps would be located at the main construction compound at Merotherie Road, Merotherie on land adjacent to the Merotherie Energy Hub, and at Neeleys Lane in Turill. The workforce accommodation camps would be established as enabling work and demobilised at the completion of construction.

The workforce accommodation camps would include a range of facilities, potentially including:

- demountable accommodation and office buildings
- workforce amenities, including food and catering, fitness and recreational (such as indoor and outdoor recreational spaces, gymnasium areas), laundry, bathroom and first aid facilities
- utilities, including telecommunication services, electricity and water (including water tanks) (refer to Section 3.5.9 and Section 3.5.11)
- waste bins
- fire fighting equipment
- refuelling tank
- parking area and bus stop
- equipment, materials and gas storage
- generators
- wastewater treatment plant.

The layout of the workforce accommodation camps would be finalised during detailed construction planning.

During the operation of the workforce accommodation camps, a range of general activities would be undertaken to support the functions of the facility and minimise its impacts, such as general grounds maintenance, deliveries and waste removal, and worker movements. Where practicable, workers would be transported between the construction areas and the workforce accommodation camps via shuttle buses, to minimise potential traffic impacts of the project on local roads. This would mainly occur at the start and end of the working day.

The workforce accommodation camps would provide sufficient accommodation for all construction workers, including during the peak construction period. Food and recreation facilities, first aid facilities and a full time medical practitioner or paramedic would be provided at the camps, to minimise impacts of the construction workforce on local and regional health services.

The workforce accommodation camps are expected to operate for the duration of construction. At the end of construction, the workforce accommodation camps would be demobilised and the sites would be cleared of any temporary infrastructure and equipment, and rehabilitated.

Merotherie Road, Merotherie

The main construction workforce accommodation camp at Merotherie Road, Merotherie would be located next to the Merotherie Energy Hub main construction compound, about six kilometres south of the intersection of Merotherie Road with the Golden Highway and access to the site would be provided via these roads. The location of the workforce accommodation camp is shown in Figure 3-18. The workforce accommodation camp site is about 41 hectares in size and would accommodate up to 1,200 people.

This workforce accommodation camp would be used for the duration of construction, and would primarily house workers undertaking construction along the 500 kV network infrastructure and the remaining 330 kV network infrastructure connections.

Neeleys Lane, Turill

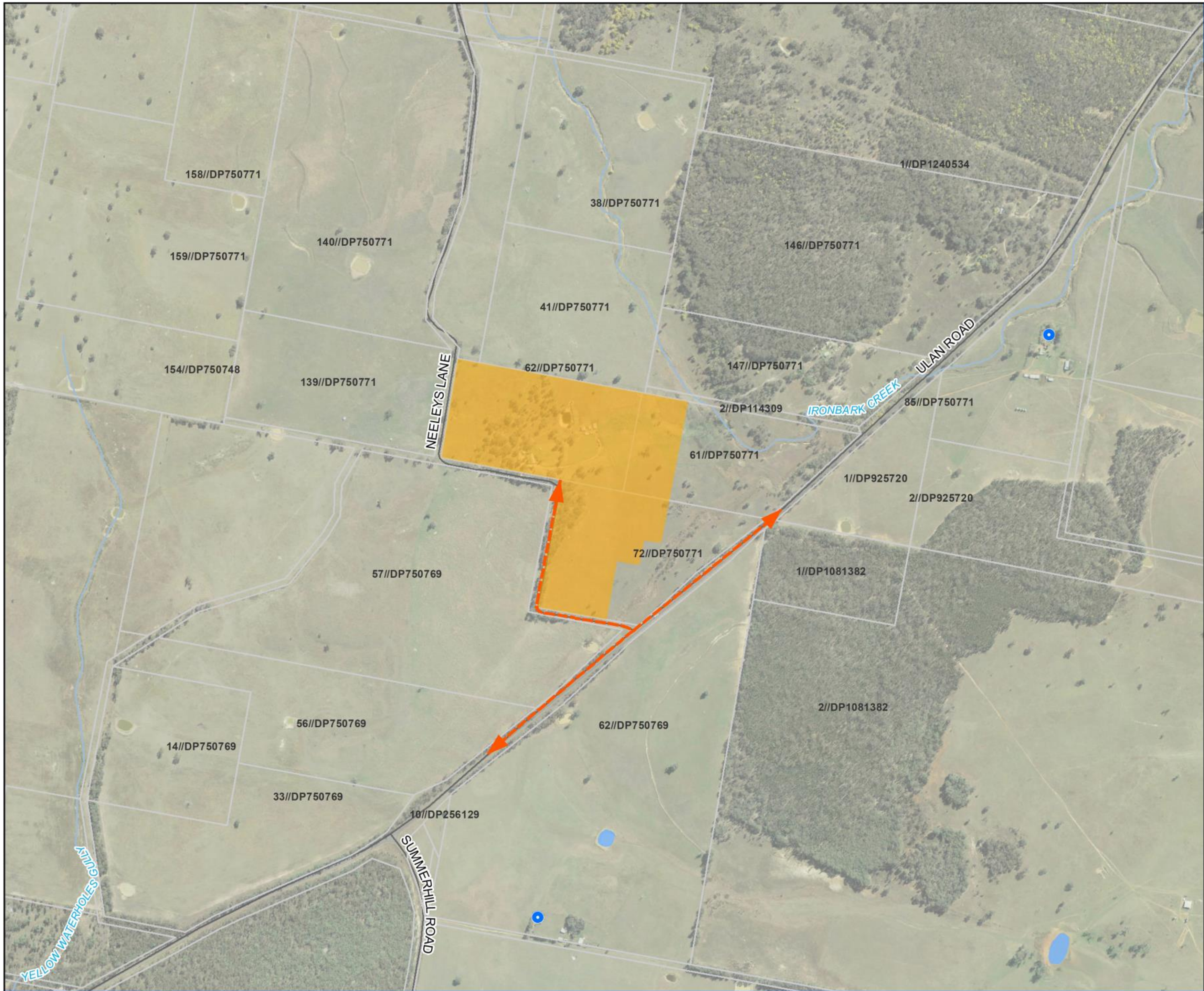
A satellite workforce accommodation camp would be located at 118 Neeleys Lane, Turill, about 11 kilometres southwest of Cassilis. The location of the workforce accommodation camp is shown in Figure 3-20.

This workforce accommodation camp would primarily service the construction workforce undertaking works along the 330 kV network infrastructure, particularly the Cassilis, Coolah and Leadville connections. Access to the site would be provided via Neeleys Lane, Ulan Road and Castlereagh Highway. The camp would accommodate up to 600 people. The Neeleys Lane/Ulan Road intersection may require upgrades to ensure safe access, which would be confirmed in the detailed design phase. If required, EnergyCo intends to assess and determine these intersection upgrades under Division 5.1 of the EP&A Act, to allow these time critical works to be determined and commence construction prior to the determination of the CSSI application. However, the road, bridge and intersection upgrades are also included in the EIS so that in the event they are not determined under a separate planning and approval process, they can be determined as part of this project under the CSSI application.

Additional workforce accommodation

It is anticipated that at the commencement of construction, prior to the operation of the workforce accommodation camps, a small number of construction workers would utilise existing local hotel, motel and rental accommodation. The workforce required to utilise existing accommodation facilities would be limited primarily to those required for the establishment of workforce accommodation camps only, as well as a small number of project management personnel.

Figure 3-20
Workforce accommodation camp at Neeleys Lane, Cassilis

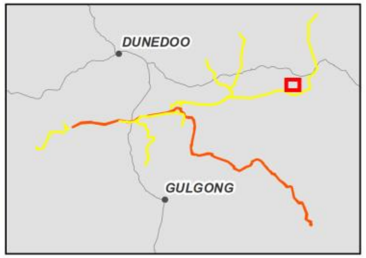


Legend

- Workforce accommodation camp
- Access in/out
- Road
- Watercourse
- Water body

Sensitive receiver

- House



0 200 400 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

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Data sources: WSP 2023

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3.5.8 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.

- air compressors
- backhoes
- bulldozers
- buses
- boom lift
- cable tensioner/puller
- cable hauling winch
- cable drum stands
- chainsaws
- concrete batch plants
- concrete agitator
- concrete vibrator
- concrete pump
- cranes (various sizes)
- crushing plants
- drill and blast units and associated support plant/equipment
- drones
- dump trucks
- elevated work platform
- excavators (various sizes)
- explosives for blasting
- flatbed trucks
- forklift
- fuel trucks
- generators
- graders
- helicopter and associated support plant/equipment
- knuckle boom
- mulcher
- piling rigs
- plate compactor
- pneumatic jackhammers
- rigid tippers
- rollers
- scrapers
- screening plants
- semi-trailers
- skid steer/positrack loaders
- telehandler
- tilt tray trucks
- transport trucks and trailers
- trench roller
- trenchers
- watercarts.

3.5.9 Resources and materials

Excavation volumes

Excavation would be required for activities such as transmission line tower construction, preparation of the energy hub and switching station sites to provide level surfaces, trenching for drainage, earthing, and electrical conduits and grading and levelling of access tracks. Excavation works would be carried out using earth moving equipment such as excavators, dozers, piling rigs and rock breakers, and blasting equipment (where required).

The construction methodology for the project has been developed with the aim of providing balanced cut (excavation) and fill (embankment) volumes at the energy hubs to reduce the amount of excavated material requiring off-site disposal at appropriately licenced facilities. Excavated spoil from the construction area would be reused on-site wherever feasible. Any on-site reuse would be within the construction area (unless otherwise agreed with adjacent landowners), and would not substantially alter the landform or drainage near the transmission line towers or other associated network infrastructure.

Table 3-7 provides an indicative estimate of earthworks quantities required for the project.

Table 3-7 Indicative earthworks quantities

Project component	Approximate fill requirements (m³)	Approximate cut volume (m³)	Approximate cut volume to be taken off-site (m³)	Approximate fill volume to be imported
Transmission lines	0	61,000	61,000	0
New Wollar Switching Station	77,000	52,000	3,000	28,000
Merotherie Energy Hub	410,000	310,000	5,000	105,000
Elong Elong Energy Hub	250,000	200,000	5,000	55,000
330 kV switching stations	129,000	95,000	13,000	47,000
Access roads and access tracks	123,000	123,000	0	0

Water supply

Water would be required during construction for:

- dust suppression on construction work areas and access tracks through the use of a water spray attached to a tanker vehicle
- on-site concrete batching
- earthworks and pavement compaction
- wetting backfill material (if it is too dry for effective compaction)
- general worker facilities at the construction compounds and workforce accommodation camps
- irrigation for landscaping.

It is estimated that around 700 megalitres of water would be required for construction per year, comprising:

- around 250 megalitres of non-potable water for:
  - dust suppression
  - earthworks and pavement compaction
  - landscaping
- around 450 megalitres of potable water for:
  - accommodation camps and ancillary facilities
  - concrete batching activities.

The actual water usage during construction is expected to vary during the construction period depending on the nature and extent of construction activities taking place. Opportunities to minimise water demand would be identified during detailed construction planning and implemented where feasible.

The use of non-potable water over potable would be preferred, however this is dependent on the location and nature of the water use activity as well as the quantity and quality of available water at the time. Water for construction of the project would be sourced according to the following hierarchy, where feasible and reasonable, and where water quality and volume requirements are met:

- rainwater harvesting (non-potable water)
- reuse of construction water (non-potable water)
- reuse of treated wastewater (discussed in section below) and/or groundwater inflows (non-potable water), where practicable

- reuse of treated mine water (non-potable water), if practicable. The potential reuse of treated mine water would be investigated during continued design development (refer to Section 19.1 (Hydrology, flooding and water quality))
- existing unregulated surface water sources (non-potable water), including the Upper Talbragar River Water Source, Lower Talbragar River Water Source and Upper Goulburn River Water Source, under water access licences for the project. The available water in each water source is dependent on conditions in each water source, which are dependent on the climate. The water quality of these water sources would be tested to determine the need for treatment prior to use in construction activities (refer to Section 19.1 (Hydrology, flooding and water quality)
- extraction from regulated groundwater sources via new groundwater bores (non-potable water), primarily for dust suppression. Two new bores would be established, one at each of the energy hubs at Elong Elong and Merotherie as shown in Figure B-1 in Appendix B (Project description mapping), to source the groundwater. Around 125 megalitres of groundwater would be taken over the construction period from each of the Lachlan Fold Belt Murray-Darling Basin (MDB) Groundwater Source and Gunnedah-Oxley Basin MDB Groundwater Source under water access licences for the project
- existing regulated and unregulated surface water sources (potable water). Potable water would be sourced from council owned potable water supplies in Dunedoo and Coolah (in the Warrumbungle LGA) and Gulgong (in the Mid-Western Regional LGA) where possible. Other sources would be investigated if these council owned supplies are not able to supply water to the project.

Water would be transported from water sources, water suppliers and/or groundwater extraction points via tanker truck and stored in storage tanks located at the workforce accommodation camps, construction compounds and switching stations.

EnergyCo has commenced discussions with a number of water suppliers within the broad region within which the project would be located, to identify the sources and availability of the volume of water (potable and non-potable) required for the project from existing facilities. Further investigation of options for the provision and storage of construction water would be undertaken during continued development of the project design and detailed construction planning, in consultation with local councils, water utility companies, licence holders and mine operators. The preferred sources of construction water and the method of construction water storage would be confirmed prior to the start of construction.

The construction water balance, and the potential impacts of the proposed approach to supplying construction water on water availability, environmental flows and water dependent ecosystems, are considered in Section 19.1 (Hydrology, flooding and water quality) and Section 19.3 (Groundwater).

On-site wastewater management

Wastewater treatment facilities would be established at the construction compounds and workforce accommodation camps to manage effluent and greywater. The systems would be designed to collect wastewater from construction activities (including concrete washout), showers, kitchens, laundries and toilets, with toilet and kitchen facilities located both at the workforce accommodation camps and the office areas.

Wastewater produced during the initial establishment of the workforce accommodation 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 project 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. The most suitable treatment processes and plant configuration would be finalised as part of detailed construction planning.

The wastewater treatment system would be designed, maintained and monitored in accordance with *Onsite domestic wastewater management, Designing and Installing On-Site Wastewater Systems* (WaterNSW, 2019), *AS/NZS 1547:2012 On-site domestic wastewater management* (Standards Australia, 2012) and the *Australian 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).

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.

The wastewater treatment facilities would be designed to produce effluent that meets the water quality requirements for dust suppression and use for other construction activities within the construction area.

The volume of water to be treated at the workforce accommodation camps would depend on the number of personnel at each accommodation camp at any given time. The water treatment plant would be designed with a capacity able to treat the estimated peak construction workforce at each accommodation camp site and would assume up to 240 litres of water would be used per day, per person. On this basis, an EPL for sewage treatment in accordance with clause 36 of Schedule 1 of the *Protection of the Environment Operations Act 1997* is not anticipated to be required.

At construction work areas outside the workforce accommodation camps, bathroom facilities would be installed to provide amenity to workers at these locations. All liquid waste generated from these locations would be removed and transported to a licensed facility.

Energy and fuel use

Construction of the project 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 supply would be required throughout construction at the main construction compounds, workforce accommodation camps and switching station sites. Electricity needs on site would likely be provided by connection of the construction site offices and workforce accommodation camps to the local power grid. Generators would be used where it is not practicable to obtain power from the local grid or through the use of solar panels, at the construction compounds and workforce accommodation camps. Electricity would be supplied to the 330 kV switching station sites via portable generators.

The estimated annual construction electricity demand for the main construction compounds and workforce accommodation camps is 9,925 megawatts per hour.

Other resources and materials

A range of other materials and resources would also be required during the construction of the project. The project design has included careful consideration of the construction methodology and selection of materials and resources to ensure fit for purpose and to minimise resource consumption, in accordance with the *Waste Avoidance and Resource Recovery Act 2007*. Indicative quantities and the potential sources of construction materials are provided in Table 3-8. All quantities have been estimated based on the current project design and would be subject to further refinement during further design development.

Construction materials would be sourced locally, where practicable, to benefit the local economy. Materials that are not available locally would be sourced from other locations within NSW, or within Australia if not available in NSW. Some project components are not produced in Australia and would have to be sourced from overseas, such as synchronous condensers, steel reinforcement and electrical switchgear.

Consistent with the principles of the circular economy, opportunities for reuse and the use of recycled and sustainable materials would be identified during the subsequent phases of the project design and construction, for example, supplementary cementitious material content in concrete, recycled aggregate products and recycled steel. Material selection would be undertaken with consideration to optimising durability (thus reducing the frequency or need for replacement) and minimising embodied energy and carbon footprint.

Table 3-8 Indicative quantities and sources of resources required for construction

Material/project component	Estimated quantity required	Anticipated source/origin.(including entry point to Australia for imported components)
Quarry products	356,000 tonnes	Central West
Concrete	600 cubic metres	Central West
	97,000 cubic metres	On-site from concrete batching plants at the main construction compounds
Steel	57,980 tonnes	Sydney
Aggregate	137,900 tonnes	Central West
Reinforcement	5,300 tonnes	Newcastle
Drainage pipes (consisting of a range of standard materials such as polyvinyl chloride (PVC) and concrete)	4,350 metres	Sydney
Bituminous materials (spray seal)	633,000 square metres	Central West and Newcastle
Transformers and synchronous condensers	16 units	Newcastle
Electrical switchgear and other electrical materials	7,075 containers	Sydney
Pre-fabricated buildings (ancillary buildings, equipment control buildings and acoustic sheds at energy hubs and switching stations)	24 units	Newcastle

3.5.10 Construction routes and traffic volumes

Construction vehicle movements would occur on the public road network to travel to and from the construction area on a daily basis. Vehicle movements would comprise both heavy and light vehicles and the volume of movements would vary across the road network depending on the construction activity being undertaken across the construction period.

The majority of movements would comprise heavy vehicles transporting project infrastructure, equipment and plant, construction materials, waste and water on the public road network. A smaller proportion of vehicle movements would comprise mini-buses and light vehicles associated with workforce personnel travelling on public roads to and from workforce accommodation camps and construction areas.

Non-standard or OSOM loads would also be required for the energy hubs (such as delivery of transformer units), switching stations and transportation of transmission line tower materials. These loads would be transported to the construction compounds via the public road network.

The selection of the energy hub locations considered their access and their relative proximity to major roads (State roads or highways) alongside other site selection criteria. Additionally, construction routes have been developed to minimise impacts on local roads as far as practicable, while providing the most direct route to the road network and meeting specific road requirements (such as specified routes for the movement of heavy vehicles).

General construction routes and volumes

Construction routes that would be used on a daily basis to facilitate construction and the maximum number of movements to and from construction areas (during peak hour during the peak construction period) along these roads (including workforce accommodation camps), are shown in Figure B-3 in Appendix B (Project description mapping). Deliveries from the wider region would use the regional public road network to link with these routes. These construction routes would be reviewed during detailed construction planning.

Further investigations would be carried out during continued design development to determine if materials, plant and equipment (standard size loads only) could be transported from the Sandy Hollow/Gulgong Railway to the construction area.

Oversize and overmass haulage routes and rail freight

Non-standard or oversized loads would have to be transported to the construction compounds from shipping ports in NSW. It is anticipated the delivery of large specialist equipment would originate from the Port of Newcastle (Newcastle) to the construction compounds via pre-approved OSOM routes.

The final construction routes for OSOM vehicle movements would be determined during detailed construction planning in accordance with the heavy vehicle haulage guidelines and in consultation with the National Heavy Vehicle Regulator and relevant local councils and government agencies, where required. Access to construction compounds from the pre-approved OSOM routes would be provided using access roads which, if required, would be upgraded as part of separate planning and approval processes to meet appropriate specifications to accommodate these movements and vehicle types (refer to Section 3.2.4 and Section 1.4).

Construction workforce parking

Parking for the construction workforce would be mainly located within the construction compounds and workforce accommodation camps. Given the transient nature of construction works along the transmission line alignments, and potentially long distances between these construction areas and the workforce accommodation camps and construction compounds, it is expected that workers would typically be transported by bus (or other type of crew vehicle) between construction work areas and their relevant workforce accommodation camp. Workers travelling in light vehicles from accommodation camps to transmission lines, such as stringing crews, would park in designated areas within the transmission line easement that are outside of areas of active construction work.

3.5.11 Utilities

Construction of the project would require adjustments to a number of existing utilities during works associated with the energy hubs, maintenance facility, switching stations and transmission lines. This would include protection or relocation works to utilities, including communications, gas mains and energy transmission.

4 Statutory context

This chapter outlines the statutory context for the project and explains the relevant environmental impact assessment and planning approval process. This chapter also outlines the environmental planning instruments applicable to the project. Further detail regarding the statutory context and compliance of the project is provided in Appendix C (Statutory compliance).

4.1 Overview

The project was declared to be critical State significant infrastructure (CSSI) under section 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) by the New South Wales (NSW) Minister for Planning and Public Spaces on 23 November 2020. The project is listed in Schedule 5, Clause 23 of the State Environmental Planning Policy (SEPP) (Planning Systems) 2021 (Planning Systems SEPP) and is subject to approval by the NSW Minister for Planning and Public Spaces under Division 5.2, Part 5 of the EP&A Act. The assessment and approval requirements applicable to the project under the provisions of the EP&A Act are described in Section 4.2. Other approvals and permits relevant to the construction and operation of the project are discussed in Section 4.2.2.

The project is also a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and requires approval from the Australian Minister for the Environment and Water. In determining that the project is a controlled action, the Australian Government's Department of Climate Change, Energy, the Environment and Water (DCCEEW) advised that the project will be assessed in accordance with the NSW Assessment Bilateral Agreement under Part 9 of the EPBC Act. This is discussed in more detail in Section 4.3.

4.2 NSW legislation

4.2.1 Environmental Planning and Assessment Act 1979

Permissibility

State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP) is an environmental planning instrument that sets out the permissibility of infrastructure development and how it is assessed under the EP&A Act.

Clause 2.44 of the Transport and 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 public authority without consent on any land. However, development may not be carried out on land reserved under the *NSW National Parks and Wildlife Act 1974* (NP&W Act) without consent unless the development is (in general terms) authorised under that Act. This includes, among other criteria, development that 'is carried out on land to which the NP&W Act applies over which an easement has been granted and is not contrary to the terms or nature of the easement'.

For the purposes of clause 2.44:

- the project is characterised as an electricity transmission or distribution network under clause 2.43 of the Transport and Infrastructure SEPP. Its components fall within the definition in clause 2.43 which, among other things, includes transmission lines and substations
- Energy Corporation of New South Wales (EnergyCo) is a public authority for the purpose of clause 2.44. It is a NSW Government statutory authority constituted under the *Energy and Utilities Administration Act 1987*, and as such, defined as a 'public authority' under section 1.4(1) of the EP&A Act and clause 2.3(2) of the Transport and Infrastructure SEPP.

Around 2.5 kilometres of the proposed Cassilis connection would traverse a section of land reserved under the NP&W Act, being the Durridgere State Conservation Area. Section 153 of the NP&W Act empowers the Minister administering the NP&W Act (the NSW Minister for Environment and Heritage) to grant an easement through a state conservation area for the 'erection of standards, posts, wires and appliances for the conveyance or transmission of electricity'. EnergyCo has commenced discussions with the NSW National Parks and Wildlife Service concerning the creation of an easement for the project within the Durridgere State Conservation Area.

The project is permissible without consent, pursuant to clause 2.44 of the Transport and Infrastructure SEPP, as it is defined as an electricity transmission or distribution network and would be carried out by or on behalf of EnergyCo (a public authority), subject to securing an easement in accordance with section 153 of the NP&W Act, prior to any determination by the NSW Minister for Planning and Public Spaces under the EP&A Act.

Under clause 2.44(2) of the Transport and Infrastructure SEPP, a reference to development for the purpose of an electricity transmission or distribution network includes a reference to certain activities associated with the development, including (but not limited to) construction works, emergency or routine maintenance works and environmental management works. Certain maintenance and vegetation management works are considered exempt development under the provisions of clause 2.46 of the Transport and Infrastructure SEPP.

Planning approval process under Division 5.2 of the EP&A Act

Sections 5.12 and 5.13 of the EP&A Act provide for the declaration of State significant infrastructure (SSI) and CSSI. On 23 November 2020, the NSW Minister for Planning and Public Spaces made the Environmental Planning and Assessment Amendment (Central-West Orana Renewable Energy Zone Transmission Order) 2020. The Order declares the whole Central-West Orana Renewable Energy Zone (REZ) Transmission project to be CSSI by adding that project as a new clause, gazetted on 16 December 2020, in Schedule 5 of the State Environmental Planning Policy (State and Regional Development) 2011, now clause 23 in Schedule 5 of the Planning Systems SEPP. As CSSI, the project requires approval from the NSW Minister for Planning and Public Spaces under Division 5.2, Part 5 of the EP&A Act.

On the 21 February 2023, the (then) NSW Minister for Planning (the relevant minister now is the Minister for Planning and Public Spaces) made the Environmental Planning and Assessment Amendment (Central-West Orana Renewable Energy Zone Transmission Order) 2023. The Order amended the declaration to:

> *(a) include the construction and operation of battery energy storage systems, and*
>
> *(b) exclude development for the purposes of upgrading, relocating or widening existing public roads—*
>
> *(i) carried out on land in the Central-West Orana Renewable Energy Zone, and*
>
> *(ii) subject to a determination made under the Environmental Planning and Assessment Act 1979, Division 5.1.*

The Secretary's Environmental Assessment Requirements (SEARs) for the project were issued on 7 October 2022 in response to the lodgement of a SSI application (SSI-48323210) and supporting Scoping Report on 9 September 2022 (refer to Appendix A (SEARs checklist)). Supplementary SEARs were issued by the NSW Department of Planning and Environment (DPE) on 28 March 2023 to include the relevant Commonwealth requirements in accordance with the NSW Assessment Bilateral Agreement (refer to Section 4.3.1). This Environmental Impact Statement (EIS) has been prepared to address the SEARs, the Supplementary SEARs and the requirements of Division 5, Part 8 of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation) (refer to Appendix C (Statutory compliance)). This EIS has also been prepared having regard to the *State Significant Infrastructure Guidelines, October 2022* (DPE, 2022h).

The EIS will be publicly exhibited as required by the EP&A Act. During the public exhibition period, DPE will invite the public and agencies to make submissions on the project. After the public exhibition period closes, EnergyCo anticipates that DPE will ask EnergyCo to respond to any issues raised in the submission(s) received and prepare a Submissions Report.

Following the publication of the Submissions Report (and Amendment Report or Preferred Infrastructure Report if required), the Secretary will prepare an Assessment Report which will be provided to the NSW Minister for Planning and Public Spaces in accordance with the provisions of section 5.18 of the EP&A Act. The Assessment Report must be considered by the Minister in determining whether or not to approve the carrying out of the infrastructure. The Minister's approval may be subject to conditions of approval, in accordance with section 5.19 of the EP&A Act.

The project would be constructed and operated in accordance with the conditions of approval, the project as described in the EIS and any Submissions Report and/or Preferred Infrastructure Report (if required), and the mitigation and management measures proposed in this EIS.

The applicable planning approvals process for the project is summarised in Figure 4-1.

The project may also require additional approvals under other NSW legislation as discussed in Section 4.2.2.

NSW environmental planning instruments

Section 5.22 of the EP&A Act provides that environmental planning instruments (EPIs), such as Local Environmental Plans (LEPs) and SEPPs, do not apply to CSSI projects other than the relevant provisions of the Transport and Infrastructure SEPP and the Planning Systems SEPP that declare certain infrastructure as SSI or CSSI and identify development that does not require consent. Notwithstanding, as a matter of good practice in respect of addressing environmental impacts, the following key EPIs have been considered in this EIS:

- State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Biodiversity and Conservation SEPP)
- State Environmental Planning Policy (Primary Production) 2021 (Primary Production SEPP)
- State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP)
- State Environmental Planning Policy (Resources and Energy) 2021 (Resources and Energy SEPP)
- Warrumbungle Local Environmental Plan 2013
- Mid-Western Regional Local Environmental Plan 2012
- Dubbo Regional Local Environmental Plan 2022
- Upper Hunter Local Environmental Plan 2013.

Further consideration of these policies is provided in Appendix C (Statutory compliance).

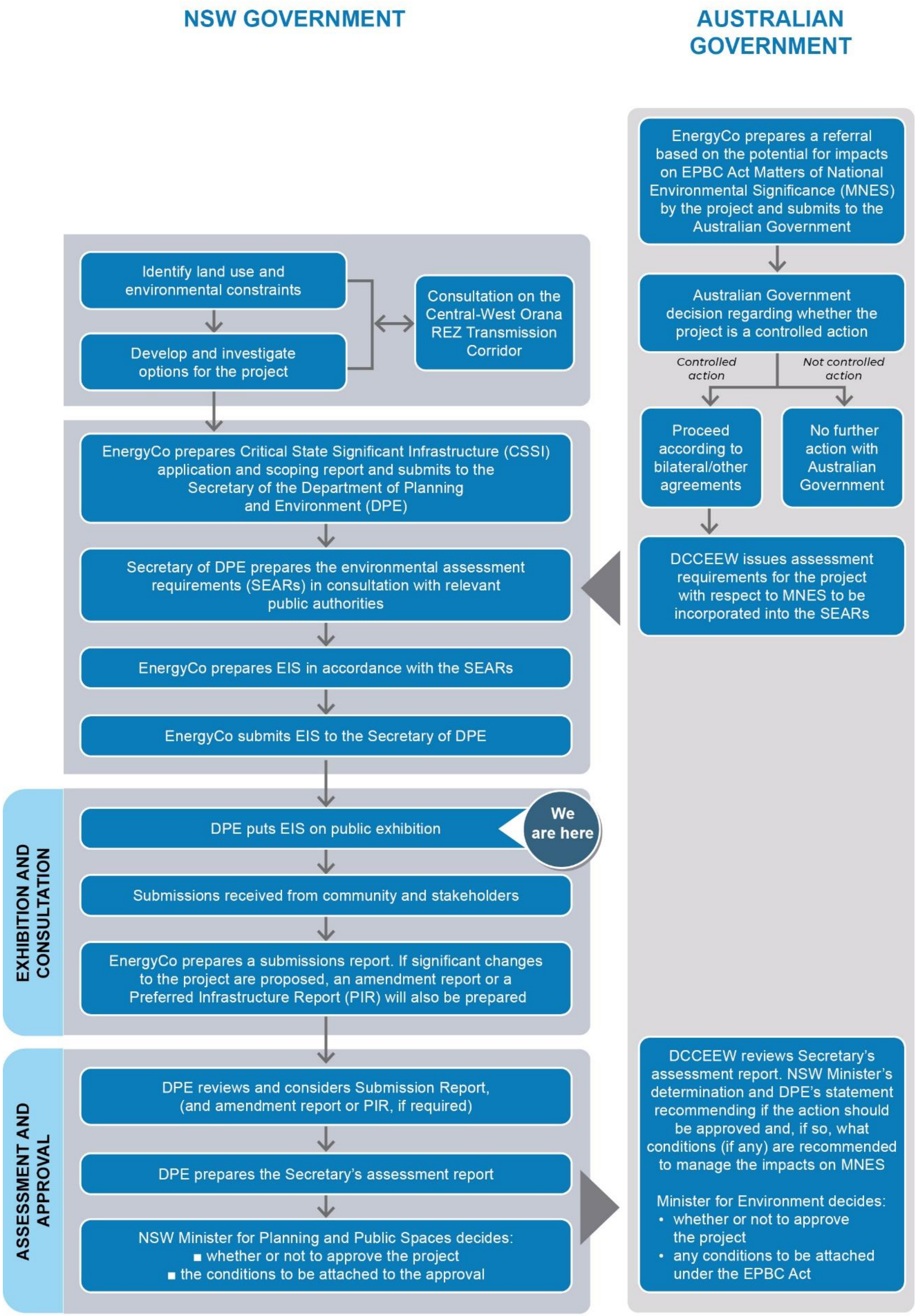


Figure 4-1 Assessment and approval process for the project

4.2.2 Other NSW legislation

Table 4-1 identifies approvals under other NSW legislation that should be substantially consistent with approved CSSI, approvals that are not required for approved CSSI, and approvals that may be required regardless of the project's declaration as CSSI.

Table 4-1 Other approvals required to carry out the project

Relevant provision	Application of provision to project
Approvals that should be substantially consistent with approved CSSI that are relevant to the project	Approvals or authorisations that cannot be refused if they are necessary for carrying out approved CSSI and are substantially consistent with the Division 5.2 approval, including: • an approval under Part 3 of the *Coal Mine Subsidence Compensation Act 2017* (CMSC Act) • environment protection licences (EPLs) under Chapter 3 of the *Protection of the Environment Operations Act 1997* (POEO Act) • consent under section 138 of the *Roads Act 1993* (Roads Act) 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 the CMSC Act, EnergyCo would require approval as parts of the project would be located within the Mudgee mine subsidence district. With respect to EPLs, Schedule 1 of the POEO Act does not define electrical transmission lines or associated infrastructure (such as switching stations and substations) as a scheduled activity requiring an EPL. The project is unlikely to exceed the criteria listed in Schedule 1 of the POEO Act for the following scheduled activities: • crushing, grinding or separating materials (clause 16), as the project would not process more than 150 tonnes of materials per day or 30,000 tonnes of materials per year • helicopter-related activities (clause 20), as the activity at each construction compound would not have an intended capacity of more than 30 flight movements per week (where take-off and landing are separate flight movements) • sewage treatment (clause 36), as each plant would not have a processing capacity that exceeds 2,500 persons equivalent (as determined in accordance with guidelines established by an NSW Environment Protection Authority Gazettal notice), or exceeds 750 kilolitres per day (whichever is the greater). With respect to Road Occupancy Licences, the project would potentially require temporary/partial closure(s) of classified and unclassified roads for the construction of the project (during, for example, stringing of transmission lines over public roads). Road works may also be required on unclassified roads as part of the project to establish new access points for the energy hubs and to the transmission line alignment. EnergyCo would requires consent form the relevant roads authority under section 138 of the Roads Act to undertake work on or over classified roads. However, by reason of clause 5(1) of Schedule 2 of the Roads Act, EnergyCo, as a public authority, is not required to obtain approval to carry out work on unclassified roads other than a Crown road (subject to that clause ceasing to have effect by proclamation).

Relevant provision	Application of provision to project
Approvals that are not required for approved CSSI	Approvals of potential relevance to the project which are not required for CSSI projects under section 5.23(1) of the EP&A Act, include: • a permit under sections 201, 205 or 219 of the *Fisheries Management Act 1994* (FM Act) • an approval under Part 4, or an excavation permit under section 139 of the *Heritage Act 1977* (Heritage Act) • an Aboriginal heritage impact permit under section 90 of the NP&W Act • a bushfire safety authority under section 100B of the *Rural Fires Act 1997* • various approvals under the *Water Management Act 2000* (WM Act), including water use approval under section 89, a water management work approval under section 90, and an activity approval (other than aquifer interference approvals) under section 91. Section 5.23(2) of the EP&A Act specifies that Division 8 of Part 6 of the Heritage Act does not apply to prevent or interfere with the carrying out of approved SSI. Section 5.23(3) of the EP&A Act specifies that 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 project would be: • an interim protection order (within the meaning of the NP&W Act) • 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 • a remediation direction under Division 3 (Remediation directions) of Part 6A of the NP&W Act • an order or direction under Part 11 (Regulatory compliance mechanisms) of the *Biodiversity Conservation Act 2016* (BC Act) • an environment protection notice under Chapter 4 of the POEO Act • an order under section 124 of the *Local Government Act 1993*.
NSW legislation and concurrent approvals	Other NSW legislation which has been considered as part of this EIS and which would be, or may be, applicable to the project regardless of the project being declared CSSI Includes: • *Aboriginal Land Rights Act 1983* • *Biodiversity Conservation Act 2016* • *Biosecurity Act 2015* • *Coal Mine Subsidence Compensation Act 2017* • *Contaminated Land Management Act 1997* • *Crown Land Management Act 2016* • *Electricity Infrastructure Investment Act 2020* • *Land Acquisition (Just Terms Compensation) Act 1991* • *Native Title (New South Wales) Act 1994* • *Protection of the Environment Operations Act 1997* • *Rail Safety Act 2012* • *Waste Avoidance and Resource Recovery Act 2001* • *Water Management Act 2000.* Further detail of the requirements of this legislation is provided in Appendix C (Statutory compliance).

4.2.3 Ecologically sustainable development

Clause 192(1)(f) of the EP&A Regulation requires the EIS to include the reasons justifying the carrying out of the infrastructure, considering biophysical, economic and social factors, including the principles of ecologically sustainable development (ESD).

Clause 193 of the EP&A Regulation outlines the four principles of 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.

EnergyCo has considered the principles of ESD as part of the design development of the project. A discussion of how the project has considered ESD principles is included in Section 23.3.4 of Chapter 23 (Justification and conclusion).

4.3 Commonwealth legislation

4.3.1 Environment Protection and Biodiversity Conservation Act 1999

Matters of national environmental significance (MNES), such as Commonwealth listed threatened species and ecological communities, are protected under the EPBC Act. Under the EPBC Act, proposed actions that are likely to have a significant impact on MNES must be referred to the Australian Minister for the Environment and Water. The Minister will determine whether the action is a controlled action and therefore requires approval from the Minister under the EPBC Act. The Minister will also determine the method under which the environmental impact of the action will be assessed.

EnergyCo referred the project to the Minister on 2 February 2023 (referral no. 2022/09353). DCCEEW, as delegate for the Australian Minister for the Environment, determined on 2 March 2023 that the project is a controlled action and that it would be assessed under the NSW Assessment Bilateral Agreement.

The NSW Assessment Bilateral 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. However, a separate EPBC Act approval is still required.

DPE issued Supplementary SEARs on 28 March 2023 to include the relevant Commonwealth requirements under the NSW Assessment Bilateral Agreement. This EIS has been prepared to address these requirements (refer to Appendix A (SEARs checklist)).

A summary of the potential impacts to MNES as a result of the project is presented in Appendix C (Statutory compliance). As detailed in Chapter 10 (Biodiversity) and Appendix A (SEARs checklist), the project would have a significant impact on EPBC listed threatened flora and fauna species and ecological communities.

4.3.2 Other Commonwealth legislation

The *Native Title Act 1993* has also been considered as part of this EIS. Further detail about the requirements of this legislation is provided in Appendix C (Statutory compliance).

5 Community and stakeholder engagement

This chapter outlines the engagement activities that have been carried out for the project and provides a summary of the views of the community and other stakeholders that were recorded during these engagement activities. This chapter also outlines proposed future engagement to be carried out for the project during exhibition of the Environmental Impact Statement (EIS) and during construction if the project is approved.

5.1 Engagement strategy

5.1.1 Engagement approach

EnergyCo recognises the importance of early and effective engagement with communities and stakeholders and is committed to:

- implementing a transparent, meaningful and inclusive approach to working with communities and stakeholders who are directly and indirectly affected by the project
- enabling stakeholder participation throughout the project development process in a manner that is clear and transparent and ensures stakeholders understand how their feedback will be used
- providing sufficient and timely information to enable communities and stakeholders to give informed feedback
- tailoring engagement and communications to consider different stakeholder needs and expectations.

EnergyCo's communication and engagement approach broadly aligns with the following documents and guidelines:

- *Undertaking Engagement Guidelines for State Significant Projects* (NSW Department of Planning and Environment (DPE), 2022h)
- *Quality Assurance Standard for Community and Stakeholder Engagement* (International Association for Public Participation (IAP2), 2015)
- *Community Engagement Guidelines For Building Powerlines For Renewable Energy Developments – A guide for proponents, landholders and communities* (Clean Energy Council (CEC), 2018)
- *Property Acquisition Standards* (NSW Government, 2019)
- *First Nations Guidelines* (Office of Environment and Climate Change (OECC), 2022)
- *Community Participation Plan* (DPIE, 2019b).

5.1.2 Engagement objectives

The key communication and engagement objectives for the project are to:

- provide regular and targeted information to the community and stakeholders about the progress of the project and the broader Central-West Orana Renewable Energy Zone (REZ), including opportunities to provide feedback
- inform interested and affected communities and stakeholders about the project and its potential impacts
- ensure community and stakeholder feedback informs the project development process
- respond to enquiries, complaints and requests for information in a timely manner
- effectively manage expectations of the community and stakeholders in relation to project impacts, including cumulative impacts from the project and renewable generation projects
- promote the benefits the project will bring to local communities in the Central-West Orana region
- establish EnergyCo as the point of contact for the project and the REZ as a whole
- build community and stakeholder confidence in EnergyCo, the project and the REZ
- promote the project in the broader context of the *NSW Electricity Infrastructure Roadmap* (NSW Department of Planning and Environment, 2020).

5.2 Key stakeholders

Table 5-1 provides a list of stakeholder groups who have been or will be engaged with in relation to the project. EnergyCo expects this list to grow and diversify as the development of the project continues and the engagement broadens.

Stakeholder identification and engagement will continue throughout the development of the project and will be updated as appropriate.

Table 5-1 Key stakeholder groups for the project

Stakeholder group	Stakeholders
NSW Government elected representatives	• Premier of NSW, the Hon Chris Minns MP • Minister for Climate Change, Minister for Energy, Minister for the Environment, and Minister for Heritage, Hon Penny Sharpe MP • Minister for Planning and Homes, Hon Paul Scully MP • Member for Dubbo, Dugald Saunders MP • Member for Barwon, Roy Butler MP • Member for Upper Hunter, David Layzell MP.
Australian Government elected representatives	• Minister for Climate Change and Energy, Hon Chris Bowen MP • Member for Calare, Hon Andrew Gee MP • Member for Parkes, Hon Mark Coulton MP • Member for New England, Hon Barnaby Joyce MP.

Stakeholder group	Stakeholders
Energy industry stakeholders	• Australian Energy Market Operator (AEMO) • Consumer Trustee (AEMO Services Limited) • Australian Energy Regulator (AER) • Australian Energy Market Commission • Australian Energy Infrastructure Commissioner • Energy Security Board • Australian Renewable Energy Agency • Australian Energy Council • Clean Energy Council • Energy Consumers Australia • Renewable Energy Sector Board.
Local governments within the study area	• Mid-Western Regional Council • Dubbo Regional Council • Warrumbungle Shire Council • Upper Hunter Shire Council • Orana Joint Organisation of Councils.
Government departments and agencies	• Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) • NSW Department of Planning and Environment (DPE) and its divisions: — Crown Lands — Heritage NSW — Biodiversity Conservation Services — National Parks and Wildlife — Water — Crown Lands • NSW Department of Primary Industries (DPI) and its divisions: — Agriculture • NSW Environment Protection Authority (EPA) • NSW Department of Premier and Cabinet • Infrastructure NSW • Transport for NSW • Department of Regional NSW and its divisions: — Local Land Services — Mining, Exploration and Geoscience • NSW Telco Authority • Forestry Corporation of NSW • Subsidence Advisory NSW • Aboriginal Affairs NSW • Regional Development Australia • National Indigenous Australians Agency • Civil Aviation Safety Authority (CASA).
Developers of renewable generation projects	• Proponents of renewable generation projects in the Central-West Orana REZ (existing, under development and potential future).

Stakeholder group	Stakeholders
Directly impacted landowners	• Landowners directly impacted by the project, including: — owner occupiers — investment owners — other interest holders — mining landowners • Peabody Wilpinjong Mine • Yancoal Moolarben Coal Mine • Glencore Ulan Coal Mine Complex.
First Nations stakeholders	• Traditional owners • Dubbo Local Aboriginal Land Council (LALC) • Gilgandra LALC • Mudgee LALC • Walhallow LALC • Wellington LALC • Wanaruah LALC • NSW Aboriginal Land Council • National Native Title Tribunal • Three Rivers Regional Assembly (TRRA) • Native Title Service Provider for Aboriginal Traditional Owners in New South Wales and the Australian Capital Territory • Office of Registrar of NSW Land Claims.
Wider community	• Local land users e.g. irrigators, farmers near the project that are not considered directly impacted and/or adjacent landowners • Local communities within the Mid-Western Regional, Dubbo Regional, Warrumbungle and Upper Hunter LGAs • Environment groups • Local businesses • Progress associations and development groups • Chambers of commerce • Jobseekers, training and employment agencies • Industry groups • Road users • Community groups with an interest in the Central-West Orana REZ • NSW Farmers Association • Local emergency services.

Stakeholder group	Stakeholders
Employment and training stakeholders	• Government stakeholders: — Electricity Infrastructure Jobs Advocate — NSW Department of Education — Training Services NSW, West Region — Department of Regional NSW — Department of Employment and Workplace Relations, Far West Orana — Association of Independent Schools NSW • Education and training providers: — Universities and tertiary education — TAFE NSW • Unions: — Mining and Energy Union South Western District — Electrical Trades Union.
Suppliers	• NSW and Australian suppliers for the construction and operation of Central-West Orana REZ projects.
Network service providers	• Transgrid • Essential Energy.
Other utility providers	• Service/utility providers (e.g. electrical, telecommunications, sewer, water) that may be impacted by the project.
General public	• Members of the public who may be impacted by or interested in the project.

5.3 Engagement to date to support the EIS

5.3.1 Overview

In 2020, the NSW Government engaged Transgrid, as NSW's jurisdictional transmission planner (at the time), to carry out early development work to guide the planning of new transmission infrastructure for the Central-West Orana REZ. In December 2020, Transgrid released a preliminary study area for the project that ran northwest from the existing transmission network near Merriwa, passing south of Dunedoo before connecting back into the existing transmission network to the east of Wellington. The preliminary study area also included an option to extend the project further south towards Lake Burrendong and included an upgrade of the existing substation at Wollar.

Between December 2020 and September 2021, Transgrid carried out community, landowner and stakeholder engagement on the preliminary study area for the transmission route. Engagement activities included letters sent out to landowners, community information sessions, community events, social media posts and print advertisements, meetings with landowners, community members, First Nations stakeholders, local councils and other stakeholders, and establishment of a dedicated phone number, email address and website to provide project information. Feedback received was consolidated, and published in the Central-West Orana REZ Transmission Community Engagement Feedback Report, December 2020 – September 2021 (Transgrid, 2021b).

In November 2021, the Central-West Orana REZ was formally declared by the Minister for Energy and Environment and EnergyCo was appointed as the Infrastructure Planner (pursuant to section 23(5) of the *Electricity Infrastructure Investment Act 2020* (NSW)) to lead the delivery of REZs in NSW. At this time, EnergyCo assumed responsibility for engaging local communities and stakeholders to inform the development of new transmission network infrastructure within the Central-West Orana REZ.

In February 2022, EnergyCo announced a revised study corridor for the project which would reduce impacts on sensitive land uses in the region and deliver greater capacity to meet future energy needs. Community feedback received by Transgrid was considered in developing the revised study corridor. In particular, the eastern section of the preliminary study area was redesigned to locate the corridor on or next to existing disturbed land such as mining areas, existing transmission lines and wind and solar developments, to avoid high-quality agricultural land, where possible.

EnergyCo invited the community and stakeholders to provide feedback on the revised study area for the project in February and March 2022. A community feedback report was released in June 2022 which outlined the consultation outcomes and next steps (EnergyCo, 2022a). The report is available here: Revised study corridor community feedback report (energyco.nsw.gov.au)).

In September 2022, EnergyCo held information sessions with the community to coincide with the release of the Scoping Report for the project.

In addition to community consultation, EnergyCo has been engaging with local councils, government agencies and other key stakeholders since mid-2022 to understand key local issues and priorities in the project area and wider REZ. Further consultation was carried out with the wider community between January and March 2023 to inform how community impacts and benefits will be coordinated in the REZ, including through feedback invited via an online community survey. A community feedback report was released in June 2023 which outlined the findings from the survey (EnergyCo, 2023). The report is available here: Community feedback report (energyco.nsw.gov.au).

Since March 2022 EnergyCo has been engaging with landowners within the transmission corridor to understand land uses and refine the design of the transmission alignment. The formal acquisition process for transmission easements and associated transmission infrastructure was initiated in February 2023 via the distribution of opening letters to directly affected landowners for the energy hubs and substation sites. Opening letters were issued for transmission easements and associated transmission infrastructure in May 2023.

5.3.2 Summary of engagement activities

EnergyCo's communication and engagement activities to date are summarised in Table 5-2.

Table 5-2 Summary of engagement activities

Activity	Description
Ongoing activities	
Dedicated phone number and email address	A dedicated email address and phone number have been provided to receive and respond to enquiries from the community and interested stakeholders: Phone: 1800 032 101 (9 am to 5 pm, Monday to Friday) Email: cwo@energyco.nsw.gov.au.
EnergyCo project website	The EnergyCo project website (energyco.nsw.gov.au) provides information on the project background and need (including details about the Central-West Orana REZ), how the community can get involved, community consultation that has been carried out and links to project documents. The project webpage is updated regularly as new information becomes available.
E-newsletters	Regular project updates and opportunities for engagement are distributed via the project's community email list which currently has about 600 subscribers.
Landowner engagement	Ongoing direct engagement has been carried out with landowners to inform the development of the project, including relevant mining companies. The land acquisition process was initiated in February 2023 with opening letters issued for the energy hubs and substation sites. Opening letters were issued for transmission easements and associated transmission infrastructure in May 2023.

Activity	Description
Stakeholder meetings and briefings	Regular briefings have been carried out with key stakeholders including local councils, elected representatives, agencies and stakeholder groups to discuss matters relating to the project and communities in the REZ, including strategies to manage cumulative impacts and for the delivery of community benefits. EnergyCo holds regular briefings with a number of important key stakeholders including generation projects, local mine operators, local councils, government agencies and elected representatives.
Stakeholder management database	Records of all stakeholder correspondence have been maintained in the project's stakeholder management database (Consultation Manager).
Field work notifications	Notifications of field investigation work have been provided to landowners in the vicinity of where field work will be carried out between mid-2022 and mid-2023, including survey, geotechnical and environmental investigations to inform the EIS and design for the project. These are also published on the project website.
Revised study corridor – February/March 2022 consultation	
Project overview	A project overview document was published on 25 February 2022 to inform people about the project and explain the next steps. The document was made available online and in hard copy format at engagement events. It contains information about the background and need for the project, Central-West Orana REZ, EnergyCo, route identification process, planning and approval process, property acquisition, planned community and stakeholder consultation, contact details and figures and maps of the REZ, revised study corridor and proposed transmission infrastructure.
Media release	A media release was distributed to local and regional media outlets on 25 February 2022 announcing the revised study corridor.
Letter to landowners	Letters were sent out to about 350 landowners within the revised study corridor to inform them about the project and invite feedback.
Advertisements	Print advertisements were published in late February and early March 2022 in the Daily Liberal, Mudgee Guardian and Gulgong Advertiser to promote the project and provide opportunities for engagement.
Information sessions	Six drop-in information sessions were held for community members to meet the project team and ask questions. These were attended by about 130 individuals. The sessions were held at local venues in Wellington, Gulgong and Dunedoo.
Stakeholder briefings	Briefings were conducted with local councils and key industry stakeholders, including elected representatives, organisations and interest groups. The briefings included presentations and discussions on the need for the project, any upcoming planning issues that all parties should be aware of, how stakeholders would like to be engaged, and any other relevant topics.
Registered Aboriginal Party advertising – June 2022	
Advertising	Print advertisements requesting registration of First Nations stakeholders interested in the project published in the following newspapers during mid-June 2022: • Koori Mail • Mudgee Guardian and Gulgong Advertiser • Dubbo Daily Liberal • Dunedoo District Diary • Merriwa District Diary • Western Magazine • Coolah District Diary • Wellington District Leader.
Direct letters	Letters were sent directly to First Nations stakeholders inviting them to become a Registered Aboriginal Party (RAP) for the project.

Activity	Description
Project update – June 2022	
Project update	A project update newsletter was published on EnergyCo's website on 27 June 2022. It was distributed via letterbox distribution to properties in the area in early July via Australia Post. The project update was used to inform people about the current status of the project and next steps, including an invitation for community members to submit applications for the Central-West Orana REZ Community Reference Group.
E-newsletter	An e-newsletter was sent to about 200 registered community members and key stakeholders.
Website update	Updated project information was uploaded to EnergyCo's website.
Community feedback report	A community feedback report was published on EnergyCo's website which summarises the consultation carried out in February and March 2022 on the revised study corridor. The report is available here: Revised study corridor community feedback report (energyco.nsw.gov.au)).
Advertisements	Print advertisements were published in early July to promote the project update and invite applications to join the Community Reference Group through the following media outlets: • Mudgee Guardian and Gulgong Advertiser • Dubbo Daily Liberal • The Land • Dunedoo District Diary • Merriwa District Diary • Western Magazine • Coolah District Diary • Wellington District Leader.
Release of the Scoping Report and refined study corridor – September 2022 consultation	
Project update	A project update newsletter was published on EnergyCo's website on 7 September 2022. It was distributed via letterbox distribution to properties in the study area on 7 September via Australia Post. The project update was used to inform people about the release of the Scoping Report and invite them to attend EnergyCo's upcoming community information sessions in the region.
E-newsletter	An e-newsletter was sent to about 290 registered community members and key stakeholders.
Website update	Updated project information was uploaded to EnergyCo's website.
Information sessions	Seven drop-in information sessions were held for community members to meet the project team and ask questions. These were attended by about 143 individuals. The sessions were held at local venues in Wellington, Dunedoo, Coolah and Gulgong.
Advertisements	Print advertisements were published in early September to promote the project update and invite people to attend the information sessions through the following media outlets: • Mudgee Guardian • Dubbo Daily Liberal • Western Magazine • Dunedoo District Diary • Wellington District Leader • Wellington Times • Coolah District Diary • Merriwa District Diary.
Social Impact Assessment – October 2022 to March 2023	
Interviews	In October 2022 EnergyCo engaged WSP to carry out social impact interviews with landowners and community groups in the REZ to inform the Social Impact Assessment for this EIS (Technical paper 7 – Social). Forty-four face to face, phone and online interviews were conducted between November 2022 and May 2023 to invite further feedback about the project, which included interviews with councils, landowners hosting infrastructure, neighbouring the project and not hosting project infrastructure, community organisations, First Nations organisations and public services (emergency services and health services)..

Activity	Description
Online survey	Landowners within the study corridor were invited to provide feedback via an online social impact assessment survey. The online survey to invite feedback about the project was distributed to 80 landowners hosting project infrastructure, neighbouring the project and not hosting project infrastructure, and was subsequently shared amongst the community. A total of 104 responses to the online survey were received between 10 November and 8 December 2022. Further details on engagement for Social Impact Assessment is provided in Chapter 13 (Social).
Engagement on community benefit initiatives – January 2023	
Project update	A project update newsletter was published on EnergyCo's website and distributed via letterbox distribution to properties in the study area via Australia Post on 23 January 2023. The project update was used to invite people to attend EnergyCo's upcoming information sessions on the recent investigations into community benefit initiatives for the REZ. The newsletter also invited people to complete EnergyCo's online community survey on a number of key topics in the REZ.
E-newsletter	An e-newsletter was sent to about 450 registered community members and key stakeholders.
Website update	Updated project information was uploaded to EnergyCo's website.
Information sessions	Three information sessions were held for community members to meet the project team and ask questions. The sessions included a presentation by the project team followed by a Q&A session. These were attended by about 92 individuals. The sessions were held at local venues in Wellington, Coolah and Gulgong.
Online community survey	An online survey was open from 23 January to 31 March 2023. The survey invited feedback from the community on a number of key topics to inform the development of community benefit initiatives in the REZ.
Advertisements	Print advertisements were published in January and February to promote the project update and invite people to attend the information sessions through the following media outlets: • Dubbo Daily Liberal • Dunedoo District Diary • Wellington Leader • Coonabarabran Times • Mudgee Guardian and Gulgong Advertiser • Coolah District Diary.
Community feedback report	A community feedback report was published on EnergyCo's website in June 2023 which outlines the responses from the community survey The report is available here: Community feedback report (energyco.nsw.gov.au).

5.3.3 Community consultation

EnergyCo has undertaken extensive engagement with communities and landowners to help inform the development and refinement of the study area and to understand issues of importance to the community to be addressed in the EIS. Community and landowner sentiment has formed a critical part of the route development process to date and will continue as EnergyCo further refines the detailed design of the project.

Community consultation activities have included:

- establishment of a Community Reference Group with five meetings held to date
- community information sessions to coincide with updates to the study corridor in March 2022 and September 2022
- provision of project information and updates via a range of channels including website, social media, newsletters and project overview documents
- media advertisements to promote community events or project updates
- one-on-one meetings with community groups

- project phone number and email address to facilitate inquiries to EnergyCo
- community feedback reports to summarise issues raised during consultation
- meetings with property owners directly affected by the project
- interviews and an online survey to support the Social Impact Assessment as part of the EIS
- community information sessions and online surveys to support the community benefit initiatives for the REZ.

Issues raised during community consultation include:

- consultation, including inadequate consultation and consultation fatigue from the amount of development in the region
- construction including disturbance of private land, additional pressure on social services in the region from the temporary construction workforce (including health services) and the use of temporary workforce accommodation camps during construction
- impacts to agriculture activities during construction and operation including any restrictions on activities as a result of the easement
- environmental impacts including vegetation clearing, electric and magnetic fields and erosion, loss of heritage items, visual amenity and waste generation
- visual impacts of the project
- bushfire risks associated with the transmission line as a source of ignition
- clarification of the process for the development of the alignment including any alternatives considered
- REZ planning and governance including the need, approach and communication
- property impacts including acquisition, compensation and impacts to agricultural operations
- socio-economic impacts including business impacts and community benefits.

A detailed list of issues raised during community consultation and how these issues have been addressed in the EIS is provided in Appendix D (Engagement summary).

5.3.4 Agency consultation

Consultation with Commonwealth and NSW Government Agencies was carried out to understand the detailed assessment requirements to be addressed in the EIS. The following agencies were consulted:

- DCCEEW in relation to the assessment of potential impacts of the project on Matters of National Environmental Significance (MNES)
- DPE and its divisions:
  - Crown Lands
  - Heritage NSW
  - Biodiversity Conservation Services
  - National Parks and Wildlife
  - Water
  - Crown Lands
- CASA in relation to potential impacts on protected airspace

- The EPA in relation to a range of environmental matters such as noise and water and environmental licensing
- The Agriculture Division of DPI in relation to the assessment of potential impacts on agricultural land and enterprises
- Forestry Corporation NSW (FCNSW) was engaged about property access to lands managed by FCNSW
- Subsidence Advisory NSW to identify subsidence related design requirements for the project as it is located partly within the Mudgee mine subsidence district
- Minerals Exploration Group (part of the Department of Regional NSW) to understand the requirements where the transmission corridor crosses areas subject to a mineral exploration licence
- The Telco Authority in relation to potential impacts to the telecommunications network
- interviews were held with NSW government agencies to inform the Social Impact Assessment (Technical paper 7 – Social) for the project.

A detailed list of issues raised during agency consultation and how these issues have been addressed in the EIS is provided in Appendix D (Engagement summary).

5.3.5 Council consultation

EnergyCo regularly meets with councils to discuss the project and the development of the broader Central-West Orana REZ, including Mid-Western Regional Council, Dubbo Regional Council, Warrumbungle Shire Council and Upper Hunter Shire Council (note, amendments to the study corridor published in September 2022 extended the corridor into the Upper Hunter Shire Council). Around 75 meetings have been held with local councils since early 2022. A range of issues are discussed during these meetings, with particular focus on cumulative impacts within the REZ.

Key issues and priorities resulting from EnergyCo's engagement with local councils include the impacts of temporary workforce accommodation, opportunities to create legacy benefits in relation to housing, impacts on council owned roads, capacity of waste infrastructure to deal with anticipated waste volumes, construction water demand and council capacity to resource the volume of work generated by the REZ.

A detailed list of issues raised during council consultation and how these issues have been addressed in the EIS is provided in Appendix D (Engagement summary).

EnergyCo is consulting councils on a series of studies to inform how cumulative impacts in the Central-West Orana REZ will be managed. The studies cover a range of issues which have been identified as priorities to the community including:

- workforce accommodation
- road upgrades and traffic management
- training and skills
- waste management
- mobile connectivity
- social infrastructure.

Feedback received from councils as part of the studies will be used to identify mitigation strategies for managing cumulative impacts in the Central-West Orana REZ.

EnergyCo will continue to work closely with councils on cumulative impact strategies and other issues as the project progresses.

5.3.6 Aboriginal heritage consultation

Aboriginal stakeholder and community consultation and engagement activities for the project have been undertaken in accordance with the processes and methods outlined in *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010a), as well as additional project-specific communication strategies to promote transparent and frequent two-way dialogue between the Aboriginal community and the project team.

As part of the Aboriginal Cultural Heritage Assessment prepared to support the EIS (Technical paper 5 – Aboriginal cultural heritage assessment report), the project team has been liaising with 39 Aboriginal organisations and/or individuals. In June 2022, EnergyCo sent notification letters to First Nations stakeholders, including LALCs, National Native Title Tribunal, NTSCORP, Office of the Registrar of NSW Land Claims, Local Land Services and local councils, to provide information about the project and invite Aboriginal knowledge holders to become a RAP for the project. Print advertisements requesting registration of First Nations stakeholders interested in the project were also published in a number of local newspapers during mid-June 2022.

The RAPs include locally based Wiradjuri and Gomeroi individuals and organisations based primarily in Orange, Dubbo, Wellington and Gunnedah, as well as the broader Aboriginal community with an interest in cultural heritage management. RAPs also include representatives of the claimants for two known native title claims under the Commonwealth *Native Title Act 1993* (NC2011/006 and NC2018/002) identified in the construction area through searches of the registers maintained by the National Native Title Tribunal.

Opportunity for Aboriginal involvement in consultation for the project was provided throughout the Aboriginal Cultural Heritage Assessment, including:

- attendance at four face-to-face and/or online meetings during key phases of the project
- participation in a 12-week field survey of the construction area
- participation in a six-week archaeological test excavation of the construction area
- participation for key knowledge-holders to undertake interviews with a highly experienced anthropologist to discuss cultural values.

Over 490 interactions have been undertaken with the RAPs across these opportunities and included some 480 person days of on-site activities. Discussions with the RAPs have been extensive and wide-ranging over the 20-month assessment process. Feedback on the project and Aboriginal Cultural Heritage Assessment activities has generally focussed on who speaks for Country, the tangible sites and places identified as part of the field investigations, and targeted discussion around key sites including rockshelters and grinding grooves, and their future management. Further Aboriginal stakeholder and community consultation and engagement has been undertaken outside the Aboriginal Cultural Heritage Assessment, through First Nations Working Group as described in Section 5.4.3.

5.3.7 How the feedback has been used

The feedback and suggestions received from the community and stakeholders have been considered in combination with engineering, environmental, land use and social studies, to further refine the project and inform the development of this EIS. Community and landowner feedback has formed a key role in the initial development and refinement of the transmission corridor.

Appendix D (Engagement summary) provides a detailed analysis of the feedback provided by community and stakeholders and how this has been addressed by the project.

5.4 Working groups and forums

5.4.1 Community benefit initiatives

EnergyCo has been engaging with key stakeholders since mid-2022 to inform how impacts will be managed in the REZ while also providing long-term benefits for local communities.

From January to March 2023, EnergyCo sought feedback from the wider community to understand local views and sentiment about a number of key issues in the Central-West Orana REZ. Feedback was invited via a community survey which covered housing and accommodation, employment and training, community benefit-sharing initiatives and other priority topics. A total of 290 survey responses were received from a wide range of community and stakeholders.

In June 2023 EnergyCo published a consultation report (EnergyCo, 2023) outlining the survey responses. The feedback received will inform various strategies and initiatives for the Central-West Orana REZ.

Summary of key survey findings

Of the 290 community survey responses received in early 2023, three quarters of participants said they live in the REZ, while almost a third said they work in the Central-West Orana REZ. Seven per cent of participants said they work on a project related to the Central-West Orana REZ and 13 per cent said they are just interested in EnergyCo's work.

The responses identified priority areas to the community for benefit funding and initiatives. Key findings are summarised in Table 5-3.

Table 5-3 Key findings from the community survey (January to March 2023)

Topic	Key findings
Community benefit funding	• Health services or infrastructure was the highest priority for community benefit funding, with nearly half of participants including it in their top three priorities. • Nearly two thirds of participants said that grants for benefit funding should be given to community groups to deliver projects.
Training and employment	• Survey participants were asked to rank the importance of various potential initiatives for their communities. Trainee and apprentice positions were viewed as the most important initiative, with nearly 60 per cent of participants ranking it as very important.
Cumulative impacts to communities	• Survey participants were asked to rank the impacts they are most concerned about in their communities. Participants were generally concerned about all the impacts identified, with the strongest areas of concern being impact to land use and agriculture (65 per cent very concerned) and roads and traffic (64 per cent very concerned).
Workforce accommodation	Survey participants were asked how they think workers should be accommodated during the construction delivery phase. • Nearly half of participants indicated that a mix of temporary camps and existing local accommodation should be used. • Local business and supplier opportunities was identified as the most important factor for proponents to consider when planning workforce accommodation.
Impact to local services	• When asked which local services they are most concerned about in their community, 80 per cent of participants identified medical services as a concern. • Accommodation availability and emergency services were the next two biggest areas of concern, with both topics identified by more than 60 per cent of participants.
Telecommunication black spots	• The delivery of improved telecommunications services in known blackspot areas, as well as improving mobile coverage more generally in the REZ, were seen as the priority areas, along with major roads in the area.
Community energy initiatives	• More than half of participants viewed community energy and community battery programs as very important, in addition to solar, battery and energy efficiency support schemes.

5.4.2 Community Reference Group

EnergyCo established a Community Reference Group in August 2022 to provide an open forum for discussion between EnergyCo, community representatives and key stakeholders in relation to the project and Central-West Orana REZ. The Community Reference Group will discuss matters relating to the planning and delivery of the project, as well as broader REZ issues.

The objectives of the Community Reference Group are to:

- establish good working relationships and promote information-sharing between EnergyCo, local community representatives and key stakeholders
- provide Community Reference Group members with visibility of the project and enable them to share project information via their networks
- keep members informed about project activities, key milestones and opportunities to provide feedback
- provide an avenue for EnergyCo to seek community and stakeholder input on project matters
- allow community members to seek information from EnergyCo and provide feedback.

The Community Reference Group consists of:

- an Independent Chairperson who acts as the convenor, facilitator, mediator and advisor for the Community Reference Group. The Independent Chairperson acts independently and impartially and is the key point of contact between the Community Reference Group and EnergyCo
- four community representatives who are current residents and/or landowners in the REZ
- five representatives from local community or stakeholder groups.

In addition, representatives from local councils and LALCs are invited to participate in the Community Reference Group, including Dubbo Regional Council, Warrumbungle Shire Council, Mid-Western Regional Council, Upper Hunter Shire Council, Dubbo LALC, Mudgee LALC, Gilgandra LALC, Wellington LALC and Walhallow LALC. It is at these organisations' discretion if they nominate to attend the Community Reference Group meetings.

Developers of generation projects will be invited to participate in the Community Reference Group on a regular basis to discuss matters such as the management of cumulative impacts within the REZ. Other non-Community Reference Group members, such as individuals or stakeholder organisations with specific remits and expertise, will be invited to join Community Reference Group meetings as appropriate.

The Network Operator of the project will participate in the Community Reference Group from around the third quarter of 2023 onwards.

The Community Reference Group has held five meetings to date:

- Meeting #1 – Thursday 1 September 2022
- Meeting #2 – Tuesday 29 November 2022
- Meeting #3 – Monday 30 January 2023
- Meeting #4 – Thursday 27 April 2023
- Meeting #5 – Thursday 20 July 2023.

The next Community Reference Group meeting is scheduled for Monday 23 October 2023 in Mudgee NSW. Future meetings will continue to be held quarterly with dates and times agreed upon by group members.

5.4.3 First Nations Working Group

A First Nations Working Group was established in 2020 to help inform the preliminary design for the transmission corridor.

In August 2022, the Minister for Energy issued guidelines on consultation with First Nations communities for energy infrastructure delivered under the NSW Electricity Infrastructure Roadmap, including the Central-West Orana REZ (OECC, 2022).

These guidelines, required under section 4(1) of the *Electricity Infrastructure Investment Act 2020* (the enabling legislation of the NSW Electricity Infrastructure Roadmap), build on, but do not replace, existing consultation requirements under other legislation, in particular the *National Parks and Wildlife Act 1974* (NSW) and the *Native Title Act 1993* (Cth).

EnergyCo and the DPE worked with First Nations advisors to engage with local First Nations communities on the development of the guidelines.

A First Nations Working Group comprised of Aboriginal community representatives, LALCs, Aboriginal working parties, government support services and local First Nations organisations will be re-established. The working group will aim to support and coordinate local First Nations community engagement during the planning and development phase of the REZ Transmission project.

A representative from the NSW Aboriginal Land Council and members of the First Nations Working Group were interviewed in March 2023 as part of the Social Impact Assessment for the EIS (Technical paper 7 – Social).

5.4.4 Skills and Workforce Working Group

EnergyCo established the Skills and Workforce Working Group for the Central-West Orana REZ in March 2023 to address skills gaps and workforce supply across the REZ.

The Skills and Workforce Working Group consists of representatives from:

- EnergyCo
- NSW Treasury
- NSW Office of Energy and Climate Change
- NSW Department of Education
- Training Services NSW, West Region
- Department of Regional NSW
- Department of Planning and Environment
- Department of Employment and Workplace Relations, Far West Orana
- TAFE NSW
- Charles Sturt University
- Association of Independent Schools NSW
- RDA Orana
- Electrical Trades Union
- VERTO
- ACEnergy
- Squadron Energy

- Lightsource BP
- Iberdrola
- ACEN Australia
- Acciona Energia
- Tilt Renewables
- RES Australia
- ib Vogt
- X-Elio
- CWP Renewables
- Dubbo Regional Council
- Mid-Western Regional Council
- Warrumbungle Shire Council
- AEMO
- Clean Energy Council
- Three Rivers Regional Assembly
- Mudgee LALC
- Mining and Energy Union South Western District
- NSW Farmers Association.

The working group includes representatives from the energy sector, the education and training sectors, local First Nations communities, relevant unions, representatives from the Renewable Energy Sector Board, local governments, the Commonwealth Government and NSW Government.

The first meeting of the Skills and Workforce Working Group was held on 5 April 2023. Future meetings are planned to be held quarterly.

5.4.5 Candidate foundation generators interface meetings

EnergyCo is holding ongoing meetings with major renewable energy generators, called candidate foundation generators, to coordinate the development of generation projects and their connection to the transmission network. Candidate foundation generators include:

- Acciona Energy
- Squadron Energy (previously CWP Renewables)
- Lightsource BP
- Marble Energy
- Origin Energy
- RES Group
- Tilt Renewables
- ACEN Australia.

5.5 Future engagement

5.5.1 Engagement approach

Engagement will continue on specific issues and opportunities relevant to the project following lodgement of the EIS for exhibition, in accordance with *Undertaking Engagement Guidelines for State Significant Projects* (DPE, 2022h). This will include community information sessions during the EIS exhibition period to allow community members to discuss aspects of the EIS with the project team.

EnergyCo is committed to continue to engage landowners, the community and stakeholders throughout all project stages and to build and maintain strong relationships within the communities where the proposed transmission infrastructure will be located.

The general project information and feedback mechanisms summarised in Table 5-2 will continue to be available during further design development and preparation of the Submissions Report. These mechanisms will be complemented with further direct community and stakeholder engagement activities focused on:

- providing information and project updates at key stages during design development and preparation of the Submissions Report
- engagement with affected landowners and community groups about the project and key design decisions that may impact them
- engagement and coordination with generation projects in the Central-West Orana REZ, particularly around project interfaces and in relation to cumulative impacts
- engagement with regulatory agencies during preparation of the Submissions Report to ensure a complete and robust Submissions Report.

5.5.2 Exhibition of the EIS

Public exhibition of the EIS will be for a minimum of 28 days as stated in section schedule 1, clause 12 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Advertisements will be placed in local media giving information regarding the project and display of the EIS. During the exhibition period, government agencies, stakeholders and the community will be able to review the EIS and will have the opportunity to make a written submission to the DPE for consideration in its assessment of the project. The EIS will be published online and submissions can be made through the Major Projects website here: Central-West Orana REZ Transmission | Planning Portal - Department of Planning and Environment (nsw.gov.au).

Consultation activities during the public exhibition of the EIS will be consistent with those undertaken for the Scoping Report and will include:

- community information sessions
- local radio and newspaper advertising
- project website updates and resources
- a digital EIS (available at http://cworeztransmission.com.au/)
- letterbox distribution
- stakeholder meetings
- government stakeholder engagement.

Interactive map

An interactive map is available on the EnergyCo project website. This provides an online tool to show the project and other geographical information about the project and explore the key outcomes of the EIS through interactive mapping. The interactive map will also allow its viewers to:

- relate the project to the broader geographic context
- analyse multiple datasets for the project simultaneously
- view up-to-date information about the project
- identify the transmission alignment in relation to their properties
- use specialised tools for retrieving information.

Project notifications and updates

As part of the exhibition of the EIS, EnergyCo will publish and distribute information to communicate the EIS. This will include:

- project update newsletter
- EIS guide and fact sheets
- website update and online tools and resources
- advertising in local media outlets
- e-newsletter
- media release
- display information at drop-in community information sessions.

5.5.3 Construction of the project

Should the project be approved, EnergyCo would continue to consult with stakeholders and the community during construction in accordance with the conditions of approval. Further information about the consultation activities and tools during the construction phase will be provided in the EIS.

EnergyCo is also in the process of undertaking a competitive tender process for the appointment of a Network Operator, who would be responsible for the design, construction, financing, operation and maintenance of the Central-West Orana REZ network infrastructure (refer to Section 1.5). The preferred Network Operator will be responsible for compliance of the project with planning approval requirements under the EP&A Act and engagement with communities and stakeholders about project-related matters during construction and operation.

6 Approach to impact assessment

6.1 Overview

The project as presented in this Environment Impact Statement (EIS) has been developed to avoid and minimise impacts where practicable and has been designed to a level where the potential impacts of the project can be appropriately identified and assessed. Some flexibility has been factored into the design of the project as described in this EIS to allow for certain design elements and construction methodologies to be refined as part of the continued design development and construction planning process. EnergyCo would seek to reduce environmental impacts and improve environmental outcomes through continued refinement of the project design and construction methodology where practicable.

This chapter outlines the approach that has been adopted in assessing the potential impacts of the project.

Further detail on the design and construction methodology refinement process is provided in Section 21.5.2.

6.2 Assessment approach

The assessment of potential environmental impacts as part of this EIS has, for the most part, been undertaken by assessing impacts on a 'worst case' basis with the exception of biodiversity. Conducting the impact assessment this way was intended to ensure that a rigorous level of assessment was undertaken, while also leaving open the possibility of further reducing impacts to sensitive receivers and the surrounding environment through the detailed design process.

Most of the impact assessments (with the exception of biodiversity for the reasons outlined in Section 6.2.1) have conservatively assumed that the construction area in its entirety could potentially be impacted by the project. The construction area encompasses all project infrastructure elements, including:

- transmission lines and towers
- energy hubs
- switching stations
- access roads to switching stations and energy hubs
- access tracks to easements
- access tracks along easements
- communications infrastructure
- workforce accommodation facilities
- construction compounds
- brake and winch sites
- laydown and staging areas.

Certain mitigation measures identified in this EIS require impacts to be further considered during the detailed design and construction planning processes, in order to, where practicable, further minimise or avoid impacts. This also includes further considering exclusion areas for any sensitive features such as Aboriginal and non-Aboriginal heritage sites.

6.2.1 Biodiversity

In relation to biodiversity impacts, 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 project (within the broader construction area). This approach was adopted to provide as realistic an assessment as practicable and avoid a 'worst case' approach. Adopting a 'worst case' approach for this environmental aspect in particular would result in a substantial overestimation of the likely biodiversity impacts of the project (for example, assuming the whole of the transmission line easement would be cleared of vegetation when this is known to not be the case). The disturbance area for assessing impacts to biodiversity has been identified based on the reference design however it is indicative at this stage. The disturbance area would be confirmed during finalisation of the project design and construction methodology and would be developed with the aim of avoiding and minimising potential impacts to biodiversity, where practicable.

The disturbance area would have varying degrees of physical disturbance within the construction area to reflect the construction and operational requirements of the project, specifically:

- Disturbance area A – land within the operation area where complete vegetation removal would be required (to be completed during construction), including areas at and around the transmission line towers in the permanent easement, new/upgraded access tracks, energy hubs, switching stations and associated infrastructure, as well as temporary areas required for brake and winch sites, construction compounds, workforce accommodation camps, energy hubs, switching stations and associated infrastructure. All areas, except areas corresponding with temporary disturbance (such as brake and winch sites), would be subject to ongoing maintenance during operation for operational and safety requirements, including bushfire risk management.
- Disturbance area B – all other land within the operation area that does not form part of disturbance area A, including land in between transmission line towers in the permanent easement, in which removal of vegetation would be required if the vegetation has the potential to exceed a height of two metres. It is assumed no ground disturbance would occur in this area, except for vegetation which has the potential to exceed a height of two metres. Clearance of vegetation with the potential to exceed two metres in height would include either removal of the root ball or stump grinding. Vegetation clearance heights are set for operational and safety requirements, including bushfire risk management.
- Disturbance area HZ – an area adjacent to Disturbance area B (generally 10 metres wide) along the 500 kV transmission lines where there would be impacts to selected trees or part of a tree that are within the risk category height range 20–30 metres and have been identified as having poor structural stability (i.e. which pose a risk of falling). The number of trees that are likely to be at risk of falling is likely to be minimal, however it has been conservatively assumed that a nominal 10% of this area is likely be impacted. A structurally sound tree with no obvious risk of falling within this zone would not be removed.

The width of the disturbance areas A and B varies for the 330 kV and 500 kV transmission lines, in accordance with the required easement widths and construction methodologies. Figure 6-1 and Figure 6-2 identify the allocation of each area for each transmission line type.

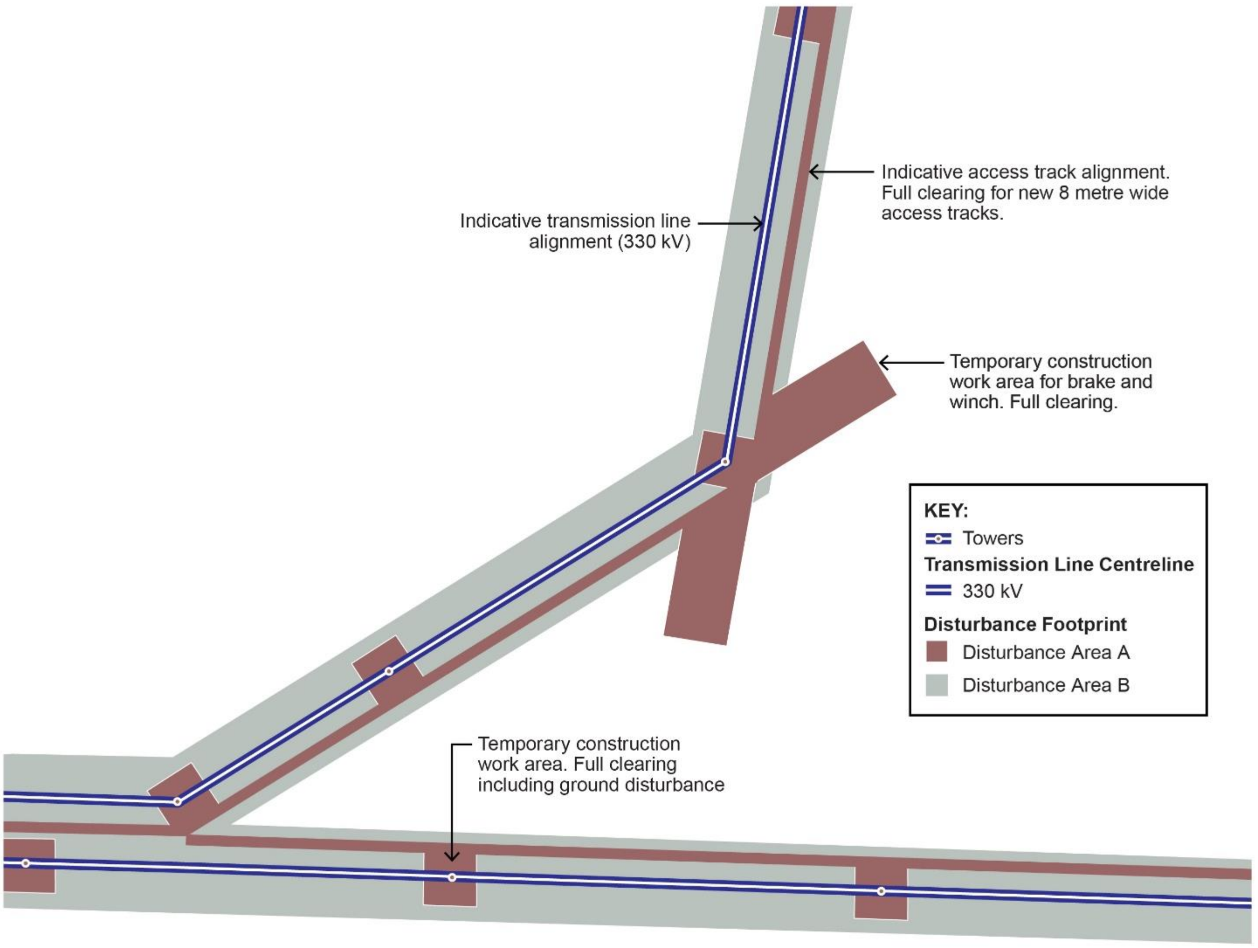


Figure 6-1 Indicative disturbance area definition for a typical 330 kV transmission line section [not to scale]

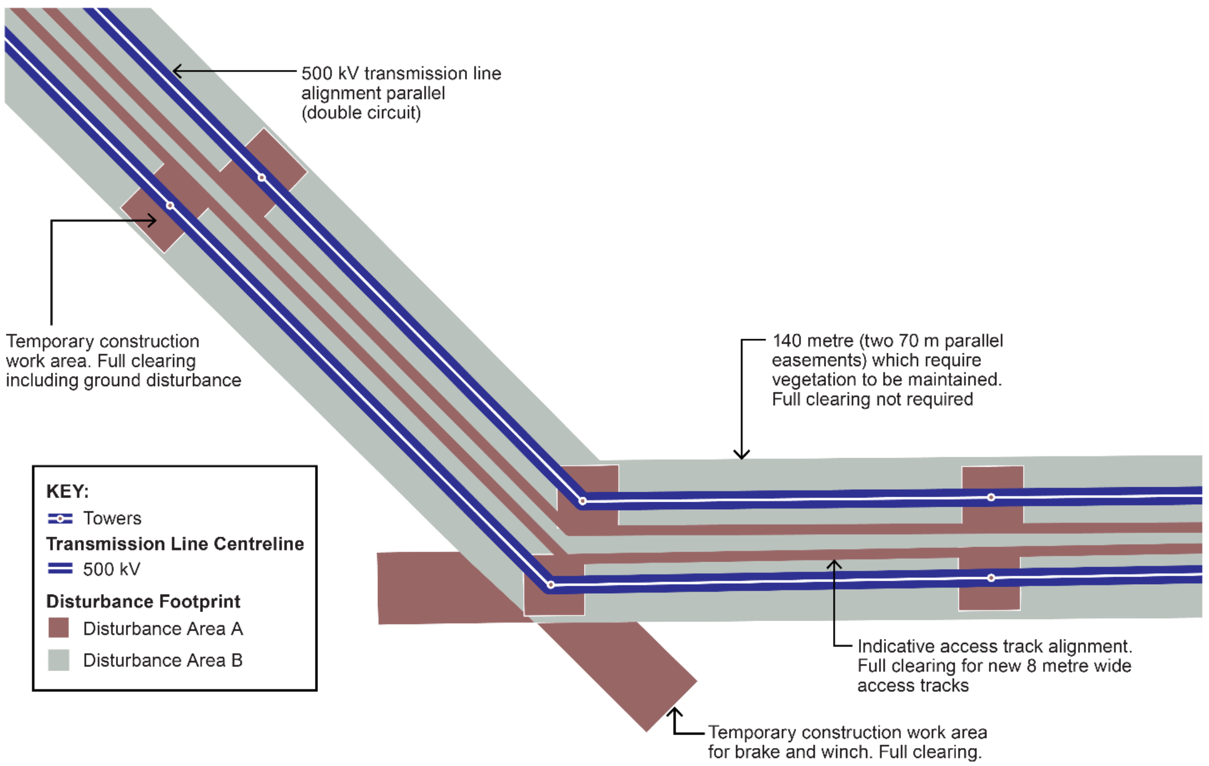


Figure 6-2 Indicative disturbance area definition for a typical 500 kV transmission line section [not to scale]

6.2.2 500 kV transmission line between Merotherie and Elong Elong energy hubs and the Elong Elong energy hub

As identified in Section 3.5.3 of this EIS, the Merotherie Energy Hub — Elong Elong Energy Hub connection, and the Elong Elong Energy Hub would initially be operated at a 330 kV capacity and not the full 500 kV capacity. However, the impacts associated with the construction of the infrastructure and operating parameters of the full 500 kV capacity line and 500 kV components at Elong Elong Energy Hub are presented in this EIS. That is, this EIS assesses the impacts of both the construction of this infrastructure for a 500 kV capacity and its operation at that capacity which presents the potential worst case scenarios of the potential impacts (excluding biodiversity) of the Merotherie Energy Hub — Elong Elong Energy Hub connection and Elong Elong Energy Hub.

6.2.3 Unsurveyed areas

As part of the preparation of the EIS, field surveys were undertaken for a range of issues with a focus on biodiversity and heritage. Due to landowner access restrictions or logistical constraints due to wet weather, it was not practicable during the assessment period of these environmental matters to survey the full length and extent of the construction area. With respect to biodiversity and heritage matters, a summary of the potential field validated uncertainties has been identified below:

- For biodiversity, the assessment has relied upon existing mapping and aerial photography for Plant Community Types (PCTs) where surveys could not be completed. Seasonal survey for threatened species was also limited significantly in some locations as a result of access restrictions, resulting in some areas being unsurveyed or only surveyed in certain seasons. As a result the assessment has adopted a conservative approach and assumed presence for a number of threatened species. Further information is provided in section 2.6 of Technical paper 4 – Biodiversity.
- For Aboriginal heritage, around 21 per cent of the construction area was not surveyed. Test excavations were completed at locations to validate the predictive models developed from desktop information. The methodology was developed in discussions with Heritage NSW, who requested certain requirements in response to the logistical and access constraints for the project. Further information is provided in section 8.3 of Technical paper 5 – Aboriginal cultural heritage assessment report.
- For non-Aboriginal heritage, around six of the 26 heritage items (comprising of listed and potential heritage items) identified in the desktop assessment were not inspected, and survey of the entire construction area was not practicable due to weather and access constraints. Further information is provided in section 3.4 of Technical paper 6 – Non-Aboriginal heritage.

Further survey efforts for both biodiversity and Aboriginal heritage are ongoing for the remaining sections of the project. Where additional field surveys are able to be undertaken prior to approval, this information would be presented in the Submissions Report to be prepared following exhibition of the EIS.

6.3 Identification of key issues

To identify the potential environmental, social and economic impacts that may arise as a result of the project and to determine the required level of assessment of these impacts in accordance with the *State significant infrastructure guidelines – preparing a scoping report* (DPIE, 2021c) (Scoping Report guidelines), a preliminary environmental risk analysis was completed as part of the *Central-West Orana Renewable Energy Zone Transmission Project Scoping Report* (EnergyCo, 2022) (Scoping Report). The preliminary environmental risk analysis was based on a preliminary design for the project and limited environmental information available at that time.

The preliminary environmental risk analysis has been updated to reflect the additional design development undertaken since the Scoping Report, the SEARs, the results of field investigations and feedback from property owners, community and stakeholders.

Impacts have been categorised as 'key' or 'other' issues, based on the consequence of each potential impact (minor, moderate and major) and likelihood of the impact (unlikely, likely, certain). In determining the consequence, the scale of the impact (severity, geographical extent, and duration) and sensitivity of the receiving environment has been considered (including values held by stakeholders and vulnerability to change).

Having regard to these categorisations, 'key issues' for the project were identified where impacts had the potential to be of a major or moderate nature and where further detailed investigation was required to better understand the impact and potential mitigation measures. 'Other' issues were identified where there were minor impacts as a result of construction and/or operation of the project, which could be managed effectively with the implementation of standard and/or best practice management and mitigation measures. Further detail on the risk assessment methodology is provided in Chapter 22 (Environmental risk analysis).

The key environmental impacts identified for the project which have been subject to detailed investigation are:

- land use and property
- agriculture
- landscape character and visual amenity
- biodiversity
- Aboriginal heritage
- non-Aboriginal heritage
- social
- economic
- noise and vibration
- hazard and risk, including bushfire
- traffic and transport
- waste management and resource use
- cumulative impacts.

Other impacts requiring assessment but considered to have low potential impacts were considered to be hydrology, flooding and water quality, groundwater, soils and contamination, air quality and climate change and greenhouse gas.

7 Land use and property

This chapter provides an assessment of the potential land use and property impacts of the project and identifies mitigation measures to minimise these impacts. The SEARs as they relate to land use and property, and where in the EIS these have been addressed, are detailed in Appendix A.

7.1 Legislative and policy context

Potential land use and property impacts resulting from the project were assessed with consideration of the following legislation and key policies:

- *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act) and subordinate legislation and instruments including:
  - *Environmental Planning and Assessment Regulation 2021* (NSW) (EP&A Regulation)
  - State Environmental Planning Policy (Primary Production and Rural Development) 2019 (Rural SEPP))
  - Mid-Western Regional Local Environment Plan (LEP) 2012
  - Warrumbungle LEP 2013
  - Dubbo Regional LEP 2022
  - Upper Hunter LEP 2013
- *Crown Lands Management Act 2016* (NSW) and the *Crown Land Legislation Amendment Act 2017* (NSW)
- *Lands Acquisition (Just Terms Compensation) Act 1991* (NSW)
- *Local Land Services Act 2013* (NSW)
- *National Parks and Wildlife Act 1979* (NSW) (NP&W Act)
- *Native Title Act 1994* (NSW)
- *Aboriginal Land Rights Act 1983* (NSW)
- *Civil Aviation Safety Regulation 1998* (NSW)
- *Central West and Orana Regional Plan 2041*
- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Biodiversity Conservation Act 2016* (NSW) (BC Act)
- *Native Title Act 1993* (Cth).

The land use and property assessment has also considered the findings of other impact assessments completed to support the EIS and the legislative framework that applies to specific assessment matters to the extent relevant to the assessment of land use and property impacts. Chapter 4 (Statutory context) and Appendix D (Statutory compliance) provide more detail on the statutory context for the project.

In addition, Chapter 2 (Strategic context) of the EIS provides detail on the strategic land use planning policies and energy sector policies of relevant to the project.

7.2 Assessment approach

7.2.1 Study area

The land use study area comprises a four-kilometre buffer either side from the construction area, to understand the context of the areas immediately surrounding the project. Where relevant to do so, the broader region has also been considered in this assessment by Local Government Area (LGA), however the assessment of property impacts has generally been limited to the construction and operational areas (i.e. the land directly impacted by the project).

7.2.2 Assessment approach

The methodology for assessing the potential land use and property impacts of the project involved:

- reviewing the legislation and policy context relevant to land use and property impacts
- identifying and mapping existing land uses within the defined 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 as it relates to land use and property, including attributes such as land and soil capability and land use, that can help evaluate the nature and productivity of agricultural enterprises in the defined study area, which is the dominant land use
- a review of native title claims, including a search of the following databases
  - the Register of Native Title Claims
  - the National Native Title Register
  - the Register of Indigenous Land Use Agreements
  - Native Title applications, registration decisions and determinations
- a review of Aboriginal land claims, including a search of the NSW Register of Aboriginal Land Claims
- a review of previous reports, and relevant technical papers developed to support the preparation of the EIS
- assessing the potential changes to land use and impacts to property from construction and operation of the project, including consideration of the issues raised through engagement with community, stakeholders and landowners of relevance to the land use and property assessment (refer to Chapter 5 (Community and stakeholder engagement) for further detail)
- identifying mitigation and management measures to avoid, minimise and manage the potential changes to land use and property impacts identified as part of this assessment.

7.3 Existing environment

7.3.1 Land zoning

Most of the study area is zoned RU1 (Primary production) by the applicable LEPs. Scattered areas of RU3 (Forestry), R5 (Large lot residential), C1 (National parks and reserves), and C3 (Environmental management) are located around the central, western and southeastern sections of the study area.

Areas of land zoned R5 (Large lot residential), which generally have a higher density of residential properties than land zoned RU1 (as indicated by the number of sensitive receivers identified in noise catchment areas outlined in Chapter 15) are located:

- north of the township of Wollar
- east of the new Wollar Switching Station — Merotherie Energy Hub connection
- south of the Merotherie Energy Hub — Elong Elong Energy Hub connection.

The extent of land zoned C1 (National parks and reserves), and C3 (Environmental management) generally increases in the southeastern section of the study area, and reflects the presence of national park estate and state forest reserves, including the Goulburn River National Park and Durridgere State Conservation Area

Corridors of land zoned as SP2 (Infrastructure) are located within the study area, and are associated with major road and rail lines, including the Castlereagh and Golden highways.

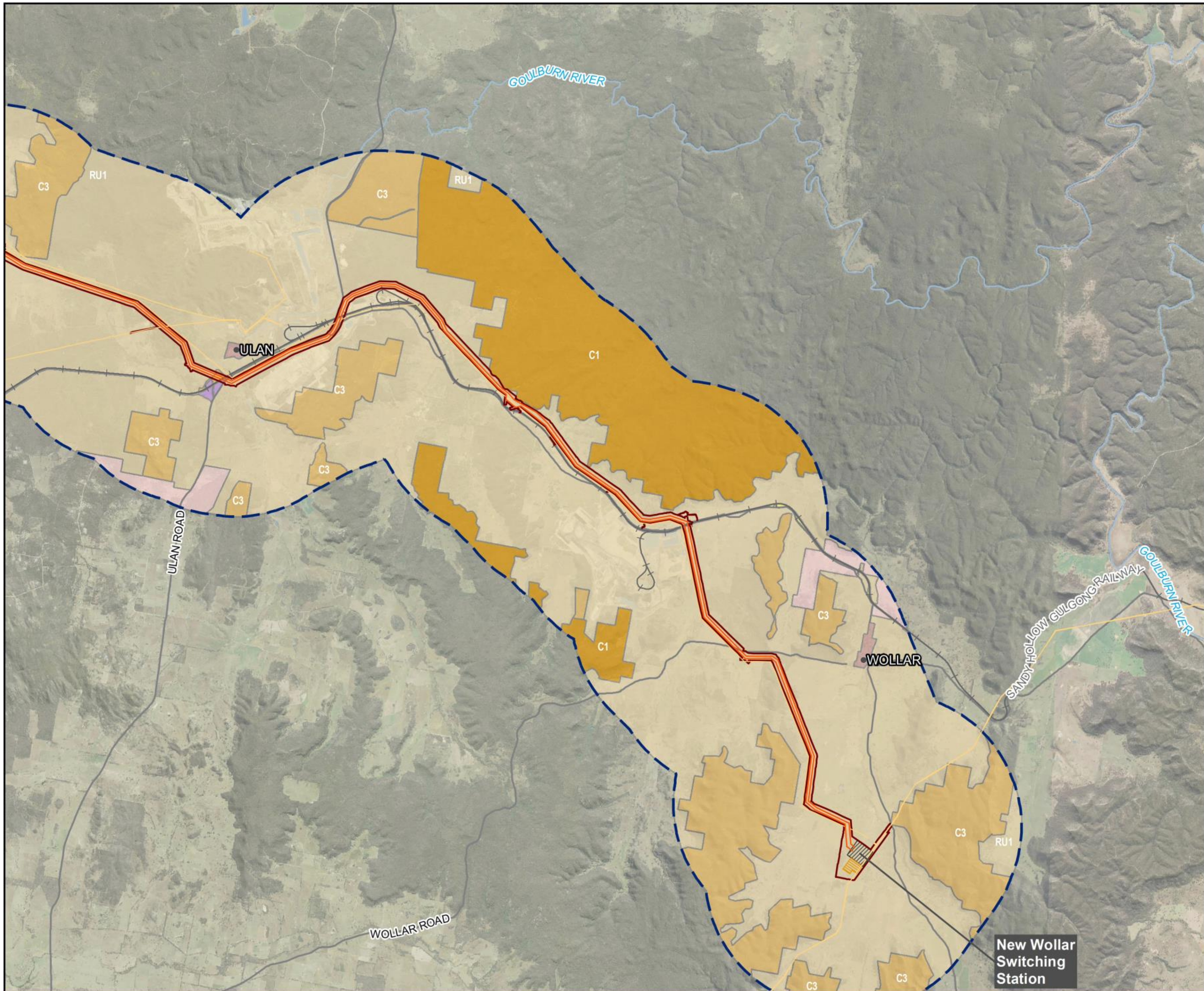
The largest regional centre is the town of Dubbo, around 50 kilometres to the west of the project and outside of the study area. Other larger town centres near (but outside of) the study area include:

- Coolah, around 15 kilometres to the north of the M2 switching station
- Dunedoo, around 17 kilometres to the north of the M7 switching station
- Gulgong, around 10 kilometres to the southeast of the M9 switching station.

Within the study area, the townships of Ulan and Wollar, zoned RU5 (Village), are located adjacent to the existing mining operations (refer to Section 7.3.2). A small area to the southeast of Ulan is zoned IN3 (Heavy industrial), however it is noted this land is currently undeveloped. The villages of Uarbry and Cassilis (zoned RU5) are in the northeastern section of the study area, adjacent to the Coolah and Cassilis connections respectively.

Figure 7-1 shows land zoning across the study area.

Figure 7-1
Land zoning
Page 1 of 4



Legend

- Study area
- Construction area
- Construction compound
- Energy hub / 500kV switching station
- 500 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse
- Water body

Land zoning

- C1 - National parks and nature reserves
- C3 - Environmental management
- IN3 - Heavy industrial
- R5 - Large lot residential
- RU1 - Primary production
- RU5 - Village
- SP2 - Infrastructure

0 2 4 km

Coordinate system: GDA 1994 MGA Zone 55
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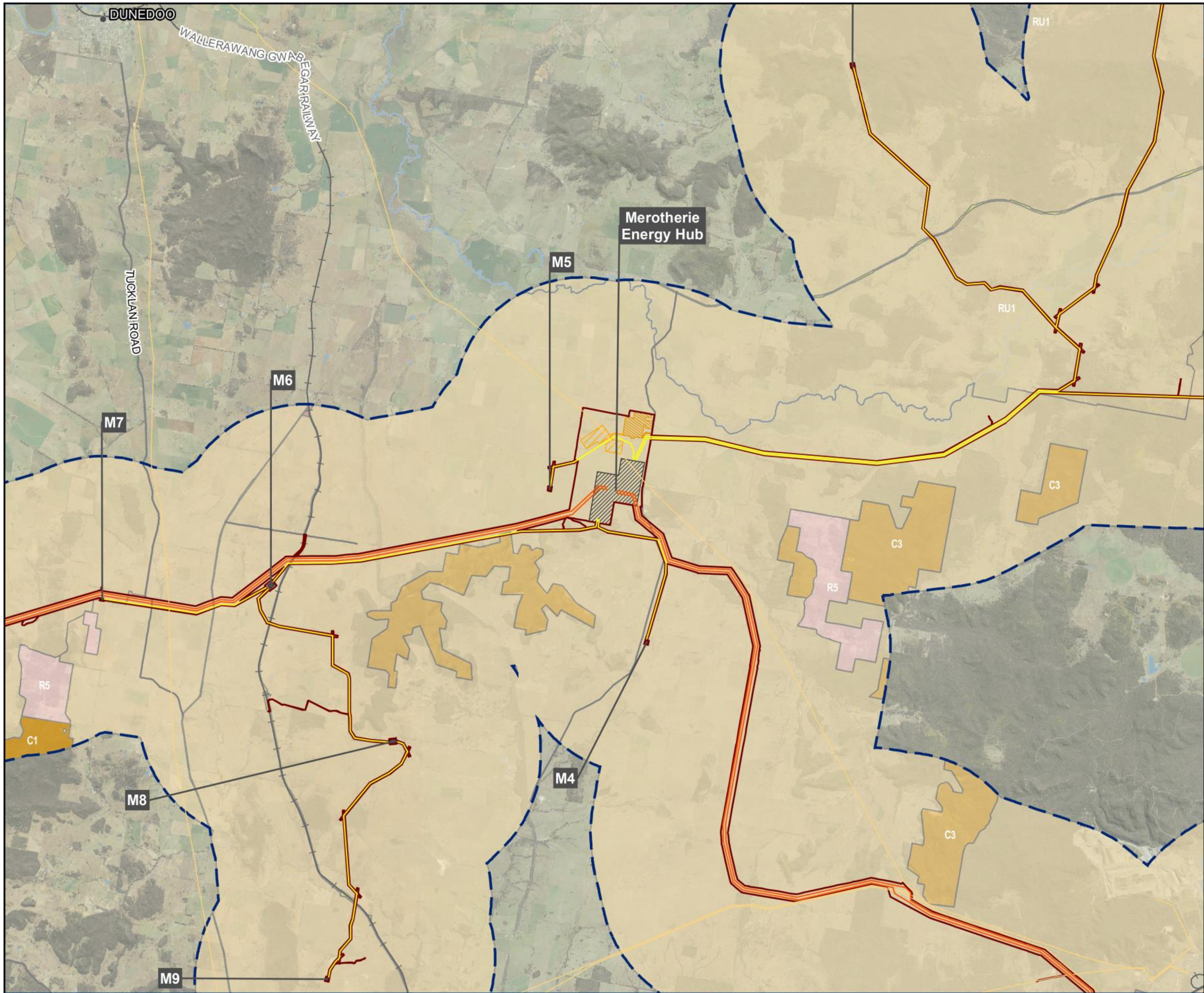
Data sources: WSP 2023

Figure 7-1
Land zoning
Page 2 of 4

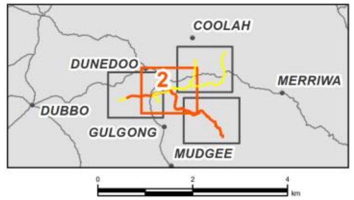


Legend

- Study area
- Construction area
- Workforce accomodation camp
- Construction compound
- Energy hub / 500kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse
- Water body

Land zoning

- C1 - National parks and nature reserves
- C3 - Environmental management
- R5 - Large lot residential
- RU1 - Primary production
- RU5 - Village
- SP2 - Infrastructure



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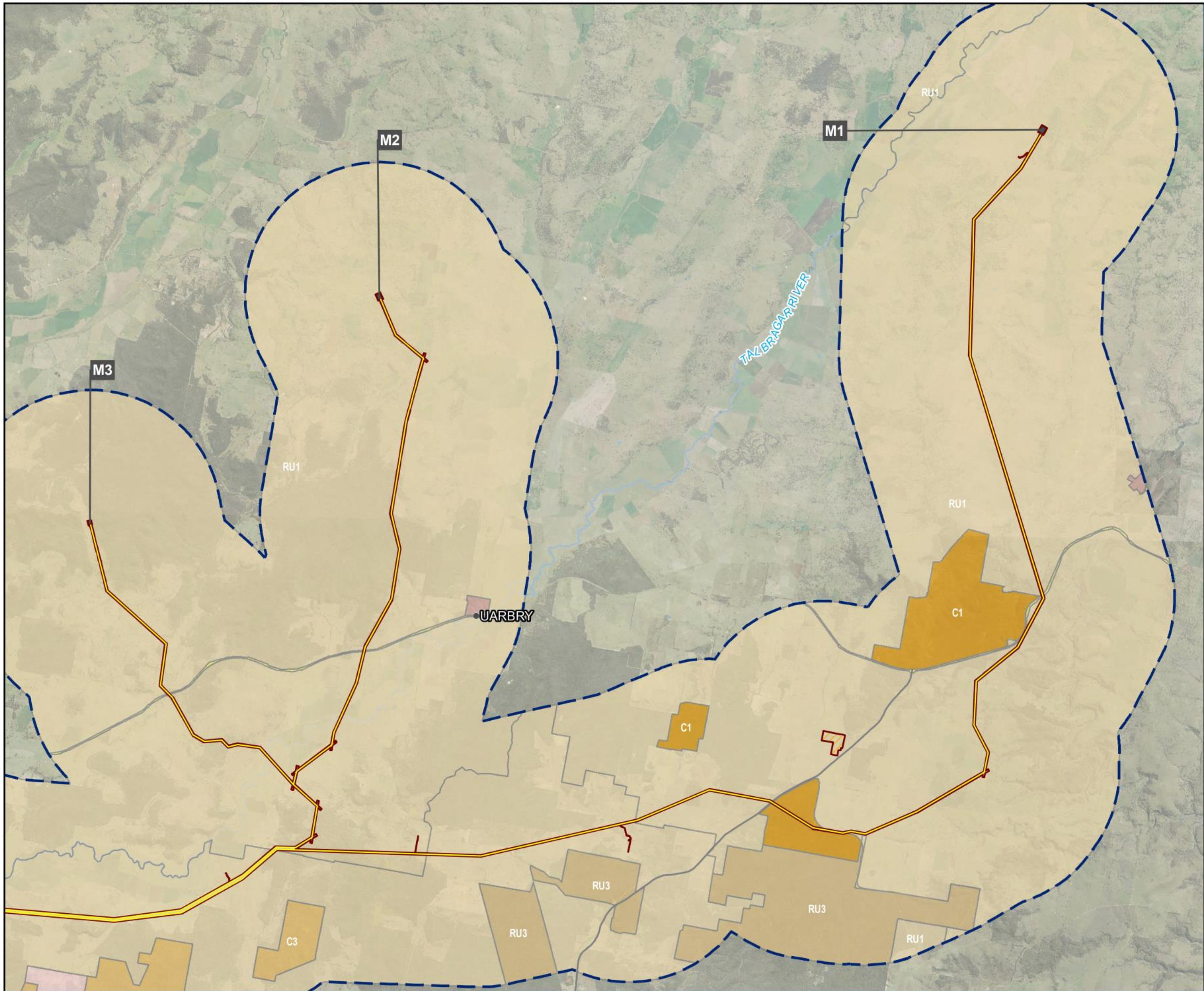

Figure 7-1
Land zoning
Page 3 of 4

Legend

- Study area
- Construction area
- Workforce accomodation camp
- 330 kV switching station
- 330 kV transmission line
- Road
- Watercourse
- Water body

Land zoning

- C1 - National parks and nature reserves
- C3 - Environmental management
- R5 - Large lot residential
- RU1 - Primary production
- RU3 - Forestry
- RU5 - Village
- SP2 - Infrastructure

0 2 4 km

Coordinate system: GDA 1994 MGA Zone 55
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Data sources: WSP 2023

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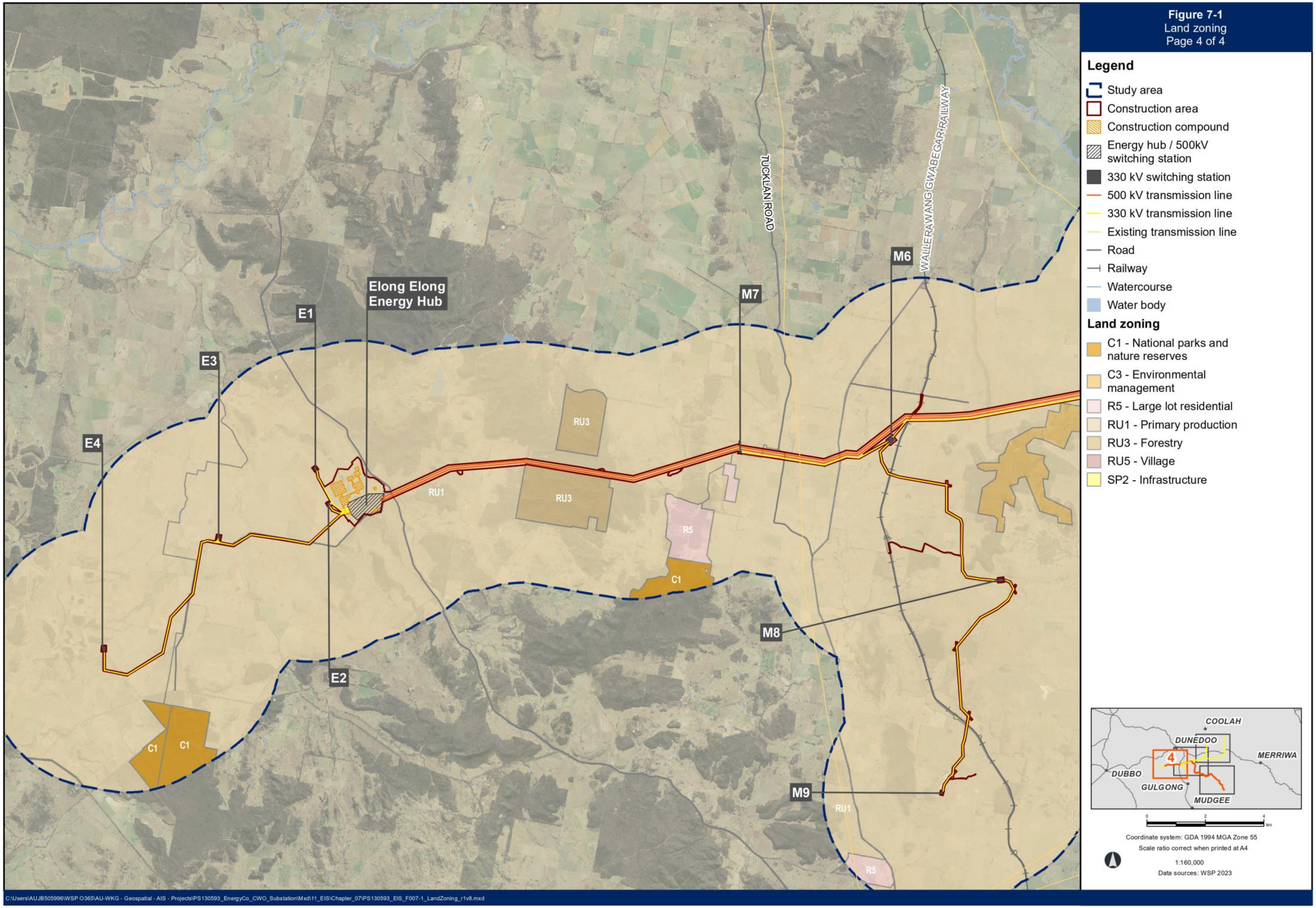

Figure 7-1
Land zoning
Page 4 of 4
Legend
Study area
Construction area
Construction compound
Energy hub / 500kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing transmission line
Road
Railway
Watercourse
Water body
Land zoning
C1 - National parks and nature reserves
C3 - Environmental management
R5 - Large lot residential
RU1 - Primary production
RU3 - Forestry
RU5 - Village
SP2 - Infrastructure
Elong Elong Energy Hub
E1
E2
E3
E4
M6
M7
M8
M9
TUCKLAN ROAD
WALLERAWANG GWABEGAR RAILWAY
RU1
RU3
R5
C1
COOLAH
DUNEDOO
MERRIWA
DUBBO
GULGONG
MUDGEE
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Coordinate system: GDA 1994 MGA Zone 55
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Data sources: WSP 2023
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7.3.2 Land use

The primary land use within the study area is agriculture, which makes up around 72 per cent of the total study area. Around 17.6 per cent of the study area is defined as 'other minimal use' which refers to areas of land that are largely unused and consist primarily of residual native vegetation.

Land uses within the study area are described in Table 7-1 and shown in Figure 7-2. It should be noted land use mapping does not take into consideration areas within the Moolarben coal mine, which have been approved for open cut mining, and as such remain mapped as grazing areas (as detailed in Mining and Exploration and associated Figure 7-4 further below).

Table 7-1 Land use within the study area

Land use[1]	Study area (Ha)	Proportion of study area (%)
Agriculture – grazing modified pasture	51,070	29.7
Agriculture – grazing native vegetation	46,605	27.1
Other minimal use[2]	30,270	17.6
Agriculture – cropping	24,035	14.0
Nature conservation (protected areas)	10,475	6.1
Mining	3,940	2.0
Production of native forestry	1,805	1.1
Residential and farm infrastructure	1,775	1.0
Rivers/Marsh/Wetlands	1,360	0.8
Other land uses[3]	505	0.3
Total	**171,840**	

1. Identified land use is based on aerial and satellite imagery dated September 2017 and published by DPE in 2020 (NSW DPE, 2020a)
2. 'Other minimal use' refers to areas of land that are largely unused (in the context of the main use) but may have ancillary uses. For example it may be a deliberate decision by the land manager or the result of other circumstances, such as terrain features which make use difficult or prohibitive. It may include defence lands/natural areas, stock routes, residual native cover or land under rehabilitation or restoration (ABARES, 2016).
3. 'Other land uses' include managed resource protection, perennial horticulture, irrigated cropland, intensive animal production, manufacturing and industrial, services, utilities, transport and communication, reservoirs/dams which are present land uses in the study area, however consist of smaller areas.

Agriculture

The type of agricultural land use varies across the study area, however as detailed in Table 7-1, the grazing of native and modified pastures is the dominant use, making up around 57 per cent of the study area, with cropping activities making up around 14 per cent.

In general:

- the southeastern section of the study area is dominated by the grazing of both modified pastures and native vegetation, with some areas of minimal land use, but very little cropping
- the northeastern section of the study area (which includes the Cassilis, Coolah and Leadville connections) is dominated by grazing land uses (on both modified pastures and native vegetation) with some minimal land use, however cropping land uses are also mapped around the Talbragar River floodplains. While irrigated cropping is mapped in areas of the Talbragar River floodplain, no irrigation areas are recorded in this area.

- areas near the western part of the Merotherie – Elong Elong connection, and the Tallawang west and south connections consist of a mix of grazing (modified and native pastures) with some cropping lands on lower lying areas
- areas near the eastern part of the Merotherie – Elong Elong connection consists of grazing (native vegetation and modified pastures), forestry uses and areas of minimal use
- areas to the west of the Elong Elong Energy Hub are dominated by cropping land uses
- grazing of cattle and sheep (for wool and meat) is common throughout the study area.

Around 72 per cent of the construction area consists of agricultural land used for the grazing of native and modified pasture. Around an additional 20 per cent of the construction area consists of agricultural land used for cropping, and less than one per cent of the construction area contains agricultural land used for residential and farm infrastructure.

Around 50 per cent of the study area consists of land classified by the Land and Soil Capability Assessment Scheme (Office of Environment & Heritage (OEH), 2012a) as having moderate to low capability (Class 5), which largely restricts agricultural land use to grazing, and some horticultural activities. When considering the construction area, this increases to around 75 percent. Refer to Chapter 8 (Agriculture) for further details on the land and soil capability of the study area.

The study area also contains areas mapped as Biophysical Strategic Agricultural land (BSAL). BSAL is land with high quality soil and water resources that can sustain high levels of productivity and require minimal management to maintain that quality (DPE, 2013). Areas of BSAL are located at the northern end of the Cassilis connection, within areas of the Talbragar River and Cainbil Creek floodplains, to the west of the Tallawang connection and to the west of the Elong Elong Energy Hub (refer to Chapter 8 (Agriculture) and Technical paper 2 – Agriculture).

Protected areas, State forests and biodiversity offsets

The study area contains a number of areas reserved under the NP&W Act and managed by the NSW National Parks and Wildlife Service (NPWS), State forests reserves and biodiversity offset sites or conservation areas under the NP&W Act or BC Act associated with nearby mining operations.

The location of these areas is shown in Figure 7-2 and Figure 7-3.

National Parks and other conservation land managed by NSW NPWS

Areas under the management of the NSW NPWS, include:

- the Goulburn River National Park, located in the southeastern section of the study area. The national park covers an area of around 70,000 hectares and was established in 1983. It contains significant Aboriginal cultural heritage values, with more than 300 known sites, mainly associated with the Goulburn River which extends for around 90 kilometres through the national park. The national park is also a locally listed heritage item, and is currently under consideration for inclusion in the National Heritage Curtilage of the Greater Blue Mountains Area – additional heritage values and areas (refer to Chapter 12 (Non-Aboriginal heritage)). Objectives of the national park relate to the conservation and maintenance of biodiversity, threatened species, and scenic and catchment values of the Goulburn River (OEH , 2003)
- the Munghorn Nature Reserve, located in the southeastern section of the study area. Established in 1961, this nature reserve is the second oldest nature reserve in Australia. Covering around 5,935 hectares it contains significant Aboriginal cultural heritage values, unique natural rock formations, and high bird diversity (OEH, 2003)

- the Durridgere State Conservation Area (SCA), established in 2005, covers an area of 6,172 hectares across six disconnected portions of land in the north eastern section of the study area. The land was formerly the Curryall, Turill and Durridgere State Forests, and from the early 1900's up to its establishment was used for hardwood timber harvesting. The current woodland is now an important refuge for threatened species and provides important linkages to wilderness areas in the Sydney Basin and NSW South Western Slopes Bioregion (OEH, 2014a)
- the Goodiman SCA, established in 2005 and covering 569 hectares is in the central section of the study area. The Goodiman SCA was a former State Forest estate that was primarily commercially logged for timber production. It provides an important area of remnant native vegetation and species mix between two overlapping bioregions and has regional significance linking Yarrobil National Park to the south and Tuckland State Forest in the north (OEH, 2014b)
- the Dapper Nature Reserve, established in 1981 and covering 998 hectares is in the western section of the study area. Formerly a state forest reserve, it contains an important area of remnant vegetation in an otherwise highly cleared landscape. The reserve receives small numbers of visitors per year, primarily research groups and birdwatchers and is restricted by locked gates, with permission required to enter (OEH, 2014c).

State forests

Two state forests, managed by the NSW Forestry corporation, are also located in the study area:

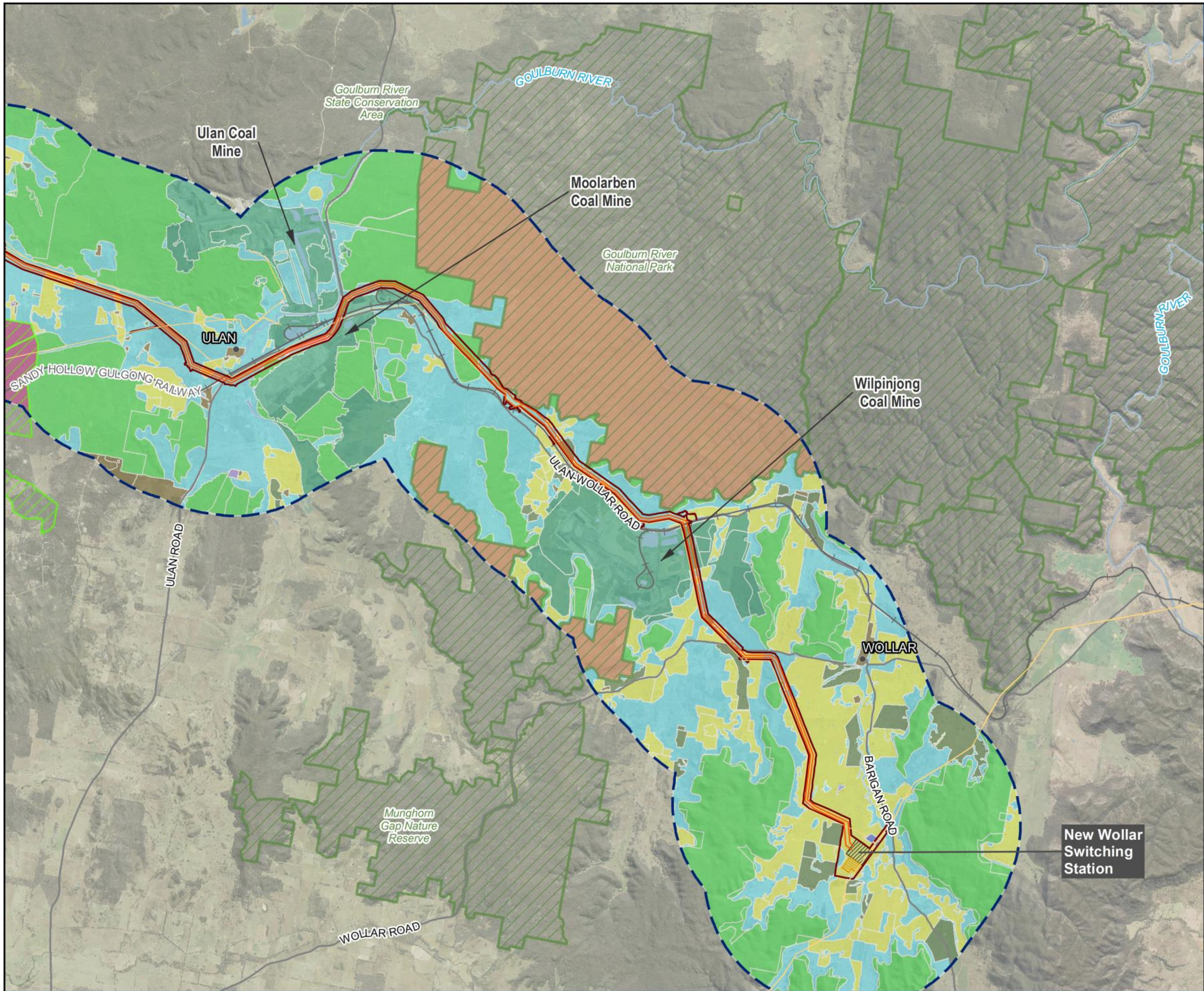
- the Tuckland State Forest covering around 890 hectares, located either side of the Merotherie Energy Hub — Elong Elong Energy Hub connection
- the Cope State Forest, covering around 2,200 hectares, located to the south of the new Wollar Switching Station — Merotherie Energy Hub connection.

Both State forests are subject to the Integrated Forestry Operations Approval for South-Western Cypress Region, which set out the environmental rules for how forestry operations can be carried out on State forests and Crown timber lands.

These forests are categorised as General Management Zones (Zone 4) State forests, which are managed for timber production (NSW Forestry Corporation, 2022), however, there are currently no harvest plans identified for either State forest. Both State forests are open to hunting activities.

Biodiversity offset areas

The study area also contains biodiversity offset sites, enhancement and conservation areas, and areas proposed to be rehabilitated following mining operations at Wilpinjong, Moolarben and Ulan coal mines. The respective development consents and project approvals for each of the mines set out conditions in respect of biodiversity offsets/conservation and rehabilitation. This includes areas required to be managed under both State (EP&A Act and BC Act) and Commonwealth EPBC Act legislation and approvals, and are generally located in the southeastern section of the study area, adjacent to and within the associated mining operations.

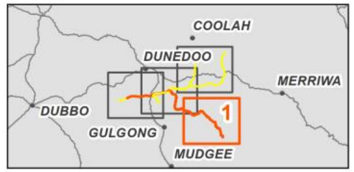


Legend

- Study area
- Construction area
- Construction compound
- Energy hub / 500 kV switching station
- 500 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse
- Water body
- State forest
- NPWS estate

Land use

- Nature conservation
- Other minimal use
- Grazing native vegetation
- Production native forestry
- Grazing modified pastures
- Cropping
- Perennial horticulture
- Manufacturing and industrial
- Residential and farm infrastructure
- Utilities
- Transport and communication
- Mining
- Reservoir/dam



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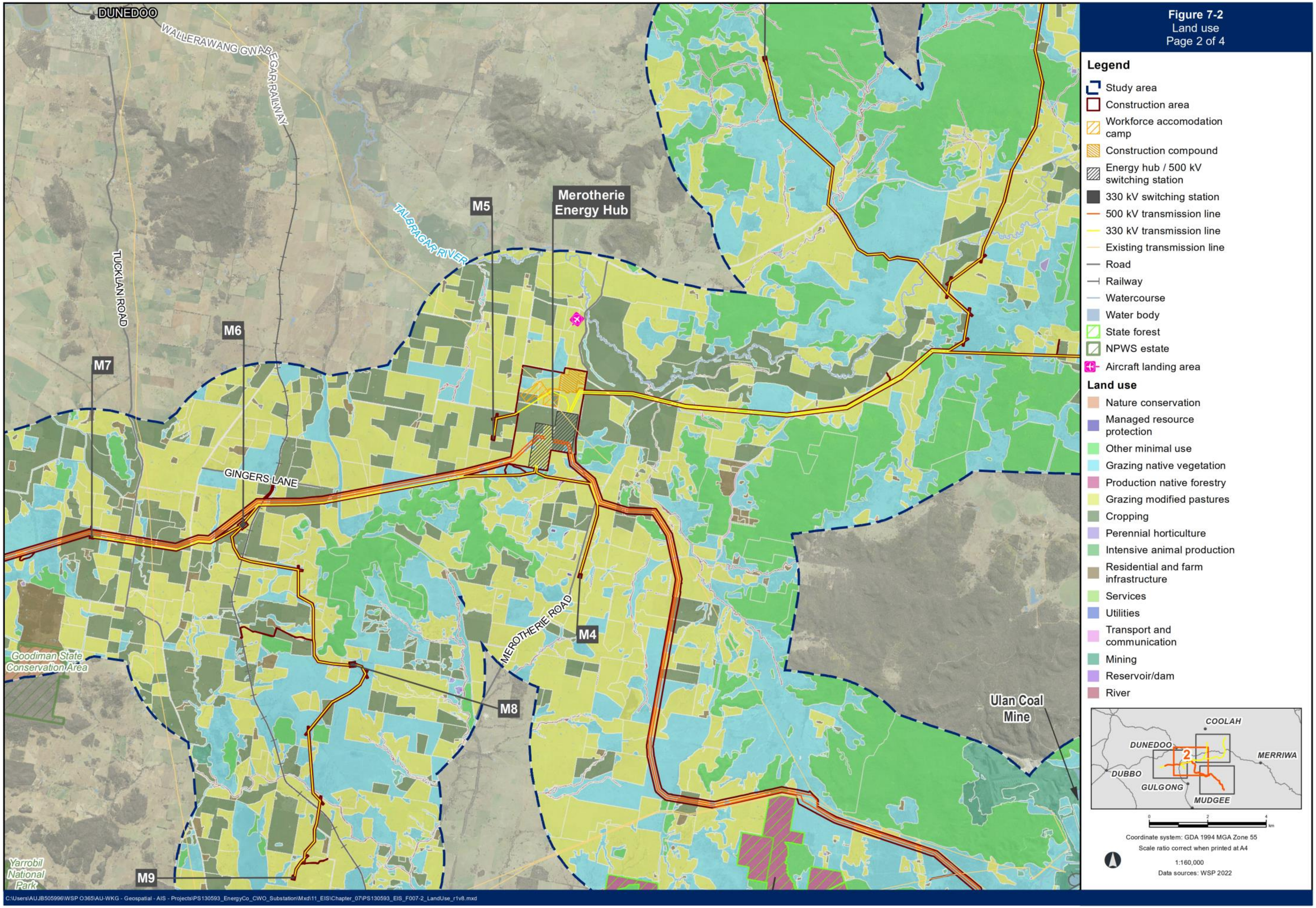
Figure 7-2
Land use
Page 2 of 4
Legend
Study area
Construction area
Workforce accomodation camp
Construction compound
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing transmission line
Road
Railway
Watercourse
Water body
State forest
NPWS estate
Aircraft landing area
Land use
Nature conservation
Managed resource protection
Other minimal use
Grazing native vegetation
Production native forestry
Grazing modified pastures
Cropping
Perennial horticulture
Intensive animal production
Residential and farm infrastructure
Services
Utilities
Transport and communication
Mining
Reservoir/dam
River
DUNEDOO
WALLERAWANG GWABEGAR RAILWAY
TUCKLAN ROAD
TALBRAGAR RIVER
M5
Merotherie Energy Hub
M6
M7
GINGERS LANE
MEROTHERIE ROAD
M4
M8
M9
Goodiman State Conservation Area
Yarrobil National Park
Ulan Coal Mine
COOLAH
DUNEDOO
MERRIWA
DUBBO
GULGONG
MUDGEE
2
Coordinate system: GDA 1994 MGA Zone 55
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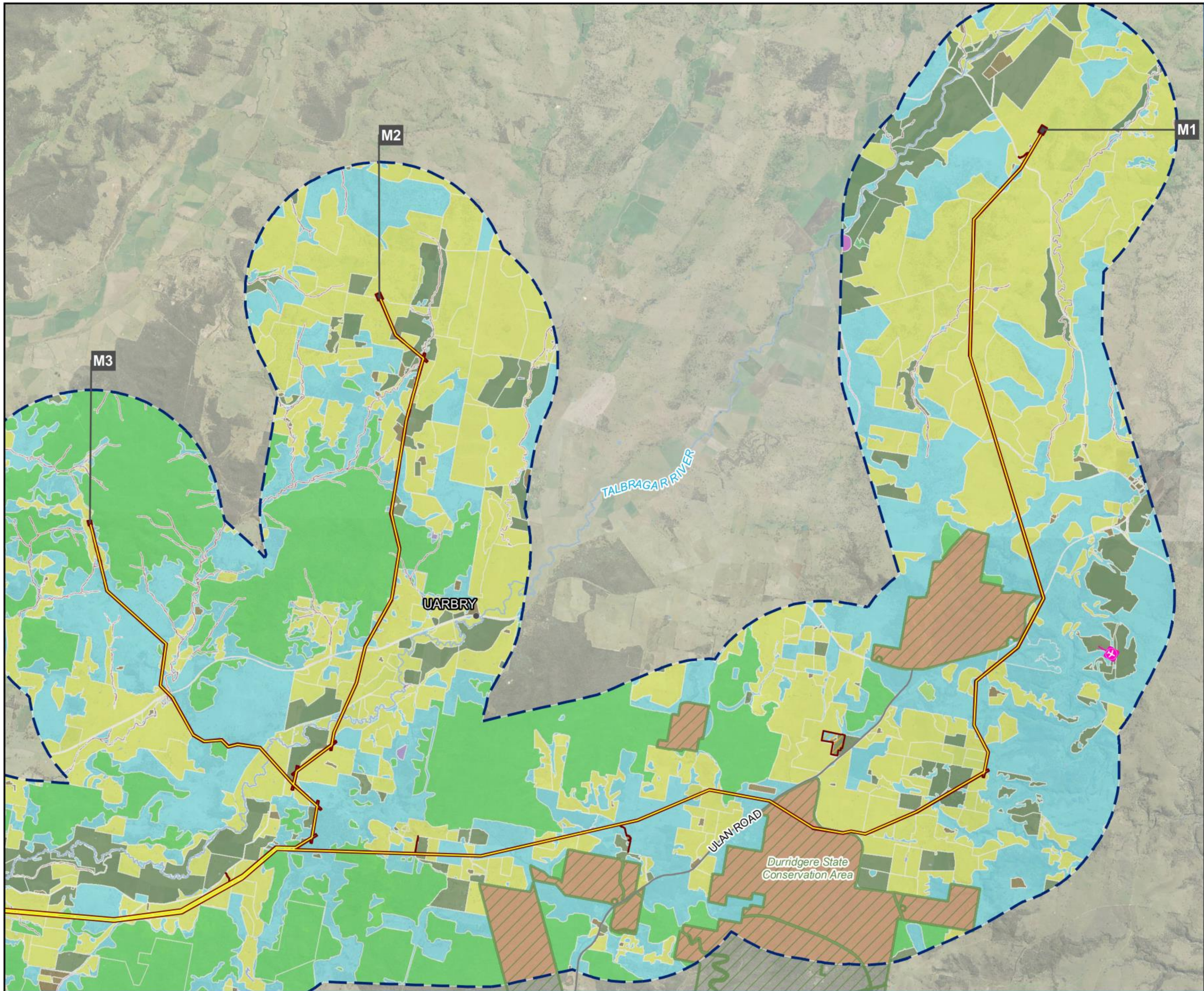

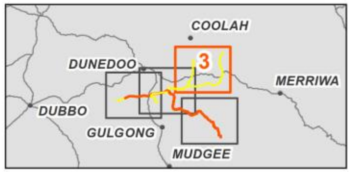

Legend

- Study area
- Construction area
- Workforce accomodation camp
- 330 kV switching station
- 330 kV transmission line
- Road
- Watercourse
- Water body
- NPWS estate
- Aircraft landing area

Land use

- Nature conservation
- Managed resource protection
- Other minimal use
- Grazing native vegetation
- Grazing modified pastures
- Cropping
- Perennial horticulture
- Irrigated cropping
- Intensive animal production
- Residential and farm infrastructure
- Services
- Utilities
- Transport and communication
- Mining
- Reservoir/dam
- River

0 2 4 km

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
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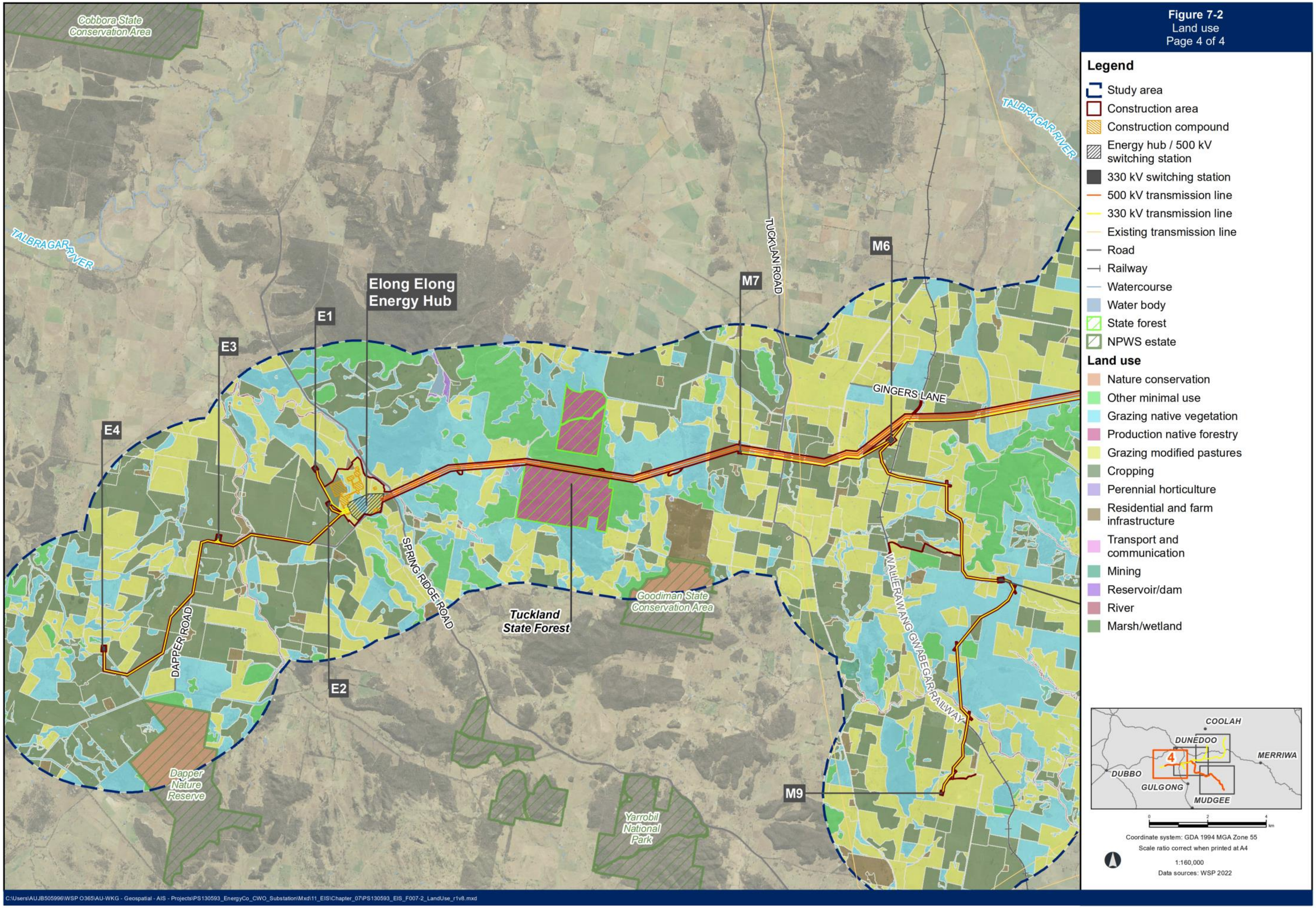

Figure 7-2
Land use
Page 4 of 4
Legend
Study area
Construction area
Construction compound
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing transmission line
Road
Railway
Watercourse
Water body
State forest
NPWS estate
Land use
Nature conservation
Other minimal use
Grazing native vegetation
Production native forestry
Grazing modified pastures
Cropping
Perennial horticulture
Residential and farm infrastructure
Transport and communication
Mining
Reservoir/dam
River
Marsh/wetland
Cobbora State Conservation Area
TALBRAGAR RIVER
Elong Elong Energy Hub
E1
E2
E3
E4
M6
M7
M9
TUCKLAN ROAD
GINGERS LANE
SPRING RIDGE ROAD
DAPPER ROAD
WALLERAWANG GWABEGAR RAILWAY
Tuckland State Forest
Goodiman State Conservation Area
Dapper Nature Reserve
Yarrobil National Park
COOLAH
DUNEDOO
MERRIWA
DUBBO
GULGONG
MUDGEE
4
Coordinate system: GDA 1994 MGA Zone 55
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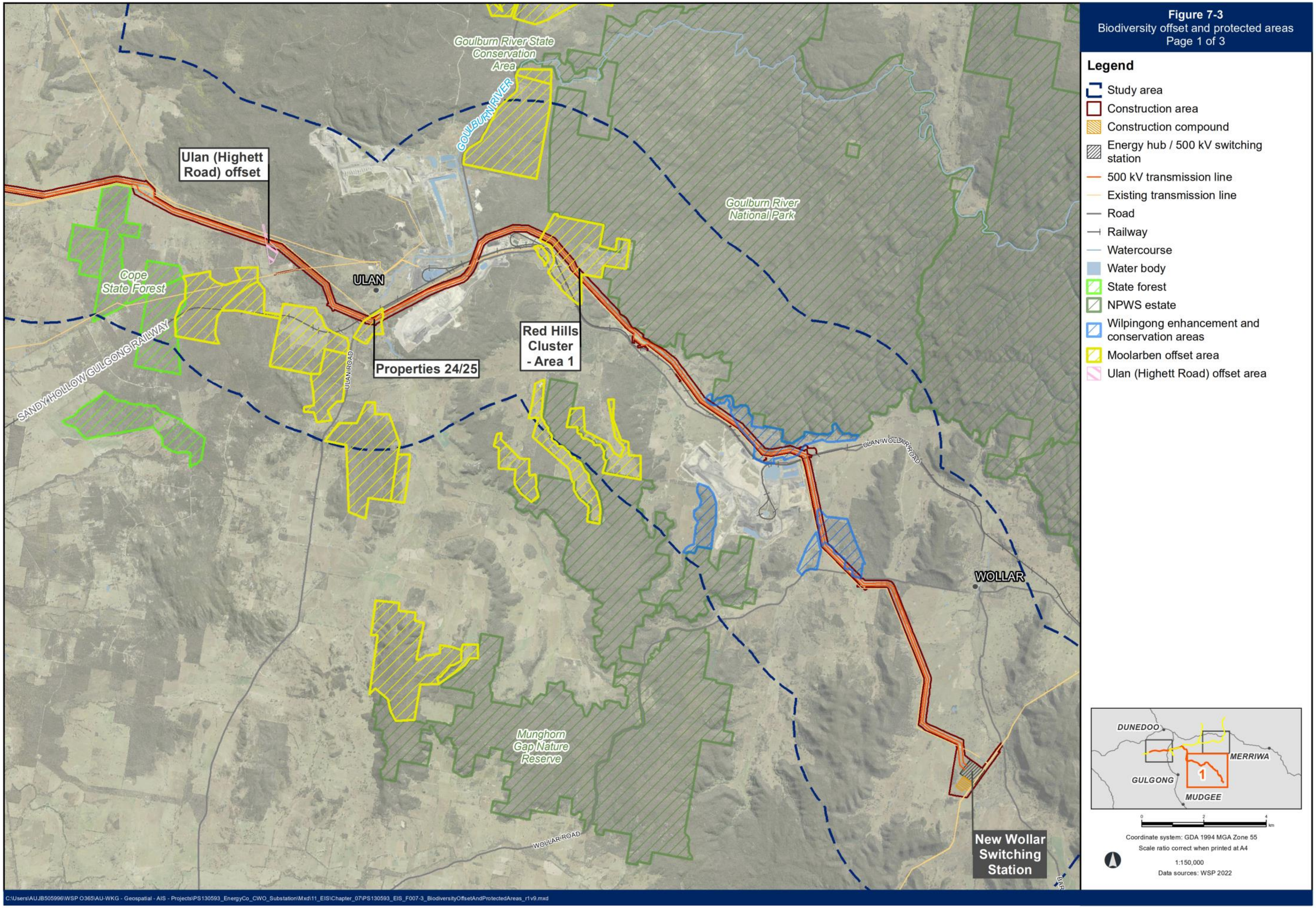

Figure 7-3
Biodiversity offset and protected areas
Page 1 of 3
Legend
Study area
Construction area
Construction compound
Energy hub / 500 kV switching station
500 kV transmission line
Existing transmission line
Road
Railway
Watercourse
Water body
State forest
NPWS estate
Wilpingong enhancement and conservation areas
Moolarben offset area
Ulan (Highett Road) offset area
Goulburn River State Conservation Area
GOULBURN RIVER
Goulburn River National Park
Ulan (Highett Road) offset
ULAN
Cope State Forest
SANDY HOLLOW GULGONG RAILWAY
ULAN ROAD
Properties 24/25
Red Hills Cluster - Area 1
ULAN-WOLLAR ROAD
WOLLAR
Munghorn Gap Nature Reserve
WOLLAR ROAD
New Wollar Switching Station
DUNEDOO
MERRIWA
GULGONG
MUDGEE
1
Coordinate system: GDA 1994 MGA Zone 55
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Figure 7-3
Biodiversity offset and protected areas
Page 2 of 3

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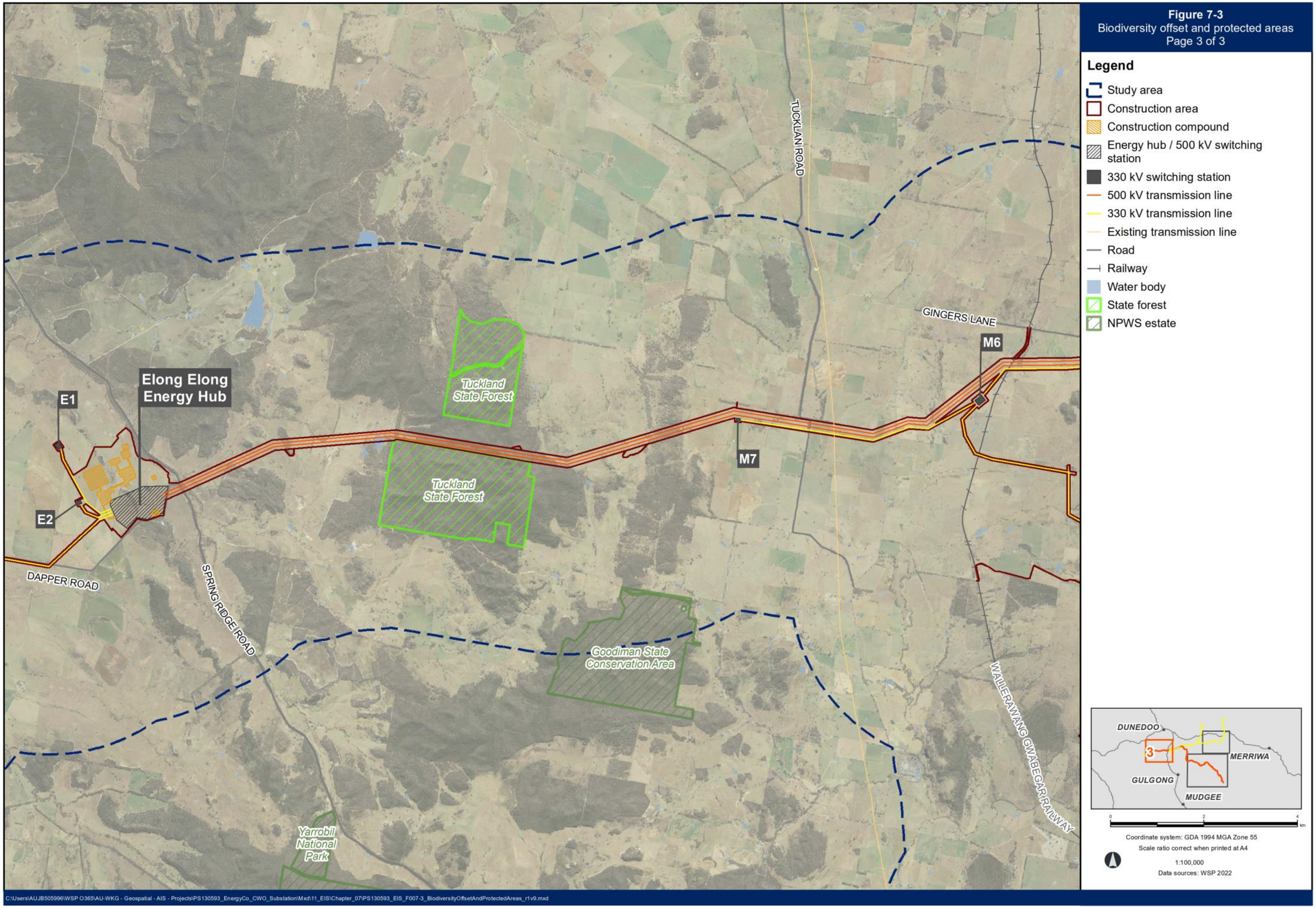

Figure 7-3
Biodiversity offset and protected areas
Page 3 of 3
Legend
Study area
Construction area
Construction compound
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing transmission line
Road
Railway
Water body
State forest
NPWS estate
TUCKLAN ROAD
GINGERS LANE
M6
M7
E1
E2
Elong Elong Energy Hub
Tuckland State Forest
Tuckland State Forest
DAPPER ROAD
SPRING RIDGE ROAD
Goodiman State Conservation Area
Yarrobil National Park
WALLERAWANG GWABEGAR RAILWAY
DUNEDOO
MERRIWA
GULGONG
MUDGEE
3
0
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km
Coordinate system: GDA 1994 MGA Zone 55
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Mining and exploration

Mine operations

Three coal mining operations – Moolarben Coal Mine, Wilpinjong Coal Mine and Ulan Coal Mine are located in the southeastern section of the study area and consist of both surface and underground mining operations as well as large areas of vegetated land (which includes biodiversity offset areas). The construction area intersects land owned by all three coal mining operations.

In total, the three operators hold approvals to extract up to a maximum of 37.85 million tonnes of coal per annum. Generally, the mining operations include:

- administration, workshops, and storage areas
- active surface pits and underground shafts
- haulage and access roads
- water management systems and associated water infrastructure
- material loading and transport infrastructure (including conveyers and rail infrastructure)
- rehabilitation areas and biodiversity offset areas.

It is noted Moolarben coal mine has current and approved open cut mining within areas mapped as 'grazing native vegetation' in Figure 7-2. This area is shown as OC4 in Figure 7-4.

Parts of the study area and construction area are located on land within the Mudgee mine subsidence district, where there are potential subsidence risks from historical or current mining activities (refer to Chapter 16 (Hazard and risk).

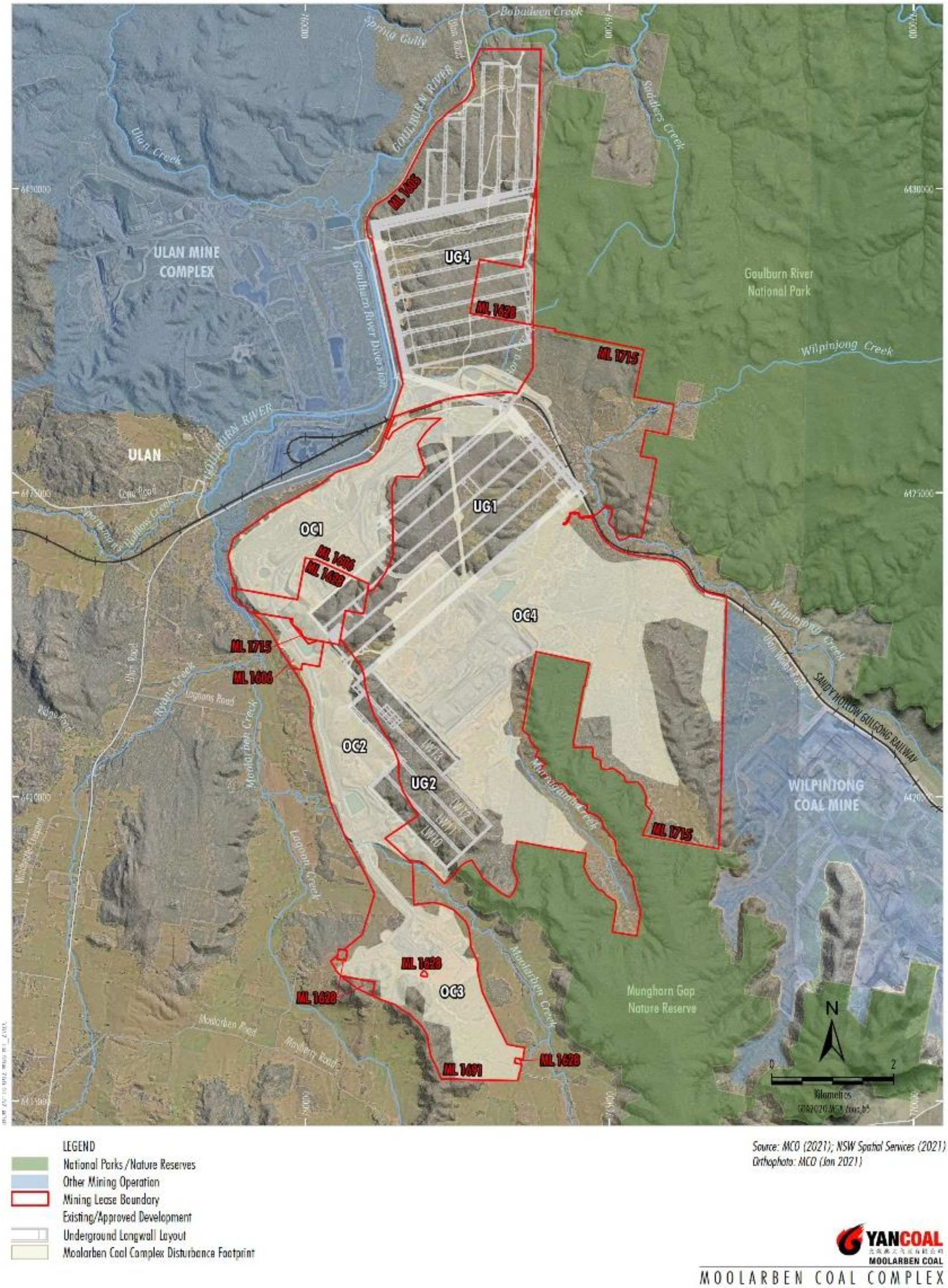


Figure 7-4 Moolarben mining operations (Yancoal, 2021)

Mineral exploration

The study area includes extensive areas covered by exploration licences, mining leases and mining lease applications. These leases and licences allow the holder to undertake mining, exploration or prospecting for minerals and petroleum within a specified area. Most of these leases and licences cover portions of land in the southeastern section of the study area, adjacent to the existing mining operations, and are for the purpose of coal and mineral exploration.

Table 7-2 provides a summary of all mining lease, mineral exploration, and mining lease applications relevant to the study area. A review of specific information pertaining to exploration activity was limited, as activity reports are confidential in nature. As such, the extent of current exploration or exploration activities within the exploration licence areas, including exploration licences which intersect the construction area, are not known.

Table 7-2 Mining leases and exploration licences within the study area

Location within study area	Licence number(s)	Licence type	Holder	Year of expiry
Southeastern	EL9399, EL6169, EL7091	Exploration licence	Wilpinjong Coal Pty Ltd	2028 EL6169 and EL 7091 expired
Southeastern	ML1573, ME1795, ML1779	Mining lease	Wilpinjong Coal Pty Ltd	2027–2040
Southeastern	MLA616	Mining lease application	Wilpinjong Coal Pty Ltd	n/a
Southeastern	EL6288, EL7074	Exploration licence	Moolarben Coal Pty Ltd	2023–2026
Southeastern	ML1715, ML1606, ML1628, ML1605, ML1691	Mining lease	Moolarben Coal Pty Ltd	2028–2036
Southeastern	ML1799, ML1726, ML1754, ML1697, ML1365, ML1341, ML1798, ML1486	Mining lease	Ulan Coal Mines Ltd	2027–2041
Southeastern	CCL741	Consolidated coal lease	Ulan Coal Mines Ltd	2027
Southeastern	ML1813	Mining lease	Ulan Stone Pty Ltd	2042
Southeastern	ML1219, ML268, ML1209, ML267, PIL1294	Mining lease	Dronvisa Pty ltd	2039
Southeastern/ Central	EL8405, EL8160, EL8159	Exploration licence	Bowdens Silver Pty Ltd	2024–2026
Northeastern	EL8687, EL9363, EL5573, EL9419, EL7542	Exploration licence	Ulan Coal Mines Ltd	2024–2028
Northeastern	MLA609	Mining lease application	Ulan Coal Mines Ltd	n/a
Northeastern	ML1486, ML1554. ML1656	Mining lease	Ulan Coal Mines Ltd	2023–2042
Central	EL8366	Exploration licence	Munro Geological Services Pty Ltd	2023
Central	EL9138	Exploration licence	Gilmore Metals Pty Ltd	2024
Central	EL8734	Exploration licence	Colossus Metals Pty Ltd	2025
Central	ML1241, ML6023, ML265, ML1652	Mining lease	Sibelco Australia Ltd	2024–2032
Western	EL9290	Mining lease	Orange Minerals Pty Ltd	2026

Aviation

No aerodromes or defence sites are located in the study area. The nearest aerodromes are located at Dubbo and Mudgee, located around 56 kilometres west and 32 kilometres south of the project, respectively.

Three private aircraft landing areas (ALAs) (refer to Figure 7-2) are located within the study area, at:

- Dalkeith, around 2.2 kilometres to the east of the Cassilis Connection
- Tongy, around 4.4 kilometres to the east of the Coolah Connection
- Merotherie, around 2.1 kilometres to the north of the Merotherie Energy Hub.

In addition to aviation activities at these aircraft landing areas, the NSW NPWS also conduct aerial baiting activities as part of their pest management using helicopters in nearby national park estate.

Travelling stock reserves and Crown Land

The grazing industry often uses a network of Crown reserves called Travelling stock reserves (TSRs). These are commonly managed by Local Land Services (LLS) under the *Local Land Services Act 2013* (NSW) and generally permit the moving or grazing of stock on foot around NSW. TSRs can either be linear and associated with public roads or Crown Land lots.

In NSW, TSRs are more frequently found in areas further to the west of the project, however a review of the TSR – State Classification Map (OEH, 2017) (accessed November 2022) identified two linear TSRs within the study area and a small number of scattered individual lots of Crown Land. The Barney's Reef Road TSR extends in a north south direction within Barney's Reef Road reserve and intersects the construction area. The second TSR identified in the study area extends in a north south direction to the east of Uarbry, and outside of the construction area. Both these TSR's have some local connectivity within other adjacent Crown Land, with the TSR associated with Barney's Reef Road (when combined with other Crown reserves) extending for around 21 kilometres in a north south direction.

The two linear TSRs within the study area are classified as Category 3 TSRs. This category of TSRs are described as those which are rarely, if ever used for travelling stock or emergency management, but are important, valued and used for other reasons such as biodiversity conservation, First Nations Peoples' heritage or recreation (NSW Government, 2021).

The category 3 TSR is likely associated with PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion. This PCT corresponds to a critically endangered threatened ecological communities (TECs) listed on both the BC Act and the EPBC Act which has been mapped within the road reserve at Barneys Reef Road (refer to Chapter 10 (Biodiversity).

In addition to the TSRs identified within the study area, there are a number of Crown Land parcels scattered throughout the study area including large parcels and linear corridors (that correspond to paper roads and waterways). Most of the larger parcels of Crown Land are in the southeastern section of the study area.

Aboriginal land claims

In NSW, the *Aboriginal Land Rights Act 1983* (NSW) provides a process through which Aboriginal Land Councils may claim Crown Land, being 'Claimable Crown Land'. A successful claim results in the transfer of the freehold in the relevant land to Aboriginal Land Council. Crown Land that is 'claimable' under the Act includes land that is not lawfully used or occupied and is not needed or likely to be needed, for an essential public purpose.

The construction area contains two parcels of Crown Land which are subject to an undetermined Aboriginal Land Rights claim. This includes small parcels of Crown Land adjacent to Laheys Creek (Lot 7300 DP 1149498), and south of the Golden highway (Lot 7001, DP 96945).

Transport infrastructure

The study area contains two major road transport routes, the Golden Highway and Castlereagh Highway, which provide key road transport links with the surrounding region. The Golden Highway forms part of the State road network and the Castlereagh Highway forms part of the State and national road network. In additional to these key road transport links, there are smaller regional and local roads throughout the study area that provide access and links to nearby towns, villages, and agricultural properties (refer to Chapter 17 (Traffic and transport)).

The study area also contains an existing rail network that includes:

- the Sandy Hollow Gulgong Railway line (referred to as the Ulan Line) which extends from Sandy Hollow in the upper Hunter to Gulgong. The rail line, operated by the Australian Rail Track Corporation (ARTC) is predominantly used to transport coal from the Ulan, Moolarben and Wilpinjong coal mines to the Port of Newcastle, and includes coal loading loops and rail infrastructure at each mine site
- the Wallerawang Gwabegar Railway line (operated by ARTC) extends from Wallerawang in the south to Gwabegar in the north, passing the study area between the towns of Gulgong and Dunedoo. The rail line was progressively opened between 1884 and 1910 (refer to Technical paper 6 – Non-Aboriginal heritage) and has recently been used to transport coal from several coal mine operations south of Mudgee, however regular rail traffic has been suspended on the rail line from the Airly Colliery (around 70 kilometres south of Mudgee) to Gulgong.

Electrical infrastructure

The study area contains existing electrical network infrastructure including infrastructure owned and operated by Transgrid:

- the existing Wollar 500 kV substation
- Transmission Line 79 – a 330 kV transmission line that extends from the existing Wollar Substation to the Wellington Substation
- Transmission Line 5A3 – 500 kV double circuit transmission line that extends from the Bayswater Power Station to the existing Wollar Substation
- Transmission Line 5A5 – a 500 kV double circuit transmission line that extends from the existing Wollar Substation to the Mount Piper Power Station.

In addition, there are multiple 12.7 kV, 22 kV and 66 kV transmission lines owned and operated by Essential Energy located throughout the study area.

Pipeline infrastructure

No petroleum or high-pressure gas pipelines intersect or are adjacent to the study area. There remains potential for other buried pipeline infrastructure to be present.

Planned future land use

As outlined in Chapter 2 (Strategic context), the study area lies within the Central-West Orana REZ. The Central-West Orana REZ was identified by the NSW Government as one of five renewable energy zones in NSW that will support the transition from traditional energy sources to lower emissions alternatives through the development of renewable energy projects.

The Central-West Orana REZ has a long history of agricultural and mining activities, which is reflected by the current land use and economic output of the study area and region. It is expected that agricultural activities would continue to make up a significant proportion of land use, and along with mining provide significant economic benefits to the region. However as part of the energy transition, there are a large number of renewable energy projects either operational, proposed, approved or under construction within the Central-West Orana REZ and surrounding region.

These current and proposed projects (which cover around 43,500 hectares of the study area), along with the development of the project, are part of a larger strategic land use transition within the Central-West Orana REZ. The co-existence of renewable energy generation and storage projects and agricultural land use is supported by the *Central West and Orana Regional Plan 2041* which recognises the establishment of the Central-West Orana REZ, while aiming to ensure compatibility with existing land use practices and minimising associated environmental and social impacts.

7.3.3 Property

Land tenure

Land tenure in the study area is predominantly freehold, with some areas of Crown Land (including road reserves), rail corridors, TSRs, state forests and NSW National Parks and Wildlife estate (refer to Section 7.3.2).

There is a total of 110 land holdings which are intersected by the construction area (two of which are government owned). The average size of agricultural establishments across the four LGA's within the study area is around 1,200 hectares (refer to Technical paper 2 – Agriculture).

Native Title

A search of the National Native Title Tribunal on 24 November 2022 identified three known native title claims under the *Native Title Act 1993* (Cth) within the study area. Each of these native title claims cover a portion of the study area and remain undetermined. These include:

- a claim by the Warrabinga-Wiradjuri people (NC2016/005), which includes three small areas near the Wilpinjong coal mine in Wilpinjong, Wollar and Munghorn
- a claim by the Gomeroi people (NC2011/006) which extends from the NSW-QLD border in the north, to an area north of Mudgee in the south, the Great Dividing Range in the east, and Coonamble in the west. This native title claims covers the northeastern section of the study area, specifically the Cassilis, Leadville and Coolah connections
- a claim on behalf of the Warrabinga-Wiradjuri people (NC2018/002) which extends from Dunedoo in the northwest and southeast to the Blue Mountains. This native title claim covers the remainder of the study area, except for the western section around the Elong Elong Energy Hub.

The register did not identify any Indigenous Land Use Agreements applying to the study area.

7.4 Potential impacts – construction

The project has been designed to avoid and/or minimise potential impacts to land use and property during construction, including:

- positioning infrastructure in areas that align with current land use activities, or, where practicable, based on landowner feedback, and the willingness of landowners to host project infrastructure within an easement on their property, as well as considering the location of proposed adjoining renewable energy generators
- utilising already disturbed land, such as mining land, and located next to existing transmission line easements.

It is acknowledged that in some locations along the project alignment, competing land use, property and technical constraints are present. At these locations a balanced approach to corridor planning is required to determine the most appropriate project alignment, while minimising impacts on land use, property and the environment during construction. Where possible, easements and land acquisition has been through negotiated agreement in consultation with the relevant landowners.

7.4.1 Land use changes

The project would require the use of land temporarily for construction and permanently for operation. Impacts to land use during operation, while long term, would commence during construction. The construction area of the project, comprising around 3,980 hectares (92 per cent of which are currently agricultural land use (refer to Table 7-3)), includes all land required to support the construction of the project and includes land for:

- energy hubs and the New Wollar switching station
- 330 kV switching stations
- transmission line towers
- brake and winch sites
- communication infrastructure
- workforce accommodation camps
- construction compounds
- access roads
- access tracks
- other ancillary facilities.

The construction area also includes land between transmission line towers, which would form the transmission line easement.

At the commencement of construction, the current land use within the construction area would cease, either permanently at locations where permanent infrastructure would be required (energy hubs and the New Wollar Switching Station, 330 kV switching stations, transmission line towers, and access roads and access tracks), or temporarily while construction activities are being carried out (brake and winch sites, construction compounds, workforce accommodation camps and transmission line easements). In this regard, land use within areas of the transmission line easement would be only temporarily affected during construction, and would be able to recommence following the completion of these activities, subject to some restrictions for safety and operational reasons.

Table 7-3 Land use within the construction area

Land use	Total area (Ha)	Proportion of construction area (%)
Agriculture – grazing modified pasture	1660	41.7
Agriculture – grazing native vegetation	1225	30.8
Agriculture – cropping	775	19.5
Other minimal use[1]	195	4.9
Mining	55	1.4
'Other' land uses[2]	30	<1
Nature conservation (protected areas)	15	<1
Residential and farm infrastructure	15	<1
River	10	<1
TOTAL	3,980	

1. Other minimal use refers to areas of land that are largely unused (in the context of the main use) but may have ancillary uses, for example it may be a deliberate decision by the land manager or the result of other circumstances, such as terrain features which make use difficult or prohibitive. It may include defence lands/natural areas, stock routes, residual native cover or land under rehabilitation or restoration (DPE, 2023).
2. In this case, 'Other' land uses include managed resource protection, production of native forests, utilities, transport and communication and reservoirs and dams, which are present land uses in the construction area, however consist of smaller areas.

Agricultural areas

The agricultural land that would be occupied by the construction area is equivalent to approximately three per cent of the total agricultural area in the study area and 0.19 per cent of the total agricultural land in the four LGAs within which the project is located.

Construction of the project, including land requirements, would have a range of potential impacts on agricultural areas at different stages of construction and in different areas, depending on the intensity of construction activities required and the construction activities being undertaken at any given time.

For estimating total impacts to agricultural land use during construction, it has been conservatively assumed that the entire construction area (including the transmission line easement) (consisting of around 3,660 ha of agricultural land use) would be unavailable for agricultural activities and use. It is noted however, that construction activities associated with the transmission line, including transmission tower erection, transmission line stringing and vehicle and machinery movements along access tracks, would be intermittent and would not occur for the full duration at any one location. The length of disruption at other structures such as energy hubs and switching stations is expected to be longer (and in some cases permanent).

Due to the linear nature of the project, land directly impacted during construction typically forms part of a larger agricultural land holding. In addition to the temporary change in land use, the project has the potential to disrupt the use and/or internal access to adjoining land (if not properly managed). For example, the construction of the transmission line could disrupt access across to adjoining parcels or remaining sections of a larger parcel of land. Where this occurs, access may be temporarily affected and would be managed by the construction contractor in consultation with the landowner.

Land that is not permanently required for the operation of the project and has not been acquired by EnergyCo would be returned to its former use once construction activities have finished, in accordance with conditions of approval and any relevant property management plans. The continuation of existing land uses would be able to occur in these areas, subject to some restrictions for safety and operational reasons. Pre-condition assessments of the construction area will be undertaken to determine the general condition of the land. This will inform requirements for rehabilitation within Property Management Plans established with landowners.

In addition to the land use change, while the project has sought to minimise impacts to land use, construction of the project has the potential to directly affect land capability and the availability of BSAL within the region, with the potential to reduce efficiency, productivity and viability of agricultural land. These impacts (along with impacts on biosecurity, and agricultural operations) are discussed further in Chapter 8 (Agriculture), and Technical paper 2 – Agriculture.

Protected areas and biodiversity offset areas

The alignment of the project has avoided direct impacts to protected areas and biodiversity offset areas where practicable. This includes:

- Goulburn River National Park, which while outside the construction area, is at its closest point, immediately adjacent to the New Wollar to Merotherie Energy Hub connection
- Munghorn Gap Nature Reserve, which is around 2 kilometres to the south and southwest of the New Wollar to Merotherie Energy Hub connection
- portions of the Durridgere SCA which are located in a patchwork of areas adjacent to the Cassilis connection.

Construction of the project would have a direct impact (via the clearing of vegetation within the transmission line easement) to two protected areas/biodiversity offset areas:

- around 15 hectares of one portion of the Durridgere SCA
- existing biodiversity offset sites, enhancement and conservation areas or areas proposed to be rehabilitated following mining operations at the Wilpinjong, Moolarben and Ulan coal mines (refer to Table 7-4).

As noted in Chapter 2 and 3, EnergyCo is seeking approval for a transmission line alignment that is largely consistent with the approved Liverpool Range Wind Farm project, between switching station M1 and the Durridgere SCA on the basis that only one would be progressed. Consistent with Tilt Renewables modification assessment report (SSD 6696), if Tilt Renewables is successful in securing access rights to the project, their external transmission line and connection infrastructure would be removed. In this scenario, there would be a net decrease in impacts to the SCA as a result of the project. If Tilt Renewables is not successful in securing access rights to the project, then EnergyCo would not progress the Cassilis connection.

The proposed portion of the alignment through the Durridgere SCA significantly reduces the area of clearing within the SCA (to around 15 hectares) when compared to the approved Liverpool Range Wind Farm (LRWF) (around 40 hectares). The project alignment has been located as close to and parallel to the Durridgere SCA boundary as possible to minimise impacts. However, EnergyCo would need to secure an easement in accordance with the NP&W Act and address any specific biodiversity impacts in accordance with BC Act and EPBC Act. EnergyCo would continue to consult with NSW NPWS to secure this easement.

The project also traverses biodiversity offset sites associated with three mining projects in the southeast of the construction area. As noted in Chapter 2, the development of the project alignment through the mining areas was progressed following community feedback which indicated a strong preference for the project to be relocated off the Merriwa Cassilis plateau into areas that have existing disturbance or are public land.

Developing an alignment through the mining areas, where there was existing infrastructure and transmission lines, had the advantage of maximising the use of existing disturbed land, avoiding Goulburn River National Park to the north, Munghorn Gap Nature Reserve to the south, and providing a strong connection to the NSW transmission system at Wollar.

However, the narrow corridor and multiple operational mining constraints in this part of the construction area has resulted in a transmission line alignment that traverses the following biodiversity offset sites:

- land identified for enhancement and conservation areas (Area A and B) for the Wilpinjong mine, as well as areas identified for rehabilitation following the closure of the mine
- land secured for offsets for:
  - the Moolarben mine (Red Hills Cluster – Area 1 and Ulan 18 Cluster – property 24 and 25)
  - the Ulan mine (the Highett Road site).

To manage the implications to the approvals held by the three mining operators as well as impacts to property, EnergyCo would:

- identify and secure alternative biodiversity offsets that achieve the biodiversity outcomes required in the approvals issued for the mining operations under the EP&A Act and EPBC Act. The alternative offsets would be determined in consultation with DPE, the Australian Government Department of Climate Change, Energy, the Environment and Water and NPWS as relevant
- support mining operators in seeking modifications to the relevant environment and planning approvals, as relevant, and support the associated changes to the biodiversity management plans and/or conservation agreements to reflect the location of the transmission easement and consequential reduced offset areas, as relevant

- assist mining operators to modify or vary applicable conservation agreements or arrangements as required as a result of the impacts of the project
- assist mining operators to remove or vary notations on title in respect of any biodiversity conservation arrangements.

Table 7-4 Impacts to mine operation biodiversity commitments

Mine operator	Area	Area of impact (ha)
Wilpinjong	Enhancement and conservation areas, which total around 575 hectares.	51.7
Moolarben	Two offset areas: • Red Hills Cluster (Area 1), an area that totals around 440 hectares • Ulan 18 Cluster (property 24 and 25), an area that totals around 57 hectares.	41.03
Ulan	One offset area located at Highett Road, an area that totals around 19 hectares.	5.57

State forests

Construction of the project would not directly impact the Tuckland or Cope State Forest. However due to the proximity of the construction area to the boundary of the Tuckland State Forest, for safety reasons there may be temporary impacts to the normal use of the state forest during construction (such as access limitations and restrictions on activities such as hunting in some areas). EnergyCo would consult with the relevant stakeholders to establish appropriate measures and communication requirements.

Mining and exploration

Mining operations

Development of the alignment through the mining operations areas has been undertaken in consultation with the mine operators to minimise impact on their operations. Construction of the project has the potential to temporarily impact the operations of Wilpinjong, Moolarben and Ulan coal mines where the construction area crosses existing mine sites.

Areas of potential impact at the Wilpinjong coal mine include former active mining areas which have been mined, backfilled, and in some areas rehabilitated. At the Moolarben coal mine, areas of potential impact include a small area of Longwall 401 which is proposed to be mined prior to construction, as well as internal haulage and access roads and tailing dams. For the Ulan coal mine, while the construction area includes parts of the Ulan mining lease, it does not traverse any planned extraction areas.

EnergyCo have developed the transmission line alignment in the mining areas in consultation with mine operators to avoid or minimise interactions with active mining areas, thereby minimising the disruptions to mining operations during construction. However, the construction of transmission line towers, access roads, brake and winch sites, as well as activities such as the stringing of transmission lines, may result in some temporary short term reconfigurations of some ancillary operations. These would be managed in coordination with mine operators to minimise any temporary impacts to operations so that mining can continue as planned.

For the Wilpinjong coal mine the construction area is intended to be excised from the mine operations plan and the construction area would be excised from the active mining area of the Moolarben coal mine extent.

As part of the alignment is located in the Mudgee mine subsidence district, a mine subsidence assessment was carried out to support an application to Subsidence Advisory NSW in accordance with Subsidence Advisory Merit Assessment Policy. The assessment considered the timing of mining activities in relation to the project's construction program, and the proximity to current and planned mining activities.

The assessment found that based upon the existing underground mine plans and the distance to the project, there are no proposed workings that would result in mine subsidence effects on the proposed 500 kV transmission line route.

Outside the Mudgee mine subsidence district, the project approaches close to an open cut pit in the Moolarben mine. However, based upon the distance to the project there would only be minor effects, due to stress relief from groundwater drawn down.

Mineral exploration

Table 7-5 provides a summary of exploration licences intersected by the construction area. In general, the construction area covers less than four per cent of each exploration licence area, with the exception of EL6169 where the construction area covers around 16.3 per cent of the exploration licence area.

Table 7-5 Exploration licences within the construction area

Licence number	Licence expiry	Resource	Approximate Exploration area (ha)	Exploration area within project area (ha)	Exploration area within project area (%)
EL6169	Expired (renewal sought)	Coal	1266	200	16.3
EL6288	2023	Coal	5,080	140	2.7
EL8160	2025	Minerals	25,789	79	0.3
EL9419	2028	Coal	4,152	80	1.9
EL8366	2023	Minerals	4,075	157	3.8
EL9138	2024	Minerals	28,553	174	0.6

Construction of the project would temporarily limit exploration activities for the duration of construction within the construction area, and in some cases the immediate surrounding area due to safety requirements. Limits to exploration activities would extend to both ground-based exploration as well as explorations undertaken via airborne survey methods, which use low flying helicopters or light aircraft with ground penetrating radar. Given the size of the exploration areas relative to the construction area these impacts are expected to be minor.

Aviation

Construction of the project would not impact flight operations at Mudgee or Dubbo airports, or the nearby aircraft landing areas within the study area (as identified in Section 7.3.2). However, conflicts between construction activities (including helicopters/drones and cranes) and other non-project aircraft would need to be managed. EnergyCo would engage with landowners to manage any potential conflicts with use of these areas and construction activities.

Electrical infrastructure

As described in Section 3.2.4, construction of the project would require the adjustment and augmentation of the existing Transgrid and Essential Energy transmission and distribution lines at locations where they would intersect with the project transmission line alignment. This includes:

- Transgrid Transmission Line 79 between the New Wollar Switching Station and Merotherie Energy Hub
- 12.7 kV, 22 kV and 66 kV Essential Energy distribution lines near the Merotherie and Elong Elong energy hubs and Moolarben, Ulan and Wilpinjong coal mines
- Transgrid's 500 kV transmission lines 5A3 (Bayswater to Mount Piper) and 5A5 (Wollar to Mount Piper) at the New Wollar Switching Station.

All protection and adjustments activities would be undertaken in consultation with individual asset owners.

Where the new project transmission lines intersect existing Essential Energy distribution lines, undergrounding of short sections of these utilities may be required. Where undergrounding is not required, including at locations where the transmission lines would cross Transgrid Line 79 and other infrastructure, temporary hurdles with netting may be required during construction as part of protection works, allowing continued use during the stringing operation.

Where adjustments or relocations to electrical infrastructure are required, short-term disruptions to these assets may occur during this work and any disruptions would be managed by the utility owner. Affected property owners would be notified in advance of any disruptions.

Other utilities (excluding electrical infrastructure)

The project design would continue to consider the location of, and potential impacts to, services and utilities, however construction of the project would likely require the permanent adjustment and/or protection of other utilities such as telecommunications and gas mains. Consultation with relevant service providers would be undertaken be undertaken prior to construction.

Transport infrastructure

The impacts of the project on the road and rail network, and property access during construction is addressed in Chapter 17 (Traffic and transport).

Travelling stock reserves and Crown Land

Construction of the project would affect one parcel of Crown Land associated with the TSR which extends along Barneys Creek Road, as well as parcels of land associated with Crown roads (including paper roads), and waterways (including Laheys Creek and Wilpinjong Creek). Where these parcels of Crown Lands are enclosed (i.e. fenced within a landowners property), they remain Crown Land.

It is possible that the movement of livestock along the TSR or public roads or the use of the Crown lands intersected by the project would be affected temporarily by restricted access where they intersect with construction areas. However, these restrictions would be of limited duration during some construction activities and transmission line stringing. Therefore, the project is not expected to significantly prevent or hinder livestock movements or impact the use of TSRs or livestock routes.

EnergyCo would continue to liaise with the LLS during continued development of the project design to understand how and when the TSRs are used, and how impacts can be avoided, where possible. Alternative access arrangements would be made as required.

Where the construction area crosses enclosed Crown Lands, landowners would continue to use the land subject to the construction activities taking place on their property. All access protocols would be captured in Property Management Plans to be developed for each impacted property.

Aboriginal land claims

The construction area for transmission lines would cross two parcels of Crown Land which are subject to undetermined land claims under *Aboriginal Land Rights Act 1983* (NSW). This includes a small parcel of Crown land adjacent to Laheys Creek and one parcel of Crown Land to the south of the Golden Highway, where temporary access would be required to facilitate construction. EnergyCo would continue to liaise with the LLS and/or the relevant LALC (depending on the status of this claim) to gain access to these land parcels.

EnergyCo is continuing to consult with the relevant Aboriginal Land Councils in relation to the project (refer to Chapter 5 (Community and stakeholder engagement) for more information).

Future land uses

As discussed in Section 7.3.2, there are a number of planned and future renewable energy projects identified within the Central-West Orana REZ. Construction of the project is not expected to adversely impact on these projects and EnergyCo would continue to liaise with the relevant landowners and developers to minimise any future land use conflicts. Refer to Chapter 20 for an assessment of the cumulative land use impacts of the project and planned renewable energy generation and storage projects.

7.4.2 Property impacts

Land acquisition or leasing

Construction of the project would require the temporary access or acquisition of land within the construction area. This would require:

- securing of temporary construction easements over freehold land to facilitate construction of the transmission line, including access tracks and brake and winch sites, and securing permanent transmission line easements (including for towers) upon completion of construction (refer to Section 7.5.2)
- securing an easement through the Durridgere SCA in accordance with the NP&W Act
- temporary leasing of freehold land for the construction of 330 kV switching stations. The leasing of freehold land would be secured by a construction lease negotiated with landowners
- permanent acquisition of freehold land for the Merotherie Energy Hub, Elong Elong Energy Hub, and New Wollar Switching Station to facilitate the construction of the proposed permanent project infrastructure, and permanent acquisition of freehold land for the workforce accommodation camp off Neeleys Lane. Acquisitions of privately owned land would be carried out in consultation with the landowner and in accordance with the requirements of the *Land Acquisition (Just Terms Compensation)* Act *1991* and preferably by negotiated agreement
- securing permanent and temporary access to the transmission easement and the temporary easement.

Construction easements would be created for the transmission lines (and access tracks) prior to the commencement of construction, with all transmission easements being in place upon completion of construction. Acquisitions of all interests in land would be carried out in consultation with the relevant landowner in accordance with the requirements of the Land Acquisition (Just Terms Compensation) Act 1991 (NSW) (Just Terms Act) and preferably resolved by negotiated agreement.

Construction of the project may require adjustments to property infrastructure (such as agricultural sheds, fencing and gates) and/or the reconfiguration of cropping lands where precision farming operations with permanent wheel tracks are undertaken.

Any adjustments to fences, dams, access tracks or other property infrastructure required for the project would be undertaken in consultation with the landowner and at no cost to the landowner, and management through property management plans. Adjustments required to private property infrastructure for the operation of the project would preferably be completed at the commencement of construction to minimise disruption for landowners.

Property access

During construction, temporary restrictions would be put in place within the construction area, which have the potential to restrict landowner access to sections of their properties. The impacts of these temporary restrictions would be dependent on the location of the temporary easement in relation to property boundaries and paddock configurations. While these restrictions are likely to be of short duration due to the progressive nature of construction, they may require the landowners to use alternative routes at times to access parts of their property.

These impacts would be minimised though the development of mitigation measures, which would include Property Management Plans, developed in consultation with each landowner, and would detail alternative access routes, communication protocols and outlined any temporary restrictions on use of the construction area.

Native title

There are no existing native title claims identified within the construction area. Construction of the project would not impact the three existing native title claims identified within the project study area.

7.5 Potential impacts – operation

7.5.1 Land use changes

Operation of the project would result in a permanent change to the operation area from the existing land use to electrical infrastructure, where energy hubs, switching stations and transmission line towers are located. In land subject to the transmission line easement, existing land uses would continue, subject to some restrictions on activities. For example, the project has a total operational area of around 2,665 hectares (subject to ongoing refinement and finalisation as part of continued design development), however much of existing land use activities (grazing and cropping) would be able to continue in areas of land under transmission lines, subject to conditions.

EnergyCo propose to acquire an area of land that is greater than the extent of proposed permanent infrastructure at the Merotherie and Elong Elong energy hubs. The extent of land is consistent with the construction area of the project (refer to Chapter 3 (Project description) for details of the operational area and construction area at the energy hubs). It is envisaged that these areas would remain under the ownership of EnergyCo following commencement of operation. At the Merotherie Energy Hub this consist of around 360 hectares, where the future use of the land would be confirmed during detailed design. At the Elong Elong Energy Hub, this consist of around 180 hectares, where it is expected that the interim 300 kV operation would extend into a portion of this area. As the potential future use of these larger areas would be subject to confirmation during detailed design and as part of future planning of the Central-West Orana REZ, they have not been included in the assessment of operational impacts of the project.

Agricultural areas

While the operational area of the project consists of around 2,440 hectares of agricultural land, permanent project impacts (resulting in a change in land use) would consist of around 825 hectares or 34 per cent of the total area of agricultural lands within the operational area. These direct impacts, commencing during construction, would include the footprints of transmission line towers, energy hubs and switching stations, access tracks, and access roads (noting most access roads are within the energy hubs and switching stations). The direct impact to agricultural land is equivalent to 0.13 per cent of the total agricultural land in the four LGAs within which the project is located.

As discussed, the land subject to the transmission line easements and immediately next to the easement would continue to be able to be used for agricultural activities such as grazing and cropping, however, land within the transmission line easement would be subject to certain restrictions for safety and operational reasons (refer to Section 7.5.2).

Further details on the operational impacts of the project related to loss of land use productivity, agricultural operations and biosecurity risks are discussed in Chapter 8 (Agriculture).

Protected areas and State Forests

Operation of the project would result in a permanent transmission line easement within the Durridgere SCA. The easement through the Durridgere SCA would be up to 60 metres wide and impact around 15 hectares of the Durridgere SCA. Operation of the project would not impact the Tuckland or Cope State Forests.

Mining and exploration

Mining operations

For the Wilpinjong coal mine the operation area is intended to be excised from the mine operations plan and the operation area would be excised from the active mining area of the Moolarben coal mine extent. The operational maintenance requirements of the project and respective mining operations would be managed through interface agreements with mining operators, where required. Accordingly, the project is not expected to impact upon mining operations. As discussed in Section 7.4.1 in consideration of mine subsidence, based on the timing of mining activities, and the location of the current and planned mining activities, there would be no proposed mining activities what would result in subsidence impacts on the project.

Mineral exploration

Consistent with the construction of the project, once operational the project would impact future exploration activities in areas directly below or adjacent to project infrastructure due to safety, structural, operational, or engineering limitations. Operation of the project however would not prevent access to the exploration licence areas for ground-based exploration of minerals. If mineral deposits were discovered within these exploration lease areas, and these deposits were of commercial viability, the development of these mineral resources would need to consider the location of project infrastructure and operational requirements.

Aviation

Operation of the project would not impact flight operations at Mudgee or Dubbo airports, or the nearby aircraft landing areas (as identified in Section 7.3.2), however the presence of new electrical infrastructure has the potential to conflict with aerial agricultural aviation activities. Additional information about potential aviation impacts and their management is included in Chapter 16 (Hazards and risk) and Technical paper 1 (Aviation).

Travelling stock reserves and Crown Land

Operation of the project would not impact the use of TSRs or Crown Land within the operation area.

The transmission line traverses one TSR and several parcels of Crown Land that associated with waterways, Crown roads, roadside areas or the Durridgere SCA. The ongoing operation and maintenance of the transmission line would not impact the continued use of these land parcels (including enclosed Crown Lands); however, activities within these areas may be subject to certain restrictions for safety and operational reasons (refer to Section 7.5.1). No permanent infrastructure would be located on Crown Land, meaning any enclosed Crown Land would remain in place.

Crown Land (paper roads) located within the Elong Elong Energy Hub would be permanently acquired, and land use would change from its current agricultural land use to electrical infrastructure.

Transport infrastructure

The impacts of the project on the road and rail network, and property access during operation is addressed in Chapter 17 (Traffic and transport).

Future land uses

Operation of the project would support planned land use changes in the Central-West Orana REZ by providing the energy transmission network required to facilitate planned and future renewable energy generation and storage projects. Land use changes would occur largely in response to the introduction of the project. Once operational, EnergyCo would continue to engage with operators of planned and future energy generators throughout operations, such as during any maintenance works or any figure upgrade works required on the transmission network.

7.5.2 Property impacts

Freehold land acquisition

As identified in Section 3.5.1, operation of the project would require the permanent acquisition of 30 parcels of land for project infrastructure. This would include the full and partial acquisition of land for:

- New Wollar Switching Station
- Merotherie Energy Hub (including the maintenance facility)
- Elong Elong Energy Hub
- 330 kV switching stations (13 sites)
- the Neeleys Lane workforce accommodation camp.

In most instances, the acquisition of land for permanent project infrastructure would reduce the size of the remaining landholding. The exception to this is the Merotherie and Elong Elong energy hubs where the landholding has been acquired in full. Most land where permanent project infrastructure would be located is zoned as RU1 (Primary Production) under the relevant LEPs and contains a minimum lot size of 100 hectares.

The size of the parcels and the remaining areas, configuration and/or access arrangements may affect how these areas of land are used in the future, noting some of these areas are identified for proposed renewable energy projects. Access arrangements to improve connectivity in affected properties would be appropriately considered and implemented (as far as reasonably practical) during detailed design.

For 330 kV switching stations, these would generally be constructed within land where future renewable energy and storage generators are proposed. The position of the switching stations may result in the fragmentation of existing land parcels, however the location and position of the 330 kV switching stations has been chosen based on consultation with the proposed renewable energy projects and landowners to minimise the potential for this fragmentation of land.

Easements

New easements would be created for the proposed transmission lines. Easements would restrict certain activities along the transmission line and provide 'right of way' for operators to operate and maintain the infrastructure. The easement would also ensure safe electrical clearances during the operation of the transmission lines.

Land access for the Network Operator would preferentially rely on use of existing access gates, driveways, access tracks or as otherwise agreed with landowners (e.g. driving over paddocks when agricultural cropping is not a constraint). Permitted activities within easements would depend on the nature or scale of the activity, as well as proximity to the transmission line and structures. The following activities would generally be permitted within the transmission line easements, however, may be subject to certain restrictions for safety and operational reasons as outlined in EnergyCo's *Living and Working near transmission line easements fact sheet* (EnergyCo, 2022):

- agriculture and grazing
- landscaping and paving
- installing drainage
- water and sewer pipes
- the movement of vehicles and machinery
- the parking of light vehicles.

All other activities are not allowed within the defined exclusion zones, unless otherwise agreed to by the Network Operator. The potential impact on agricultural productivity is discussed in Chapter 8 (Agriculture).

Easements would be created on sections of three Crown Land parcels that are subject to separate undetermined land claims under *Aboriginal Land Rights Act 1983*. The establishment of the project and associated easements is essential for a public purpose (energy transmission). EnergyCo would continue to liaise with the relevant landowner at the time of establishing the easement.

Property access

Access to the transmission line easement would be via access tracks that have been established during construction and retained for operational purposes.

In some cases, access agreements with landowners may be required to allow operational access to the transmission line easement from the nearest public road. These access easements would be negotiated with landowners as necessary. Where access agreements are in place, the future Network Operator may install lockable and signed access gates should the landowner not have a suitable nearby access gate.

Native title

There are no existing native title claims identified within the operation area. Operation of the project would not impact the three existing native title claims identified within the project study area.

7.6 Management of impacts

7.6.1 Environmental management

Land use and property impacts would be managed in accordance with the Construction Environmental Management Plan. This would set out land use and property objectives to minimise impacts to land use and property, by detailing site boundaries, no go zones, key land use and property within and adjacent to the construction areas, and consultation with impacted land owners to minimise impacts associated with the construction of the project such as access and the temporary severance of land.

7.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to land use and property are listed in Table 7-6. Mitigation measures in other chapters that are relevant to the management of construction and operation impacts to agriculture and aviation include:

- Chapter 8 (Agriculture), specifically measures that address the impacts to agricultural land use during construction and operation
- Chapter 16 (Hazard and risk) specifically measures that address the impacts to aviation during construction and operation.

Table 7-6 Proposed mitigation measures – Land use and property

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
LP1	Land use	The design will continue to be refined to minimise potential impacts on existing land uses and properties as far as practicable.	Detailed design	All locations
LP2	Land requirements	Prior to the commencement of construction, land for the energy hubs will be acquired in consultation with landowners and in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW).	Detailed design	Energy hubs
LP3	Impacts to land use	Pre-condition assessments of the construction area will be undertaken to determine the existing condition of assets, infrastructure, utilities and the general condition of the land. This will inform requirements for rehabilitation within Property Management Plans established with landowners.	Pre-construction and construction	Construction area – transmission lines
LP4	Impacts to utilities and services	The location of all services and utilities within the construction area will be confirmed during detailed design, and any required protection or relocation works will be designed in consultation with utility providers.	Detailed design	All locations
LP5	Indirect impacts on State forests	EnergyCo will consult with Forestry Corporation of NSW and any relevant stakeholders with regards to access limitations to State forests.	Pre-construction	Locations where the project intersects State Forests
LP6	Impacts to TSRs	Local Land Services will continue to be consulted during detailed design to confirm how impacts on travelling stock reserves will be managed during construction and operation. Alternative access arrangements will be made as required.	Detailed design	Barneys Reef TSR

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
LP7	Impacts to mine operations	To minimise disruption to mining activities, mine operators will be consulted on construction methodologies and activities as part of continued design development and prior to and during construction activities. This will include consultation relating to: • any adjustments to existing mining-related infrastructure (fences, tracks, mine roads, access tracks etc) • the timing and location of construction works, especially where there are some restrictions on vehicle or construction equipment movements • the timing and location of construction works which have the potential to impact mine operations, such as the stringing of transmission lines over existing mine infrastructure or active mining areas.	Pre-construction and construction	Mining areas
LP8	Impacts to existing biodiversity offset sites	EnergyCo will, in consultation with applicable regulatory authorities, Glencore, YanCoal and Peabody, identify and secure biodiversity offsets for impacts to existing biodiversity offset sites (associated with the Wilpinjong, Moolarben and Ulan coal mines approvals).	Pre-construction and construction	Existing biodiversity offset areas
LP9	Land disturbance	Disturbed areas will be stabilised and appropriately rehabilitated back to pre-construction condition where practical, or as agreed in consultation with the relevant landowner and documented in Property Management Plans.	Construction	Construction area
LP10	Land requirements	The permanent acquisition of land for the switching stations will be carried out by EnergyCo in consultation with landowners and in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW).	Detailed design	Switching stations
LP11	Land requirements	Easements will be established for transmission lines by EnergyCo in consultation with landowners and in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW) and *Crown Lands Management Act 2016* (NSW) (as relevant) at the completion of construction.	Detailed design	Transmission lines

8 Agriculture

This chapter provides an assessment of the potential agricultural impacts of the project and identifies mitigation measures to minimise and manage these impacts, as provided in Technical paper 2 – Agriculture (Technical paper 2). The SEARs as they relate to agriculture, and where in the EIS these have been addressed, are detailed in Appendix A.

8.1 Legislative and policy context

Potential agricultural impacts resulting from the project were assessed in line with the SEARs and the following legislation, policies and plans:

- *Biosecurity Act 2015* (NSW)
- *Local Land Services Act 2013* (NSW)
- State Environmental Planning Policy (Primary Production) 2021
- The land and soil capability assessment scheme (Office of Environment & Heritage (OEH), 2012)
- Agricultural land use mapping resources in NSW (Squires, 2017)
- Infrastructure proposals on rural land (NSW Department of Primary Industry (DPI), 2013b)
- Interim protocol for site verification and mapping of biophysical strategic agricultural land (BSAL) (OEH, 2013)
- Regional Strategic Weed Management Plans 2017-2022, and Regional Strategic Pest Animal Management Plans 2018-2023 for Central Tablelands Local Land Service (LLS), Central West LLS and the Hunter LLS.

8.2 Assessment approach

8.2.1 Study area

The agricultural study area comprises the construction area of the project. In some instances, a wider study area (comprising a four-kilometre buffer from the construction area) has been included to understand the agricultural context of the areas immediately surrounding the project. This wider study area is consistent with the land use and property study area (refer to Chapter 7 (Land use and property)).

In addition, where relevant to do so, the broader region has also been considered to allow for the inclusion and assessment of regional data, generally defined by local government areas (LGAs).

8.2.2 Assessment approach

The methodology involved:

- a review of the legislative and policy context for the agricultural impact assessment
- landowner interviews, conducted in November 2022, to obtain information on the agricultural enterprises at each property, as well as the views of landowners on the impacts of the project
- analysing and describing the existing environment, using:
  - publicly available data such as the Australian Bureau of Statistics (ABS), GIS databases and satellite imagery
  - data obtained for the project from sources such as field based landowner interviews and engagement with local councils
  - reference materials (such as the Land and Soil Capability Assessment Scheme (LSC) (OEH, 2012) that can help evaluate the nature and productivity of agricultural enterprises in the defined study area
- assessing impacts of the project (during both construction and operation) on agriculture, including impacts related to the permanent or temporary use of land considering biosecurity impacts, and the potential for disruptions to agricultural activities and productivity
- identifying mitigation and management measures that minimise potential impacts of the project.

8.3 Existing environment

8.3.1 Agricultural land use

Agricultural land use is the dominant land use within both the construction area and the wider study area. In the wider study area around 71 per cent (or 121,755 hectares) of the total area is used for agricultural purposes. This consists of the grazing of native and modified vegetation (around 57 per cent) and land used for cropping activities (around 14 per cent). When considering the construction area only, agricultural land use comprises around 92 per cent of the total land use, with grazing and cropping activities comprising around 72.5 and 19.5 per cent of the area respectively (refer to Table 8-1).

While land use mapping indicates that irrigated cropping is not undertaken in the construction area, satellite imagery suggests areas on the Talbragar River flood plain in the central section of the project, are irrigated.

Table 8-1 Agricultural land within the construction area and wider study area

Agricultural land use	Construction area		Wider study area	
	ha (approximate)	%	ha (approximate)	%
Grazing native pasture	1,225	30.8	46,605	27.1
Grazing modified pasture	1,660	41.7	51,070	29.7
Cropping	775	19.5	24,035	14.0
Horticulture	0	0.0	20	0.01
Irrigated cropping	0	0.0	10	<0.01
Intensive animal production	0	0.0	15	0.02
Total Agricultural land use	**3,660**	**92%**	**121,755**	**71%**
Non-Agricultural land use	320	8	50,085	29%
Total Land use	**3,980**	**–**	**171,840**	**–**

In terms of agricultural land use within the construction area:

- the southeastern section is dominated by the grazing of both modified pastures and native vegetation, but very little cropping
- the northeastern section (which includes the Cassilis, Coolah and Leadville connections) is dominated by grazing (on both modified pastures and native vegetation) with some cropping on lower lying areas. This is consistent with the western part of the Merotherie – Elong Elong connection, and the Tallawang west and south connections. The eastern part of the Merotherie – Elong Elong connection consists of grazing (native vegetation and modified pastures)
- areas to the west of the Elong Elong Energy Hub (including Cobbora north connection, Cobbora west connection and Goolma connection) are dominated by cropping land uses. However, in any particular year the cropping area may include a substantial portion which is in a pasture phase of the cropping rotation.

Detailed land use mapping is included in Chapter 7 (Land use and property).

8.3.2 Agricultural operations

The average land holding (property size) within the four LGAs in which the project is located is around 1,200 hectares. Consistent with the mapped land use, agricultural operations in the construction area mostly consist of sheep and cattle operations, with some cropping activities occurring in areas of higher quality soils (refer to Section 8.3.6).

As outlined in Section 7.3.2, aircraft landing areas (ALAs) are located on agricultural properties within the study area.

8.3.3 Travelling stock reserves

The study area intersects with one Travelling stock reserve (TSR) (LLS, 2022), namely Barneys Reef TSR, an 87 hectare linear TSR covering the roadside of approximately 12 kilometres of Barneys Reef Road in the Central Tablelands LLS region. It is a category 3 TSR which is described as 'rarely, if ever used for travelling stock or emergency management, but is important, valued and used for other reasons such as biodiversity conservation, First Nations Peoples' heritage or recreation' (LLS, undated) (refer to Chapter 7).

8.3.4 Agricultural employment and enterprises

Agriculture (defined by the ABS as agriculture, forestry and fishing) is the largest industry (by number of persons employed) in the Warrumbungle (27.6 per cent) and Upper Hunter (27.6 per cent) LGAs (ABS, 2022). In the Dubbo and Mid-Western Regional LGAs the number of persons employed in the agricultural industry is marginally lower, consisting of 5.1 and 8.8 per cent respectively. This is attributed to the urban centres of Dubbo and Mudgee, and the presence of the mining industry around Ulan.

In 2021, there were 3,589 ‘agriculture, forestry and fishing’ businesses in the four LGAs in which the project is located, representing around 33 per cent of all businesses (ABS, 2022).

8.3.5 Agricultural production value

The total gross value of agricultural production in the four LGAs is around $652 million (ABS, 2022) (refer to Table 7-1). The grazing of cattle and calves was the most valuable agricultural commodity with a total gross value of around $240 million, or 37 per cent of the total agricultural production. This is followed by the grazing of sheep and lambs which generates around $150 million or 23 per cent of the total agricultural productions. Together these make up around 89 per cent of livestock products in the LGAs. Given the total area of land occupied by grazing, this represents a value of around $268 per hectare in average annual return.

The production of 'broadacre crops' which includes wheat, hay and ‘other’ crops, generates around $194 million in total gross value, or around 29 per cent of total agricultural production in the four LGAs. When considering the total land use occupied by cropping, this represents a value of around $799 per hectare in average annual returns.

Horticulture (including the production of grapes, fruits and nuts, but excluding any wine products) generates around $9.4 million in total gross value, which represents a value of $8,219 per hectare in average annual returns.

Table 8-2 Agricultural production value across the Mid-Western Regional, Warrumbungle, Upper Hunter and Dubbo Regional LGAs (2021–2022) (ABS, 2022)

Source	Value ($ millions)	Proportion of total agricultural production (%)	Total value of agricultural production ($/hectare)
Broadacre crops	**$194.2**	**29.8**	**$799**
Wheat	$77.5	11.9	–
Hay	$48.7	7.5	–
Other broadacre crops	$68	10.4	–
Horticulture	**$9.3**	**1.4**	**$8,219**
Grapes	$0.5	<0.1	–
Fruit and nuts	$3	0.5	–
Other horticulture	$5.8	0.9	–
Livestock products	**$448.1**	**68.8**	**$268[1]**
Sheep and lambs (including wool)	$149.5	22.9	–
Cattle and calves	$243.2	37.3	–
Milk	$19.2	2.9	–
Pigs	$4.9	0.8	–
Poultry and eggs	$30.9	4.7	–
Goats and other livestock	$0.4	<0.1	–
TOTAL	$651.6	-	$302[2]

1. Figure represents the value of grazing production only.
2. Average gross value of agricultural production per hectare in 2020-2021 across the four LGAs.

The value of agricultural production is greatly influenced by seasonal and market conditions and can fluctuate widely from year to year. It also fluctuates between LGAs, where for example, cropping contributes approximately 40 per cent of the total gross value of agricultural production in the Dubbo Regional and Warrumbungle LGAs but only 15 per cent of the total value in the other LGAs.

8.3.6 Agricultural land capability

Key natural drivers of agricultural productivity include climate, the availability of water and the characteristic of soils.

In NSW there are a number of methods to assess land capability for agricultural purposes. The primary method used in this assessment is the LSC scheme, which classifies agricultural land based on its biophysical characteristics and subsequent limits they place on use (shown on Figure 8-1). Technical paper 2 provides an overview of other land capability methods considered in the assessment including a comparison to the LSC assessment scheme.

The LSC assessment scheme establishes eight classes, with Class 1 representing land capable of sustaining the most intensive land uses (such as irrigation and cropping), and Class 8 representing land that can only sustain very low intensity land uses (such as nature conservation). Detailed descriptions of the LSC classes are included in Technical paper 2.

Most of the construction area (75 per cent or around 2,975 hectares) consists of land classified as having moderate to low capability (Class 5), which largely restricts agricultural land use to grazing, and some horticultural activities. High capability land (Class 3) and moderate capability (Class 4) each comprise around 16 per cent with only a small area of Class 2 (very high capability) (less than one per cent). The remaining land is Class 6 (low capability) and Class 7 (very low capability).

Parts of the construction area (10 ha) and wider study area (1,485 ha) are associated with mining operations near the town of Ulan. These have not been assessed for land and soil capability and therefore are categorised as unclassified. It should also be noted that LSC mapping does not take into consideration areas within the Moolarben coal mine, which have been approved for open cut mining, and as such remain mapped as Class 5.

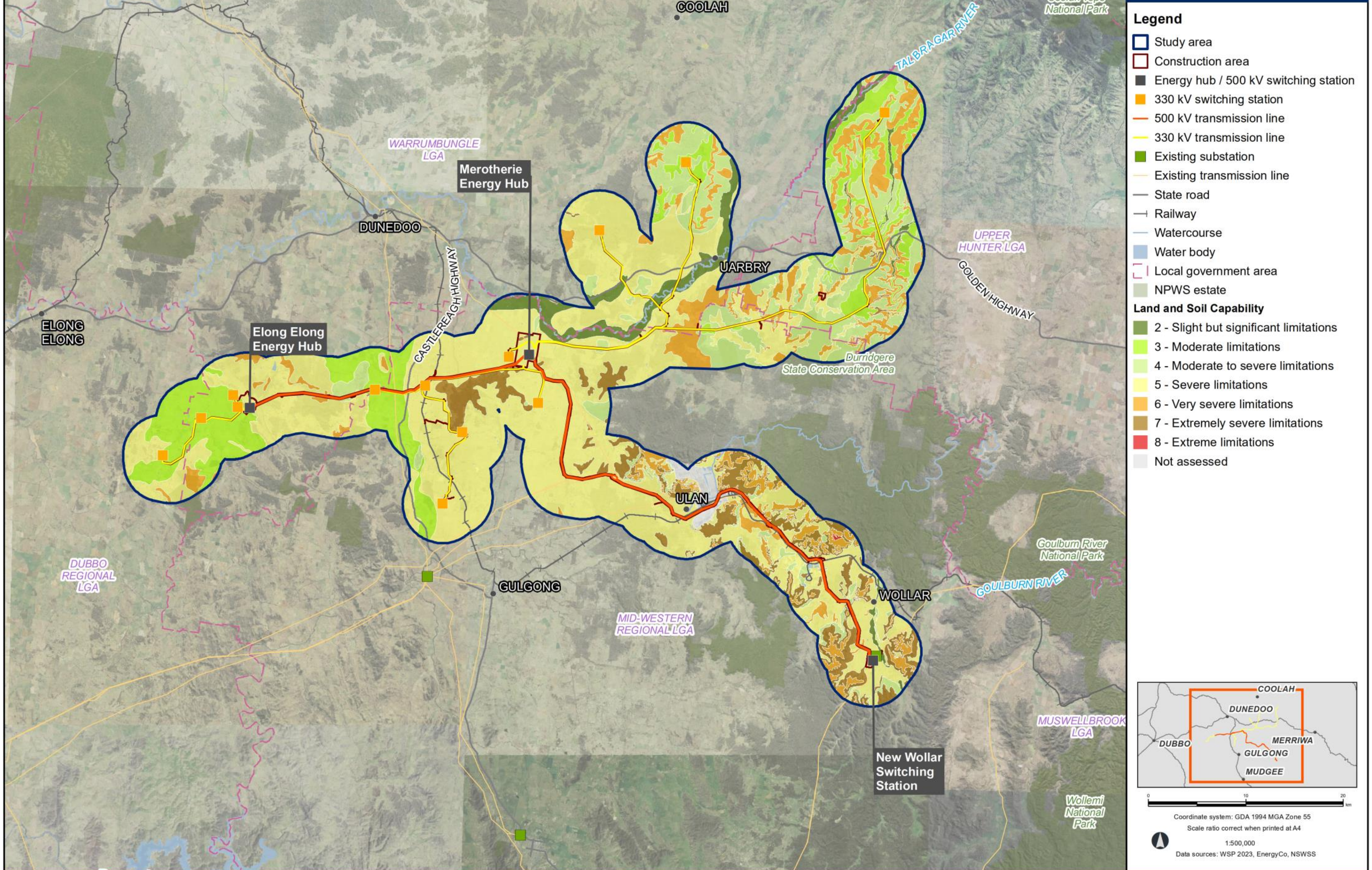
Table 8-3 Summary of land and soil capability

LSC Class/limitations	Construction area (ha)	Construction area (%)	Wider study area (ha)	Wider study area (%)
1 – Extremely high capability/no limitations	0	0.0	0	0.0
2 – Very high capability/slight limitations	25	<1.0	7,070	4.1
3 – High capability/moderate limitations	395	9.9	22,290	13.0
4 – Moderate capability/moderate to severe limitations	240	6.0	22,715	13.2
5 – Moderate–low capability/severe limitations	2,975	74.7	86,365	50.3
6 – Low capability/very severe limitations	160	4.0	19,315	11.2
7 – Very low capability/extremely severe limitations	175	4.4	12,560	7.3
8 – Extremely low capability/extreme limitations	0	0	40	<0.1
Unclassified	10	<1.0	1,485	<1.0
Total	3,980	–	171,840	–

In summary:

- the southeastern section of the construction area is dominated by class 5 (moderate to low capability), and Class 7 (very low capability). This is represented by the general dominance of grazing activities within this section.
- the central section of the construction area is dominated by moderate to low capability land (Class 5) with small areas of moderate, low and extremely low capability (classes 4, 6, and 8)
- the northeastern section of the construction area contains a complex mix of classes, consisting mostly of moderate capability lands (Class 4) with smaller areas of higher capability lands (classes 2 and 3). Very high capability land (Class 2) is located where the Coolah and Leadville connections cross the Talbragar River and Cainbill Creek floodplains
- the western section of the construction area contains a mix of high, moderate and moderate to low capability (classes 3, 4 and 5), with the higher capability lands associated with flood plains around Sandy Creek and Spring Creek, and areas of the wider study area to the west of the Castlereagh Highway
- no areas of extremely high (class 1) or very low capability (classes 1 and 7) have been identified in the construction area. A small area of class 8 (extremely low capability) is located within wider study area.

Figure 8-1
Land and soil capability
– LSC Assessment Scheme



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Other land capability assessments

In addition to the LSC assessment scheme, the NSW Government has mapped BSAL and State significant agricultural land (SSAL) (in draft). The mapping of BSAL and SSAL are both aimed at managing competing land uses, and ensuring high value agricultural lands in NSW are preserved.

BSAL is land with high quality soil and water resources capable of sustaining high levels of productivity. The purpose of mapping BSAL was to ensure the safeguarding of high yielding potential soils, and to establish a process for State significant mining and coal seam gas (CSG) development proposals to verify if BSAL is present within development sites, to minimise impacts on agricultural production.

The construction area contains around 150 ha of mapped BSAL (around 3.8 per cent of the total area), while around 17,050 hectares of the wider study area (around 10 per cent of the total) is mapped as BSAL (refer to Figure 8-2). These areas include the northern end of the Cassilis connection, areas to the west of the Elong Elong Energy Hub, west of the Castlereagh Highway, and along the Talbragar River and Cainbill Creek floodplains. These areas are generally consistent with the higher LSC classes.

Draft SSAL mapping was released by the NSW Government in 2021 (DPI, 2021). There are currently no specific requirements for the assessment of development projects in areas of draft SSAL, however the purpose was to understand the location, value and contribution to agricultural productivity in regional economics, and to assist with planning decisions on agricultural lands.

The distribution of SSAL across the study area is similar to BSAL, as the assessment is based on similar parameters. However, there are greater areas of draft SSAL than BSAL across the wider study area in the following areas:

- small areas on the southern part of the Cassilis connection
- extensive areas on the northern part of the Cassilis connection
- a small area at the northern end of the Coolah connection
- a larger proportion of the land west of the Elong Elong Energy Hub, including part of the Elong Elong Energy Hub, and most of the Cobbora north, Cobbora west and Goolma connections.

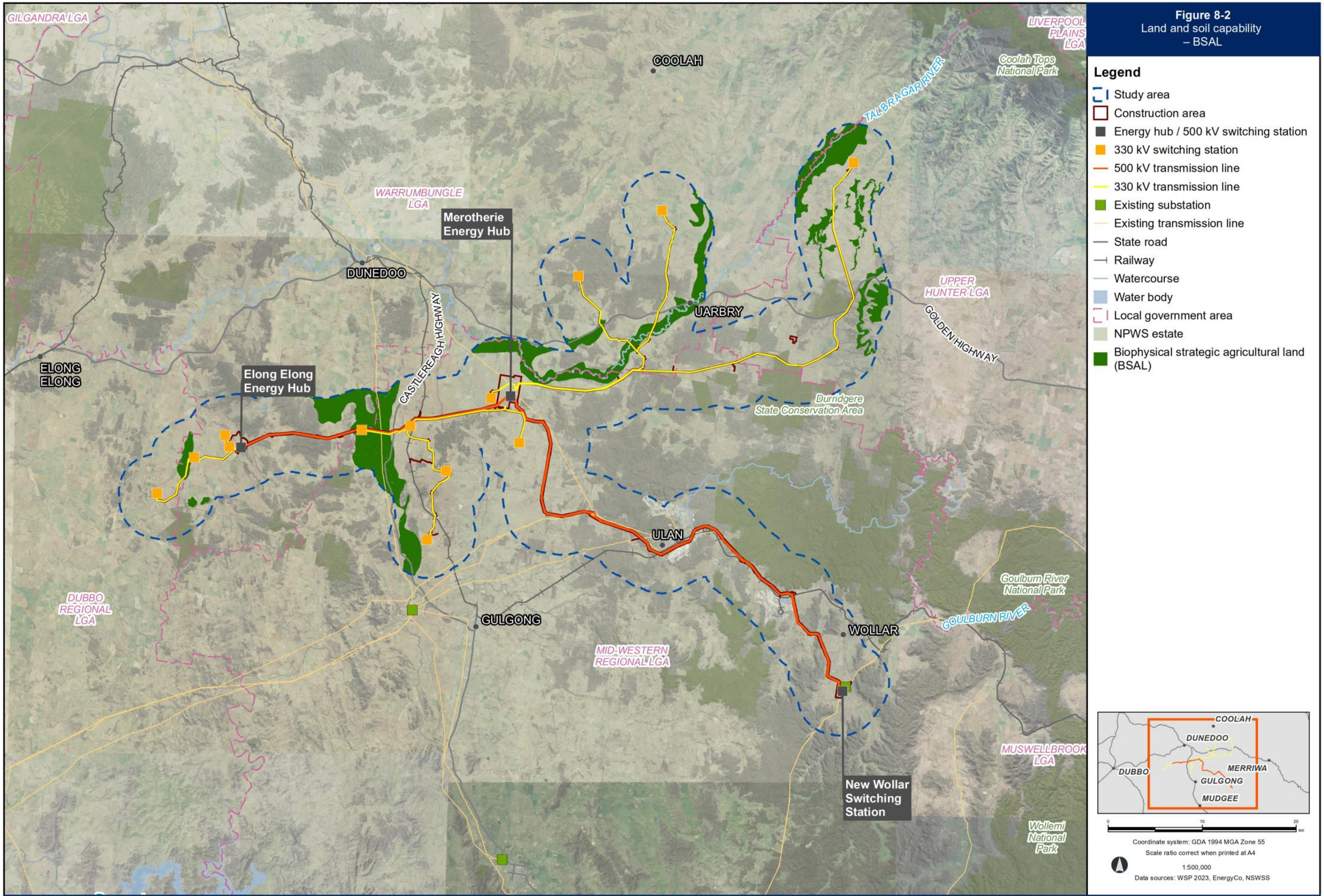

Figure 8-2
Land and soil capability – BSAL

8.3.7 Water resources

In addition to land capability considerations, agricultural productivity is also influenced by the availability and quality of surface and groundwater resources.

Surface water

Rivers and their tributaries within the wider study area provide water to support communities, agriculture and the environment. Water is used for stock and domestic use, and for irrigation.

The watercourses that intersect the construction area are described in Section 19.1.3. This includes Talbragar River, Sandy Creek, Spring Flat Creek and Moolarben Creek.

Farm dams capture and store local runoff and are mainly used for livestock purposes. Surface water is reticulated on many grazing properties using a system of pumps, pipes, tanks and livestock troughs.

Access to water (both groundwater and surface water) and favourable soil conditions has guided agricultural land uses in the Central-West and Orana regions. Surface water used for agriculture within the wider study area is mostly sourced from the local waterways and farm dams (refer to Section 19.1 (Hydrology, flooding and water quality)).

Groundwater

The wider study area covers various groundwater resources (refer to Section 19.3 (Groundwater)), with higher yields generally found in the northeastern section. Groundwater (including bores) are used for stock, domestic and irrigation purposes. However groundwater quality, particularly salinity, may limit its potential uses in some areas of porous rock groundwater sources, such as in the Gunnedah-Oxley Basin Murray Darling Basin (MDB) and the Sydney Basin MDB (DPIE, 2012). The Talbragar Alluvial Groundwater Source generally has relatively low salinity levels.

There are 23 registered groundwater users within a 500-metre buffer of the construction area, and two registered users within the construction area (refer Section 19.3 (Groundwater).

8.3.8 Biosecurity

Agricultural productivity in part, relies on the management of pests and disease. There are a number of weeds, pests, and animal and plant diseases, which pose a high risk to agricultural production in the wider study area.

Weeds

The most common weeds recorded during property inspections undertaken by the Department of Primary Industry (DPI) in 2022 within the study area was blackberry (*Rubus fruticosus*) and St John's serrated tussock wort (*Hypericum perforatum*). These were found in relatively high numbers across properties within or adjacent to the study area (DPI, 2022). These species were also identified by landowners as having the potential to become more widespread, along with:

- African lovegrass (*Eragrostis curvula)*
- Bathurst burr (*Xanthium spinosum*)
- Blue heliotrope (*Heliotropium amplexicaule*)
- Galvanised burr (*Sclerolaena birchii*)
- Macquarie pea (*Cassia* spp)
- Noogoora burr (*Xanthium occidentale*)
- Silverleaf nightshade (*Solanum elaeagnifolium*), and
- Spiny emex (*Emex australis)*.

Relevant Regional Strategic Weed Management Plans (Central Tablelands LLS, 2017; Central West LLS 2017; Hunter LLS, 2017) list numerous State priority weeds, regional priority weeds and other regional weeds. Weeds Australia (2022) also set out weeds of national significance (refer to Technical paper 2). Some of these weeds are present in the vicinity of the study area (DPI, 2022b), including serrated tussock (*Nassella trichotoma),* fireweed (*Senecio madagascariensis*), nodding thistle (*Carduus nutans*), Scotch thistle (*Onopordon acanthium*) and Illyrian thistle (*Onopordon illyricum*).

Pests

Foxes, feral pigs and wild rabbits have a widespread distribution across the wider study area, with feral goats and wild dogs occurring with a more scattered distribution. The Hunter LLS notes a higher presence of foxes, feral pigs, wild rabbits, feral goats and wild dogs around Cassilis, than across the remainder of the wider study area.

Animal and plant diseases

There are a number of potential animal diseases which may occur within the wider study area, including footrot and Ovine Johns Disease (OJD).

Footrot is a contagious bacterial disease of sheep and goats, caused by the organism *Dichelobacter nodosus (D. nodosus)* in association with several other bacteria. The occurrence of sheep footrot in the vicinity of the study area has been low in recent years. In December 2021, DPI reported a total of 25 flocks infected with virulent footrot with an infection rate of around 0.5 per cent across the Central Tablelands, Central West and Hunter LLS regions. One landowner interviewed highlight a recent outbreak of footrot, however landowners interviewed generally did not view footrot as a major problem due to its relative rarity.

OJD is an incurable infectious disease caused by the bacterium *Mycobacterium paratuberculosis*. Landowners consulted confirmed that OJD is not a substantial problem as it is currently well managed.

The study area is also within the Phylloxera Exclusion Zone which restricts the movement of grapes and grape vine material, and the entire state of NSW is a Potato Biosecurity Zone.

8.4 Potential impacts – construction

As discussed in Chapter 7 (Land use and property), the project would require the use of land (including land currently used for agricultural purposes) both temporarily for construction, and then permanently for operation in areas where permanent infrastructure is proposed.

The project has been designed to avoid and/or minimise potential impacts, including (relevantly to agriculture) by:

- positioning infrastructure in areas that align with current land use activities, or based on landowner feedback, and the willingness of landowners to host project infrastructure within an easement on their property
- utilising already disturbed land, such as existing transmission line easements.

During construction, due to the dispersed nature of the infrastructure proposed, and the way transmission lines are constructed (i.e. construction activity at any given location along the alignment would be relatively short-term), the level of impact on agricultural activities would vary, depending on the scale and intensity of construction activities. For example:

- in areas where a higher intensity of construction activities is required, such as the location of energy hubs, switching stations, worker accommodation camps and construction compounds, the project would result in direct impacts to agricultural land use, with land permanently acquired and removed from agricultural production

- in areas where the land required for construction of the transmission lines, land access would be secured by way of easements, which would restrict agricultural uses during construction. In this case, agricultural land uses such as grazing of livestock may continue for significant periods of the overall construction program, subject to the timing and location of planned construction activities.

To minimise potential impacts, Property Management Plans will be prepared in consultation with affected landowners to identify access arrangements, protocols to regularly communicate programmed construction works, and identifying sensitive agricultural periods such as lambing.

8.4.1 Loss of agricultural land

As described in Chapter 7 (Land use and property), the construction area covers around 3,980 hectares, of which around 3,660 hectares is used for agriculture. It is expected around 1,820 hectares of agricultural land would be directly affected during construction, and around 1,840 hectares of agricultural land associated with transmission line construction, would be indirectly impacted. In terms of the direct impacts on agricultural land this would include around:

- 990 hectares for the New Wollar Switching Station, Merotherie Energy Hub and the Elong Elong Energy Hub (including land for construction compounds, and the Merotherie accommodation camp)
- 495 hectares for transmission line towers
- 240 hectares for access tracks (along the transmission lines)
- 25 hectares for the Neeley's workforce accommodation camp
- 40 hectares for 330 kV switching stations
- 25 hectares for brake and winch sites, and
- 5 hectares for access roads (to/from switching stations and energy hubs).

However for the purpose of estimating total impacts, it has been conservatively assumed the entire construction area (including the transmission line easement) (3,660 hectares used for agriculture) would be unavailable for agricultural activities during the 3-year main construction period. This would result in an estimated loss of agricultural production of around $4.04 million, or $1.35 million per annum. This is equivalent to approximately 0.21 per cent of the total gross value of agricultural production across the four impacted LGAs over the same impact period.

It is noted however, this is an overestimation as construction activities associated with the transmission line, including transmission tower erection, transmission line stringing and vehicle and machinery movements along access tracks, would be intermittent and would not occur for the full duration at any one location. The length of disruption at other structures such as energy hubs and switching stations is expected to be longer (and in some cases permanent (refer to Section 8.5)).

A detailed breakdown of the direct impacts of construction on agricultural production (including the loss of value per hectares of land) is included in Table 5.1 of Technical paper 2.

8.4.2 Soil and land capability

Construction of the project would generally not affect the intrinsic capability or physical characteristics of the land in the construction area, except in small areas subject to heavy traffic or earthworks. Rather, the main impact of construction on soil and land capability would be through the temporary or permanent removal of areas from agricultural production to accommodate the project. Areas subject to heavy traffic or earthworks which are not part of the operation area would be rehabilitated.

Important agricultural land

The construction area includes around 150 hectares of BSAL, equivalent to 3.7 per cent of the construction area. While no area data exists for SSAL, a view of available mapping (DPI, 2021) indicates a marginally larger area of SSAL within the construction area when compared with BSAL.

Construction of the project would directly impact around 46 hectares of BSAL, consisting of 15 hectares for access tracks, up to 2 hectares for the construction of the M7 switching station, and 29 ha for the construction of transmission line towers. The remaining 108 hectares of BSAL within the construction area is located within the transmission line easements, where continued use of these area may continue to occur subject to the timing and location of planned construction activities.

The impact on BSAL and SSAL would be minor due to the small area involved and because agricultural production would only be temporarily unavailable on most of this area during construction. Areas which have been impacted and are not required for permanent infrastructure (i.e. transmission line easements) would be rehabilitated after construction where practical, or as agreed with the landowner. The exception to this would be where transmission towers or switching stations are located within areas of BSAL, which would be permanently removed from production (refer to Section 8.5).

8.4.3 Agricultural operations

Restricted movements

Construction of the project may result in temporary restrictions on the movement of landowners, agricultural workers, livestock, or equipment within and across the construction area. The severity of these impacts would depend on the location, scale and intensity of construction activities.

In general, areas where permanent infrastructure would be located, which would require a higher scale and intensity of construction activities, restrictions on access to these areas would limit or exclude all agricultural related movements. This would apply to energy hubs and switching stations.

In areas where a lower scale and intensity of construction activities is required, such as along the transmission line alignment between transmission towers (considered part of the construction area), agricultural land uses, such as grazing of livestock may continue where transmission lines are proposed to be constructed, subject to the timing and location of planned construction activities. Restricted movements would be managed in accordance with Property Management Plans to be developed for each landowner impacted by the project.

On-ground operations

Construction of the project has the potential to impact a number of on-ground operations through the temporary and in some cases permanent exclusion of agricultural activities from the construction area.

This includes disruptions to agricultural activities such as crop sowing, spraying and harvesting, which may delay the timing of activities and reduce agricultural yields. During the construction of the transmission line, vehicle and machinery movements may also have a direct impact on areas of crops and pasture.

Usual cultivation, crop establishment and spray travel patterns would also need to be adjusted to avoid the construction area, and care would need to be taken to avoid collisions when using wide farming equipment. This would also apply to the use of controlled traffic farming (CTF), which uses permanent wheel tracks within cropping areas to avoid soil compaction. Landowners using CTF would be required to permanently modify their systems under transmission lines prior to construction (refer to Section 8.5.2 for further discussion).

Construction of the project may also result in the generation of dust (refer to Section 19.4 (Air quality)) from vehicle movements and some construction activities. While dust exposure can also reduce the yield and quality of crops and pastures, the impact of dust is likely to be minor due to the limited earthworks, and the relatively low amount and duration of traffic flow on each access track.

In summary, these impacts on crop, pasture and operations would be relatively minor due to the small areas directly affected, and the ability to continue cropping across most of the study area during construction. Impacts to individual landowners would be managed in accordance with Property Management Plans.

Aerial agricultural operations

Localised impacts, such as limitations on the use of aerial agriculture operations (such as aerial spreading of fertilisers and aerial spraying) and the use of drones, have the potential to arise from the construction of transmission line towers in agricultural areas.

Potential impacts of aerial agriculture operations arising from the project are addressed in Chapter 16 (Hazard and risk) and Technical paper 1 – Aviation.

Livestock enterprises

The construction of the project has the potential to impact livestock as a result of disturbance of grazing land, the removal of vegetation (as shade or shelter), or damage and changes to farm infrastructure including fencing and water infrastructure.

The following impacts to livestock enterprises may occur during construction:

- livestock may be disturbed by construction activities (including the use of helicopters) and construction vehicle movement, particularly during calving and lambing periods, which can panic animals, especially if they are new to the area or not used to human contact. Any potential impacts would be minimised though consultation with impacted landowners, to adjust the timing of construction activities and/or the location of livestock grazing (if required) such that the overall effect on productivity is expected to be minor
- vegetation removal within the transmission line easement may reduce available shade and shelter in some areas. In most cases adequate shade and shelter would remain to meet livestock requirements. Grazing management may need to be modified (for example, undertaking lambing in alternative more sheltered paddocks) and replacement shade and shelter vegetation may need to be established. The overall impact on livestock productivity is expected to be small
- disruption may occur if water pipelines or fences are damaged, or gates left open
- grazing management would be disrupted if paddocks become temporarily unavailable for grazing or cause a disruption to the grazing pattern of livestock. The degree of disruption would depend on several factors such as the availability of alternative pasture, the length of disruption, and the sensitivity of the subject livestock to disturbance
- there may be some impact on livestock movement and husbandry activities if stockyards and loading facilities are located within the construction area. In these cases, facilities may have to be relocated.

In general, while there is potential for some disturbance, the effect on productivity is expected to be relatively minor as construction activities can be adjusted to minimise disturbance to livestock enterprises in consultation with landowners.

Travelling stock reserves and livestock routes

Construction of the project may result in some temporary restrictions on the movement of livestock along the Barneys Reef TSR or public roads where these routes intersect with construction areas. However, the TSR (Category 3, rarely if ever used) and public roads are generally infrequently used for livestock movements and these restrictions would be of a short duration during some construction activities and transmission line stringing. Therefore, the project is not expected to significantly prevent or hinder livestock movements or impact the use of the TSR or livestock routes. EnergyCo would continue to liaise with the LLS during continued development of the project design to understand how and when the TSR is used, and how impacts can be avoided. Alternative access arrangements would be made as required.

8.4.4 Water resources

Refer to Section 19.1 (Hydrology, flooding and water quality) and Section 19.3 (Groundwater) for a summary of the impacts of construction on water resources.

8.4.5 Biosecurity

Construction of the project has the potential to introduce or spread animal and plant diseases, feral pests and weeds, if not properly managed. This may result in an increase in costs and decreased income for agricultural properties within or adjacent to the construction area. Increased costs could include expenses associated with monitoring pests, weeds or diseases and implementing control measures. Lost income could arise from reduced production volumes or quality.

Vehicles, machinery, and personnel can all serve as potential carriers of weed seeds, plant material, and diseases, and can spread biosecurity matters over long distances. Soil and water movements associated with construction can also spread biosecurity risks, although these movements tend to occur over shorter distances. The risks of biosecurity breaches are generally highest during construction due to earthworks and increased movements of machinery, vehicles, and personnel.

Organic farmers face the same pest, weed and disease biosecurity risks as non-organic producers, however there is an additional risk associated with the introduction of non-organic plants or material to an organic property which can affect the property's organic certification. These plants and material could include genetically modified plants, mineral fertilisers, and synthetic pesticides. During construction, rehabilitation works which involve the introduction of plants would ensure genetically modified plants are not introduced. There are also alternatives to the use of mineral fertilisers and synthetic pesticides which can be used around organic productions.

Consultation with the owners of organic certified properties will be carried out to identify the specific risks and controls required to be implemented during construction.

8.5 Potential impacts – operation

8.5.1 Loss of agricultural land

Where permanent infrastructure would be established (e.g., transmission line towers, energy hubs, switching stations and permanent access tracks), operation of the project would result in a permanent change in land use, from the existing agricultural land use to electrical infrastructure. For areas within permanent easements, agricultural activities would continue with some activities restricted.

A total of around 2,440 hectares of agricultural land is located within the operational area. This includes areas of direct impact of around 825 hectares, where permanent infrastructure would be located and where agricultural land use would cease. This includes around:

- 300 hectares for Energy Hubs and the New Wollar Switching Station
- 240 hectares for access tracks
- 240 hectares for transmission line towers including the required buffer surrounding the tower
- 40 hectares for 330 kV switching stations
- 5 hectares for access roads (to/from switching stations and energy hubs).

The remainder of the agricultural land within the operational area consists of transmission line easements, where land would not be permanently removed from agricultural production. Predominant agricultural land uses which are present in the operational area, such as grazing and cropping operations would be able to continue in these, subject to certain restrictions such as height of machinery, and exclusion zones around transmission structures.

The permanent loss of agricultural land is equivalent to 0.04 per cent of the total area of agricultural land use in the four impacted LGAs, and an estimated productivity loss of around $317,550 per annum. This represents around 0.05 per cent of the total annual gross value of agricultural production across the four impacted LGAs.

As described in Chapter 7 (Land use and property), EnergyCo propose to acquire an area of land that is greater than the extent of proposed permanent infrastructure at the Merotherie and Elong Elong energy hubs. The extent of land is consistent with the construction area of the project and is currently used for agricultural purposes. It is envisaged that these areas would remain under the ownership of EnergyCo following commencement of operation. At the Merotherie Energy Hub this consist of around 360 hectares, where the future use of the land would be confirmed during detailed design. At the Elong Elong Energy Hub, this consist of around 180 hectares, where it is expected that the interim 300 kV operation would extend into a portion of this area. As the potential future use of these larger areas would be subject to confirmation during detailed design and as part of future planning of the Central-West Orana REZ, they have not been included in the assessment of operational impacts of the project.

Land and soil capability

The operation of the project would not generally affect the intrinsic capability or physical characteristics of the land in the operation area. The exception is where permanent infrastructure would remove areas from agricultural production and the soil and land capability would be lost (as outlined in Section 8.5.1), or where the soil characteristics are likely to be affected to the extent that these locations would no longer be productive for cropping or pasture areas (such as permanent access tracks which total around 240 ha of agricultural land).

With respect to important agricultural land the operational area contains around 130 hectares of BSAL, equivalent to 4.9 per cent of the total operational area. While no area data exists for SSAL, a view of available mapping indicates a marginally larger area of SSAL within the operational area when compared with BSAL. Most of the operational area, which consists of BSAL, is in the proposed transmission line easement, where grazing and cropping operations would be able to continue, subject to certain restrictions. The exception to this would be where permanent transmission line towers (including buffers) and one switching station (M7)) would result in the permanent loss of around 26 ha of BSAL from agricultural use.

8.5.2 Agricultural productions

Restricted movements

Once operational, it is unlikely the project would significantly restrict the movements of landowners, workers, livestock, or equipment. The exception to this would be restrictions on the height of agricultural machinery, which must not exceed 4.3 metres above ground level under transmission lines. Maintenance activities for the project such as inspections, maintenance, and repairs, would generally be infrequent, and temporary, and engagement with landowners would be undertaken prior to any potential restrictions on the movements. Where agricultural operations have been restricted within easements, these have been taken into account as part of the easement acquisition process.

On-ground operations

Operation of the project may impact a number of on-ground activities. These would generally be related to the inclusion of obstacles (transmission line towers and associated buffers) within the landscape, as well as the impact associated with GPS interference, and height limitations beneath and around transmission lines to maintain safe operations.

Obstacles

The presence of transmission line towers on agricultural lands may disrupt normal farming operations where operational adjustments are needed to avoid the towers. While cropping activities are permitted (with certain restrictions such as no cropping permitted within 30 metres of a transmission tower base) these adjustments would most likely affect cultivation, sowing and spraying travel patterns in areas used for cropping. The impact to productivity is expected to be minor due to the size of affected areas, distance between towers, and the ability of farming operations to continue.

Infrastructure elements such as transmission line towers are problematic for CTF, which is a farming system built on permanent wheel tracks. In areas where this method is used, permanent wheel tracks may need to be adjusted to avoid any infrastructure elements. In some instances, where straight parallel tracks are currently used, the adjusted tracks would not be straight or parallel in parts, leading to inefficiencies in cropping operations. However, there are few large-scale cropping enterprises within the operation area and the use of CTF is uncommon.

GPS interference

Many landowners in the operation area, including those employing controlled traffic farming, use GPS guidance for their cropping equipment. GPS systems use receivers in the equipment, and sometimes in a fixed base station. Concerns have been expressed that the project would have the potential to interfere with the GPS reception of base stations and cropping equipment. If the project causes nuisance interference, it would be investigated in consultation with the landowner, and may require signal boosting equipment or antenna enhancement to alleviate the problem.

Weed control

During operations, the ability of operators to complete effective weed control within crop or pasture areas would be restricted to manual applications of herbicide due to restrictions on the use of normal boom spray operations between transmission line towers.

Working height

Transmission lines above cropping areas can be hazardous due to the height of agricultural plant and equipment such as harvesters and standalone grain augers. Therefore, areas within the transmission line easement would not be suitable for grain loading and unloading activities. However, the height above ground of the transmission lines would be sufficient to enable the allowable approach distance to be maintained for cropping machinery.

Aerial operations

Aerial operations can continue in the vicinity of the project, as transmission infrastructure would remain visible from the air. However the presence of transmission lines in agricultural areas can impact aerial agriculture operations (including drones, fixed wing aircraft or helicopters) during mustering, monitoring, aerial fertilising, and pesticide spraying.

Operation of the project may impact the efficiency and effectiveness of aerial operations, as it may require adjustments in flight direction, release height, and run length to maintain safety. In some cases, aerial treatments may not be possible, requiring ground-based treatments instead, which can be less efficient. In most instances, areas unable to be treated with aerial agriculture could be treated by on-ground applications. However this option may not be feasible in some steep or inaccessible areas or instances where aerial applications are used to avoid crop damage.

Although aerial agriculture is not intensively used in the operation area, some landowners use it for weed control and fertilising, and there are three ALAs within four kilometres of the operational area. The proximity of transmission lines to existing airstrips used for aerial agriculture may also restrict the use of these airstrips and compromise safety during take-off and landing.

Proximal sensing using drones for crop monitoring is becoming more popular due to its benefits over remote sensing by satellites. Drones can also be used for mustering and livestock monitoring, while their use for pesticide spraying is being developed. The presence of transmission lines can restrict drone flight and sensing activities in areas around these structures. Further, operators are required to maintain a safe distance from transmission lines to avoid collision or interference from electrical and magnetic fields.

Livestock enterprises

In general, the impacts of the operation of the project on livestock enterprises is likely to be minor as grazing activities would be permitted to continue within the transmission line easement. The main operational impacts of the project on livestock enterprises would be minor livestock disturbance during maintenance activities.

The operation of the project may result in noise and movement disturbance of sheep and cattle during inspections or maintenance on transmission lines or transmission towers. However due to the lower number and frequency of personnel and vehicle movements during operation, these impacts are likely to be minor. There would also be the potential for damage to infrastructure and livestock disruption if gates are left open.

The presence of transmission lines can impact the use, location and height of electric fencing. Clearance requirements may limit the placement of electric fences and may require some fences to be realigned. These requirements, however, are unlikely to significantly impact grazing operations or livestock movement. In addition, standard fencing within or near transmission line easements must be earthed and isolated for safety reasons, and metal fences must be at least 25 metres away from a transmission structure (EnergyCo, 2022). These requirements may increase construction costs for some fences near transmission lines.

8.5.3 Water resources

Refer to Section 19.1 (Hydrology, flooding and water quality) and Section 19.3 (Groundwater) for a summary of the impacts of the operation of the project on water resources.

8.5.4 Biosecurity

Any activity during operation (such as inspections, maintenance and repairs) that requires access of personnel, vehicles or machinery to the transmission line easement poses a potential biosecurity risk to agricultural operations in the vicinity of the project.

The biosecurity risks and potential impacts outlined in Section 8.4.5 in relation to construction are also applicable to the operational phase. The major difference is that vehicle, machinery and personnel activity would be less intense and frequent during operation, and therefore the risk of weed, pest or disease spread would be much lower.

8.6 Management of impacts

8.6.1 Environmental management

Agricultural impacts would be managed in accordance with the Construction Environmental Management Plan. This would set out objectives to minimise impacts to agricultural operations, by detailing site boundaries, no go zones, and agricultural uses within and adjacent to the construction areas, and consult with impacted landowners to minimise impacts associated with the projects construction.

8.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to agriculture are listed in Table 8-4.

Mitigation measures in other chapters that are relevant to the management of construction and operation impacts to agriculture and aviation include:

- Chapter 7 (Land use and property), specifically measures that address the impacts land use during construction and operation
- Chapter 10 (Biodiversity), specifically measures that address biosecurity impacts during construction and operation.
- Chapter 16 (Hazard and risk) specifically measures that address the impacts to aviation during construction and operation.

Table 8-4 Proposed mitigation measures – Agriculture

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
AG1	Access impacts – construction	The location of any additional access tracks (temporary and permanent) will be confirmed in consultation with landowners to minimise impacts on agricultural activities. Where permanent tracks are required, a single access track will be designed to serve both temporary and permanent purposes, where practicable.	Detailed design and construction	All locations
AG2	Impact of structures	Where the positioning of transmission line structures and other associated permanent structures will impact: • cropping land • areas used for set up and pack up of agricultural equipment, entry points and turning areas • farm dams, or • locations of high biosecurity risk consultation will be undertaken with the affected landowner to identify opportunities to avoid or minimise these impacts, where practicable, prior to the commencement of relevant works which will impact the applicable area, equipment and/or property infrastructure.	Detailed design and construction	All locations
AG3	Disruption Impacts – Property Management Plans	Individual Property Management Plans will be developed in consultation with each landowner directly affected by construction activities. The intent of the plans is to provide a flexible approach which balances the needs of existing agricultural operations and construction activities. The plans will address relevant matters including: • access arrangements and protocols • proposed timing and location of construction works, particularly where some restriction on vehicular, equipment, grazing or livestock movements will be necessary • grazing and cropping activities on and adjacent to the construction area during the construction period • farm infrastructure arrangements • any required adjustments to property infrastructure (fences, access tracks, etc) • noise intensive activities during sensitive periods of the livestock production cycle (e.g. lambing/calving) • vehicle movements and other activities within the vicinity of livestock • movement of stock away from potential stressors created by construction activities • details of any access tracks or other infrastructure provided for temporary construction activities that are to be retained and not restored to the pre-existing condition (where requested by the land owner prior to the completion of construction within the applicable area)	Detailed design, pre-construction and construction	All relevant properties within the construction area

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
		• biosecurity requirements • contact details for the person who will liaise with landowner to provide direct avenues of enquiry for information and issues management. Property Management Plans will be developed prior to the commencement of relevant works which will impact the applicable property, activity, equipment and/or property infrastructure. The requirements of the plans will be adhered to/implemented throughout the construction period.		
AG4	Disruption Impacts – General	To minimise disruption to agricultural activities: • property infrastructure (such as gates) will be managed in accordance with landowner requirements • any damage to property infrastructure caused by construction will be repaired in a timely manner in consultation with the landowner • use of existing roads, tracks and other existing disturbed areas will be prioritised over the construction of new access tracks where practicable • where access is required across open spaces, either within the easement or to the easement, care will be exercised to ensure that surface disturbance is minimised by confining vehicular and plant movements, as far as possible, to a single route.	Detailed design and construction	All relevant properties within the construction area
AG5	Biosecurity – construction	Biosecurity controls will be implemented during construction to minimise the risk of transport or spread of disease, pests or weeds. A Biosecurity Management Plan will be developed addressing the following protocols/matters including: • weed management controls, including inspection and cleaning of plant and equipment, and management of earthworks and clearing activities • development of specific controls where high biosecurity risks are identified, e.g. appropriate measures will be implemented with respect to foot and mouth disease to control any risk of introduction of the pathogen as a result of project activities • the specific controls applicable to a property will be consistent with property biosecurity plans where they are in place. Agreed protocols will be documented in the Biosecurity Management Plan • a monitoring program to track the effectiveness of the controls identified in the Biosecurity Management Plan • consultation with the owners of organic certified properties will be carried out to identify the specific risks and controls required to be implemented.	Construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
		The Biosecurity Management Plan will be prepared in consultation with relevant local council biosecurity officers in relation to the distribution of important weeds and the location of high biosecurity risk areas		
AG6	New weed infestations	In the event of new infestations of State priority weeds as a result of construction activities, the relevant control authority will be notified in accordance with the requirements of the *Biosecurity Act 2015* and Biosecurity Regulation 2017.	Construction	All locations
AG7	Access impacts – operation	Fencing and access arrangements, such as locked gates and requirements for opening and closing of gates, will be determined in consultation with landowners. Any damage caused by maintenance activities will be repaired promptly.	Operation	Transmission line
AG8	GPS impacts	In the event that nuisance impacts on agricultural precision farming GPS signals arises due to operation of the project, the cause of any such interference will be investigated. Any disruption due to operation of the project will be addressed in consultation with the affected landowner, and may include measures such as signal boosting equipment or antenna enhancements (where applicable).	Operation	Transmission line
AG9	Biosecurity - Operation	Biosecurity controls set out in the Biosecurity Management Plan will be implemented during operation to minimise the risk of transport or spread of disease, pests or weeds during maintenance activities.	Operation	All locations
AG10	Weed management	Where present within the transmission line easement and associated areas for permanent infrastructure, weeds will be managed in accordance with the *Biosecurity Act 2015*.	Operation	All locations

9 Landscape character and visual amenity

This chapter provides an assessment of the potential landscape character and visual amenity impacts that may occur during construction and/or operation of the project and identifies mitigation measures to avoid, minimise and manage these impacts. It summarises the assessment provided in Technical paper 3 – Visual and landscape character (Technical paper 3). The SEARs as they relate to this assessment, and where in the EIS these have been addressed, are detailed in Appendix A.

9.1 Legislative and policy context

The Secretary's Environmental Assessment Requirements (SEARs) do not specify particular guidelines or standards relevant to the assessment of landscape character and visual impact that the project is required to be assessed against as part of the development of this EIS. Similarly, there is no specific guidance for landscape and visual impact assessment of transmission lines in NSW. However, the following guidance documents for the general assessment of landscape and visual impact have been followed, based on the linear nature of the majority of the project infrastructure:

- *Guideline for Landscape Character and Visual Impact Assessment EIA-N04* (Transport for NSW, 2023) which provides guidance for the assessment of linear infrastructure projects in NSW
- *Guidance Note for Landscape and Visual Assessment*, (Australian Institute of Landscape Architects Queensland, 2018) which includes definitions of key terminology and general guidance from the perspective of professional landscape and visual impact assessment practice
- *Large-Scale Solar Energy Guideline, Technical Supplement Landscape and Visual Assessment (Technical Supplement)* (Department of Planning and Environment, 2022) which provides guidance in relation to the approach to determining landscape sensitivity that can be applied to this project, and as this is the most current guidance from DPE in relation to energy projects in NSW
- *Guidelines for Landscape and Visual Impact Assessment* (Landscape Institute and Institute of Environmental Management & Assessment, 2013)
- *Dark Sky Planning Guideline* (NSW Planning and Environment, 2016).

The assessment also considered relevant state, regional and local planning strategies as outlined in Technical paper 3.

9.2 Assessment approach

9.2.1 Study area

The study area comprises a four-kilometre-wide corridor centred on the construction area (refer to Figure 9-1). This study area extent was selected on the basis it included all areas where there is the potential for landscape character and visual impacts from the project to be experienced.

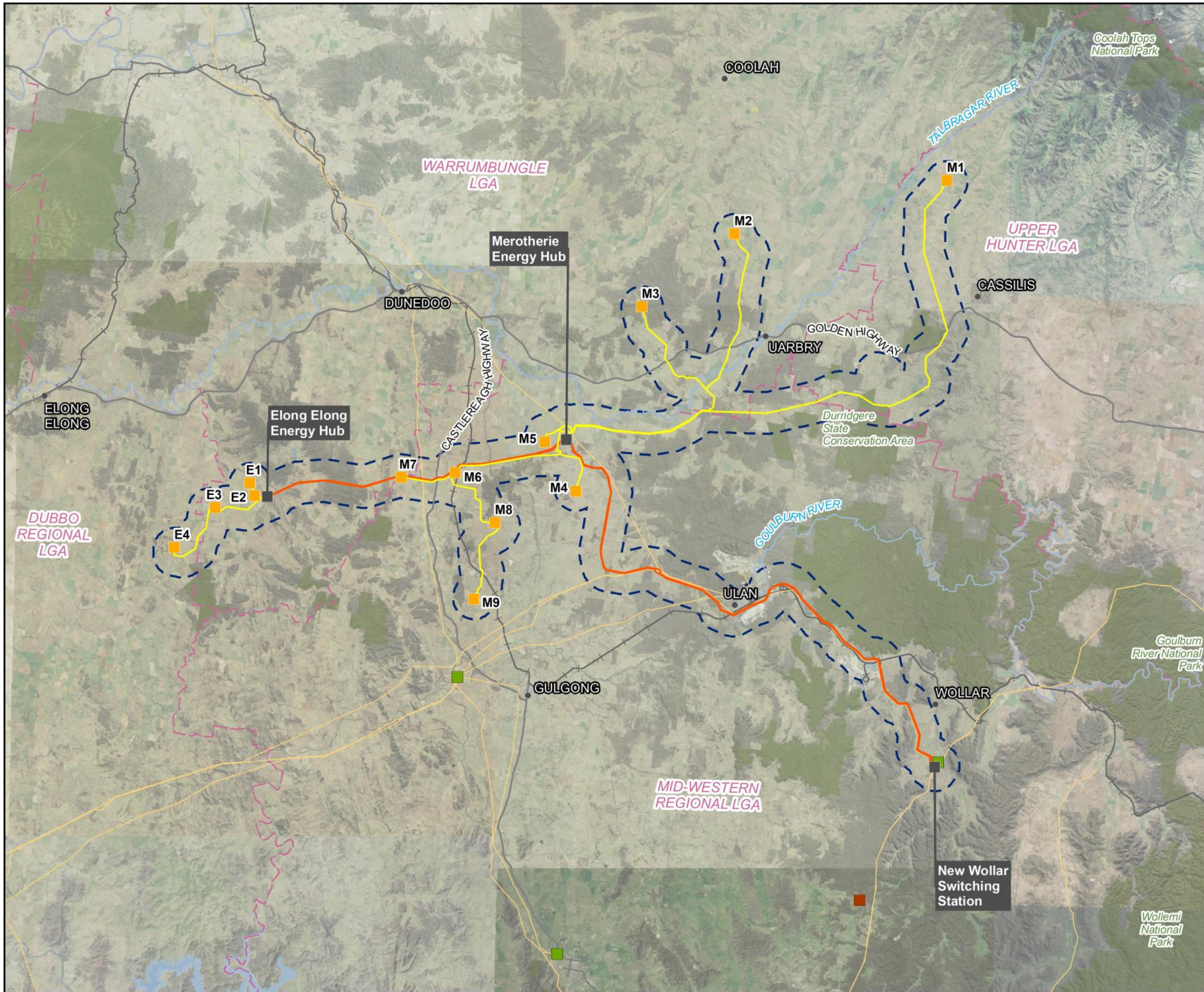

Figure 9-1
Landscape character and visual impact study area

Legend

- Study area
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Indicative microwave repeater site (Botobolar)
- Existing substation
- Existing transmission line
- State road
- Railway
- Watercourse
- Water body
- Local government area
- NPWS estate

0 10 20 km

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:500,000
Data sources: WSP 2023, EnergyCo, NSWSS

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9.2.2 Assessment approach

The assessment of landscape character and visual amenity impacts of the project is based on a reference design. The final design of project infrastructure, including locations of towers would be confirmed during detailed design.

Landscape character

The assessment of landscape character impacts included:

- the identification of landscape character types and zones within the study area. These landscape character types are based on identifying and grouping areas of similar characteristics such as geology, topography, vegetation, built form and land use patterns. These character types are then further subdivided into character zones, which considers the attributes of the area at a local scale, and any local landscape features.
- an assessment of daytime landscape character by:
  - determining the sensitivity of each identified landscape character type. This considers the value of the landscape and how susceptible it is to change and is based on the frequency and volume of use, the types of activities which occur and the presence of any specific values such as scenic quality, contribution to sense of place, and its rarity. Landscape sensitivity is based on five categories from very low to very high An example of this would be the assigning of a very high level of sensitivity to an area such as a national park, or a landscape with a distinct feature such as dramatic landform. Alternatively, a very low level of sensitivity would apply to an area without any specific scenic value or local landscape feature, or a landscape which is common across the region
  - identifying the magnitude of change that would be experienced as a result the construction and operation of the project. This considers the scale of the change that would be experienced and is based on five categories from negligible to very high. For example, a very high magnitude of change would occur where the project dominates and/or transforms the character, amenity and/or function of the landscape character. Whereas a low or negligible magnitude of change would have a minor or no change to the existing landscape, or the project is considered compatible with the existing landscape character
  - assigning a level of landscape character impact (negligible to very high) by combining the landscape sensitivity and magnitude of change to each landscape character zone (based on an impact matrix)
- an assessment of night-time landscape character, carried out with a similar approach to the daytime assessment, however considering the guidance contained in the *Dark Sky Planning Guideline* (NSW Department of Planning and Environment, 2016) and the *AS4282 Control of the obtrusive effects of outdoor lighting* (2019). These publications identify specific guidance on the identification of landscape sensitivity and the magnitude of change, appropriate to night-time periods and specific night-time values such as dark sky regions, and the predominant existing night-time environment
- identification of mitigation measures to avoid, minimise and manage any potential impacts of the project on landscape character.

Figure 9-2 provides a graphical summary of the landscape character assessment methodology. Detailed descriptions of landscape character sensitivity levels, magnitude of change levels, and impact levels specific to both day and night-time assessments are included in section 3.4 of Technical paper 3.

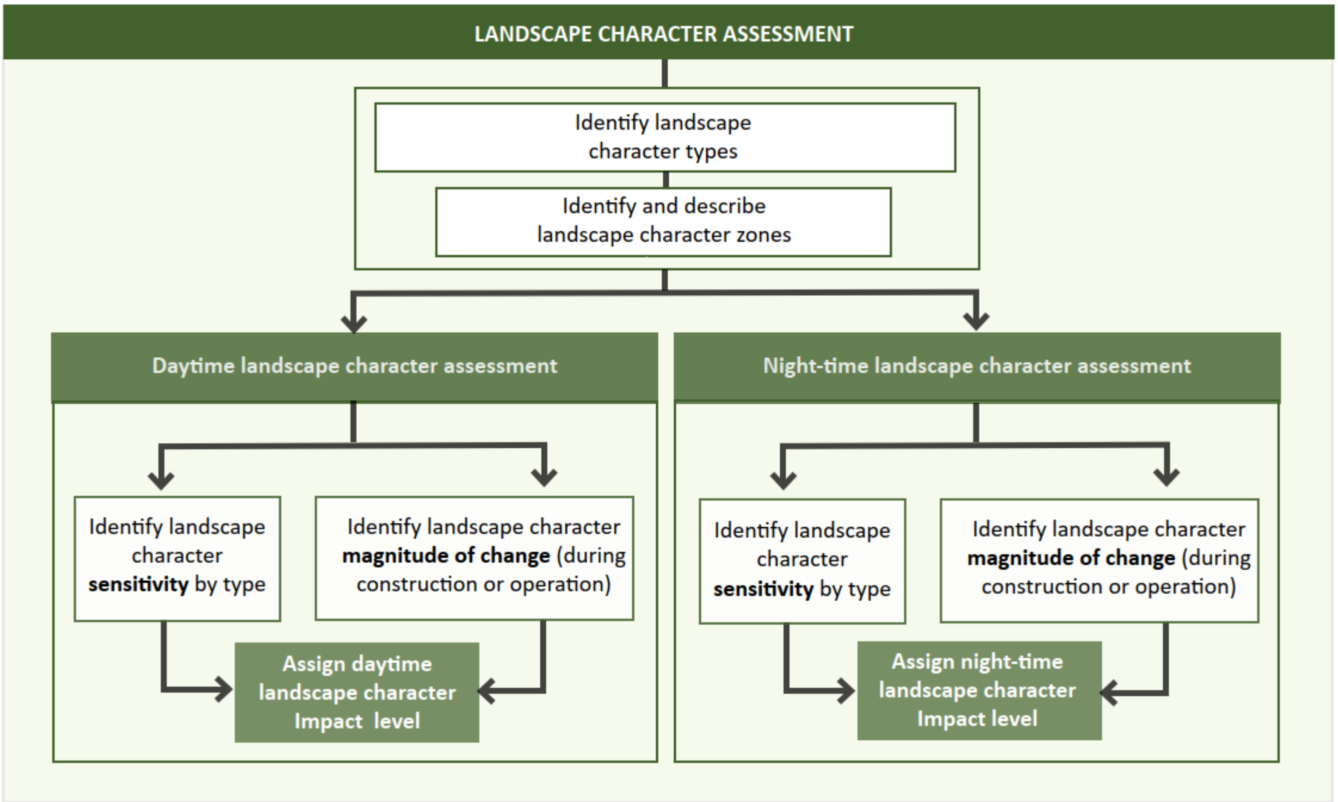

Figure 9-2 Landscape character assessment methodology

Visual amenity

The assessment of the visual amenity impacts of the project included:

- use of a 3D digital terrain (or digital elevation) model and the project reference design, with details such as the height of transmission line towers to identify areas from which the project would potentially be visible
- a visual impact assessment from public viewpoints, which involved:
  - a site inspection to verify the selection of representative public viewpoints used in the assessment. These viewpoints were chosen to include locations where the greatest number of people are likely to view the project from, such as lookouts, road corridors, or recreational areas
  - completion of viewpoint photography, and the preparation of photomontages for some viewpoints to show areas of higher sensitivity and typical views from landscape character types (included in Technical paper 3)
  - determining the daytime visual sensitivity (based on five categories from very low to very high), and magnitude of change (based on five categories from negligible to very high) for each representative viewpoint
  - assigning a level of landscape character impact (negligible to very high) by combining the visual sensitivity and magnitude of change to viewpoint (based on an impact matrix)

- visual impact assessment from private viewpoints (dwellings), which involved:
  - a preliminary visual impact screening assessment to identify potentially impacted private dwellings in the study area. This involved the:
    - identification of all private dwellings within the study area (up to 2 kilometres from the project)
    - a desktop screening assessment aimed at eliminating dwellings where a very low level of concern or effects are likely to be experienced. The screening was based on the visibility of towers within 2 kilometres, the horizontal field of view, the scenic quality of the location, or if the dwelling is associated with an approved renewable energy project (e.g. solar farm) and would not be used for residential purpose, or was mine owned
    - identifying the private dwellings from the screening assessment that require a detailed visual impact assessment
  - detailed visual assessment of the identified private dwelling to determine the potential impacts of the project. This involved:
    - detailed site inspections and photography (completed in December 2022 and April 2023) at 30 of the private dwellings to represent a range of private dwelling views
    - identifying the visual sensitivity of the view from each dwelling, by combining viewpoint sensitivity (very low to very high) and scenic quality (low, moderate, high) of the existing view
    - assigning a level of visual impact (negligible to very high) by combining the visual sensitivity and magnitude of change to each viewpoint. It is important to note that in this assessment those dwellings on properties or part of a broader land holding, that would also host project infrastructure have been identified. This is relevant as these land holders would have negotiated landholder agreements that would form compensation from the impacts of the project
- identification of mitigation measures to avoid, minimise and manage any potential visual impacts of the project.

Figure 9-3 provides a graphical summary of the approach used for the visual impact assessment. Detailed descriptions of visual sensitivity levels, magnitude of change levels, and impact levels specific to both day and night time assessments are included in section 3.5 of Technical paper 3.

To support the assessment of visual impacts, photomontages and 3D modelling have been prepared for some viewpoints (including public viewpoints and private viewpoints where access and permission to take photographs was granted). These illustrate impacts at locations where the project would be seen from locations of higher visual sensitivity and also to show a typical view within some of the landscape character types.

Photomontages are intended to illustrate the size and scale of the project and aim to accurately represent the project based on the project reference design. Photomontages have been prepared generally in accordance with the *Technical Guidance Note (06/19) Visual Representation of development proposals*, prepared by the Landscape Institute, UK (2019).

A detailed description of the methodology for the development of photomontages and 3D models is included in section 3.5 of Technical paper 3.

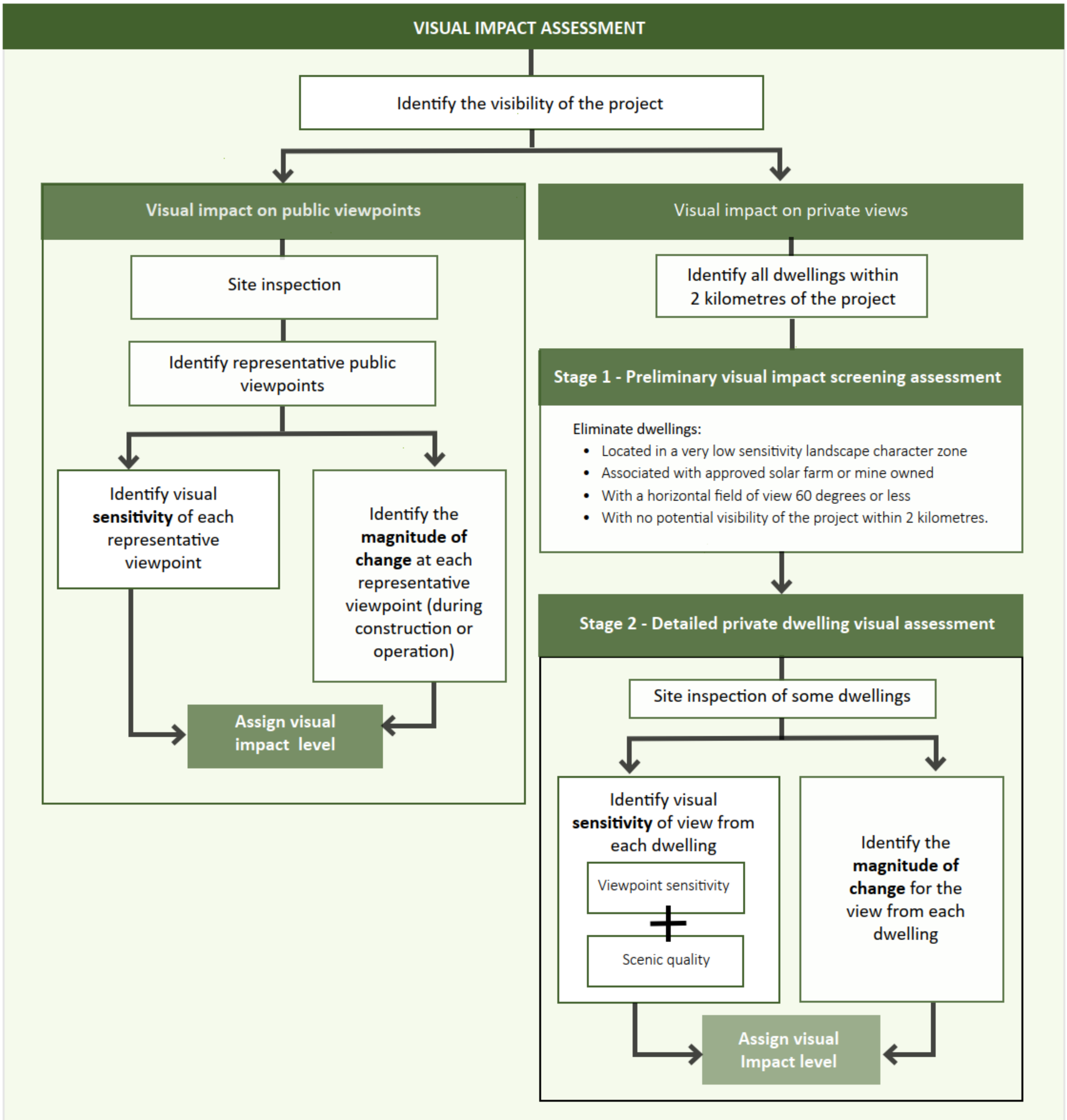

Figure 9-3 Visual impact assessment methodology

9.3 Existing environment

9.3.1 Landscape character types and daytime landscape sensitivity

Due to the nature and scale of the project there are several landscape character types across the study area which have similar characteristics in terms of geology, topography, vegetation cover, watercourses, built form and land use pattern. For this landscape character assessment, the study area was divided into four landscape character types: Rural valley (RV), Forested hills (FH), Ulan mining (M), and Undulating rural hills (URH). Each character type was then further broken down into 16 landscape character zones which have their own local characteristics.

This section includes descriptions and examples of each landscape character types (refer to Figure 9-4 to Figure 9-7. Details of the associated landscape character zones are included in Table 9-1 – Table 9-4. The location of each zone is included in Figure 9-8.

Rural valley landscape character type

The rural valley landscape character type is defined by the creek and river valleys within the study area, and adjacent land which generally consists of wide flat areas of agricultural uses, including arable farmland and some areas of grazing pastures. Although the landform varies between each character zone, it is generally low-lying and flat to gently undulating, including rural plains, which have been cleared for agriculture (refer to Figure 9-4).

The landscape character type contains a network of rural roads, homesteads and cottages on rural properties, rural structures such as sheds, yards and workshops which support the surrounding agricultural uses, and infrastructure including existing transmission lines, the existing Wollar substation.

In considering the landscape sensitivity, this landscape type would be appreciated by only a small number of people travelling along the network of rural roads including mostly residents, their visitors, as well as some tourists visiting and passing through the area. This landscape character type is a regionally common landscape and includes features such as gentle landforms, modified watercourses, local heritage places as well as lower scale transport infrastructure. There are existing transmission lines and approved renewable energy generation projects in some areas. Based on these characteristics, this landscape character type, including all the landscape character zones identified within, is considered to have a low landscape sensitivity.

Table 9-1 Description and visual sensitivity of the Rural valley landscape character zones

Landscape character zone	Description	Landscape sensitivity
Wollar rural valley (RV-01)	Located to the south of the Wollar township, this zone includes the Wollar, Barigan and Springs Flat Creek valleys. It is visually contained by the surrounding north south aligned forested ridges and hills including the Razorback Ridge to the east, and Munghorn Gap Nature Reserve to the west. The approved Wollar solar farm, located immediately to the south of the project will influence the future character of this zone, joining the existing built features which include the existing Wollar substation and Wellington to Wollar 330 kV transmission lines.	Low
Cumbo rural valley (RV-02)	Located to the west of Wollar township, including the Cumbo Creek valley, this zone includes a mixture of rural land uses and areas of revegetation as part of the enhancement and conservation areas of nearby Wilpinjong Coal Mine. Existing built features in this zone include the Wellington to Wollar 330 kV transmission lines.	Low
Talbragar River rural valley (RV-03)	Located in the centre of the study area, following the Talbragar River and associated tributaries such as Cockabutta, Mona and Salty creeks. The zone contains large areas of flat grazing pastures and dryland crops, with occasional rocky outcrops and small hills such as Cockabutta Hill and Uarbry Pinnacle. This zone contains few built features other than roads, rural dwellings and farm related structures.	Low
Munmurra River rural valley (V-04)	South of Cassilis, south of the Golden Highway. The Munmurra River has wide bends, meandering through an undulating valley, and is visually enclosed by the surrounding ridges and hills. Existing built features in this zone include the Golden Highway.	Low

Figure 9-4 Landscape examples within the Rural valley landscape character type

Forested hills landscape character type

The forested hills landscape character type consists of undulating areas with hilly ridges and escarpments rising above the surrounding rural valleys. It is an elevated landscape with heights of up to 644 metres Australian Height Datum (AHD) at Barneys Reef (refer to Table 9-2 and Figure 9-5). The uniting feature of this landscape is the concentration of native bushland. There are also patches of native cypress pine forest and managed pine plantations, which are clearly visible and different from nearby tracts of native forest and areas of farmland, such as the Tuckland State Forest.

This landscape character type is located north of Munghorn Gap Nature Reserve and includes large areas of rugged sandstone plateau and includes part of Goulburn River National Park. This area provides recreational features such as walking tracks, camping and picnic sites, and lookouts with scenic views over the surrounding area. This landscape character type also includes areas of historical mining activity, contains existing transmission lines and approved renewable energy generation projects. Landscape features in this landscape character type include regionally important scenic value, distinctive landform features, hilly and undulating ranges, native forests, and a lower presence of human settlement.

In considering the landscape sensitivity, this landscape character type contains extensive areas of native bushland and would generally be appreciated by only a small number of people travelling along roads and trails accessible to the public, including tourists and visitors to the area. The forested hills are a regionally common landscape and include features such as gentle landforms, modified watercourses, and local heritage places and lower scale transport infrastructure. Based on these characteristics, this landscape character type, including the landscape character zones identified within, is considered to have a moderate landscape sensitivity.

Table 9-2 Description and visual sensitivity of the Forested hills landscape character areas

Landscape character zone	Description	Landscape sensitivity
Wollar forested hills (FH-01)	Located south of the township of Wollar in the southeastern section of the study area, this zone includes the ridges and hills enclosing the Wollar Rural Valley landscape character zone. The forest and steep landform within Munghorn Gap Nature Reserve and the Razorback Ridge are unique features in this landscape that provide interest and scenic value.	Moderate
Durridgere, Goulburn River and Munghorn Gap forested hills (FH-02)	Located in the eastern part of the study area, including the forest areas in Durridgere State Conservation Area, Goulburn River National Park and Munghorn Gap Nature Reserve. Also includes areas with historical mining activities and existing transmission lines.	Moderate
Terraban Gap forested hills (FH-03)	Located in the northeastern section of the study area, to the south of the township of Coolah, and consists of dense areas of forest and steep terrain.	Moderate
Barneys Reef forested hills (FH-04)	Located in the central section of the study area. Barneys Reef has a distinctive landform within the study area, rising abruptly from the surrounding rural area and covered by forest. While not a protected area or reserve, Barneys Reef is zoned C3 Environmental Management in the Mid-Western Regional LEP 2012.	Moderate
Spring Ridge and Tuckland forested hills (FH-05)	Located in the western section of the study area and incorporating the forested areas between Tuckland Road and Spring Ridge Road, including Tuckland State Forest.	Moderate

Figure 9-5 Landscape examples within the Forested hills landscape character type

Mining landscape character type

This landscape character type is characterised by underground and surface coal mining activities between Wollar and Ulan, including Ulan, Moolarben and Wilpinjong coal mines (refer to Table 9-3 and Figure 9-6).

In considering the landscape sensitivity, this landscape character type contains limited scenic quality, and would be mostly experienced by staff and visitors to the mines and small numbers of people travelling along local roads such as Ulan-Wollar Road, including mostly residents. This is a highly modified landscape comprising large scale mining and energy infrastructure. There are existing transmission lines and ongoing mining operations that will continue to alter the vegetation cover and landform of this area. Based on these characteristics, this landscape character type has limited scenic quality and is of very low landscape sensitivity.

Table 9-3 Description and sensitivity of Mining landscape character zone

Landscape character zone	Description	Landscape sensitivity
Ulan mining (M-01)	Located between the townships of Wollar and Ulan, this landscape character zone is highly modified due to the long history of mining activity, resulting in extensive benches and embankments surrounding the mines.	Very low

Figure 9-6 Landscape examples within the Ulan mining landscape character type

Undulating rural hills character type

This landscape character type is a regionally common landscape which includes undulating landforms, modified and natural waterways and lower scale transport infrastructure (refer to Table 9-4 and Figure 9-7). There are existing transmission lines extending south and southeast of Dunedoo and approved renewable energy projects southwest of Dunedoo, southeast of Dunedoo, and southwest of Coolah.

The landscape has been mostly cleared for agricultural use (pastoral grazing), creating an open, rural landscape character. Rural residences are scattered on the low hills and flatter areas of landscape character zones, offering views across the surrounding landscape.

In considering the landscape sensitivity, this landscape character type would be appreciated by only a small number of people travelling along the highways and network of rural roads, including mostly residents and their visitors, as well as some tourists visiting and passing through the area. This is a regionally common landscape which includes features such as undulating landforms, modified and natural watercourses and lower scale transport infrastructure. There are existing transmission lines and approved renewable energy generation projects in some areas. Local historic places such as the Laheys Creek cemetery and Avondale homestead are unique features in this landscape that provide interest and scenic value. Based on these characteristics, this landscape type, including the associated landscape zones, is considered to have low landscape sensitivity.

Table 9-4 Description and sensitivity of Undulating rural hills landscape character zones

Landscape character zones	Description	Landscape sensitivity
Narragamba to Blue Springs undulating rural hills (URH-01)	Located in the southern section of the study area, alongside Blue Springs Road. This zone is characterised by flat to gently undulating grazing and dry land cropping areas with scattered dams, creeks and rural dwellings. Built features in this zone include the existing Wellington to Wollar 330 kV transmission lines.	Low
Birriwa to Tallawang undulating rural hills (URH-02)	Located in the central section of the study area, this zone is characterised by grazing and dry land cropping areas with scattered dams, creeks and rural dwellings. Built features in this zone include the Castlereagh Highway, local existing transmission lines and the Gwabegar branch of the Main Western railway line.	Low
Uarbry undulating rural hills (URH-03)	Located in the central section of the study area, this zone is characterised by grazing and dry land cropping areas with scattered rural dwellings, dams and creeks such as Moreton Bay and Cainbil creeks. Built features in this zone include the Golden Highway and local existing transmission lines.	Low
Tongy undulating rural hills	Located in the northeastern section of the study area, north of Moorefield Road, along the western side of Talbragar River valley west of Cassilis. This zone is characterised by remote, undulating grazing areas with few built features other than scattered rural dwellings, farm related structures and dams.	Low
Cassilis to Coolah undulating rural hills (URH-04)	Located in the northeastern section of the study area, north of Moorefield Road, along the western side of Talbragar River valley west of Cassilis, including the upper reaches of Cainbil Creek. This zone is characterised by remote, undulating grazing areas with few built features other than scattered rural dwellings, farm related structures and dams.	Low
Dapper and Elong undulating rural hills (URH-05)	Located in the western section of the study area, this zone is characterised by remote, flat to undulating grazing and cropping areas along the Sandy and Spring creek valleys, containing few built features other than scattered rural dwellings, farm related structures and dams.	Low

Figure 9-7 Landscape examples within the Undulating rural hills landscape character type

Figure 9-8
Landscape character types and Landscape character zones
Page 1 of 4

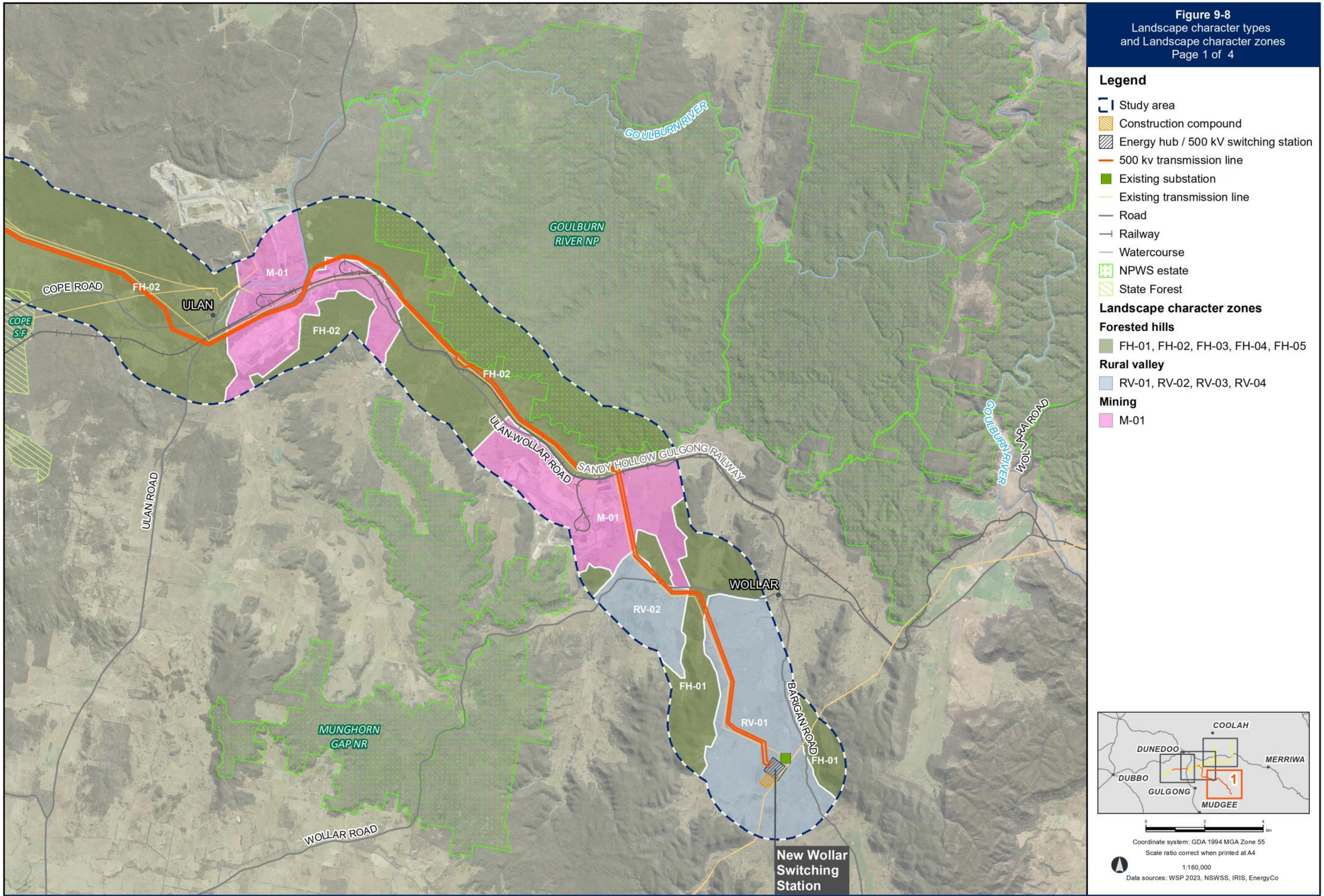

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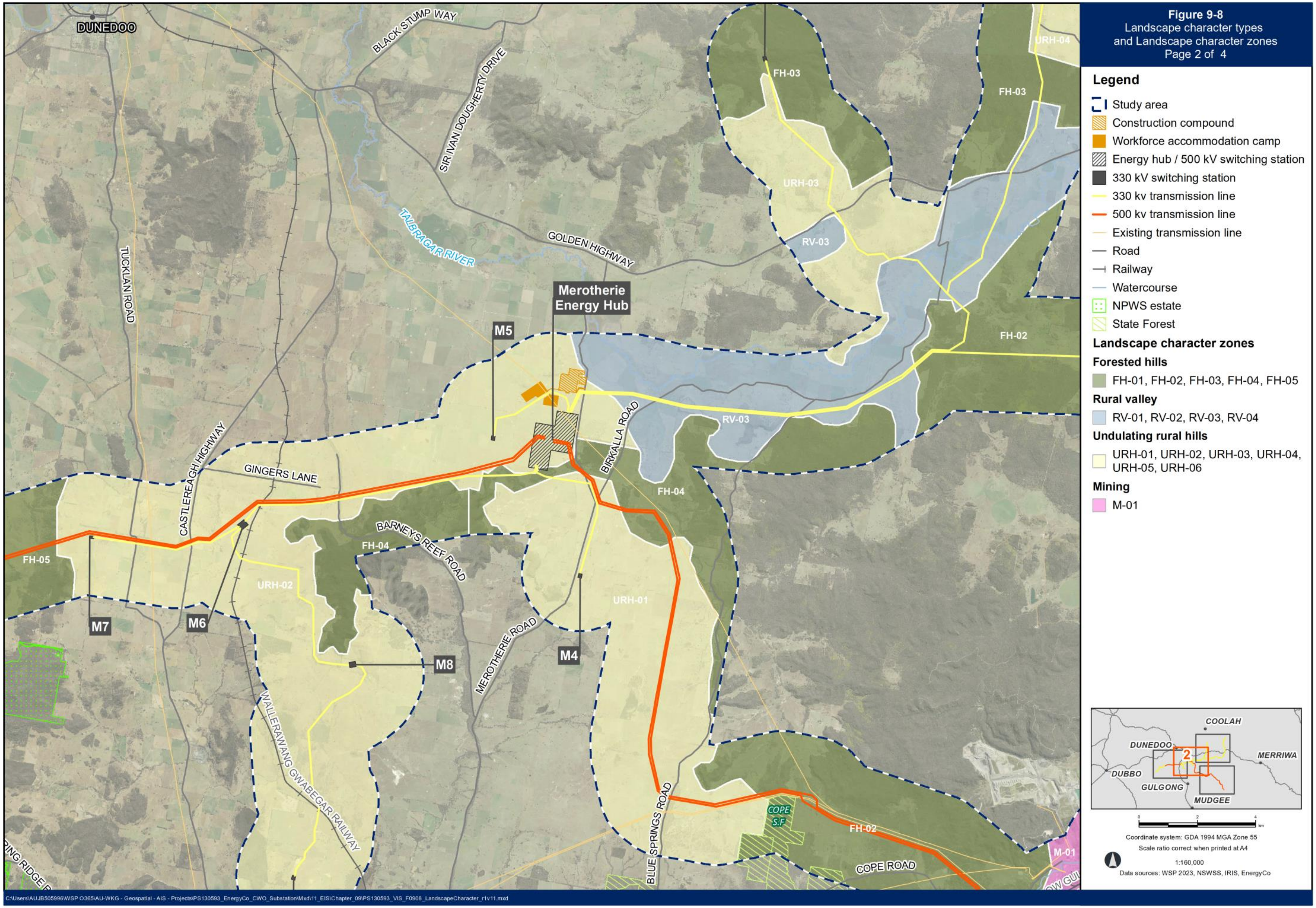
Figure 9-8
Landscape character types
and Landscape character zones
Page 2 of 4



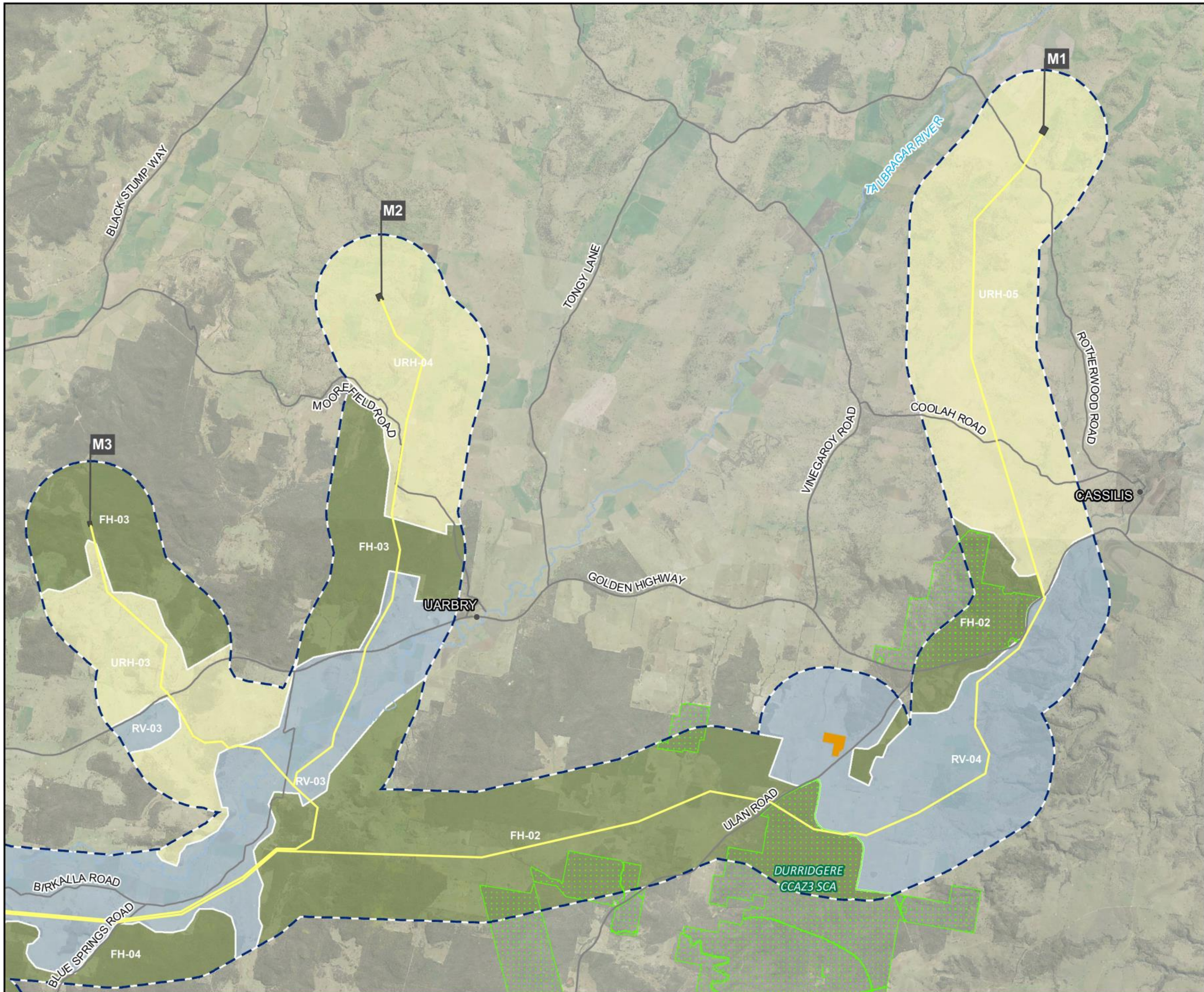


Figure 9-8
Landscape character types and Landscape character zones
Page 3 of 4

Legend

- Study area
- Workforce accommodation camp
- 330 kV switching station
- 330 kv transmission line
- Road
- Watercourse
- NPWS estate

Landscape character zones

Forested hills

- FH-01, FH-02, FH-03, FH-04, FH-05

Rural valley

- RV-01, RV-02, RV-03, RV-04

Undulating rural hills

- URH-01, URH-02, URH-03, URH-04, URH-05, URH-06

0 2 4 km

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
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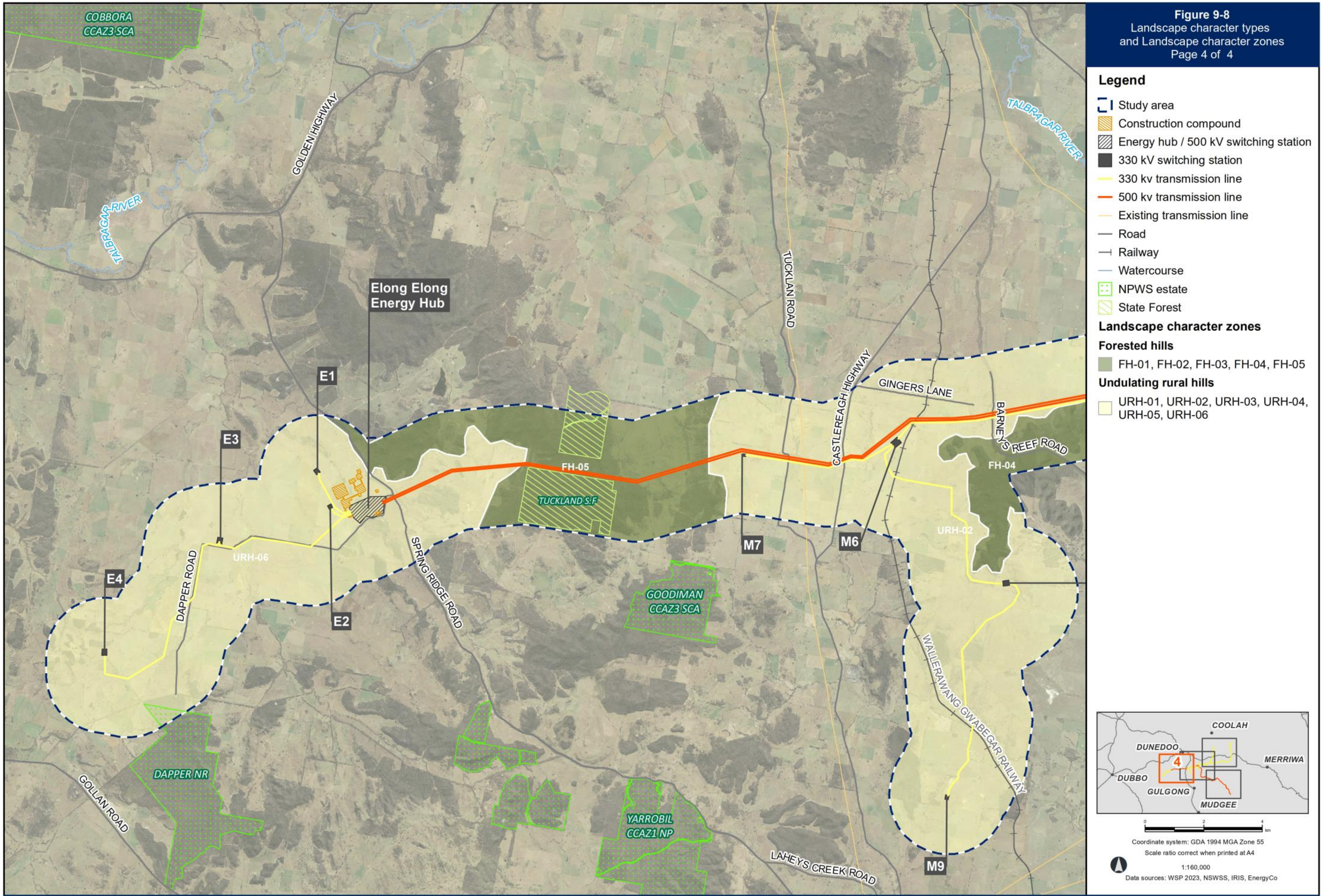
Data sources: WSP 2023, NSWSS, IRIS, EnergyCo



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9.3.2 Night-time visual sensitivity of landscape character zones

The night-time visual sensitivity of the landscape character zones in the study area range from high to low, depending on the landscape character type.

Table 9-5 outlines the existing visual sensitivity for each landscape character zone, within the four identified landscape character types.

Table 9-5 Night-time visual sensitivity by landscape character zone

No.	Landscape character types and zone	Night-time visual sensitivity
Rural valley landscape character type		
RV-01	Wollar rural valley landscape character zone	Moderate
RV-02	Cumbo rural valley landscape character zone	Moderate
RV-03	Talbragar River rural valley landscape character zone	Moderate
RV-04	Munmurra River rural valley landscape character zone	Moderate
Forested hills landscape character type		
FH-01	Wollar forested hills landscape character zone	High
FH-02	Durridgere, Goulburn River and Munghorn Gap forested hills landscape character zone	High
FH-03	Terraban Gap forested hills landscape character zone	High
FH-04	Barneys Reef forested hills landscape character zone	High
FH-05	Spring Ridge and Tuckland forested hills landscape character zone	High
Ulan mining landscape character type		
M-01	Ulan mining landscape character zone	Low
Undulating rural hills landscape character type		
URH-01	Narragamba to Blue Springs undulating rural hills landscape character zone	Moderate
URH -02	Birriwa to Tallawang undulating rural hills landscape character zone	Moderate
URH -03	Uarbry undulating rural hills landscape character zone	Moderate
URH -04	Tongy undulating rural hills landscape character zone	Moderate
URH -05	Cassilis to Coolah undulating rural hills landscape character zone	Moderate
URH -06	Dapper and Elong undulating rural hills landscape character zone	Moderate

The rural valley landscape character type has low level light sources at night, such as lighting associated with the scattered homesteads and agricultural buildings on rural properties and vehicles travelling along local roads and highways such as the Golden Highway. There would be some denser clusters of residences in the vicinity of the towns such as Wollar and Cassilis, where there would also be more vehicles travelling along local roads. Overall, the landscape character zones in this area are of low district brightness and as such, have a moderate visual sensitivity at night.

The forested hills landscape character zones are of high sensitivity due to the naturally low levels of light during the night-time. This landscape character type encompasses areas which contain protected areas and state forests, few dwellings and limited traffic, making the landscape character a naturally low light zone, resulting in a high level of night-time visual sensitivity.

By contrast, the Mining landscape character type, considered to have a low visual sensitivity at night, is heavily influenced by the mining operations which concentrates night-time lighting to areas to operational areas.

For the Undulating rural hills landscape character type, this area mainly comprises national parks, state forests and reserves with very few dwellings. Only lights from vehicles travelling along local roads and occasional night-time works at forestry sites contribute to the light levels. As such, this landscape character type and zones are considered a dark landscape and have a high level of night-time visual sensitivity.

It is noted, the study area is within the NSW Dark Sky Region, which is centred on the Siding Spring Observatory and has been established to protect its effectiveness. However, the project is around 100 kilometres at it nearest point from the observatory and is expected to have a negligible impact on the night-time sensitivity of the identified landscape character zones.

9.3.3 Public viewpoints

As outlined in Section 9.2.2 a visibility analysis was undertaken to identify the areas from which the project is potentially visible. This visibility analysis used a 3D digital terrain model (i.e. a digital graphic representation of elevation data to represent existing landform) and points at the height of each transmission tower, to identify the areas from which views to the transmission line may be seen. This analysis, combined with a site inspection was then used to select 26 representative publicly accessible viewpoints (shown on Figure 9-9). The viewpoints include representative significant views which are mostly located on local roads or highways, as no areas of open space, lookouts or other recreational areas that have a view to the project have been identified. All these identified viewpoints are considered to have low or very low sensitivity.

A description of each viewpoint and its assessed visual sensitivity is described included Table 9-6.

In addition to the ground level viewpoints, a viewpoint from the air was selected to represent recreational flights operating from Dubbo Airport and Mudgee Airports. As scenic flights offered from these airports are for tourist and recreational purposes, views from these flights are the focus of these journeys and are considered to be of moderate visual sensitivity.

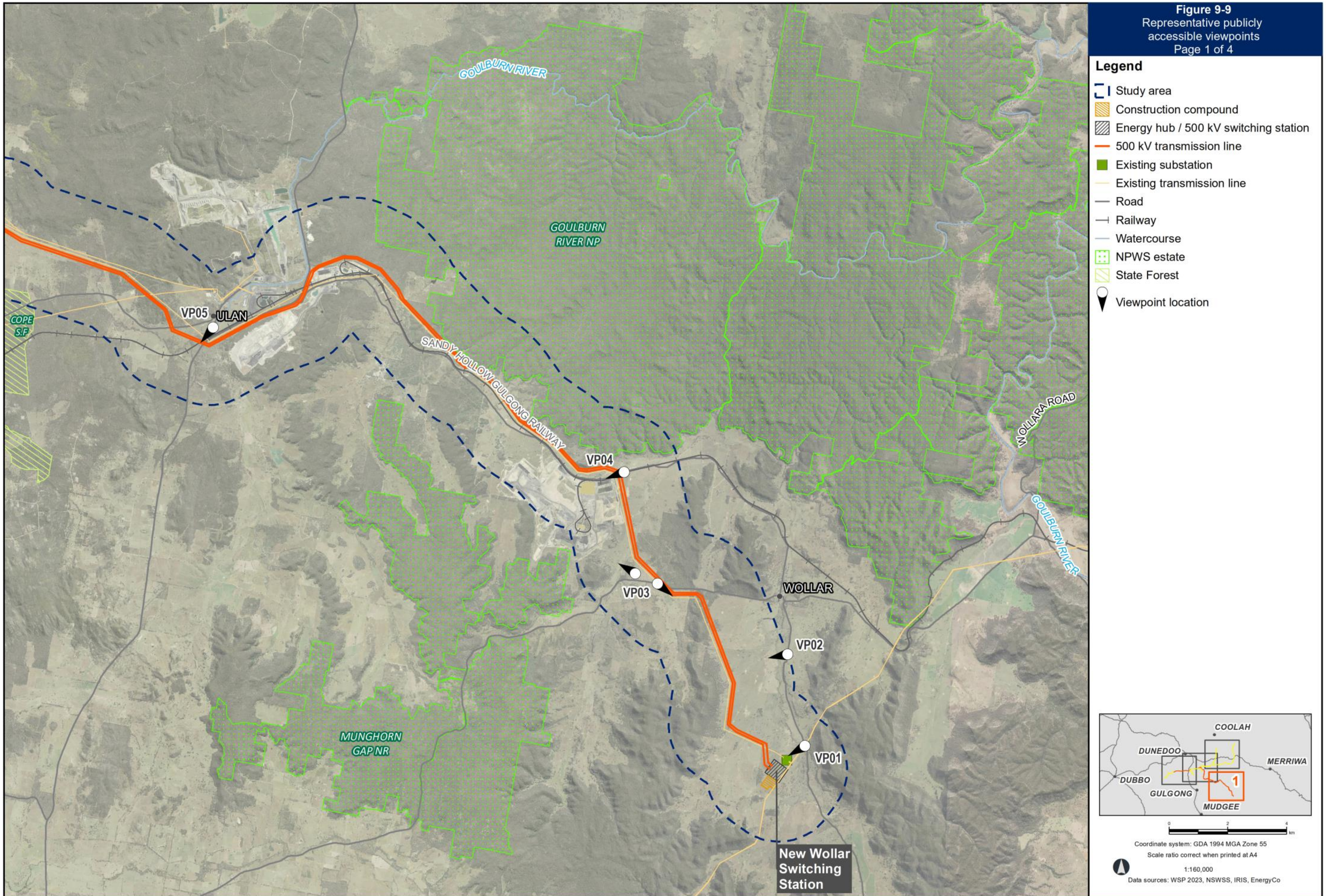
Table 9-6 Representative viewpoints

No.	Location	Description	Sensitivity
1	View southwest from Barigan Road	The view from this location includes views of existing 500 kV transmission line towers (which detract from the scenic quality), and a wide-rural valley with scattered rural dwellings across cleared agricultural land. The landform rises in the background of the view towards the Munghorn Gap Nature Reserve. Factors such as the remote location, and presence of large-scale energy generation and transmission infrastructure influence the visual sensitivity of this view.	Very low
2	View west from Barigan Road	View south of Wollar. The landscape is flat to gently undulating, with low plateaus. The valley has been mostly cleared for agricultural use. The Wellington to Wollar 330 kV transmission lines extend across the background of view. This view is somewhat common in the landscape, with the presence of large-scale energy transmission infrastructure influencing the visual sensitivity of this view.	Low
3	Views from Wollar Road	View south of Wollar either side of Wollar Road, west of Wollar. It includes views of a wide rural valley with flat to gently undulating landform that has been mostly cleared for agricultural use. The Wellington to Wollar 330 kV transmission line towers are seen crossing the road and traversing through the valley.	Very low
4	View west from Wollar-Ulan Road	View of northern part of the Wilpinjong coal mine exploration area. The landscape is highly modified, as a result of mining, rail line and open cut pits. To the north and south, the landform rises in the background of view to forested hills and plateaus. The Wellington to Wollar 330 kV transmission line towers are seen crossing the road. Although the forested hills and plateaus have scenic value, the mine and transmission line towers detract from the view.	Very low

No.	Location	Description	Sensitivity
5	View southwest from Main Street, Ulan	View of Main Street towards the Ulan Road junction. The landform in this location is largely flat to gently undulating. The Sandy Hollow-Gulgong rail line located around 200 metres away, crossing Main Street, with trains regularly seen transporting coal from the nearby coal mines. The Wellington to Wollar 330 kV transmission line towers are seen in the background of view. Views such as this are common within the landscape near Ulan.	Very low
6	View south from Blue Springs Road, Stubbo	Views of Blue Springs and Cope creek valleys, northeast of Gulgong. This sparsely settled area has landforms that are gently undulating. The Wellington to Wollar 330 kV transmission line towers are seen in the background of view. Although the rural landscape and backdrop of the Great Dividing Range add to the scenic value, the presence of transmission line towers detract from the view.	Very low
7	View east from Merotherie Road	View of Merotherie and Birkalla Road junction shows the undulating rural landscape that has been cleared for agricultural use. Small transmission line poles and overhead wires cross through the fields. This rural landscape has some gentle undulations and areas of vegetation on the high points, contributing to the scenic qualities of this view. Views such as this are common within the landscape north of Gulgong.	Very low
8	View south from Birriwa Bus Route South	View of Merotherie Road and Birriwa Bus Route South shows the rural landscape north of Barneys Reef. The vegetated hills form a backdrop to this view. The landform gently descends north towards the Talbragar River valley where the land has been cleared for agricultural use. The backdrop of Barneys Reef adds to the scenic quality of the view.	Low
9	View southeast from Birriwa Bus Route South	View from Birriwa Bus Route South. The landform gently descends north towards the Talbragar River valley. The land in this area has been cleared for agricultural use. Barneys Reef is a landscape feature in this view, adding to the scenic quality of the view.	Low
10	View southwest from Blue Springs Road	View from Blue Springs Road shows the rural landscape rising south from the Talbragar River valley to a small ridgeline at Cockabutta Hill. The land in this area has been cleared for agricultural use. This view contains a strong rural character with few large scale-built structures. The rural character and backdrop of Cockabutta Hill contribute to the scenic quality of this view.	Low
11	View northeast from Blue Springs Road, Bungaba	Views of the Talbragar River valley, south of Uarbry. The landform is flat to gently undulating, gradually rising at the edges of the valley to small hills and ridges. The land in this area has been predominantly cleared for agricultural use. Views from this location have a rural character with few large scale-built structures. The rural character and rocky outcrops contribute to the scenic quality of this view.	Low
12	View from Blue Springs Road north, Uarbry	Views to local homesteads and properties along the Talbragar River valley, south of Uarbry. The rural character and backdrop of hills contribute to the scenic quality of this view.	Low
13	View northeast from the Golden Highway, Leadville	This view shows the Golden Highway. The landform gently ascends from the Cainbil Creek valley to the surrounding low hills and ridges around Uarbry. Land use is agricultural land and scattered rural dwellings. There are no large-scale existing transmission line towers seen in this view. The rural character and backdrop of low hills add to the scenic quality of this view.	Low
14	View west from the Golden Highway, Uarbry	This view shows the Golden Highway, extending west of Uarbry, consisting of a two-lane carriageway. The landform gently rises from the Talbragar River valley to the Uarbry Pinnacle. Land use includes a mixture of cleared agricultural land and with scattered rural dwellings. The rural character and backdrop of hills including Uarbry Pinnacle add to the scenic quality of this view.	Low
15	View north from Ulan Road, Cassilis	This view shows the rural landscape north of the Durridgere State Conservation Area and to the south of the Golden Highway. The land in this area has been cleared for agricultural use, with scattered trees and buildings along ridgelines. The undulating rural character with an absence of large-scale built infrastructure contribute to the scenic quality of this view. Views such as this are common in this location.	Very low
16	Views from the Golden Highway, Cassilis	The landform around this section of the Golden Highway is elevated and undulating. A view across the Munmurra valley towards Cassilis, can be seen as the highway crosses a ridgeline, framed by trees. The forest to the north of the highway forms part of Durridgere State Forest.	Low

No.	Location	Description	Sensitivity
17	Views from Coolah Road	Views show the undulating rural hills between Cassilis and Coolah. The land in this area has been cleared for agricultural use. Views from this location contain a strong rural character with few large scale-built structures. The rural character with rolling hills contributes to the scenic quality of this view, however, this will be somewhat transformed by approved large-scale infrastructure, including wind turbines and associated development.	Low
18	View east from Rotherwood Road	Views show the undulating rural hills north of Cassilis, along the upper Talbragar River valley. The land in this area has been cleared for agricultural use. Views from this location contain a strong rural character with few large scale-built structures. The rural character with rolling hills contribute to the scenic quality of these views, however, there will be several wind turbines visible, introducing large-scale infrastructure to these views.	Low
19	Views from the Castlereagh Highway, Tallawang	View of the Tallawang Creek valley, north of Gulgong. The landform is gently undulating, including rolling hills and valleys. The land in this area has been cleared for agricultural use. Views from this location contain a strong rural character with few large scale-built structures. Barneys Reef and long distant views to the Great Dividing Range add to the scenic quality of these views.	Low
20	View west from Tucklan Road	View of the rural landscape between the Castlereagh Highway and Tuckland State Forest. The landform gently ascends west towards a small ridgeline in the background of view. The land in this area has been cleared for agricultural use. The rural character with rolling hills contributes to the scenic quality of this view. Views such as this are common in this location.	Very low
21	Views from Puggoon Road	The view shows the rural landscape between the Castlereagh Highway and Puggoon Road. The landform has been cleared for agricultural use and is undulating and gently ascends west towards a small forested ridgeline in the background of view. This view has a rural character with an undulating landform, a character that is common within the region.	Low
22	Views from Spring Ridge Road	Views of undulating rural landscape southwest of Dunedoo and west of Spring Ridge Road. The land in this area has been cleared for agricultural use and contains pockets of vegetation on ridgelines, field boundaries, roads and creeks. Views from this location contain a strong rural character with few large-scale built structures. Laheys Creek Cemetery is a historic feature in this area. The strong rural character and presence of a historic local cemetery add to the scenic quality of this view.	Low
23	View northwest from Dapper Road, near Spring Ridge Road	Views of landscape ascending west from Laheys Creek, west of Spring Ridge Road. The land in this area has been cleared for agricultural use and contains pockets of vegetation on ridgelines, field boundaries and roads. The strong rural character and lack of large-scale development add to the sense of remoteness and scenic quality of this view.	Low
24	Views from Dapper Road east	Views of undulating rural landscape north of Dapper Road. The land has been cleared for agricultural use. This location has long range views to the towards the forested hills at Cobbora State Conservation Area and Tuckland State Forest. The rural character and sense of remoteness add to the scenic quality of this view.	Low
25	View south from Dapper Road	This view shows the rural landscape ascending east from the Spring Creek valley, along Dapper Road. The land in this area has been cleared for agricultural use, but there are pockets of vegetation along field boundaries and roads. The rural character and sense of remoteness contribute to the scenic qualities of this view. However, there are no particular landscape features in this view and views such as this are common in this area.	Very low
26	View northwest from Dapper Road west	This view shows the undulating rural hills extending north of Dapper Nature Reserve. The land in this area has been cleared for agricultural use. The rural character and sense of remoteness contribute to the scenic quality of this view.	Low

Figure 9-9
Representative publicly accessible viewpoints
Page 1 of 4



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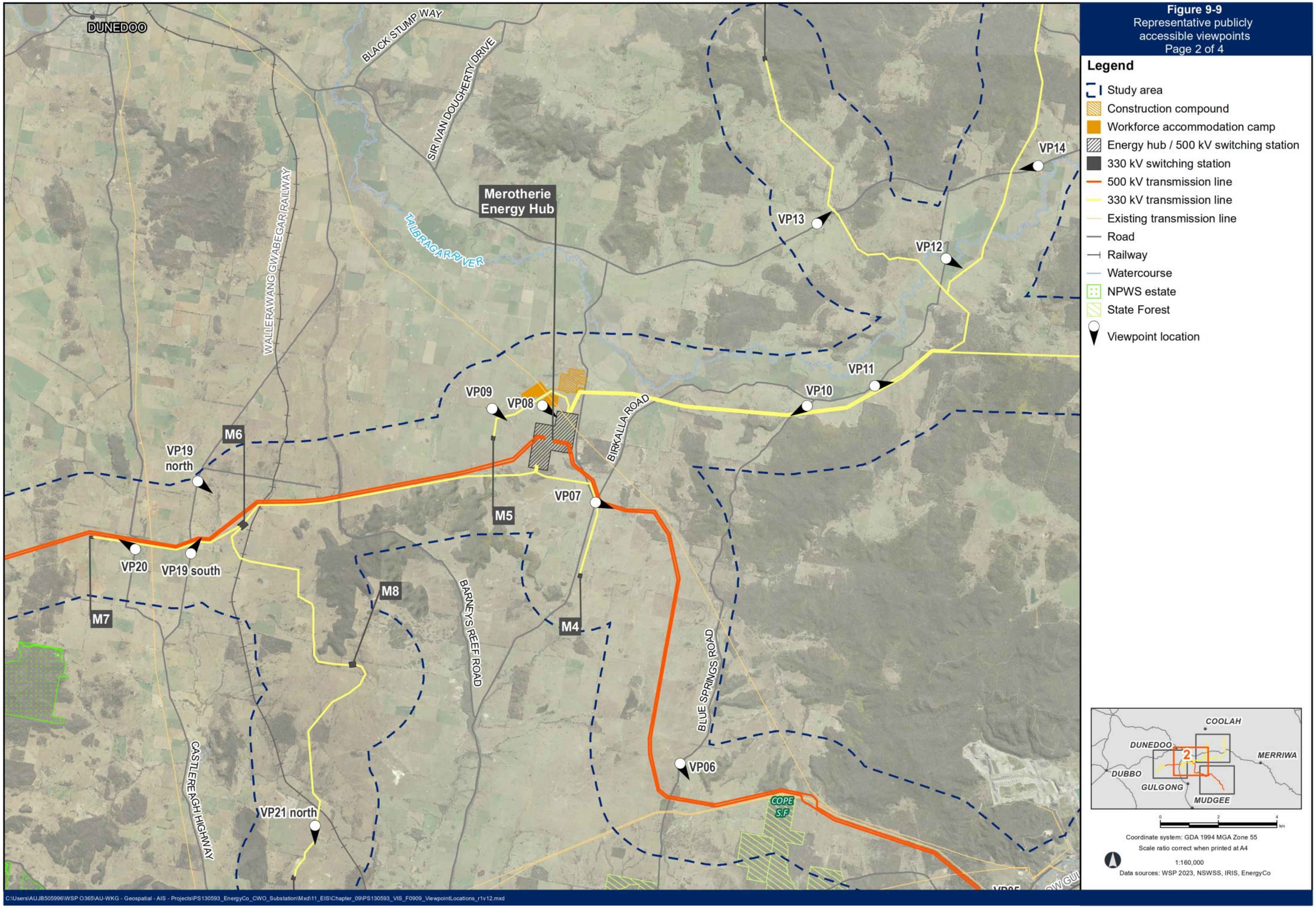
DUNEDOO
BLACK STUMP WAY
SIR IVAN DOUGHERTY DRIVE
WALLERAWANG GWABEGAR RAILWAY
TALBRAGAR RIVER
Merotherie Energy Hub
BIRKALLA ROAD
BARNEYS REEF ROAD
BLUE SPRINGS ROAD
CASTLEREAGH HIGHWAY
COPE S.F
VP06
VP07
VP08
VP09
VP10
VP11
VP12
VP13
VP14
VP19 north
VP19 south
VP20
VP21 north
M4
M5
M6
M7
M8
Figure 9-9
Representative publicly accessible viewpoints
Page 2 of 4
Legend
Study area
Construction compound
Workforce accommodation camp
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing transmission line
Road
Railway
Watercourse
NPWS estate
State Forest
Viewpoint location
COOLAH
DUNEDOO
MERRIWA
DUBBO
GULGONG
MUDGEE
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Scale ratio correct when printed at A4
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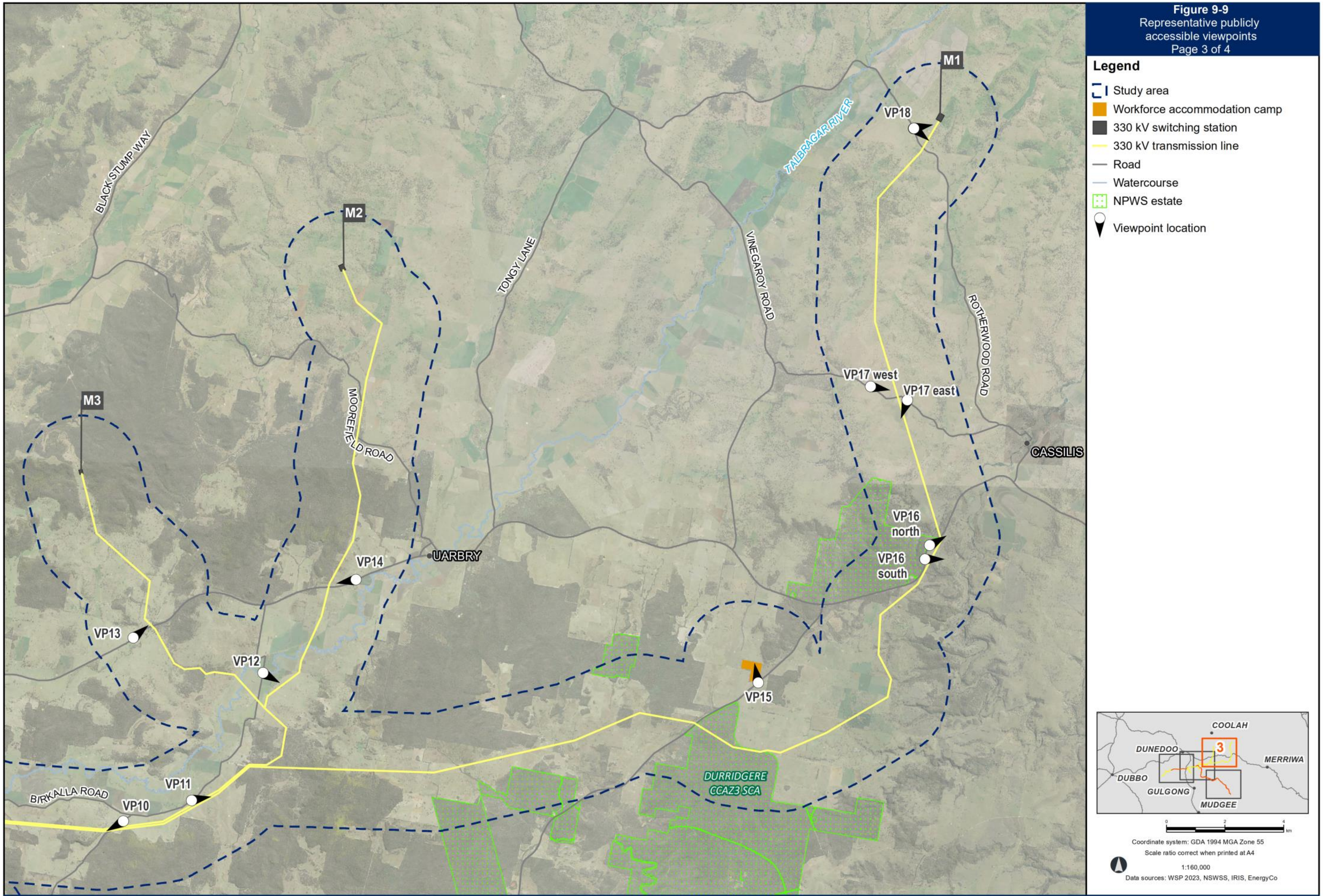
Figure 9-9
Representative publicly accessible viewpoints
Page 3 of 4



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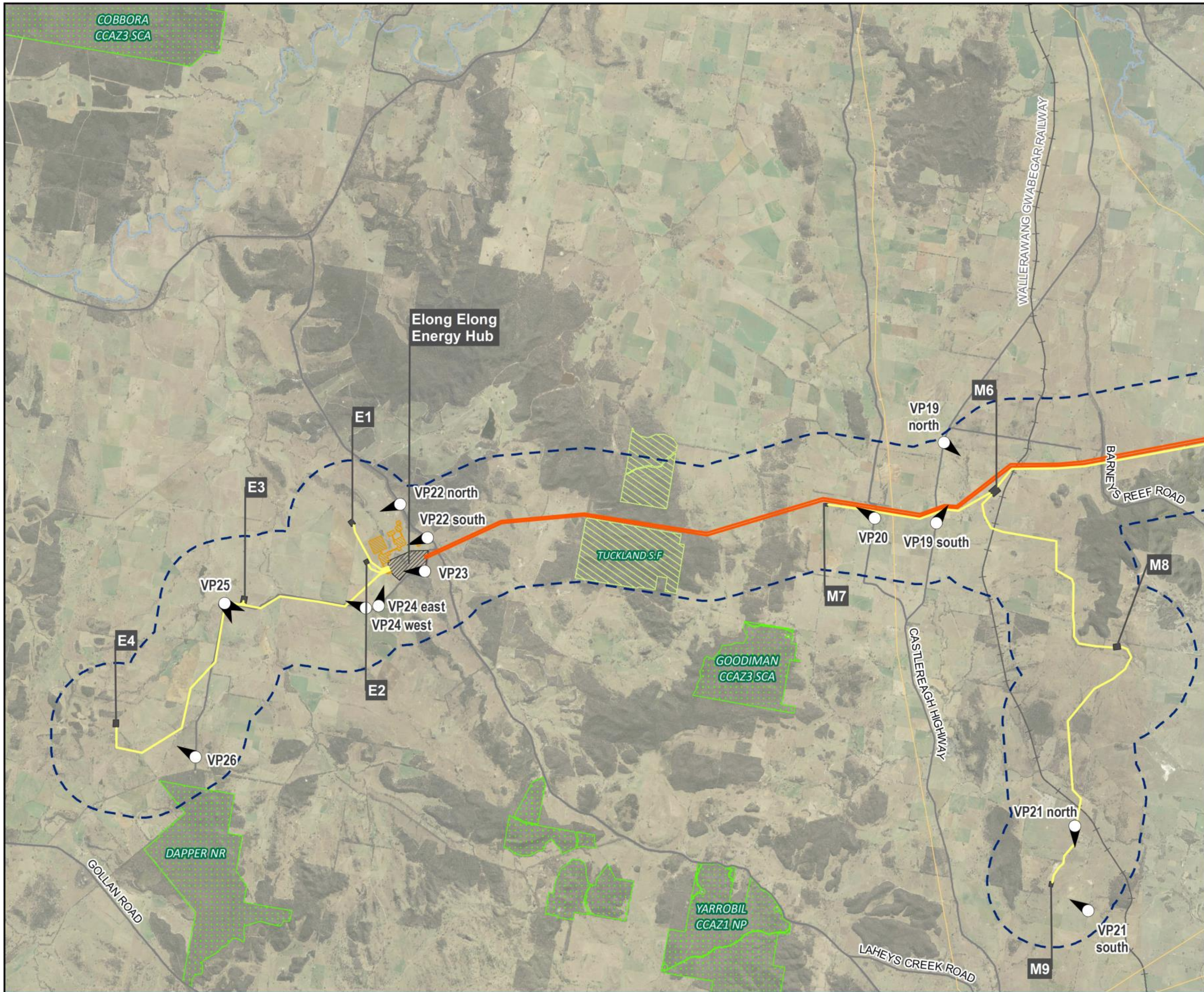


Figure 9-9
Representative publicly accessible viewpoints
Page 4 of 4

Legend

- Study area
- Construction compound
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse
- NPWS estate
- State Forest
- Viewpoint location

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:160,000
Data sources: WSP 2023, NSWSS, IRIS, EnergyCo

9.4 Potential impacts – construction

Construction of the project would result in temporary changes to the landscape character and visual amenity of the study area, which would impact residents, tourists, and road users.

Construction of the project would potentially result in landscape character and visual impacts as a result of ground disturbance, vegetation clearance, the use of large scale equipment and supporting infrastructure, the establishment and use of workforce accommodation camps and night-time lighting.

9.4.1 Landscape character impacts

Daytime impacts

In most instances, daytime impacts to landscape character would be moderate-low or moderate as construction works would result in a low to moderate magnitude of change. The exception to this is landscape character zones RV-03, RV-04, URH-02 and URH-06, where the construction of the project would result in a high magnitude of change (refer to Table 9-7). This high magnitude of change is due to the contrast between the construction activity and the more remote rural landscapes which currently do not contain large scale electricity infrastructure. It is also influenced by the intensity and extent of the construction project components (such as areas where multiple new transmission lines would be constructed). Project components that would result in a high magnitude of change (and the landscape character zones that would be impacted as a result) include:

- the Merotherie Energy Hub and Merotherie west connection (URH-02)
- sections of the Cassilis, Coolah and Leadville connections (RV-03 and RV-04)
- the Merotherie Energy Hub – Elong Elong Energy Hub connection, as well as the Tallawang west and Tallawang south connection (URH -02)
- Elong Elong Energy Hub as well as the Cobbora north, Cobbara west and Goolma connections (URH-06).

The project would have a negligible impact in the Ulan mining landscape character zone.

Table 9-7 Day time impact to landscape character zones - construction

No.	Landscape character zone	Daytime landscape sensitivity	Magnitude of change	Landscape impact
Rural valley landscape character type				
RV-01	Wollar rural valley landscape character zone	Low	Moderate	Low-moderate
RV-02	Cumbo rural valley landscape character zone	Low	Moderate	Low-moderate
RV-03	Talbragar River rural valley landscape character zone	Low	High	Moderate
RV-04	Munmurra River rural valley landscape character zone	Low	High	Moderate
Forested hills landscape character type				
FH-01	Wollar forested hills landscape character zone	Moderate	Low	Low-moderate
FH-02	Durridgere, Goulburn River and Munghorn Gap forested hills landscape character zone	Moderate	Moderate	Moderate

No.	Landscape character zone	Daytime landscape sensitivity	Magnitude of change	Landscape impact
FH-03	Terraban Gap forested hills landscape character zone	Moderate	Moderate	Moderate
FH-04	Barneys Reef forested hills landscape character zone	Moderate	Moderate	Moderate
FH-05	Spring Ridge and Tuckland forested hills landscape character zone	Moderate	Moderate	Moderate
Ulan mining landscape character type				
M-01	Ulan mining landscape character zone	Very low	Low	Negligible
Undulating rural hills landscape character type				
URH-01	Narragamba to Blue Springs undulating rural hills landscape character zone	Low	Moderate	Low-moderate
URH -02	Birriwa to Tallawang undulating rural hills landscape character zone	Low	High	Moderate
URH -03	Uarbry undulating rural hills landscape character zone	Low	Moderate	Low-moderate
URH -04	Tongy undulating rural hills landscape character zone	Low	Moderate	Low-moderate
URH -05	Cassilis to Coolah undulating rural hills landscape character zone	Low	Moderate	Low-moderate
URH -06	Dapper and Elong undulating rural hills landscape character zone	Low	High	Moderate

Night-time impacts

During the night-time, construction is expected to result in moderate to moderate-high impacts to all landscape character zones except for landscape character zone M-01. Impacts to landscape character during the night-time would occur where night-time lighting is introduced, and there is greater vegetation removal and prominence of temporary construction activities. This would include at the new Wollar switching station, the energy hubs at Merotherie and Elong Elong, and where the night lighting within the construction area, would contrast with the predominantly dark rural character.

Night-time landscape character impacts to landscape character zone M-01 would be negligible, largely as a result of the existing impacts associated with the use of lighting within the mining operations in this zone. Table 9-8 provides a summary of the landscape character zone impacts during construction.

Table 9-8 Night-time visual impact to landscape character zones – construction

No.	Landscape character zone	Night-time landscape character sensitivity	Magnitude of change	Landscape character impact
Rural valley landscape character type				
RV-01	Wollar rural valley landscape character zone	Moderate	High	Moderate-high
RV-02	Cumbo rural valley landscape character zone	Moderate	Moderate	Moderate
RV-03	Talbragar River rural valley landscape character zone	Moderate	Moderate	Moderate
RV-04	Munmurra River rural valley landscape character zone	Moderate	High	Moderate-high

No.	Landscape character zone	Night-time landscape character sensitivity	Magnitude of change	Landscape character impact
Forested hills landscape character type				
FH-01	Wollar forested hills landscape character zone	High	Low	Moderate
FH-02	Durridgere, Goulburn River and Munghorn Gap forested hills landscape character zone	High	Low	Moderate
FH-03	Terraban Gap forested hills landscape character zone	High	Moderate	Moderate-high
FH-04	Barneys Reef forested hills landscape character zone	High	Moderate	Moderate-high
FH-05	Spring Ridge and Tuckland forested hills landscape character zone	High	Low	Moderate
Ulan mining landscape character type				
M-01	Ulan mining landscape character zone	Low	low	low
Undulating rural hills landscape character type				
URH-01	Narragamba to Blue Springs undulating rural hills landscape character zone	Moderate	Moderate	Moderate
URH-02	Birriwa to Tallawang undulating rural hills landscape character zone	Moderate	High	Moderate-high
URH-03	Uarbry undulating rural hills landscape character zone	Moderate	Moderate	Moderate
URH-04	Tongy undulating rural hills landscape character zone	Moderate	Moderate	Moderate
URH-05	Cassilis to Coolah undulating rural hills landscape character zone	Moderate	Moderate	Moderate
URH-06	Dapper and Elong undulating rural hills landscape character zone	Moderate	High	Moderate-high

9.4.2 Visual amenity impacts

Visual amenity impacts – public viewpoints

The project would have visual impacts on public viewpoints ranging from low to moderate during construction. The moderate impacts occur where vegetation removal activities (i.e. access tracks, sightlines for safety, construction areas) are greater and temporary construction activities occur. These viewpoints typically lack vegetation screening to construction activity and/or provide views close to areas that would undergo leveling or areas that have a concentration of construction activity of multiple components of the project (such as transmission tower sites, energy hub sites and switching stations).

There would be a moderate-low visual impact to views from the air (along commercial flight routes) during construction as construction activity would be visible from recreational flights operating from Dubbo Airport and Mudgee Airport.

Impacts to the identified public viewpoints in the study area during construction are outlined in Table 9-9.

Table 9-9 Impact on public viewpoints – construction

No.	Location	Visual sensitivity	Magnitude of change	Visual impact
New Wollar Switching Station				
1	View southwest from Barigan Road	Very low	Moderate	Low
New Wollar Switching Station — Merotherie Energy Hub connection				
2	View west from Barigan Road	Low	Moderate	Low-moderate
3	Views from Wollar Road	Very low	High	Low-moderate
4	View west from Wollar-Ulan Road	Very low	Moderate	Low
5	View south west from Main Street, Ulan	Very low	Moderate	Low
6	View south from Blue Springs Road, Stubbo	Very low	Moderate	Low
Merotherie Energy Hub, Merotherie west connection, Merotherie south connection				
7	View east from Merotherie Road	Very low	High	Low-moderate
8	View south west from Merotherie Road	Low	High	Moderate
9	View south east from Birriwa Bus Route South	Low	High	Moderate
Cassilis, Coolah and Leadville connections				
10	View south west from Blue Springs Road	Low	High	Moderate
11	Views from Blue Springs Road north	Low	High	Moderate
12	View from Blue Springs Road north	Low	High	Moderate
13	View north east from the Golden Highway, Leadville	Low	Moderate	Low-moderate
14	View west from the Golden Highway, Uarbry	Low	Moderate	Low-moderate
15	View from Ulan Road, Cassilis	Very low	High	Moderate
16	Views from the Golden Highway, Cassilis	Low	Moderate	Low-moderate
17	Views from Coolah Road	Low	Moderate	Low-moderate
18	View east from Rotherwood Road	Low	Moderate	Low-moderate
Merotherie Energy Hub - Elong Elong Energy Hub connection, Tallawang west connection and Tallawang south connection				
19	Views from the Castlereagh Highway, Tallawang	Low	High	Moderate
20	View west from Tucklan Road	Very low	High	Low-moderate
21	View south from Puggoon Road	Low	Moderate	Low-moderate
Elong Elong Energy Hub and the Cobbora north, Cobbora west and Goolma connections				
22	Views from Spring Ridge Road	Low	High	Moderate
23	View north west from Dapper Road, near Spring Ridge Road	Low	High	Moderate
24	Views from Dapper Road east	Low	High	Moderate
25	View south from Dapper Road	Very low	Moderate	Low
26	View north west from Dapper Road west	Low	Moderate	Low-moderate

Visual amenity impacts – private dwellings

Construction activities would be occurring at multiple locations throughout the construction area at any one time. The construction of the energy hubs at Merotherie and Elong Elong would have larger scale construction activity for a longer duration compared to other construction works along the transmission line network, due to the scale of the infrastructure.

The following private dwellings are expected to be visually impacted by the construction of the project:

- private dwellings with a view to the Merotherie and Elong Elong energy hubs and associated construction areas, including dwellings 902 and 880/876 at Merotherie and dwellings 611 and 719 at Elong Elong. Dwelling 719 would also have views to helicopter activities at the Elong Elong Energy Hub.
- views to the Neeleys Lane workforce accommodation camp at Ulan Road, Cassilis from dwelling 1103
- multiple dwellings near the proposed switching stations which would experience views to construction activity associated with installing each switching station as well as the installation of connecting transmission line towers
- multiple dwellings near the proposed transmission lines, which would have views to the tower installation works and stringing of wires, progressively during construction
- multiple dwellings which would have visibility on construction vehicle movements (including heavy vehicles oversized loads), which would occur on the public road network (in addition to existing vehicle movements) to travel to and from the construction area daily.

Generally, views to the construction works would be more prominent and would contrast more noticeably with the existing setting in most rural and forested settings, because of the broader construction footprint, ground disturbance, the use of large scale equipment and supporting infrastructure. These impacts would, however, be intermittent along the transmission line corridor, and temporary in all locations.

Visual amenity impacts – night-time

Most construction works are expected to occur during standard construction hours, when construction lighting would not be required. However, in some instances, lighting would be required to facilitate construction activities in the winter months when days are shorter, or when out-of-hours works are required. The exceptions to this would include:

- the lighting of construction compounds associated with energy hubs, and staging and laydown areas at night. The lighting of these areas may be visible to dwellings 880 and 876 at Merotherie, and dwellings 611 and 719 at Elong Elong
- the 24-hour, seven days a week operation and subsequent lighting of the workforce accommodation camps. The lighting of these areas may be visible to dwelling 1103 near the Neeleys Lane workforce accommodation camp, and dwellings 880 and 876 near the Merotherie workforce accommodation camp

Construction activities associated with the transmission line infrastructure which may also be required during the night-time, which would require the use of lighting at active construction areas only. This would be temporary and related to specific task lighting as well as lighting from vehicle movements along access tracks which may be visible from nearby dwellings.

9.5 Potential impacts – operation

The project would result in the introduction of new transmission infrastructure within the landscape, including transmission line towers around 70 metres in height. Opportunities to minimise the potential landscape and visual impacts of the project have been considered in the design and alignment of permanent infrastructure such as transmission lines and towers, and energy hubs and switching stations (refer to Chapter 2 (strategic context)), in consultation with landowners (refer to Chapter 5 (Engagement)). This included:

- where possible, locating parts of the transmission line in previously disturbed areas (such as the mining areas)
- paralleling existing transmission line easements where possible to minimise new areas with transmission lines where there is no visual precedent
- consideration of the topography and any existing screening vegetation or other features
- minimising the overall transmission line length, where practicable, by coordinating generator connections to the energy hubs and locating the energy hubs centrally to renewable energy project locations
- maximising the distance between permanent project infrastructure (within the project easement) and existing dwellings and towns along the transmission line easement, including following a transmission line route which is located away from the towns of Gulgong and Dunedoo
- minimising impacts on conservation areas and cultural heritage places
- co-locating the New Wollar Switching Station with the existing Transgrid Wollar substation so as to utilise a location which is away from a large number of residential receivers.

9.5.1 Landscape character impacts

Daytime impacts

Operation of the project and the presence of permanent project infrastructure would have moderate-low to moderate landscape character impacts within the identified landscape character zones during the daytime. The exception to this is within the Ulan mining landscape character zone (M-01) where the project would have a negligible impact given the very low sensitivity of this area.

Moderate impacts to landscape character would occur in some of the forested hills, rural valley and undulating rural hills landscape character zones where the project would result in a reduction in vegetation cover in predominately vegetated forested hills landscapes. In addition, the introduction of large transmission line towers and the energy hubs would contrast with the character of the rural valley and undulating rural hills landscape character types. In particular, the project would result in a high magnitude of change at landscape character zones RV-03, RV-04, URH-02 and URH-06 as:

- the 330 kV transmission lines would be a new feature within the Talbragar River (RV-03) and Munmurra River (RV-04) landscape character zones, which are scenic rural valleys that contribute to the landscape setting of towns such as Cassilis. The transmission lines would cross both river valleys and creeks, several roads and across rural properties
- the Merotherie and Elong Elong energy hubs combined with the new 500 kV and 330 kV transmission lines would introduce major new structures within the Birriwa to Tallawang (URH-02) and Dapper and Elong (URH-06) landscape character zones.

A summary of the daytime impacts the project is expected to have on landscape character types and zones are outlined in Table 9-10.

Table 9-10 Daytime impacts to landscape character zones within the study area - operation

No.	Location	Daytime landscape sensitivity	Magnitude of change	Landscape character impact
Rural valley landscape character type				
RV-01	Wollar rural valley landscape character zone	Low	Moderate	Low-moderate
RV-02	Cumbo rural valley landscape character zone	Low	Moderate	Low-moderate
RV-03	Talbragar River rural valley landscape character zone	Low	High	Moderate
RV-04	Munmurra River rural valley landscape character zone	Low	High	Moderate
Forested hills landscape character type				
FH-01	Wollar forested hills landscape character zone	Moderate	Low	Low-moderate
FH-02	Durridgere, Goulburn River and Munghorn Gap forested hills landscape character zone	Moderate	Moderate	Moderate
FH-03	Terraban Gap forested hills landscape character zone	Moderate	Moderate	Moderate
FH-04	Barneys Reef forested hills landscape character zone	Moderate	Moderate	Moderate
FH-05	Spring Ridge and Tuckland forested hills landscape character zone	Moderate	Moderate	Moderate
Ulan mining landscape character type				
M-01	Ulan mining landscape character zone	Very low	Low	Negligible
Undulating rural hills landscape character type				
URH-01	Narragamba to Blue Springs undulating rural hills landscape character zone	Low	Moderate	Low-moderate
URH-02	Birriwa to Tallawang undulating rural hills landscape character zone	Low	High	Moderate
URH-03	Uarbry undulating rural hills landscape character zone	Low	Moderate	Low-moderate
URH-04	Tongy undulating rural hills landscape character zone	Low	Moderate	Low-moderate
URH-05	Cassilis to Coolah undulating rural hills landscape character zone	Low	Moderate	Low-moderate
URH-06	Dapper and Elong undulating rural hills landscape character zone	Low	High	Moderate

Night-time impacts

Operation of the project would introduce some low-level lighting at the New Wollar Switching Station, Merotherie Energy Hub and Elong Elong Energy Hub, and would result in moderate-low impact in landscape character zones RV-01, URH-02 and URH-06 during the night-time. In all other locations, the project would have a negligible impact to landscape character during the night-time as no permanent lighting is proposed along the transmission lines.

Maintenance activities would generally be undertaken during standard hours, however if these activities require additional lighting, impacts would be temporary, related to specific task lighting, and would unlikely result in impacts to landscape character.

Night-time landscape character impacts during operations are outlined in Table 9-11.

Table 9-11 Night-time landscape character impacts – operation

No.	Location	Night-time landscape character sensitivity	Magnitude of change	Landscape character impact
Rural valley landscape character type				
RV-01	Wollar rural valley landscape character zone	Moderate	Low	Low-moderate
RV-02	Cumbo rural valley landscape character zone	Moderate	Negligible	Negligible
RV-03	Talbragar River rural valley landscape character zone	Moderate	Negligible	Negligible
RV-04	Munmurra River rural valley landscape character zone	Moderate	Negligible	Negligible
Forested hills landscape character type				
FH-01	Wollar forested hills landscape character zone	High	Negligible	Negligible
FH-02	Durridgere, Goulburn River and Munghorn Gap forested hills landscape character zone	High	Negligible	Negligible
FH-03	Terraban Gap forested hills landscape character zone	High	Negligible	Negligible
FH-04	Barneys Reef forested hills landscape character zone	High	Negligible	Negligible
FH-05	Spring Ridge and Tuckland forested hills landscape character zone	High	Negligible	Negligible
Ulan mining landscape character type				
M-01	Ulan mining landscape character zone	Low	Negligible	Negligible
Undulating rural hills landscape character type				
URH-01	Narragamba to Blue Springs undulating rural hills landscape character zone	Moderate	Negligible	Negligible
URH-02	Birriwa to Tallawang undulating rural hills landscape character zone	Moderate	Low	Low-moderate
URH-03	Uarbry undulating rural hills landscape character zone	Moderate	Negligible	Negligible
URH-04	Tongy undulating rural hills landscape character zone	Moderate	Negligible	Negligible
URH-05	Cassilis to Coolah undulating rural hills landscape character zone	Moderate	Negligible	Negligible
URH-06	Dapper and Elong undulating rural hills landscape character zone	Moderate	Low	Low-moderate

9.5.2 Visual amenity impacts

Visual amenity impacts – public viewpoints

Operation of the project would result in a range of visual impacts to selected public viewpoints, however given the prominence of the project within the rural landscape, and the lack of existing large scale structures, most assessed viewpoints would experience a moderate to high magnitude of change (refer to Table 9-12). Areas where a high magnitude of change would occur include locations where:

- the project would be seen at close range from viewpoint 3 and viewpoint 23
- new transmission lines and 330 kV switching stations would contrast with the prevailing rural character and/or scenic qualities of the view, and where the view does not currently include any large-scale transmission lines (viewpoints 8, 10, 11, 17 and 18). At these viewpoints, multiple components of the project would be seen (transmission lines and/or 330 kV switching stations)

- the Merotherie and Elong Elong energy hubs would be prominent in a rural landscape and seen alongside connecting transmission lines (twin 500 kV transmission lines and several 330 kV transmission lines), resulting in substantial change to the character and amenity of these views (viewpoints 9, 20, 21 and 22).

Although there would be a high magnitude of change in these locations, when considered together with the visual sensitivity of the corresponding viewpoint, the resulting visual impacts range between low and moderate..

Low visual impacts would occur where views include existing transmission infrastructure or mining development, and/or where there is some visual compatibility of the project with the character of the view.

The project would have low-moderate visual impacts on views from recreational flights as the project would be visible from the air and would contrast with the rural valley and rural hill landscapes of the study area. However, the project would not be the focus or destination in the scenic flights, and other activities (such as mining) would reduce the contrast in some areas of the study area.

Photomontages depicting the changes to views as a result of the project (i.e. before and after) were prepared for locations where the project would be seen from locations of higher visual sensitivity and also to show a typical view within some of the landscape character types. These are included in Appendix F of Technical Paper 3. An example from the photomontages is provided in Figure 9-10 (before) and Figure 9-11 (after).

Impacts to the identified viewpoints in the study area during operation are outlined in Table 9-12 and Figure 9-12.

Table 9-12 Impact on viewpoints – operation

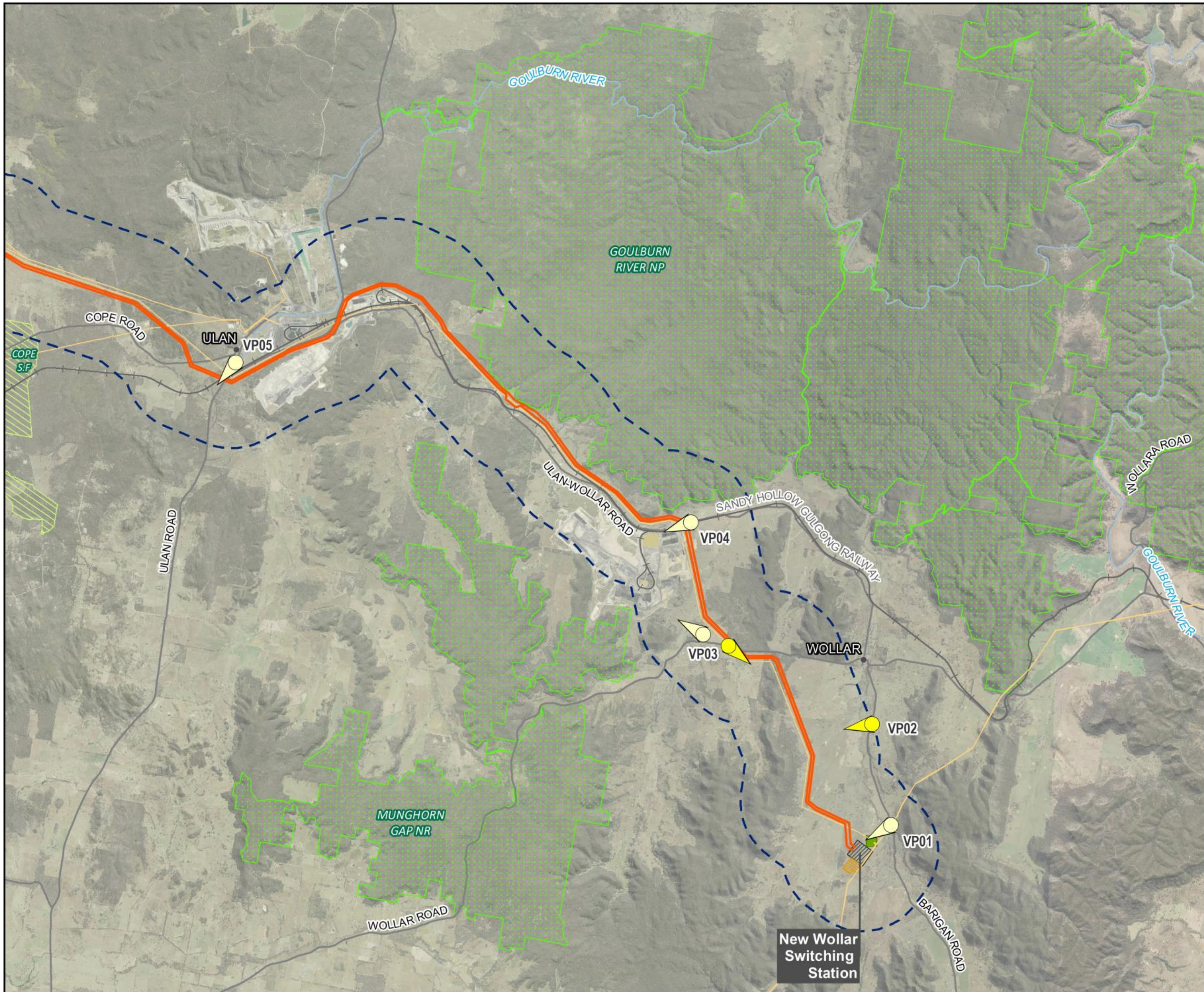
No.	Location	Visual sensitivity	Magnitude of change	Visual impact
New Wollar Switching Station				
1	View southwest from Barigan Road	Very low	Moderate	Low
New Wollar Switching Station — Merotherie Energy Hub connection				
2	View west from Barigan Road	Low	Moderate	Low-moderate
3	Views from Wollar Road	Very low	High	Low-moderate
4	View west from Wollar-Ulan Road	Very low	Moderate	Low
5	View southwest from Main Street, Ulan	Very low	Moderate	Low
6	View south from Blue Springs Road, Stubbo	Very low	Moderate	Low
Merotherie Energy Hub, Merotherie west connection, Merotherie south connection				
7	View east from Merotherie Road	Very low	High	Low-moderate
8	View south from Birriwa Bus Route South	Low	High	Moderate
9	View southeast from Birriwa Bus Route South	Low	High	Moderate
Cassilis, Coolah and Leadville connections				
10	View southwest from Blue Springs Road	Low	High	Moderate
11	Views northeast from Blue Springs Road, Bungaba	Low	High	Moderate
12	View from Blue Springs Road North	Low	High	Moderate
13	View northeast from the Golden Highway, Leadville	Low	Moderate	Low-moderate
14	View west from the Golden Highway, Uarbry	Low	Moderate	Low-moderate
15	View north from Ulan Road, Cassilis	Very low	Negligible	Negligible

No.	Location	Visual sensitivity	Magnitude of change	Visual impact
16	Views from the Golden Highway, Cassilis	Low	Moderate	Low-moderate
17	Views from Coolah Road	Low	Moderate	Low-moderate
18	View east from Rotherwood Road	Low	Moderate	Low-moderate
Merotherie Energy Hub – Elong Elong Energy Hub connection, Tallawang west connection and Tallawang south connection				
19	Views from the Castlereagh Highway, Tallawang	Low	High	Moderate
20	View west from Tucklan Road	Very low	High	Low-moderate
21	View south from Puggoon Road	Low	Moderate	Low-moderate
Elong Elong Energy Hub and the Cobbora north, Cobbora west and Goolma connections				
22	Views from Spring Ridge Road	Low	High	Moderate
23	View northwest from Dapper Road, near Spring Ridge Road	Low	High	Moderate
24	Views from Dapper Road east	Low	High	Moderate
25	View south from Dapper Road	Very low	Moderate	Low
26	View northwest from Dapper Road west	Low	Moderate	Low-moderate

Figure 9-10 Existing view looking southeast from Wollar Road

Figure 9-11 Photomontage showing new transmission lines looking southeast from Wollar Road

Figure 9-12
Impact to representative publicly accessible viewpoints

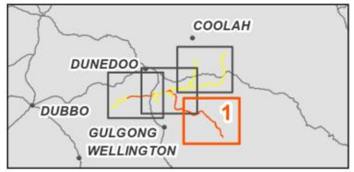


Legend

- Study area
- Construction compound
- Workforce accommodation camp
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing substation
- Existing transmission line
- Road
- Railway
- Watercourse
- Water body
- NPWS estate
- State Forest

Viewpoint location and assessment results

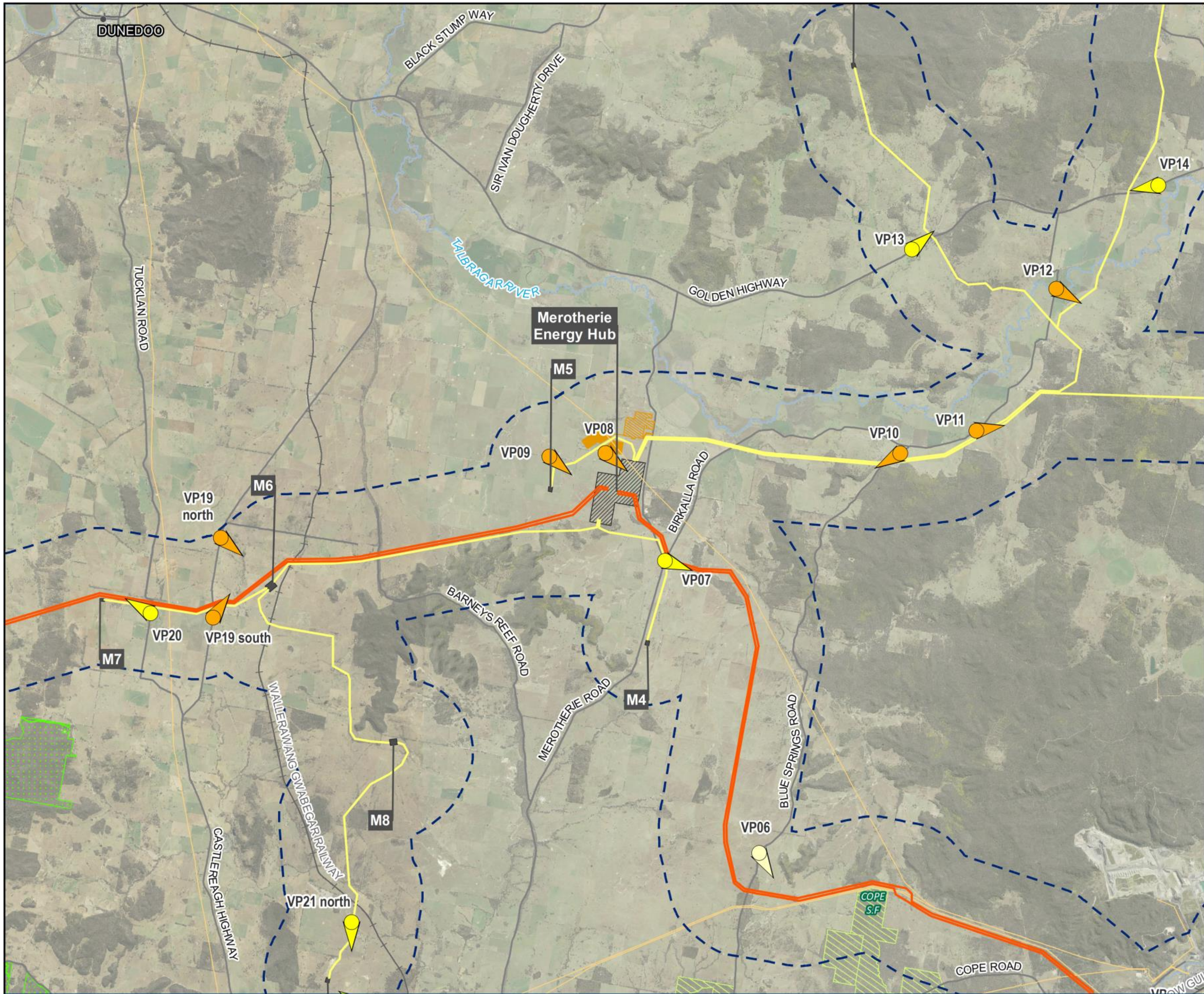
- Moderate
- Moderate-low
- Low
- Negligable



0 2 4 km

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:160,000
Data sources: WSP 2023, NSWSS, IRIS, EnergyCo

Figure 9-12
Impact to representative publicly accessible viewpoints
Page 2 of 4

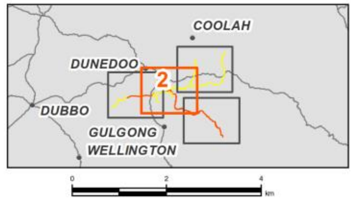


Legend

- Study area
- Construction compound
- Workforce accommodation camp
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing substation
- Existing transmission line
- Road
- Railway
- Watercourse
- Water body
- NPWS estate
- State Forest

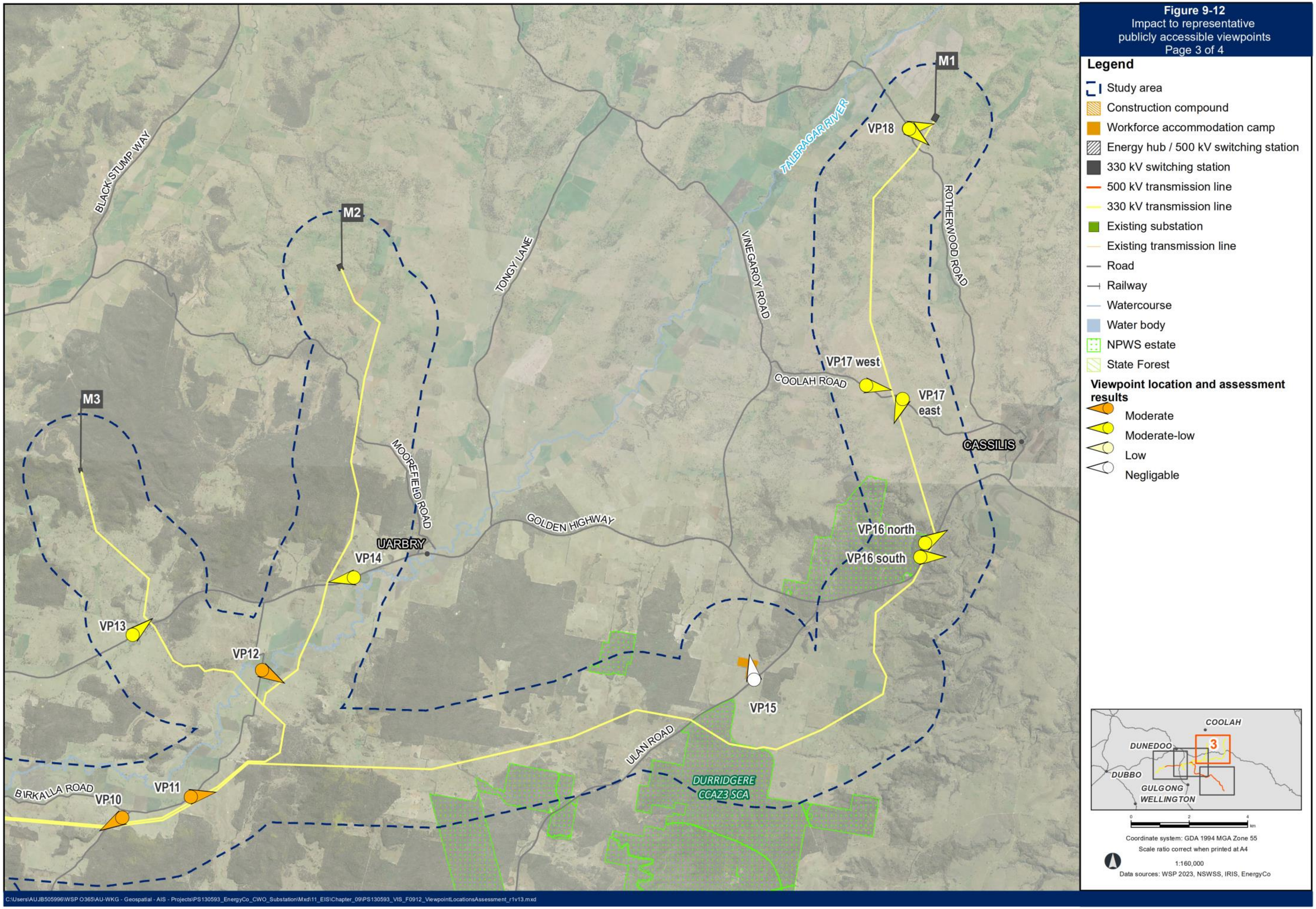
Viewpoint location and assessment results

- Moderate
- Moderate-low
- Low
- Negligable



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:160,000
Data sources: WSP 2023, NSWSS, IRIS, EnergyCo

Figure 9-12
Impact to representative publicly accessible viewpoints
Page 3 of 4



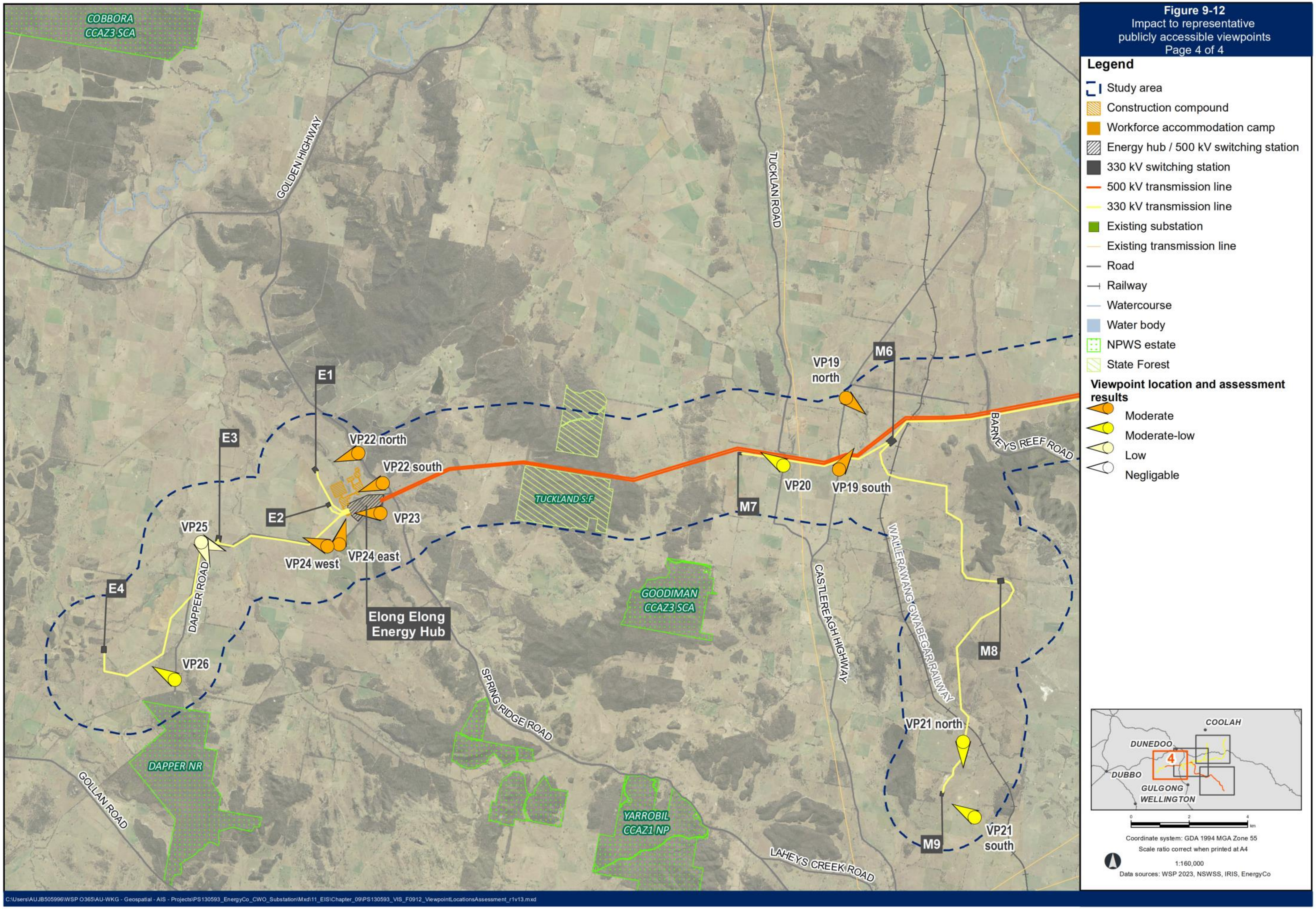


Figure 9-12 Impact to representative publicly accessible viewpoints Page 4 of 4

Visual amenity impacts – private dwellings

In accordance with the assessment approach described in Section 9.2.2, a preliminary impact screening of the 128 private dwellings located within two kilometres of the project identified 91 private dwellings as having the potential to experience impacts to visual amenity from the operation of the project. A detailed view assessment was subsequently undertaken for these 91 private dwellings to determine the potential visual impacts.

The detailed visual assessment identified the following (pre mitigation) visual amenity impacts from private dwellings:

- 13 dwellings would have a high visual impact
- 20 dwellings would have a moderate visual impact
- all remaining dwellings would have a low or negligible visual impact.

The 13 dwellings that have been assessed as having a high visual impact during operation results from the project being a prominent feature in an area with moderate scenic quality.

Of the 91 private dwellings that were identified for a detailed assessment, 52 dwellings are located within landholdings that would not host energy infrastructure for the project, and 39 are located within landholdings that would host energy infrastructure for the project.

Of these 52 non-host dwellings:

- 3 dwellings would have a high visual impact, and
- 13 dwellings would have a moderate visual impact
- all remaining dwellings would have a low or negligible visual impact.

These visual impact levels have the potential to be minimised with the implementation of mitigation measures. A summary of the results of this assessment is contained in Table 9-13 and shown in Figure 9-13.

A detailed assessment of visual amenity impacts for private dwellings is provided in Appendix J of Technical paper 3.

Table 9-13 Summary of detailed dwelling view assessment

Receiver ID	Location / address	Distance to Project operational area (metres)	Project host (Y/N)	Viewpoint sensitivity	Magnitude of change	Visual impact level
19	Barigan Road, Wollar	950	N	Moderate	Low	Low
31	Barigan Road, Wollar	1,900	Y	Moderate	Low	Low
245	28 Robison Street, Ulan,	780	N	Moderate	Low	Low
236	15 Robison Street, Ulan	750	N	Moderate	Low	Low
228	20 Robison Street, Ulan	690	N	Moderate	Low	Low
224	18 Robison Street, Ulan	680	N	Moderate	Low	Low
216	6 Bent Street, Ulan	670	N	Moderate	Low	Low
207	2236 Cope Road, Cope	500	N	Moderate	Moderate	Moderate
198	Main Street, Ulan	220	N	Moderate	Moderate	Moderate
166	9-127 Toole Road, Ulan	760	N	Moderate	Low	Low
188	3812 Ulan Road, Ulan	660	N	Moderate	Low	Low
204	2034 Cope Road, Cope	990	N	Moderate	Low	Low

Receiver ID	Location / address	Distance to Project operational area (metres)	Project host (Y/N)	Viewpoint sensitivity	Magnitude of change	Visual impact level
247	1977 Cope Road, Cope	710	N	Moderate	Low	Low
244	1936 Cope Road, Cope	1,140	N	Moderate	Low	Low
267	1910 Cope Road, Cope	920	N	Moderate	Moderate	Moderate
328	1863 Cope Road, Cope	420	Y	Moderate	Moderate	Moderate
333	1713 Cope Road, Cope	630	N	Moderate	Negligible	Negligible
335	1679 Cope Road, Cope	820	Y	Moderate	Low	Low
350	1601 Cope Road, Cope	660	N	Moderate	Moderate	Moderate
357	1599 Cope Road, Cope	650	N	Moderate	Moderate	Moderate
367	1599 Cope Road, Cope	430	Y	Moderate	Low	Low
373	440 Blue Springs Road, Stubbo	640	N	Moderate	Moderate	Moderate
399	654 Blue Springs Road, Stubbo	290	Y	Moderate	High	High
462	917 Blue Springs Road, Cope	1,650	N	Low	Negligible	Negligible
485	1083 Blue Springs Road, Cope	1,650	N	Low	Negligible	Negligible
1483	86 Rissler Road, Stubbo	210	Y	Moderate	High	High
616	1303 Blue Springs Road, Cope	1,300	N	Moderate	Negligible	Negligible
826	82 Birkalla Road, Merotherie	1,150	N	Low	Low	Low
703	677 Merotherie Road, Merotherie	280	Y	Low	Low	Low
1482	135 Birkalla Road, Merotherie	760	Y	Moderate	Negligible	Negligible
1027	951 Birriwa Bus Route North, Merotherie	1,830	N	Moderate	Low	Low
880 / 876	908 Birriwa Bus Route, Merotherie	240	Y	Moderate	High	High
902	Birriwa Bus Route south, Birriwa	2,420	N	Low	Moderate	Low
965	Birriwa Bus Route north, Merotherie	1,210	Y	Moderate	Negligible	Negligible
998	Blue Springs Road, Leadville	1,410	N	Moderate	Low	Low
955	782 Birkalla Road, Bungaba	800	N	Low	Low	Low
929	2178 Blue Springs Road, Bungaba	210	Y	Low	High	High
927	944 Birkalla Road, Bungaba	320	Y	Low	Low	Low
941	782-944 Birkalla Road, Bungaba	460	N	Low	Moderate-High	Moderate
947	675 Birkalla Road, Bungaba	580	N	Low	Negligible	Negligible
846	1811 Blue Springs Road, Bungaba	1,910	N	Moderate	Low	Low
979	2178-2461 Blue Springs Road, Bungaba	280	Y	Moderate	High	High
1152	Cliffdale Road, Leadville	680	Y	Moderate	Low	Low
1057	549 Blue Springs Road Uarbry	910	Y	Moderate	Low	Low
1195	12694 Golden Hwy, Uarbry	520	N	Moderate	Moderate	Moderate

Receiver ID	Location / address	Distance to Project operational area (metres)	Project host (Y/N)	Viewpoint sensitivity	Magnitude of change	Visual impact level
1184	190 Melrose Road, Leadville	1,700	N	Low	Negligible	Negligible
1202	Golden Highway, Uarbry	510	Y	Low	Negligible	Negligible
1200	11880 Golden Highway, Uarbry	990	N	Moderate	Low	Low
1261	247 Moorefield Road, Uarbry	1,250	Y	Low	Low	Low
1288	1370 Moorefield Road, Uarbry	660	Y	Moderate	Moderate	Moderate
1316	1280 Moorefield Road, Uarbry	780	N	Low	Low	Low
1323	1370 Moorefield Road, Coolah	1,320	N	Moderate	Low	Low
1324	Moorefield Road, Coolah	520	Y	Moderate	Moderate	Moderate
1119	121 Cliffdale Road, Uarbry	350	N	Low	Moderate	Low
1070	390 Cliffdale Road, Uarbry	2,180	N	Moderate	Low	Low
1010 / 1015	140 Turill Bus Route, Turill	870	N	Moderate	Low	Low
1037	Cliffdale Road, Uarbry	1,220	N	Moderate	Moderate	Moderate
1003	Turill Bus Route, Turill	400	Y	Low	Low	Low
1044	6293 Ulan Road, Turill	880	N	Moderate	Low	Low
1066	6293 Ulan Road, Turill	600	N	Moderate	Moderate	Moderate
1091	6569 Ulan Road, Turill	280	Y	Moderate	Moderate	Moderate
1103	Ulan Road, Turill	1,410	Y	Moderate	Negligible	Negligible
1475	Summerhill Road, Turill	930	N	Moderate	Low	Low
1159	Golden Highway, Cassilis	650	Y	Low	Low	Low
1163 / 1162	9843 Golden Highway, Cassilis	520	Y	Low	Low	Low
1308	Coolah Road, Cassilis	1,600	N	Moderate	Low	Low
1480	9843 Golden Highway, Cassilis	140	Y	Low	Low	Low
1351	1089 Rotherwood Road, Cassilis	220	Y	Low	Negligible	Negligible
741	2493 Castlereagh Highway, Tallawang	480	N	Moderate	High	High
790	2610 Castlereagh Highway, Tallawang	1,280	Y	Moderate	Moderate	Moderate
775	2584 Castlereagh Hwy, Tallawang	1,090	Y	Moderate	High	High
663 / 659	2330 Castlereagh Highway, Tallawang	980	N	Moderate	High	High
672	2342 Castlereagh Hwy, Tallawang	930	Y	Moderate	High	High
636	2282 Castlereagh Highway, Tallawang	1,320	N	Moderate	Moderate	Moderate
772	1776 Tucklan Road, Dunedoo	990	N	Moderate	Negligible	Negligible
789	327 Laheys Creek Road, Dunedoo	1,690	N	Moderate	Low	Low
732[2]	41 Spir Road, Tallawang	20	Y	Moderate	High	High
792	1744 Tucklan Road, Tallawang	1,350	N	Moderate	Negligible	Negligible
717	145 Spir Road, Tallawang	400	N	Moderate	High	High
705	Spir Road, Tallawang	530	N	Moderate	Moderate	Moderate

Receiver ID	Location / address	Distance to Project operational area (metres)	Project host (Y/N)	Viewpoint sensitivity	Magnitude of change	Visual impact level
543	330 Whistons Lane, Tallawang	1,110	Y	Moderate	Low	Low
730 / 733	1010 Laheys Creek Road, Dunedoo	390	Y	Moderate	Moderate	Moderate
531	330 Whistons Lane, Tallawang	95	Y	Moderate	High	High
487	250 Whistons Lane, Tallawang	1,340	N	Low	Negligible	Negligible
429	1450 Castlereagh Hwy, Tallawang	1,780	N	Moderate	Negligible	Negligible
385	980 Puggoon Road, Tallawang	580	N	Low	Moderate	Low
365	800 Puggoon Road, Tallawang	1,120	N	Low	Low	Low
354	775 Puggoon Road, Tallawang	350	N	Low	Moderate	Moderate
609	1420 Laheys Creek Road, Dunedoo	1,750	N	Moderate	Low	Low
611	Laheys Creek Road, Dunedoo	1,100	Y	Moderate	Low	Low
719	1050 Spring Ridge Road, Cobbora	1,060	Y	Moderate	Moderate	Moderate
539	Dapper Road, Dunedoo	55	Y	Moderate	High	High
646	1069 Sandy Creek Road, Cobbora	1,350	N	Moderate	Low	Low
580	Sandy Creek Road, Dunedoo	220	Y	Low	Low	Low
584/ 585	1198 Sandy Creek Road, Cobbora	300	Y	Low	Low	Low
480	1484 Sandy Creek Road, Dunedoo	1,460	N	Moderate	Low	Low
464	Dapper Road, Dunedoo	590	N	Moderate	Negligible	Negligible
560	Dapper Road, Dunedoo	1,010	Y	Moderate	Low	Low

1. inhabited heritage structure

Visual amenity impacts – private dwellings at night-time

As discussed in Section 9.5.1 the operation of the transmission line would not require any lighting and would therefore have no impact during operation at night. The energy hubs at Merotherie and Elong Elong Hubs would have low-level lighting at night during operation for security and maintenance access. Nearby dwellings which would experience views to the energy hub lighting at night include 880 and 876 near the Merotherie Energy Hub and dwellings 719 and 611 near the Elong Elong Energy Hub.

The switching stations, including the New Wollar Switching Station, would also be lit at night, including low-level lighting for security and maintenance access, to allows for unplanned works, faults and emergency access at night, as required. Nearby dwellings may experience views to the switching stations lighting at night.

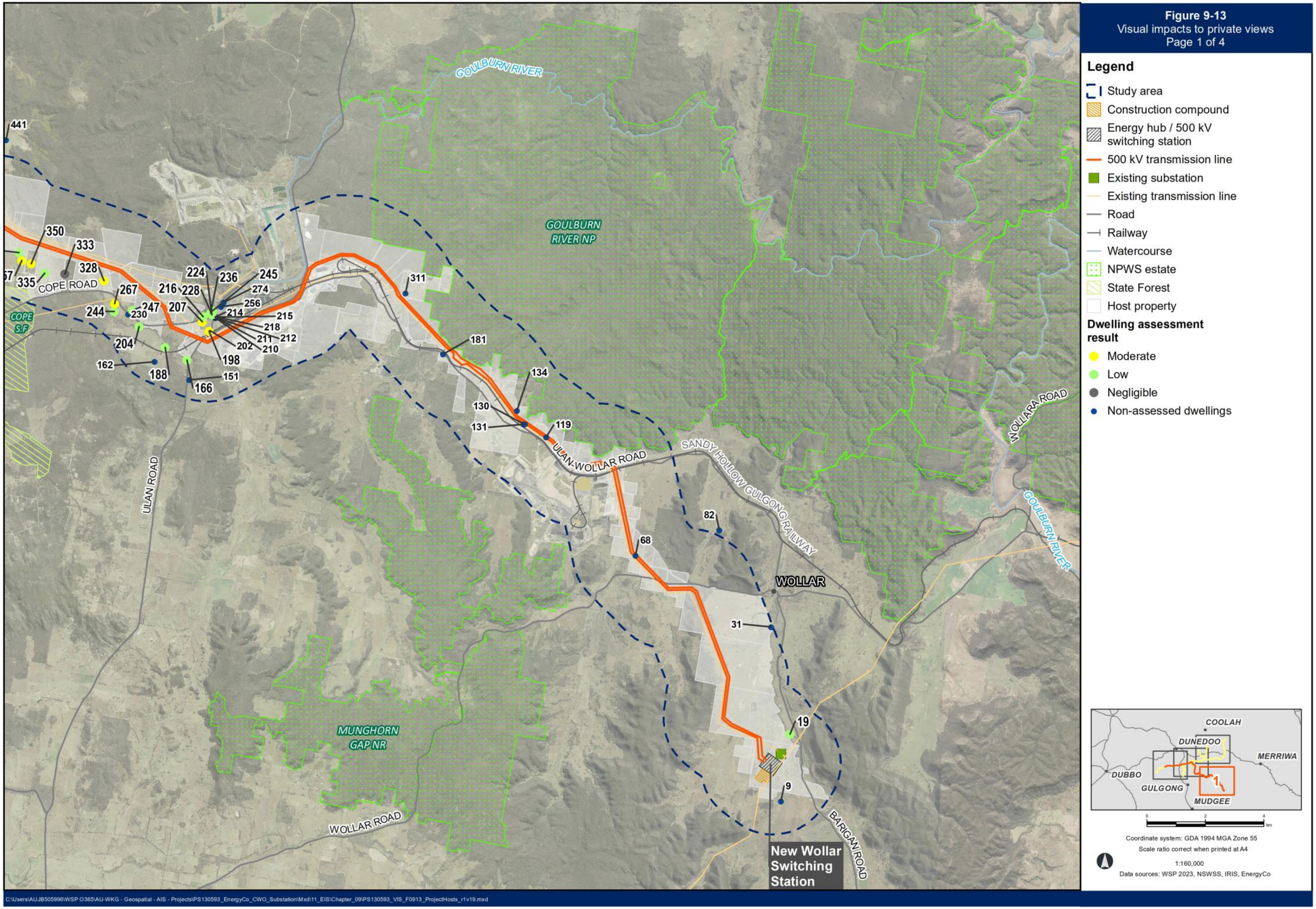


Figure 9-13
Visual impacts to private views
Page 1 of 4
Legend
Study area
Construction compound
Energy hub / 500 kV switching station
500 kV transmission line
Existing substation
Existing transmission line
Road
Railway
Watercourse
NPWS estate
State Forest
Host property
Dwelling assessment result
Moderate
Low
Negligible
Non-assessed dwellings
GOULBURN RIVER
GOULBURN RIVER NP
MUNGHORN GAP NR
COPE S.F
COPE ROAD
ULAN ROAD
ULAN-WOLLAR ROAD
SANDY HOLLOW GULGONG RAILWAY
WOLLAR ROAD
WOLLARA ROAD
BARIGAN ROAD
WOLLAR
New Wollar Switching Station
COOLAH
DUNEDOO
MERRIWA
DUBBO
GULGONG
MUDGEE
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Scale ratio correct when printed at A4
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Data sources: WSP 2023, NSWSS, IRIS, EnergyCo

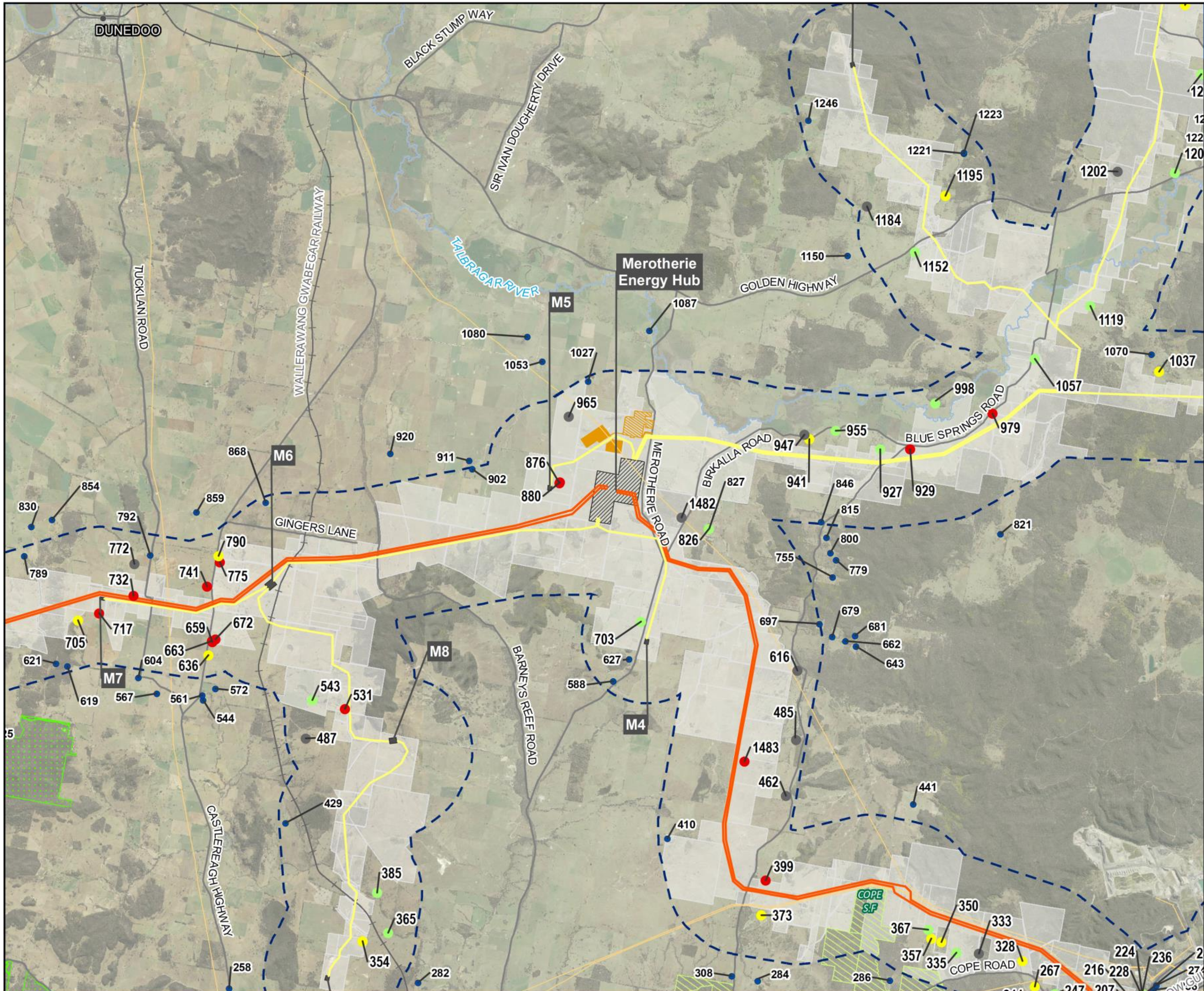
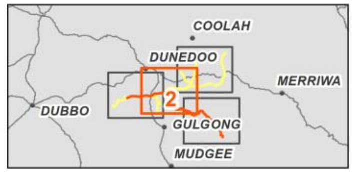


Figure 9-13
Visual impacts to private views
Page 2 of 4

Legend
- Study area
- Construction compound
- Workforce accommodation camp
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse
- NPWS estate
- State Forest
- Host property

Dwelling assessment result
- High
- Moderate
- Low
- Negligible
- Non-assessed dwellings



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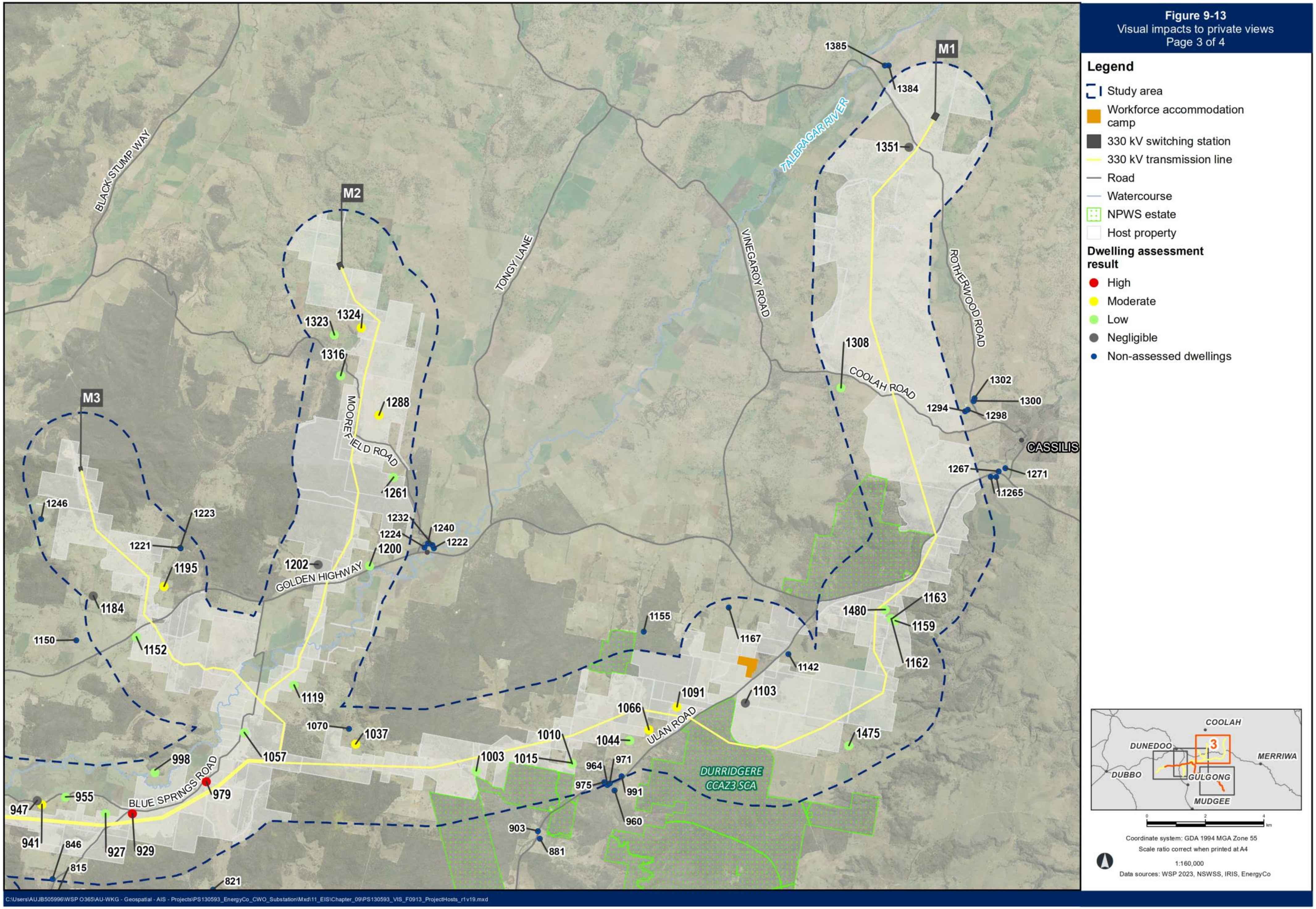
Figure 9-13
Visual impacts to private views
Page 3 of 4
Legend
Study area
Workforce accommodation camp
330 kV switching station
330 kV transmission line
Road
Watercourse
NPWS estate
Host property
Dwelling assessment result
High
Moderate
Low
Negligible
Non-assessed dwellings
M1
M2
M3
BLACK STUMP WAY
TONGY LANE
VINEGAROY ROAD
TALBRAGAR RIVER
ROTHERWOOD ROAD
COOLAH ROAD
MOOREFIELD ROAD
GOLDEN HIGHWAY
ULAN ROAD
BLUE SPRINGS ROAD
CASSILIS
DURRIDGERE CCAZ3 SCA
COOLAH
DUNEDOO
MERRIWA
DUBBO
GULGONG
MUDGEE
Coordinate system: GDA 1994 MGA Zone 55
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Data sources: WSP 2023, NSWSS, IRIS, EnergyCo
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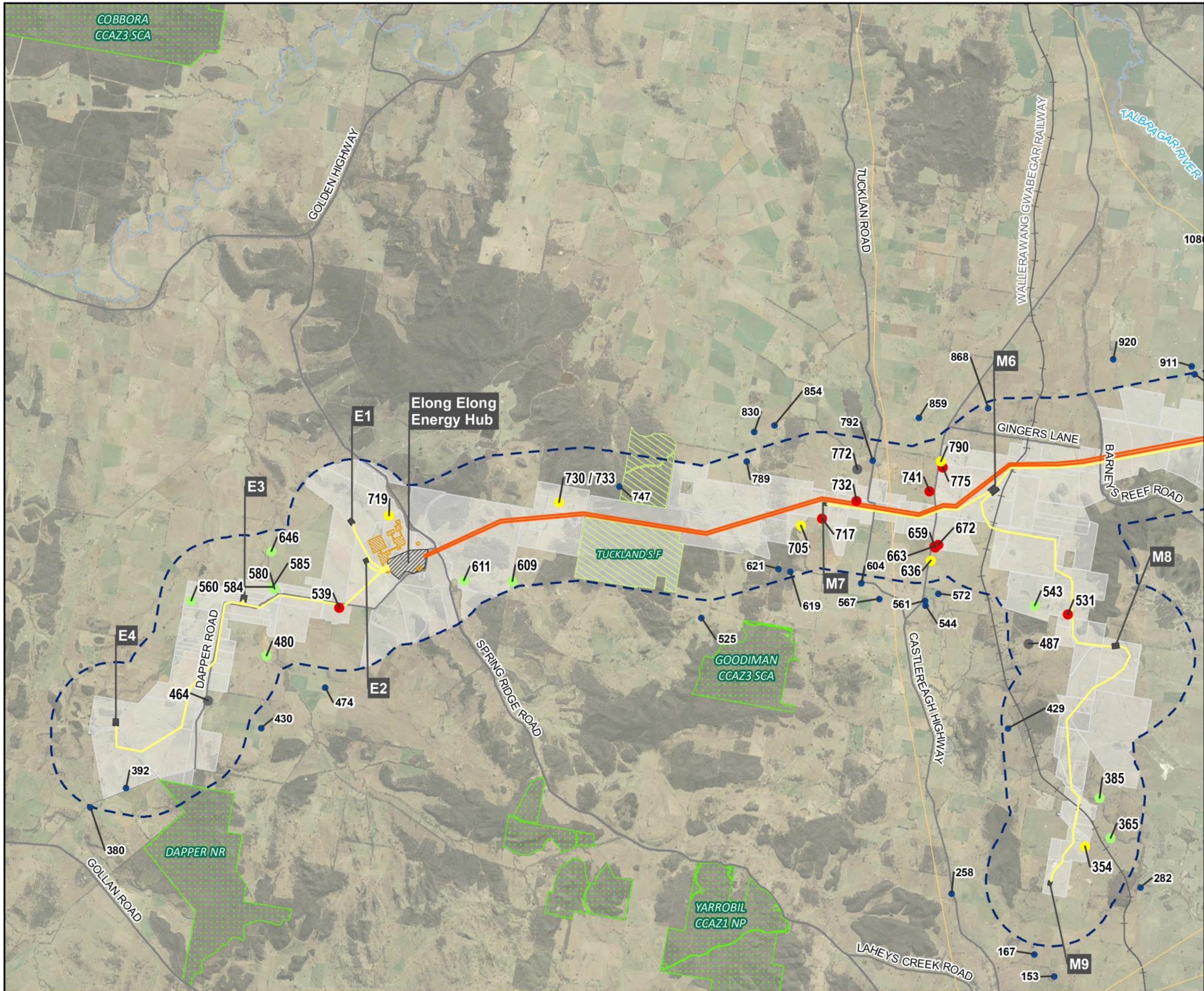
Figure 9-13
Visual impacts to private views
Page 4 of 4

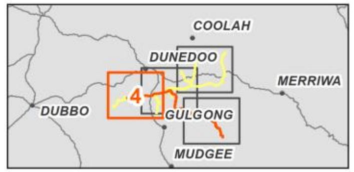


Legend

- Study area
- Construction compound
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse
- NPWS estate
- State Forest
- Host property

Dwelling assessment result

- High
- Moderate
- Low
- Negligible
- Non-assessed dwellings



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Data sources: WSP 2023, NSWSS, IRIS, EnergyCo

9.6 Management of impacts

9.6.1 Environmental management

Impacts to landscape character and visual amenity would be managed in accordance with the Landscape Character and Visual Impact Management sub-Plan (LCVIMP). The LCVIMP would identify the methods and protocols to be implemented to ensure that that the project minimises impacts on landscape character, and visual impacts to views within the public domain and private dwelling views.

The LCVIMP would address the following as a minimum, measures that will be implemented to manage:

- potential impacts on landscape character during the day during construction and operation
- potential impacts on landscape character at night during construction and operation
- potential impacts on views from the public domain during construction and operation where there is a moderate or higher potential visual impact
- potential impacts on views from private dwellings, that are not associated with property that is hosting project infrastructure, and that have a predicted moderate or higher potential visual impact during construction and operation.
- details regarding the installation and maintenance of any proposed on-site mitigation measures such as vegetation for screening.

9.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential landscape and visual impacts are listed in Table 9-14.

Mitigation measures in other chapters that are relevant to the management of construction and operation impacts to landscape character and visual amenity include:

- Chapter 10 (Biodiversity), with respect to the clearing of vegetation, and tree protection measures
- Chapter 15 (Noise and vibration), with respect to the management of construction noise
- Chapter 17 (Traffic and transport), with respect to the management of construction traffic and use of access tracks
- Section 19.4 (Air quality), with respect to the generation of dust.

Table 9-14 Proposed mitigation measures

Reference	Impact/ issue	Mitigation measures	Timing	Applicable location(s)
LV1	Vegetation retention	Vegetation clearance for the project will be limited to the minimum extent necessary for construction and operation to maximise existing visual screening and retention of the existing landscape character. Retained vegetation will be clearly demarcated on site as 'no-go zones' prior to the commencement of construction. Construction personnel will be made aware of no-go zones as part of environmental site induction(s).	Pre-construction, Construction, Operation	Whole of project
LV2	Lighting control	Lighting at construction compounds and workforce accommodation camp(s) will be designed and operated in accordance with Australian and New Zealand Standard AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting.	Pre-construction and construction	Construction compound and workforce accommodation camp(s)
LV3	Private dwellings with a moderate or high visual impact	For private dwellings on non-host properties where the project is predicted to have a moderate or high visual impact, reasonable and feasible opportunities to reduce visual impact (including provisions for screening vegetation) will be investigated. Appropriate visual screening or other options will be confirmed in consultation with the affected landowner (supported by detailed landscape plans where appropriate) and implemented either before or during construction. Maintenance of vegetative screening provided on privately owned land outside of the operation area will be the responsibility of the landowner.	Pre-construction, Construction	Private dwellings on non-host properties with a moderate or high visual impact
LV4	Lighting control	Lighting at the Energy Hubs and switching stations will be designed and operated in accordance with: • Australian and New Zealand Standard AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting • the design guidelines contained in the Siding Springs Dark Sky Planning Guideline (DPE 2016). This will include: — eliminating upward spill light — ensuring lighting is directed downwards — using shielded fittings — avoiding overlighting — switching lights off when not required, such as with the use of sensor lights — using energy efficient bulbs — using asymmetric beams if floodlighting is required — ensuring lights are not directed towards reflective surfaces — using warm white colours.	Pre-construction, Construction, Operation	Merotherie Energy Hub, Elong Elong Energy Hub, and switching stations

10 Biodiversity

This chapter provides an assessment of the potential biodiversity impacts of the project and identifies mitigation measures to minimise and manage these impacts, as provided in Technical paper 4 – Biodiversity Development Assessment Report (Technical paper 4).

As noted in Section 1.6, the project was referred to the Australian Minister for the Environment, and was determined to be a controlled action on 2 March 2023 on the basis of potential impacts to listed threatened species and communities and listed migratory species. As the project will be assessed in accordance with the bilateral assessment agreement, Supplementary Secretary's Environmental Assessment Requirements (SEARs) were issued on 28 March 2023. The SEARs as they relate to biodiversity, and where in the Environmental Impact Statement (EIS) these have been addressed, are detailed in Appendix A (SEARs checklist).

10.1 Legislative and policy context

Potential biodiversity impacts resulting from the project, including potential impacts to threatened species, communities, and their habitats were assessed in accordance with the following legislation and key policies:

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act)
- *Biodiversity Conservation Act 2016* (NSW) (BC Act)
- *Biosecurity Act 2015* (NSW)
- *Fisheries Management Act 1994* (NSW) (FM Act)
- *Local Land Services Act 2013* (NSW) (LLS Act)
- Biodiversity Assessment Method (BAM) (Department of Planning, Industry and Environment (DPIE), 2020b).

10.2 Assessment approach

10.2.1 Study area

The biodiversity study area includes the construction area and surrounding areas that have the potential to be directly and indirectly impacted by the project.

In accordance with the BAM, Technical paper 4 refers to:

- the construction area as the subject land, which includes all areas that would be directly impacted by construction and operation of the project
- the study area as the assessment area, which includes all areas within 500 metres of the centreline of the transmission line, extending up to 1,500 metres from the edge of the construction area at energy hubs and switching stations
- the locality, being the area within 10 kilometres of the subject land (or construction area), within which database searches and broader vegetation mapping to inform the assessment was based.

For the purposes of this chapter, the terms construction area, study area and locality have been used.

10.2.2 Application of the BAM

The BAM sets out how biodiversity values will be assessed, prescribes requirements to avoid and minimise impacts, establishes rules for calculating the number and class of credits required for unavoidable impacts, and determines the trading rules that will apply (with respect to offsets).

The biodiversity assessment was undertaken in accordance with the BAM and involved:

- a desktop assessment which included a review of existing Biodiversity Assessment Report's (BARs) for projects that are adjacent and/or overlapping with the locality, database searches, regional mapping resources and aerial photography for areas within the study area and/or locality
- assessing the potential for threatened species, ecological communities and/or their habitats to occur within the study area, and be impacted by the construction and/or operation of the project
- undertaking field surveys between mid-2022 and early 2023 in general accordance with the relevant NSW and Commonwealth guidelines
- assessing native vegetation cover, extent and connectivity, and broad condition of vegetation types within the study area using aerial photography, the outcomes of the desktop assessment and field survey
- assessing the potential direct and indirect impacts on native vegetation and habitats, threatened species, protected areas and key threatening processes. This included assessment of:
  - prescribed impacts (being impacts that may affect biodiversity values in addition to, or instead of, impacts from clearing vegetation)
  - serious and irreversible impacts (SAII) on threatened species, populations, or ecological communities
  - impacts on Groundwater Dependant Ecosystems (GDEs)
  - impacts on Matters of National Environmental Significance (MNES)
- identifying measures to mitigate and offset the impacts identified, including biodiversity offset obligations calculated using the BAM calculator.

Further information on the methods used in the assessment, assumptions and survey coverage is provided in section 2 of Technical paper 4.

10.2.3 Field surveys

The BAM calculator (BAM-C) specifies the type and extent of surveys required for a biodiversity assessment. A variety of survey methods were used to identify native vegetation, threatened ecological communities (TECs),as well as threatened flora and fauna species in the construction area (refer to Chapter 2 of Technical paper 4). Survey methods included:

- field validation of vegetation mapping using random meander surveys and BAM vegetation integrity plots
- threatened flora survey for candidate threatened species
- threatened fauna survey using targeted seasonal surveys, and geographic and habitat constraints assessments.

Around 70 per cent of the construction area has been subject to field survey (around 1,300 hectares) as part of this assessment. Weather and access constraints limited survey coverage for around 30 per cent or around 550 hectares of the construction area. Where this has occurred, the assessment has applied a conservative approach and assumed presence for threatened species (where relevant) or has relied upon existing mapping and aerial photography for plant community types (PCTs) until surveys can be completed.

10.2.4 Approach to vegetation removal assessment

The parts of the construction area that would be disturbed, requiring vegetation removal, during construction of the project are referred to as the disturbance area for the purposes of Technical paper 4. As detailed in Chapter 6 (Approach to impact assessment), the biodiversity assessment has assessed a refined disturbance area along the transmission lines that reflects a varying degree of vegetation disturbance within the construction area. The disturbance area has been divided in to the following categories:

- Disturbance area A – assumed for complete removal of vegetation
- Disturbance area B – assumed to have no ground disturbance except in circumstances associated with the operational requirements for vegetation maintenance to meet the vegetation clearance heights. The assumed partial vegetation clearing is restricted to clearance of vegetation with growth height potential of two metres or above.
- Disturbance area HZ – a hazard tree zone adjacent to Disturbance area B (generally 10 metres wide) where there would be impacts to selected trees that are within the risk category height range 20–30 metres and have poor structural stability posing a risk of falling.

10.2.5 Biodiversity credit calculations

BAM-C processes survey data to calculate the number and type of biodiversity credits that are required to offset the impacts of a project. Threatened species are assessed as either ecosystem credit species, species credit species or a combination of the two (referred to as 'dual credit species') in accordance with the BAM, as follows:

- ecosystem credit species (predicted): threatened species where the likelihood of occurrence and/or elements of its habitat can be confidently predicted by habitat types and landscape features
- species credit species (candidate): threatened species that cannot be reliably predicted by habitat types.

The BAM and Supplementary SEARs issued for the project also requires the discussion of TECs and species listed under the EPBC Act within Technical paper 4.

10.3 Existing environment

10.3.1 Landscape context

The construction area is located within the Brigalow Belt South (Talbragar Valley, Pilliga, Liverpool Ranges), NSW South Western Slopes (Inland Slopes) and Sydney Basin (Kerrabee) bioregions. Most of the study area has been extensively cleared for agriculture and scattered with a mosaic of fragmented patches of woodland. These remnant patches of woodland, while fragmented, provide important habitat for certain threatened species (such as the Squirrel Glider).

Key natural landscape features of the study area include:

- the Talbragar River and several named and unnamed creeks and watercourses which intersect the study area
- Goulburn River National Park, the Durridgere State Conservation Area (which extends into the construction area) and Tuckland State Forest
- a number of cliff lines, caves, crevices and rocks within the study area, such as near Ulan, Barneys Reef, Merotherie, Dunedoo, Tallawang, Leadville and the Liverpool Ranges.

Vegetation within and adjoining the study area provide connections to other key landscape features within the locality and beyond. A number of movement corridors for aerial species (such as bats and birds) exist within the locality, with key corridors being located between:

- Goodiman State Conservation Area and Yarrobil National Park, connected by Tuckland State Forest in the Inland Slopes IBRA subregion
- Munghorn Gap Nature Reserve and the Goulburn River National Park in the Kerrabee IBRA subregion.

There are no areas of outstanding biodiversity value as identified under the BC Act, or national or international important wetlands within the study area.

An overview of the broad landscape features in the locality is shown in Figure 10-1.

Further detail on the landscape features is included in Technical paper 4, including detailed landscape feature maps.

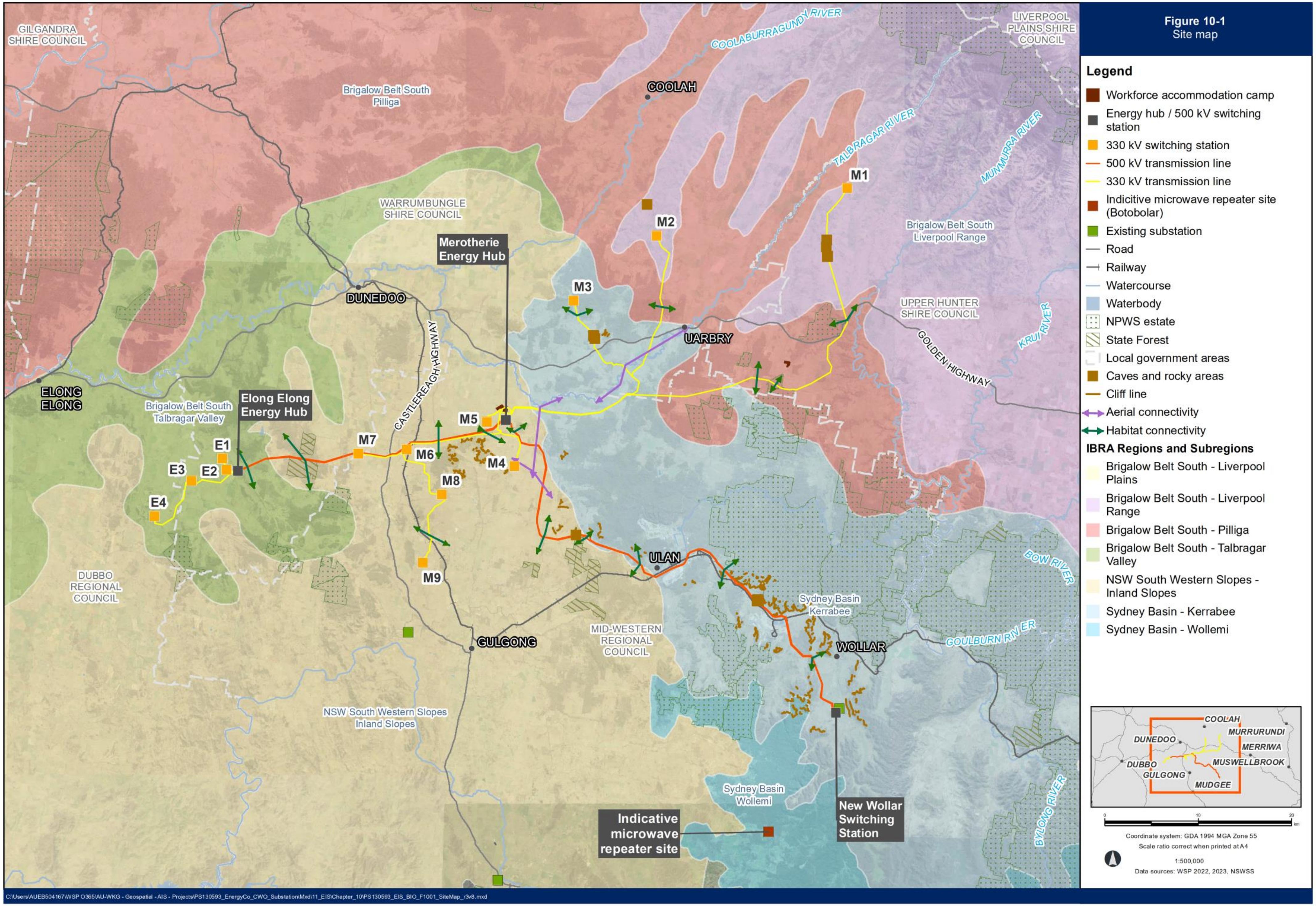

Figure 10-1
Site map
Legend
Workforce accommodation camp
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Indicitive microwave repeater site (Botobolar)
Existing substation
Road
Railway
Watercourse
Waterbody
NPWS estate
State Forest
Local government areas
Caves and rocky areas
Cliff line
Aerial connectivity
Habitat connectivity
IBRA Regions and Subregions
Brigalow Belt South - Liverpool Plains
Brigalow Belt South - Liverpool Range
Brigalow Belt South - Pilliga
Brigalow Belt South - Talbragar Valley
NSW South Western Slopes - Inland Slopes
Sydney Basin - Kerrabee
Sydney Basin - Wollemi
GILGANDRA SHIRE COUNCIL
LIVERPOOL PLAINS SHIRE COUNCIL
WARRUMBUNGLE SHIRE COUNCIL
UPPER HUNTER SHIRE COUNCIL
DUBBO REGIONAL COUNCIL
MID-WESTERN REGIONAL COUNCIL
COOLABURRAGUNDY RIVER
TALBRAGAR RIVER
MUNMURRA RIVER
KRUI RIVER
BOW RIVER
GOULBURN RIVER
BYLONG RIVER
GOLDEN HIGHWAY
CASTLEREAGH HIGHWAY
Brigalow Belt South Pilliga
Brigalow Belt South Liverpool Range
Brigalow Belt South Talbragar Valley
Sydney Basin Kerrabee
Sydney Basin Wollemi
NSW South Western Slopes Inland Slopes
COOLAH
DUNEDOO
UARBRY
ELONG ELONG
ULAN
GULGONG
WOLLAR
Merotherie Energy Hub
Elong Elong Energy Hub
New Wollar Switching Station
Indicative microwave repeater site
M1
M2
M3
M4
M5
M6
M7
M8
M9
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E2
E3
E4
COOLAH
MURRURUNDI
DUNEDOO
MERRIWA
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10.3.2 Native and exotic vegetation

Native vegetation covers around 40 per cent of the construction area, with the remaining areas consisting of buildings and roads, cropping land that has recently been ploughed and seeded, and improved pastures dominated by exotic pasture species. These areas are considered to be cleared of native vegetation (for the purposes of the LLS Act) and therefore were excluded from the biodiversity assessment, including the BAM-C.

Native vegetation recorded within the construction area has been assigned to four vegetation formations: Dry Sclerophyll Forests (Shrubby sub-formation), Dry Sclerophyll Forests (Shrub/grass sub-formation), Grassy Woodlands and Forested Wetlands.

Twenty-two PCTs occur or are assumed present in the construction area across the five IBRA sub regions, totalling 1,603 hectares. The PCTs are in varying condition, ranging from poor to moderate/good condition or are classified as thinned, derived native grassland or derived native shrubland. Derived native grassland or shrubland captures instances where the trees of the original PCT have been cleared but the remaining grasslands or shrub layer are dominated by native species. Detailed mapping of PCTs within the study area is included in Figure 14-7 of Technical paper 4.

Of the 22 PCTs, four are TECs under the BC Act and three are TECs under the EPBC Act (refer to Table 10-1).

Around 194 scattered trees, as defined in the BAM, have been identified in the construction area (refer to Figure 14-10 of Technical paper 4). Mature scattered trees within cleared landscapes are an important feature as they can provide important ecological function such as habitat. Scattered trees have been classified according to the associated PCT (consistent with the BAM).

Table 10-1 TECs identified within the construction area

Threatened ecological community (TEC)		Associated PCT	BC Act status[1]	EPBC Act status[1]	Area within the construction area (ha)
BC Act	EPBC Act				
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	Central Hunter Valley eucalypt forest and woodland	PCT 1176 – Slaty Box – Grey Gum shrubby woodland on footslopes of the upper Hunter Valley, Sydney Basin Bioregion	V	CE	2.27 (2.27)[2]
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	Grey Box (*Eucalyptus acrocarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	PCT 81 – Western Grey Box – cypress pine shrub grass shrub tall woodland in the Brigalow Belt South Bioregion	E	E	49.46 (6.92)[2]
Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	N/A	PCT 202 – Fuzzy Box woodland on colluvium and alluvial flats in the Brigalow Belt South Bioregion (including Pilliga) and Nandewar Bioregion	E	–	3.38

Threatened ecological community (TEC)		Associated PCT	BC Act status[1]	EPBC Act status[1]	Area within the construction area (ha)
BC Act	EPBC Act				
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions	White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	PCT 266 – White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	CE	CE	1,068.50 (304.78)[2]
		PCT 277 – Blakely's Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	CE	CE	
		PCT 281 – Rough-barked Apple – Red Gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South western slopes Bioregion and Brigalow Belt South Bioregion	CE	CE	
		PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	CE	CE	
		PCT 599 – Blakely's Red Gum – Yellow Box grassy tall woodland on flats and hills in the Brigalow Belt South Bioregion and Nandewar Bioregion	CE	CE	
		PCT 618 – White Box x Grey Box – red gum – Rough-barked Apple grassy woodland on rich soils on hills in the upper Hunter Valley	CE	CE	

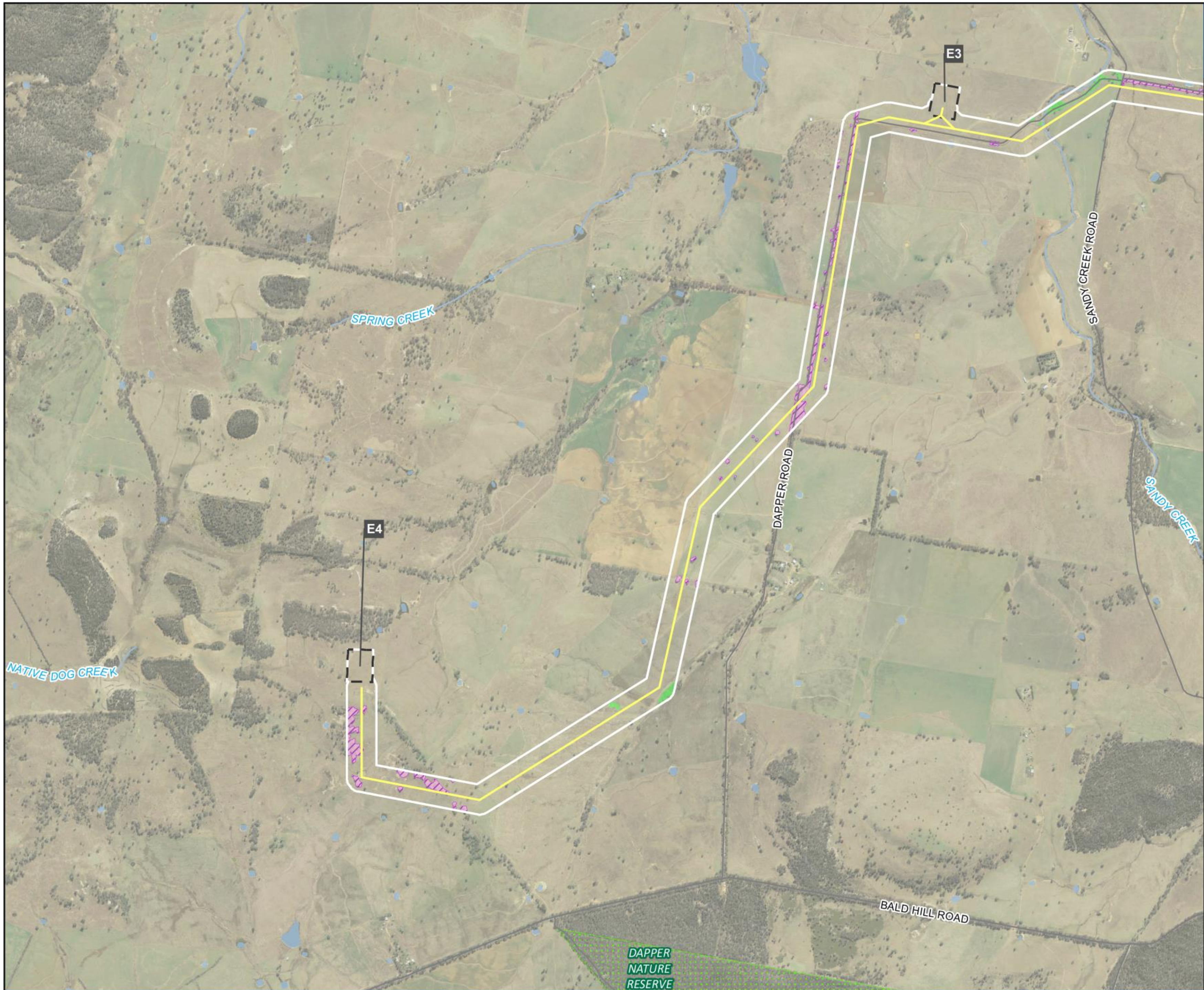
1. E – Endangered, CE – Critically endangered, V- Vulnerable
2. Total area of EPBC listed TEC

The extent of TECs vary across the construction area, as follows:

- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions is the most extensive TEC within the study area, with large extents located in the southeastern, central and northeastern sections of the construction area, and smaller patches in the western section (refer to Figure 14-8 of Technical paper 4).
- The extents of Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions are mostly located in the central section of the construction area (specifically the western portion of the Merotherie Energy Hub — Elong Elong Energy Hub connection) with some smaller patches within the northeastern section of the construction area (associated with the Tallawang south connection) (refer to Figure 10-2, which shows the full extent of this TEC within the construction area).
- The areas of Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions are limited to small patches in western section of the construction area (specifically within the Cobbora west connection and the Tallawang south connection) (refer to Figure 10-2, which shows the full extent of this TEC within the construction area).
- A small patch of Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion within the southeastern sections of the construction area (specifically the New Wollar Switching Station — Merotherie Energy Hub connection) (refer to Figure 10-2, which shows the full extent of this TEC within the construction area).

Figure 10-2 provides a snapshot of complete areas of Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion, and Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions. The full extent of all TECs is shown Figure 14-8 of Technical paper 4.

Figure 10-2
Threatened ecological communities
Map 1 of 4



Legend

- Study area
- 330 kV switching station
- 330 kV transmission line
- Road
- Watercourse
- Waterbody
- State Forest

EPBC Act listed TEC

- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered Ecological Community

BC Act listed Threatened Ecological Community (TEC)

- Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions – Endangered Ecological Community
- White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions – Critically Endangered Ecological Community

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Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

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Data sources: WSP 2023, NSWSS, EnergyCo

Figure 10-2
Threatened ecological communities
Map 2 of 4

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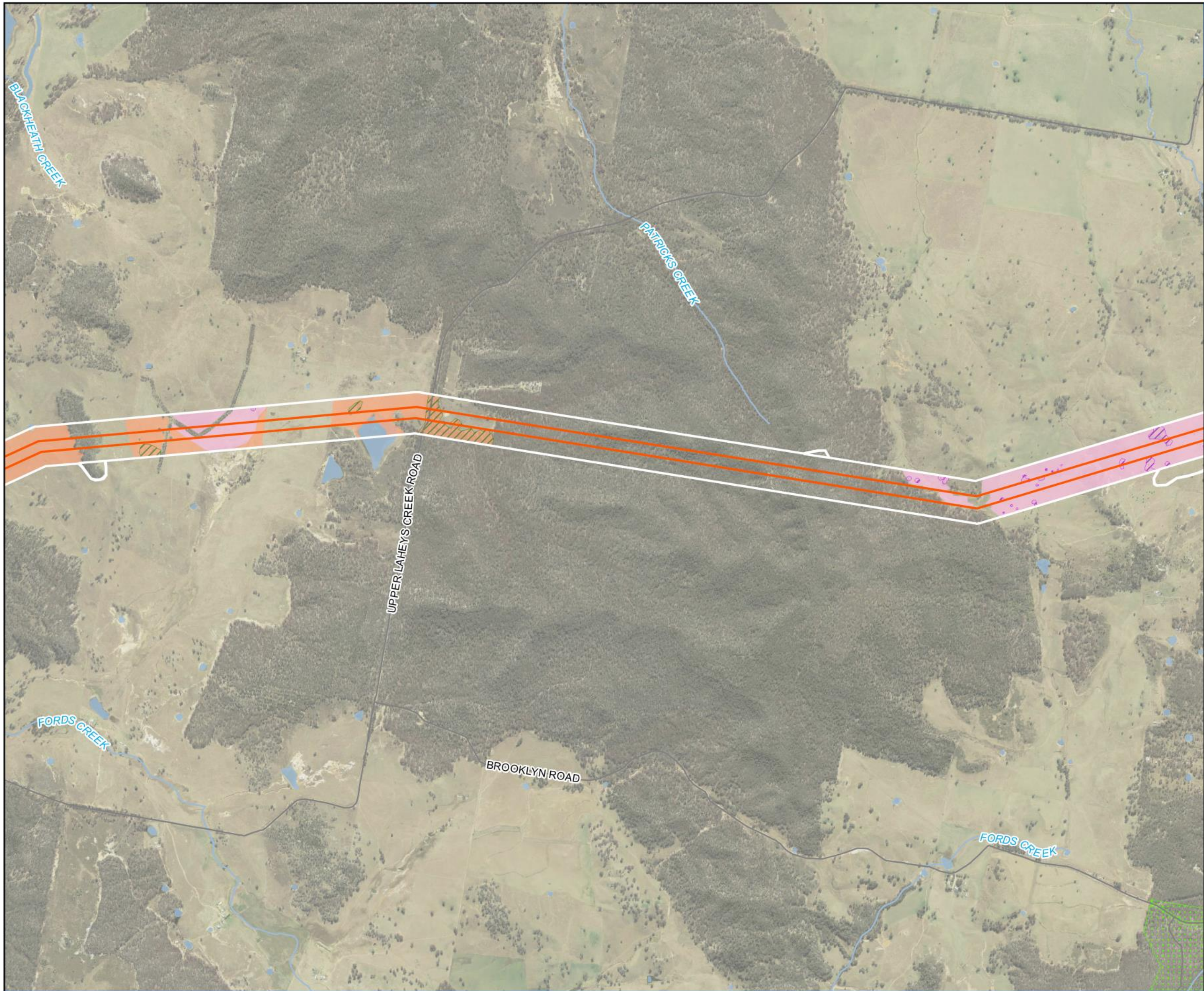
Figure 10-2
Threatened ecological communities
Map 3 of 4



Legend

- Study area
- 500 kV transmission line
- Road
- Watercourse
- Waterbody
- State Forest

EPBC Act listed TEC

- Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia - Endangered Ecological Community
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered Ecological Community

BC Act listed Threatened Ecological Community (TEC)

- Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions - Endangered Ecological Community
- White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions – Critically Endangered Ecological Community

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:35,000
Data sources: WSP 2023, NSWSS, EnergyCo

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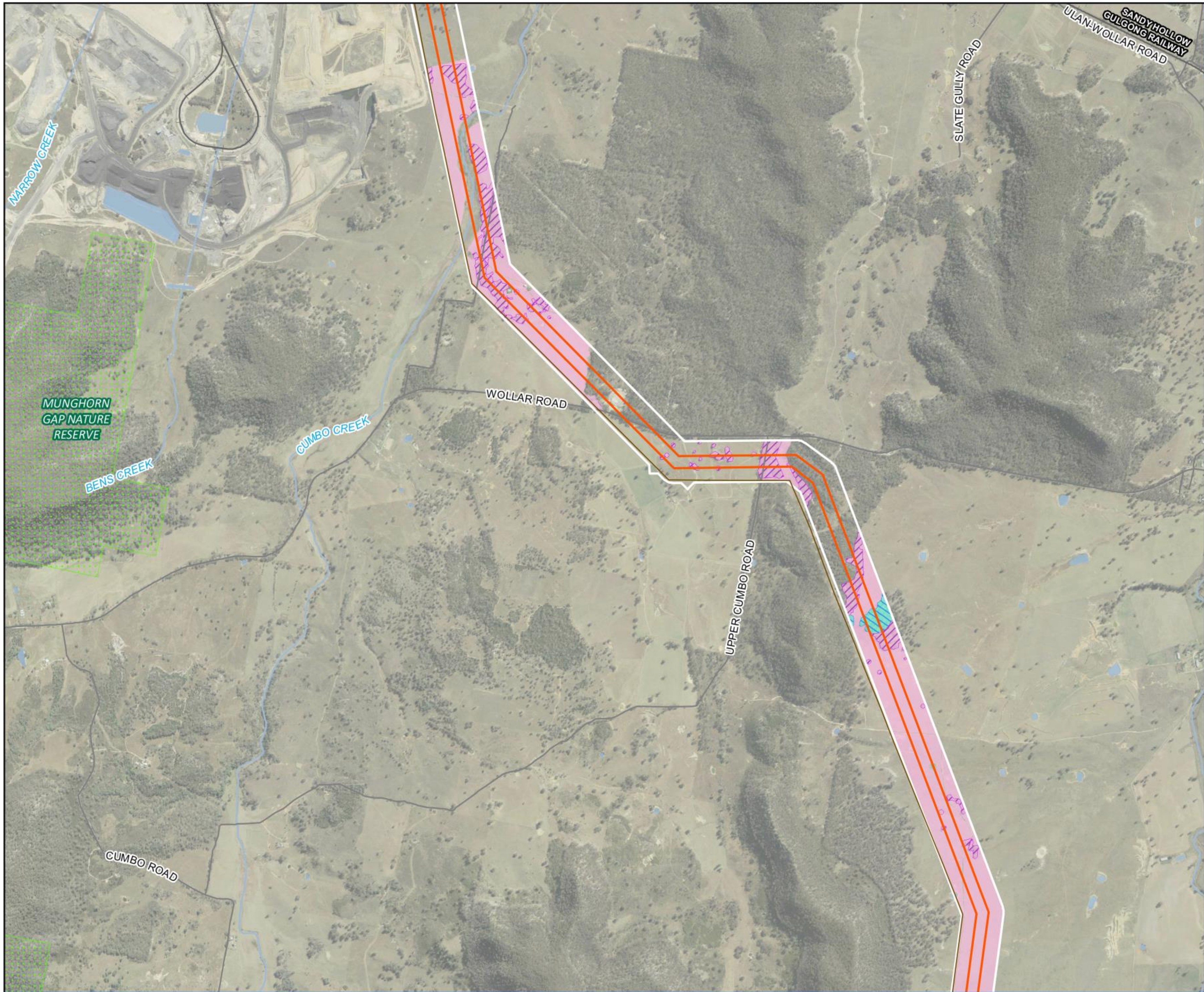
Figure 10-2
Threatened ecological communities
Map 4 of 4



Legend

- Study area
- 500 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse

EPBC Act listed TEC

- Central Hunter Valley eucalypt forest and woodland - Critically Endangered
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered Ecological Community

BC Act listed Threatened Ecological Community (TEC)

- TEC Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion
- White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions – Critically Endangered Ecological Community

0 500 1,000 Meters

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:35,000
Data sources: WSP 2023, NSWSS, EnergyCo

10.3.3 Threatened flora species

The threatened flora species or listed populations recorded within the construction area during surveys included:

- Ausfeld's Wattle (*Acacia ausfeldii)*, listed as vulnerable under the BC Act
- *Eucalyptus camaldulensis* population in the Hunter catchment, an endangered population under the BC Act
- Capertee Stringybark (*Eucalyptus cannonii*), listed as vulnerable under the BC Act
- Bluegrass (*Dichanthium setosum*), listed as vulnerable under both the BC Act and EPBC Act
- *Leucochrysum albicans subsp. Tricolor*, listed as endangered under the EPBC Act.

Plants similar to Silky Swainson-pea (*Swainsona sericea,* listed as vulnerable under the BC Act) were recorded during field surveys and referred to the Royal Botanic Gardens for confirmation. Until confirmation or otherwise, it is assumed this species has been assumed as present in the construction area.

Twelve additional threatened flora species credit species have been assumed to occur within the construction area based on the desktop assessment, presence of suitable habitat and field observations. Of the threatened flora species assumed to occur within the construction area, eight are also listed under the EPBC Act.

Further detail on the species present or assumed to occur within the study area is provided in chapter 5 of Technical paper 4.

10.3.4 Threatened fauna species

The threatened fauna species or evidence of foraging recorded within the construction area during surveys included:

- Glossy Black-Cockatoo (*Calyptorhynchus lathami*), listed as vulnerable under both the BC Act and EPBC Act
- Little Eagle (*Hieraaetus morphnoides*), listed as vulnerable under the BC Act
- Masked Owl (*Tyto novaehollandiae*), listed as vulnerable under the BC Act
- Barking Owl (*Ninox connivens*), listed as vulnerable under the BC Act
- Squirrel Glider (*Petaurus norfolcensis)*, listed as vulnerable under the BC Act
- Large-eared Pied Bat (*Chalinolobus dwyeri),* listed as vulnerable under the BC Act and EBBC Act
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*), listed as vulnerable under the BC Act
- Eastern Cave Bat (*Vespadelus troughtoni*), listed as vulnerable under the BC Act.

Thirteen additional threatened fauna species listed under the BC Act (comprising credit species, ecosystem credit species or dual credit species) have been assumed to occur within the construction area based on the desktop assessment, presence of suitable habitat or potentially suitable habitat (but yet not surveyed) and field observations. This includes bird, mammal, frog, reptile and insect species. Of the threatened species assumed to occur within the construction area, nine are also listed under the EPBC Act.

The construction area is also within the mapped important habitat area for Regent Honeyeater (*Anthochaera Phrygia*). The Regent Honeyeater is a critically endangered species under the BC Act and EPBC Act. No visual observations were made during the survey periods but is assumed present.

Further detail on the species present or assumed to occur within the study area is provided in chapter 5 of Technical paper 4.

10.3.5 Migratory species

Nineteen migratory species listed under the EPBC Act are predicted or known to occur within the locality. Migratory terrestrial species that are considered moderately likely to occur in, or fly over, the study area based on the presence of suitable habitats, and include:

- Migratory marine birds – Fork-tailed Swift (*Apus pacificus)*
- Migratory wetland species – Common Sandpiper (*Actitis hypoleucos*), Sharp-tailed Sandpiper (*Calidris acuminata)*, Latham's Snipe *(Gallinago hardwickii)*
- Migratory terrestrial species – Satin Flycatcher (*Myiagra cyanoleuca*), White-throated Needletail (*Hirundapus caudacutus*), Black-faced Monarch (*Monarcha melanopsis*), Yellow Wagtail (*Motacilla flava*) and Rufous Fantail (*Rhipidura rufifrons*).

No migratory species predicted or known to occur were recorded during field surveys, and no areas of important habitat were mapped. While some migratory species are likely to use the study area, the locality and construction area does not contain important habitat, and does not support a nationally or internationally significant proportion of a migratory species population.

10.3.6 Aquatic ecology

The project is located across the Macquarie River and Hunter River catchments, and crosses 29 named watercourses (including perennial and ephemeral watercourses), as well as several unnamed drainage lines. Section 19.1 (Hydrology, flooding and water quality) of this EIS provides a summary of watercourses intersected by the project as well as their Strahler stream order. All watercourses except for the Talbragar River, are ephemeral and are dependent on rainfall events for flow. Watercourses intersected by the construction area, which contain key fish habitat include:

- Wilpinjong Creek
- Sportsmans Hollow Creek
- Talbragar Creek
- Wagrobil Creek
- Laheys Creek.

The construction area contains mapped habitat for aquatic species and populations listed under the FM Act, including habitat for:

- the Southern Purple Spotted Gudgeon (listed as Endangered under the FM Act), mapped in the Talbragar Valley and Inland Slopes IBRA subregions in Sandy Creek, Laheys Creek, Patricks Creek, Tucklan Creek, Tallawang Creek, Huxleys Creek, Slapdash Creek, and White Creek, and some smaller unnamed watercourses
- the Eel Tailed Catfish in the Murray-Darling Basin (listed as Endangered Population under the FM Act), mapped in Talbragar River in the Inland Slopes IBRA subregion
- the Darling River Hardyhead in the Hunter River Catchment (listed as Endangered Population under the FM Act), mapped in Turill Creek, Four Mile Creek in the Pilliga and Liverpool Range IBRA subregions.

In the absence of any targeted aquatic threatened species surveys, these species are assumed to occur. It is noted an incidental observation of Eel Tailed Catfish was made in Laheys Creek during nocturnal bird and mammal surveys.

There are no FM Act listed ecological communities present in the construction area.

10.3.7 Groundwater dependent ecosystems

The Bureau of Meteorology's GDE Atlas (Bureau of Meteorology (BOM), 2022) identifies 17 unique high priority terrestrial GDEs and five high priority aquatic GDEs within the study area.

Terrestrial native vegetation high priority GDEs generally comprise of Grassy Woodland and Forested Wetland vegetation formation. High priority terrestrial GDEs are generally limited to patches of remnant vegetation mostly located in the southern eastern and western sections of the study area, with smaller patches around the central section. High priority aquatic GDEs are limited to small sections of vegetation along Rouses creek, Sportsman Hollow Creek, Stubbo Creek, the Talbragar River and Tallawang Creek.

Table 10-2 provides a summary of high priority GDEs within the study area, with their locations show on Figure 14-17 of Technical paper 4.

Table 10-2 High priority GDE's within the study area (BOM 2022)

Type	GDE name	Catchment	Area (ha)
Terrestrial	*Angophora floribunda, Eucalyptus blakelyi, Eucalyptus melliodora, Acacia implexa, Dodonaea viscosa*	Macquarie-Bogan Rivers/ Hunter River	61.5 / 0.7
Terrestrial	*Angophora floribunda, Eucalyptus melliodora, Brachychiton populneus subsp. populneus, Callitris endlicheri*	Macquarie-Bogan Rivers	6.6
Terrestrial	Black Sallee – Tussock Grass open woodland of the South Eastern Highlands Bioregion	Macquarie-Bogan Rivers	0.1
Terrestrial	Blakelys Red Gum – Rough-barked Apple shrubby woodland of central and upper Hunter	Hunter River/ Macquarie-Bogan Rivers	42.9 / 37
Terrestrial	Blakelys Red Gum – Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion	Macquarie-Bogan Rivers	21.5
Terrestrial	*Eucalyptus blakelyi, Eucalyptus melliodora , Eucalyptus bridgesiana/Acacia dealbata/Themeda triandra*	Macquarie-Bogan Rivers	7.9
Terrestrial	*Eucalyptus camaldulensis, Casuarina cunninghamiana, Callistemon sieberi, Leptospermum polygalifolia*	Macquarie-Bogan Rivers	9.3
Terrestrial	*Eucalyptus conica, Eucalyptus blakelyi, Eucalyptus melliodora, Callitris glaucophylla, Acacia decora*	Macquarie-Bogan Rivers	15.6
Terrestrial	*Eucalyptus fibrosa, Callitris endlicheri, Eucalyptus sparsifolia, Acacia linearifolia, Phyllanthus hirtellus*	Macquarie-Bogan Rivers	2.0
Terrestrial	*Eucalyptus melliodora, Eucalyptus blakelyi, Angophora floribunda/Acacia implexa , Geijera parviflora*	Macquarie-Bogan Rivers	5.3
Terrestrial	*Eucalyptus melliodora, Acacia decora, Maireana microphylla, Bothriochloa macra, Austrostipa bigeniculata*	Macquarie-Bogan Rivers	0.2
Terrestrial	*Eucalyptus melliodora, Pimelea curviflora var. curviflora, Acacia implexa, Acacia decora*	Macquarie-Bogan Rivers	5.2
Terrestrial	*Eucalyptus microcarpa, Callitris glaucophylla, Allocasuarina luehmannii, Maireana microphylla*	Macquarie-Bogan Rivers	42.7
Terrestrial	River Oak/Purple Wiregrass/Plains Grass grassy riparian forest of the Merriwa Plateau	Hunter River	3.1
Terrestrial	River Red Gum riparian tall woodland/open forest wetland in the Nandewar Bioregion and Brigalow Belt	Macquarie-Bogan Rivers	11.7
Terrestrial	Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats	Hunter River/ Macquarie-Bogan Rivers	18.6 / 2.4

Type	GDE name	Catchment	Area (ha)
Terrestrial	Western Hunter Flats Rough-barked Apple Forest	Hunter River/ Macquarie-Bogan Rivers	238.9 / 7.5
Aquatic	Rouses	Hunter River	0.03
Aquatic	Sportsmans Hollow	Hunter River	11
Aquatic	Stubbo	Macquarie-Bogan Rivers	0.7
Aquatic	Talbragar River	Macquarie-Bogan Rivers	11.5
Aquatic	Tallawang	Macquarie-Bogan Rivers	4.7

10.4 Potential impacts – construction

This section presents the potential residual impacts of the project on biodiversity during construction which have not been avoided based on design development to date. Key impacts on biodiversity during construction include the clearing of native vegetation, the removal of threatened species and/or their habitats, and indirect impacts that can impact adjacent vegetation or habitats due to disturbance by construction nearby or as a result of the spread of a weed or pathogen.

10.4.1 Avoidance and minimisation of impacts

The development of the design of the project has sought to balance the various potential environmental and social constraints of the study area with engineering limitations and project cost (refer to Chapter 2 (Strategic context) of this EIS for more information about project development). This includes maximising the avoidance and/or minimisation of biodiversity impacts where practicable, including:

- selection of an intentionally narrow study corridor to reflect the presence of biodiversity constraints including Goulburn River National Park, Munghorn Gap Nature Reserve, and mapped Important Regent Honeyeater habitat.
- locating sections of the study corridor in disturbed mining areas and adjacent to existing transmission lines where practicable to avoid or minimise impacting important biodiversity constraints including Important Regent Honeyeater habitat
- use of large areas of cleared land to enable development of a transmission line alignment that avoids or minimises impacts to high-quality ecological values, where practicable
- avoidance of populations of *Zieria ingramii, Diuris tricolor* and *Homoranthus darwinioides* identified during field surveys near Spring Ridge Road and Sandy Creek Road at Cobbora
- avoidance of identified breeding habitat for the Little Eagle at the Merotherie energy hub site
- inclusion of the 330 kV transmission line connections to potential future and approved renewable energy generation projects as part of the project, to provide an optimised transmission network solution that would reduce both the number and length of transmission lines in the network by providing a coordinated approach to their development, thereby minimising potential environmental impacts associated with this infrastructure
- selection of an east-west alignment between the Merotherie and Elong Elong energy hubs that traverses the narrowest section of intact vegetation that is contiguous with Tuckland State Forest, and uses areas that are devoid of TECs such as areas to the east and west of Wallerawang Gwabegar Railway

- rationalisation of 330 kV switching station locations and associated transmission lines at Elong Elong Energy Hub in order to maximise the use of Category 1 land (exempt land under the LLS Act) as well as the removal of a northern connection across Spring Ridge Road that impacted mapped TECs along Laheys Creek
- replacement of the proposed Uarbry Energy Hub with 330 kV switching stations within the development footprints of the Liverpool Range and Valley of the Winds projects, thereby avoiding impacts to TECs located on the wide valley floor in the area between the two renewable energy projects. EnergyCo also developed a transmission alignment to the Liverpool Range Wind Farm project that terminated further south than the original location resulting in comparatively less impacts to Box Gum Woodland
- termination of the project at Elong Elong Energy Hub, which avoided areas of mapped TECs in varying condition to the south-west towards Uungula and south to Burrendong (noting this corridor may be investigated in the future and subject to a separate assessment and approval)
- use of predominately Category 1 land in the positioning of infrastructure within the preferred sites selected for Elong Elong and Merotherie energy hubs
- selection of vegetation clearing strategies to avoid full clearing of the construction area in its entirety and/or the operation area
- use of areas that have been previously disturbed (such as roads, tracks, fence lines)
- selection of ancillary facilities sites (such as construction compounds) in areas that:
  - have been previously disturbed or would require disturbance for permanent infrastructure as part of the operation of the project
  - are areas of lower ecological and heritage value
  - avoid impacts to threatened species (or their habitats)
  - are located at an appropriate distance from watercourses (greater than 200 metres)
- avoidance of impacts to caves, where practicable
- avoidance or minimisation of impacts to rocky habitats, habitat connectivity and species movement, as well as impacts to water-related values and impacts of vehicle strike.

10.4.2 Native vegetation

Construction of the project would result in direct impacts to around 1,032 hectares of native vegetation (including areas of TEC) comprising:

- approximately 592 hectares of full clearing (Disturbance area A) within the easement or elsewhere within the construction area (such as energy hubs, switching stations, brake and winch sites, accommodation camps, and construction compounds). At locations where permanent infrastructure would be constructed (i.e. energy hubs, switching stations and transmission line towers), these impacts, while commencing during construction would likely be permanent. In areas where permanent infrastructure would not be located (i.e. accommodation camps, brake and winch sites), these areas would be temporarily impacted and regenerated following construction
- approximately 433 hectares of partial clearing (Disturbance area B) within the easement, where the ground layers remain (such as the areas between and adjacent to transmission line towers, or areas around individual construction facilities including compounds and workforce accommodation camps)
- approximately seven hectares within a hazard tree zone (Disturbance area HZ), where trees within the risk category height range of 20–30 metres are considered for structural stability, with trees that post a risk of falling removed.

Table 10-3 provides a summary of the direct impacts on the TECs listed under the BC Act and EPBC Act.

Where partial clearing occurs, the integrity of the remaining PCT would be impacted in terms of its composition and condition (structural and function). However, it would avoid total loss of species richness of the PCT, encourage continued presence of native species in these areas and limit the colonisation opportunities for introduced species.

Two of the four TECs are listed as being at risk of SAII, and direct impacts to one EPBC listed TEC (White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland) are identified as being potentially significant.

Offsets for full and partial clearing would be required and are outlined in Section 10.6.3, noting some PCTs would not require offsets in accordance with the BAM. Opportunities to further reduce the impacts to native vegetation, particularly TECs, would be considered during detailed design.

Table 10-3 Summary of direct impacts of the project on TECs

Threatened ecological community (TEC)		Direct impact (ha)		Risk of SAII
BC Act	**EPBC Act**	**BC Act**	**EPBC Act**	
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	Central Hunter Valley eucalypt forest and woodland	1.96	1.95	N/A
Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions	Grey Box (*Eucalyptus acrocarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia	20.26	5.98	N/A
Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	N/A	2.99	N/A	Yes
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions	White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland	575.95	287.45	Yes
	Total	601.16	295.38	–

10.4.3 Terrestrial flora

Sixteen threatened flora species listed under the BC Act would be directly impacted by the project, and would require an offset (as per the BAM) (refer to Table 10-4).

A total of 12 flora species listed under the EPBC Act would be impacted by the project, of which no impacts are identified as being potentially significant.

Table 10-4 Direct impacts of the project on threatened flora species or populations (species credit species)

Scientific name/Common name	Listing[1]		Loss of habitat (ha) or individuals (known presence)	Loss of habitat (ha) or individuals (assumed presence)	Risk of SAII
	BC Act	EPBC Act			
Acacia ausfeldii/Ausfeld's Wattle	V	–	4.35	4.26	N/A
Commersonia rosea/Commersonia rosea	E	E	0	3.25	Yes
Dichanthium setosum/Bluegrass	V	V	3.8	124.74	N/A
Eucalyptus camaldulensis – endangered population/ Eucalyptus camaldulensis population in the Hunter catchment	E	–	1.4	0	N/A
Eucalyptus cannonii/Capertee Stringybark	V	–	12 plants	0	N/A
Euphrasia arguta/Euphrasia arguta	CE	CE	0	7.54	Yes
Homoranthus darwinioides/Fairy Bells	V	V	0.12	9.39	N/A
Leucochrysum albicans var. tricolor/Hoary Sunray	–	E	5 plants	0	N/A
Monotaxis macrophylla/Large-leafed Monotaxis	E	–	0	43.7	N/A
Ozothamnus tesselatus/Ozothamnus tesselatus	V	V	0	3.3	N/A
Pomaderris queenslandica/Scant Pomaderris	E	E	0	0.73	N/A
Swainsona recta/Small Purple-pea	E	E	0	3.9	N/A
Swainsona sericea/Silky Swainson-pea	V	–	0.14	15.61	N/A
Tylophora linearis/Tylophora linearis	V	E	0	23.84	N/A
Digitaria porrecta/Finger Panic Grass	E	–	0	2.2	N/A
Thesium australe/Austral Toadflax	V	V	0	2.2	N/A
Androcalva procumbens/Androcalva procumbens	–	V	0	15.9	N/A
Pomaderris cotoneaster/Cotoneaster Pomaderris	E	E	0	21.2	N/A

1. V – Vulnerable, E -Endangered, CE – Critically endangered

Two threatened flora species are identified as being at risk of an SAII. This includes *Euphrasia arguta* and *Commersonia rosea*. These species are assumed to occur (due to access constraints during field survey) based on the presence of potential habitat, though the likelihood of a population of either species being present in the subject land is low (refer to Technical paper 4).

10.4.4 Terrestrial fauna

Threatened fauna species

Fifteen threatened fauna species listed under the BC Act would be directly impacted by the project and require an offset (as per the BAM requirements) (refer to Table 10-5).

Nine fauna species listed under the BC Act are also listed under the EPBC Act and would be directly impacted by the project, with impacts to one fauna species (Regent Honeyeater) identified as being potentially significant.

Table 10-5 Summary of direct impacts of the project on threatened fauna species (species credit species)

Scientific name/Common name	Listing[1]		Loss of habitat (ha) (known presence)	Loss of habitat (ha) (assumed presence)	Risk of SAII
	BC Act	EPBC Act			
Anthochaera phrygia/Regent Honeyeater	CE	CE, M	95.8	0	Yes
Aprasia parapulchella/Pink-tailed Legless Lizard	V	V	0	16.36	N/A
Calyptorhynchus lathami/Glossy Black-Cockatoo	V	V	0	31.4	N/A
Cercartetus nanus/Eastern Pygmy-possum	V	–	0	151.22	N/A
Chalinolobus dwyeri/Large-eared Pied Bat	V	V	130.3	0	Yes
Delma impar/Striped Legless Lizard	V	V	0	83.4	N/A
Hoplocephalus bitorquatus/Pale-headed Snake	V	–	0	92.34	N/A
Hoplocephalus bungaroides/Broad-headed Snake	E	V	0	10.8	Yes
Ninox connivens/Barking Owl	V	–	0	23.6	N/A
Petaurus norfolcensis/Squirrel Glider	V	–	107.53	270.31	N/A
Petrogale penicillata/Brush-tailed Rock-wallaby	E	V	0	19.9	Yes
Phascolarctos cinereus/Koala	E	E	0	608.8	N/A
Tyto novaehollandiae/Masked Owl	V	–	0	6.63	N/A
Vespadelus troughtoni/Eastern Cave Bat	V	–	39.28	0	Yes
Polytelis swainsonii/Superb Parrot	V	V	0	2.63	N/A

1. V – Vulnerable, E -Endangered, CE – Critically endangered, M - Migratory

Five threatened fauna species are identified as being at risk of an SAII. This includes two threatened microbat species (Eastern Cave Bat and Large-eared Pied Bat), Brush-tailed Rock-wallaby, Borad-headed snake, and the Regent Honeyeater.

The project would impact habitat buffers associated with breeding habitat for the cave-dependant microbat species, Brush-tailed Rock-wallaby and Broad-headed snake. Specifically, the construction of the project:

- would directly impact some areas located within 100 metres of potential breeding habitat for two threatened microbat species (refer to Table 10-5). While this would comprise potential foraging habitat, it would not result in the removal of any assumed breeding habitat features such as caves
- includes some areas of potential foraging habitat of the Brush-tailed Rock-wallaby, however the likelihood of a sub-population being present is low (refer to Technical paper 4), and the project would not directly impact on irreplaceable habitat features such as rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines

- includes areas located within of 100 m of assumed potential habitat of the Broad-headed Snake (exposed rocky sites on sandstone outcrops and benching, especially in areas with a west to north-west aspect and large hollow-bearing trees). However, construction would not directly impact on irreplaceable habitat features.

The project would impact around 96 hectares of mapped 'important habitat' for the Regent Honeyeater, which represents around 0.32 per cent of the species' geographical range. This would result in localised fragmentation of the species habitat. However the population is not currently considered to be severely fragmented (based on EPBC Act criteria and regulations), and therefore there is no evidence that the population would become unviable as a result of the project's construction.

Fauna habitat and connectivity

The removal of vegetation communities would impact fauna due to the removal of foraging and breeding habitats (as outlined in Table 10-5).

Built structures such as old farm buildings and wooden fence posts that can provide threatened species habitat is located within the construction area. No evidence of potential use by threatened species was recorded during survey. Any impact due to the removal of these structures would be minor and mitigation measures (including pre-clearing surveys required under mitigation measure B10) would be implemented to minimise risk of mortality.

Scattered trees located within the construction area would be removed and would be offset in accordance with the BAM. Most of these trees contain hollows that have the potential to provide habitat for native fauna.

Construction of the project has the potential to impact habitat connectivity for the Squirrel Glider, threatened woodland birds and threatened bat species where the transmission line easement intersects areas of native vegetation including:

- in the Durridgere State Conservation Area and surrounding native vegetation
- areas adjacent to the Tuckland State Forest
- along Spring Ridge Road and the nearby riparian corridor
- in large patches of vegetation between the Goulburn River National Park, Cope State Forest and Munghorn Gap Nature Reserve.

During construction, the transmission line corridor would be permeable and impacts to connectivity would be minor.

10.4.5 Indirect impacts

A summary of indirect impacts associated with construction is presented in Table 10-6.

Table 10-6 Summary of indirect impacts during construction

Indirect impact	Details	Consequence
Inadvertent impacts on adjacent habitat or vegetation	Construction of the project has the potential to result in the abandonment of nests of threatened bird species (specifically the Little Eagle) if disturbed. In addition, the construction area is within 100 metres of rocky areas containing caves, overhangs, crevices, cliffs or escarpments that may be breeding habitat for threatened micro bat species. Breeding success may be influenced by construction during the breeding season. Disturbance of soils and construction activities have the potential to result in sedimentation and erosion, and mobilisation of contaminants, which could impact adjoining native vegetation and aquatic habitats. If not properly managed, sediment laden runoff and spills could impact water quality and impact aquatic life, particularly where the construction area is located near rivers, creek lines and key fish habitats. These impacts have the potential to temporarily reduce the viability of habitat for aquatic and semi aquatic species, however, would be readily managed through mitigation measures (refer to Section 19.1 (Hydrology, flooding and water quality)).	Moderate
Reduced viability of adjacent habitat due to edge effects	During construction, the clearing of native vegetation would result in new edges being created, however indirect impacts on adjacent native vegetation are unlikely due to the observed quality of the woodland and forest habitats adjacent to these areas. These impacts while considered negligible, would be greatest during construction, and decrease over time with increased resilience of managed vegetation and habitats over time.	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 are unlikely to have long term adverse impacts on the viability of adjacent habitats, as: • noise impacts would be short-term and mostly limited to day time periods • light spill is not expected to be to an extent that would impact the viability of adjacent habitats. Mitigation measures would require lighting designs to be in accordance with the *National Light Pollution Guidelines for Wildlife* (DCCEEW, 2023) • in terms of increased dust: — construction impacts associated with permanent vegetation clearing is limited to areas subject to full clearing (i.e. Disturbance area A). Along the transmission line, this clearing area would mostly be buffered by vegetation that would be subject to partial clearing. Partial clearing would have limited dust generation — increased vehicle movements would have a short-term increase in localised dust levels although given the ongoing agricultural landscape usage, current dust levels are unlikely to substantial increase to an extent that would adversely reduce the viability of adjacent habitats. Beyond the transmission line, dust impacts are likely to also be limited and short term in nature.	Negligible
Transport of weeds and pathogens from the site to adjacent vegetation	The spread of weeds and pathogens has the potential to lead to long term impacts via a reduction of native vegetation integrity in surrounding habitats. However, biosecurity measures would be implemented during construction to ensure risks are managed appropriately.	Negligible
Increased risk of starvation, exposure and loss of shade or shelter	Displacement of resident fauna species during native vegetation clearing is considered relatively low due to the modified vegetation structure resulting from long term agricultural stock grazing. Given the linear nature of the project and mostly highly mobile nature of most potential resident fauna species the increased risk of starvation, exposure and loss of shade or shelter due to the project is considered low.	Negligible

Indirect impact	Details	Consequence
Loss of breeding habitats	The loss of breeding habitat such as hollow-bearing trees, nests, dreys, burrows and fallen timber has the potential to affect native animals such as: • hollow-dependent bats • hollow-nesting and canopy-nesting birds • arboreal mammals • reptiles and amphibians • terrestrial fauna (incl. species that utilise burrows and fallen timber). The loss of breeding habitats is unlikely to extend beyond the construction area. Impacts beyond this area would be avoided through mitigation and management measures.	Moderate
Trampling of threatened flora species	Reduction in population extent and available habitat of threatened flora species that occur in the ground stratum could occur due to trampling or unauthorised material, storage, vehicle and plant equipment. Mitigation measures would include protection for these areas and inadvertent impacts such as trampling is considered unlikely.	Low
Increased risk of fire	During construction, the project would implement the required bushfire management measures to manage any increased risk of bushfire. APZs have been included in the construction area.	Low

10.4.6 Aquatic ecology

Construction of the project would be mostly limited to above-ground construction activities. All permanent disturbance areas (initially disturbed during construction) are located outside core riparian zone areas, and all transmission line towers would be located at least 50 metres away from waterways. Any indirect impacts associated with construction of the project (such as reduction in water quality due to soil erosion), would be readily managed through mitigation measures (refer to Section 19.1 (Hydrology, flooding and water quality)).

Direct impacts to riparian areas (and key fish habitat), which has the potential to result in impacts to processes which sustain threatened biodiversity, would be limited to:

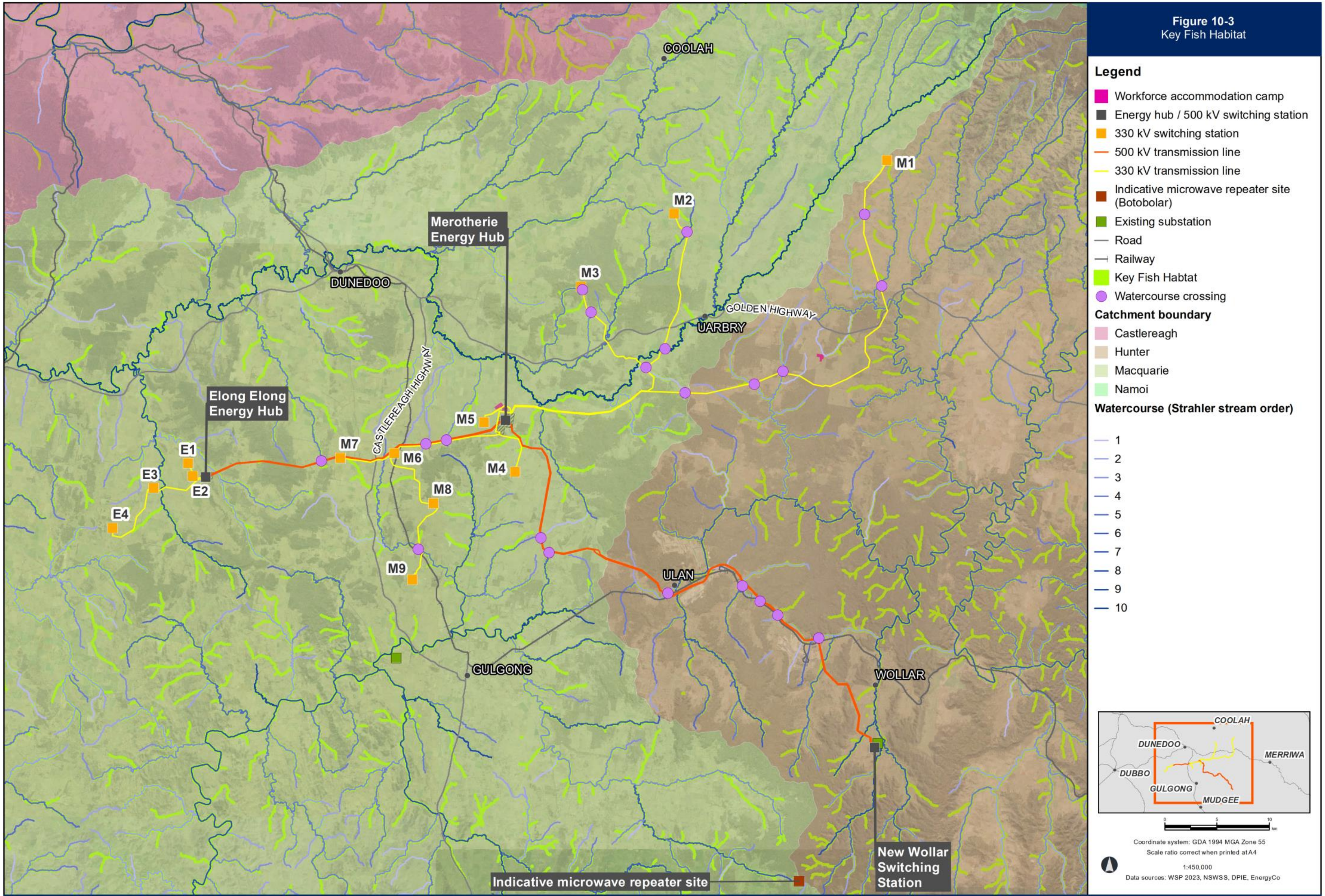
- the removal or trimming of tree canopy on the watercourse banks to facilitate the construction of the powerlines spanning each riparian area
- the installation of temporary watercourse crossings in the form of culverts, causeways, or fords, where alternative vehicle access routes are impractical.

To minimise the disturbance of the bed and banks of waterways, where the trimming of riparian vegetation is required, all trunk bases and understorey would be retained in-situ adjoining the watercourse banks. In addition, all water course crossings would be designed and installed in accordance with relevant Department of Primary Industries (DPI) guidelines for watercourse crossings including:

- *Why do fish need to cross the road? Fish Passage Requirements for Waterway Crossings* (DPI, 2003)
- *Guidelines for Controlled Activities on Waterfront* Land (DPI, 2012)
- *Policy and Guidelines for Fish Habitat and Conservation and Management* (DPI, 2013).

Temporary impact associated with vehicle water crossings during construction would be limited where practicable to existing farm tracks and crossing points, and any impact to water quality would be temporary and negligible. Each riparian area would continue to function as it currently performs. It is considered unlikely that temporary impacts would result in any long term degradation of mapped key fish habitat areas or aquatic ecology.

Figure 10-3
Key Fish Habitat



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10.4.7 Groundwater dependent ecosystems

Construction of the project would result in direct impacts to around 45 hectares of vegetation in areas mapped as high priority GDEs. These direct impacts have been considered in the assessment of construction impacts outlined in Section 10.4.2.

With reference to the indirect impacts on GDEs, none of the construction activities would result in any permanent groundwater take or permanent groundwater drawdown that would alter the groundwater flow outside of the direct impact areas. Given this, native vegetation assessment under the BAM is considered adequate to address the direct impacts on terrestrial GDE native vegetation and the proposed development is considered unlikely to result in any indirect additional impact on GDEs.

Further details on the impacts of the project on groundwater is included in Section 19.3 (Groundwater).

10.5 Potential impacts – operation

The project would have limited ongoing biodiversity impacts once operational. The key potential operational impacts are associated with access to the operation area for the maintenance of infrastructure, ongoing vegetation management, collision with transmission lines, and the potential for impacts of EMF on local fauna populations.

10.5.1 Native vegetation and terrestrial flora

Ongoing vegetation management is likely to occur every 12 months to maintain vegetation heights to manage risks associated with bushfire and adequate clearance within transmission line easements. The impacts of this activity have been factored into the construction impact assessment through the predicted impacts to vegetation integrity.

Maintenance activities have the potential for:

- inadvertent impacts to retained threatened flora or habitats that occur at ground level due to trampling or unauthorised material, storage, vehicle and plant equipment being placed in these areas. Should this occur, it would have a low impact on threatened flora or their habitats
- the spread of weeds and pathogens, which would lead to a reduction in native vegetation integrity (in the absence of controls).

All maintenance activities during operation would be subject to environmental protocols to ensure retained biodiversity values are adequately protected and appropriate biosecurity controls are in place (refer to Section 10.6).

10.5.2 Terrestrial fauna

Noise, dust and light impacts

Maintenance activities have the potential to generate noise, dust or light which may impact areas of fauna habitats which adjoin operational areas. Excessive noise and light can alter the behaviour of fauna or interfere with the normal functioning of fauna (including nocturnal fauna). Excessive dust can impact vegetation growth and the health of adjacent vegetation. During operation:

- the generation of noise and dust, mostly due to vehicle movements, is likely to be minimal as it would generally be undertaken over a short duration, and periodically, based on scheduled maintenance times
- there would be minimal impacts to adjacent habitats from light spill due to an absence of lights on the transmission line towers and within the transmission line easements. In these areas the main contributor to light spill would be from the movement of vehicles (if they are undertaken during the evening and night) and maintenance activities, which would also be undertaken over a short duration, and periodically, based on scheduled maintenance times
- light spill from other components of the project (such as energy hubs and switching stations) while likely to occur daily, would be minimal and unlikely to adversely reduce the viability of adjacent habitats. Lighting designs to be in accordance with the *Australian and New Zealand Standard AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting* and the *Siding Springs Dark Sky Planning Guideline* (DPE, 2016), which would minimise spill into adjoining areas.

Breeding habitat

As outlined in Section 10.5.1, ongoing vegetation management is likely to occur every 12 months within the transmission line easement. Vegetation management has the potential to cause further loss breeding habitats such as nests, dreys and burrows.

Vegetation clearing protocols would be developed and implemented to ensure vegetation clearing limits within the easement are maintained.

Fauna injury and mortality

The project has the potential to impact threatened fauna due injury or mortality arising due to collision with transmission lines, EMF and vehicle strike.

Impacts due to collision with transmission lines or EMF impacts with new infrastructure would typically affect larger and higher-flying birds, and which generally reside over larger territories, such as birds of prey, ravens and magpies, cockatoos and some parrots, waterbirds and waterfowl.

With respect to the impacts of EMF, it is widely observed that some bird species regularly use electrical transmission lines, towers and poles for perching and nesting. However, no conclusive evidence has been identified to suggest that EMF would have a significant effect on the long term viability of local bird populations, with the best mitigation considered designing towers that discourage birds from nesting on them.

In terms of the risk of collision with transmission lines, while this type of indirect impact has the potential to lead to an increase in bird mortality, mitigation measures (including bird flappers/ divertors) would be implemented to ensure the likely impacts are minimised. In addition:

- the project is mostly located well away from waterways and major wetlands that would provide habitat for large flocks of water birds, which reduces the overall risk
- transmission lines are likely to be below flight paths for most species.

With respect to vehicle strikes, maintenance activities requiring site access would be undertake on a regular basis, however they would generate low volumes of traffic. As such, while the risk cannot be eliminated, the potential impact to threatened fauna species would be minor.

Fauna habitat and connectivity

As outlined in Section 10.4.4, the project has the potential to impact habitat connectivity for the Squirrel Glider, threatened woodland birds and threatened bat species where the transmission line easement intersects areas of native vegetation. The transmission lines would result in a highly permeable structure for biodiversity and connectivity is expected to remain largely unaffected for all species. While the impacts to connectivity would be permanent, the potential consequences would be minor. Any impacts are likely to reduce over time as biodiversity acclimatises to the presence of the transmission line and towers.

10.5.3 Aquatic ecology

Once operational, the project would have negligible impacts on aquatic habitats for threatened species. Any disturbance for maintenance activities would be infrequent and of lower magnitude than construction. Environmental operational protocols would be implemented to minimise any impacts to downstream watercourses.

10.6 Management of impacts

10.6.1 Environmental management

Biodiversity impacts would be managed in accordance with a Biodiversity Management sub-plan (BMP), which would be prepared and implemented as part the Construction Environmental Management Plan (CEMP). The BMP would include at a minimum:

- the location and extent of areas of vegetation clearance and habitat disturbance, as well as procedures for clearing of vegetation, including pre-clearing surveys and procedures for the relocation of flora and fauna
- the location and extent of areas to be protected, and procedures for the removal of vegetation and protection of retained vegetation, including vegetation adjacent to construction areas
- weed management protocols
- procedures for unexpected TECs or threatened flora and fauna found during construction, including stop work procedures
- monitoring requirements and compliance management.

In terms of the statutory or policy basis for the mitigation measures outlined below in Table 10-7, the identification of measures to mitigate or manage impacts has been done in accordance with BAM Subsection 8.4.1 and BAM Subsection 8.4.2.

10.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to land use and property are listed in Table 10-7. Mitigation measures in other chapters that are relevant to the management of construction and operation impacts to biodiversity include:

- Chapter 8 (Agriculture), with respect to biosecurity
- Chapter 9 (Landscape character and visual amenity), with respect to light spill
- Section 19.1 (Hydrology, flooding and water quality), with respect to water quality
- Section 19.2 (Soils and contamination), with respect to soil and erosion impacts and ground water management.

Table 10-7 Proposed mitigation measures – Biodiversity

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
B1	Avoidance of threatened species and threatened ecological communities	Sensitive areas to be avoided during detailed design and sensitive areas (including species polygons, buffered threatened species locations (including off site features adjacent to the subject land) and areas of Threatened Ecological Communities)) will be identified on sensitive area plans using spatial data. The detailed design process will avoid and minimise impacts on sensitive areas where feasible and reasonable including: • micro siting of transmission line infrastructure • prioritising areas with a Vegetation Integrity score <17 as per section 9 of the Biodiversity Assessment Method (2020).	Detailed design/ Pre-construction	Identified sensitive areas
B2	Avoidance of threatened species and threatened ecological communities	Prior to construction activities taking place within the Little Eagle nest buffer and during the breeding season (from Spring until after young and fledged in early Summer), an ecologist will be engaged to determine if the species is present. If present, an impact assessment of proposed activities will be completed to determine what, if any, activities can take place within the buffer area, and what mitigation measures need to be implemented. Measures may include cessation of certain activities, amending the construction methodology including selecting alternative plant or equipment.	Detailed design/ Pre-construction	Within Little Eagle tree nest buffer area(s)
B3	Avoidance of threatened species and threatened ecological communities	Prior to construction activities taking place within 100 m of rocky areas containing caves, overhangs or crevices, cliffs or escarpments and during the breeding season for the Large-eared Pied Bat, Eastern Cave Bat, Large Bent-winged Bat (November to February), an ecologist will be engaged to determine if the species are present. If present, an impact assessment of proposed activities will be completed to determine what, if any, activities can take place within the 100 m and what mitigation measures need to be implemented. Measures may include cessation of certain activities, amending the construction methodology including selecting alternative plant or equipment.	Detailed design/ Pre-construction	Within 100 metres of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments as mapped by Technical paper 4 – Biodiversity Development Assessment Report

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
B4	Micro-siting of associated works and access tracks	Micro-siting of construction infrastructure (including site offices, compounds and access tracks) will be undertaken to minimise vegetation clearing and disturbance of watercourses. This will include: • prioritising areas of low biodiversity value • utilising existing access tracks, where feasible • locating waterway crossings at located at narrow width locations • minimising the quantity of cut and fill activities.	Pre-construction/ construction	All locations
B5	Connectivity corridors	Connectivity corridors are to be investigated in the form of installation of under-transmission line glider poles (in accordance with clearance requirements for transmission lines and infrastructure) where the construction area will impact habitat connectivity for arboreal species (see Appendix J of Technical paper 4 – Biodiversity Development Assessment Report for an examination of regional and terrestrial habitat connectivity and target species for mitigation). The exact location and design of under-transmission line glider poles and/or rope bridges will be nominated as part of a Connectivity Strategy guided by the locations of habitat connectivity outlined in Figure 14-14 and 14-15 of Technical paper 4 – Biodiversity Development Assessment Report. Where poles are proposed to be installed on land adjacent to the easement, they will be subject to landowner agreement and captured in the property management plan. This strategy will require ongoing management of connectivity corridors.	Pre-construction (Connectivity Strategy) Construction Operation (Corridor Management)	Relevant locations
B6	Impacts on availability of nesting hollows	A Supplementary Hollow and Nest Strategy will be developed and implemented for the creation of nest boxes or other hollow creation method to provide alternative roosting and/or nesting habitat for threatened fauna displaced during clearing. A target ratio for the provision of three artificial hollows/nest boxes for every occupied hollow removed will be implemented. Where supplementary hollows are proposed to be established on land adjacent to the easement, these will be subject to landowner agreement and captured in any property management plan.	Nest box/hollows are to be installed at least 3 months prior to commencement of clearing works where practicable in each construction area.	Relevant locations
B7	Biosecurity impacts	A Biosecurity Management Plan will be prepared an implemented to ensure biosecurity risks are suitably controlled. The plan will include protocols to be followed to minimise biosecurity risks including, but not limited to the cleaning of vehicles and machinery (incl. floor pans), boots and clothing to remove and/or kill pathogens and remove weed seed and/or plant bodies. All trucks containing loads of weed contaminated material will be covered. Mechanical and chemical weed control will be done in consultation with landowners.	Pre-construction/ construction	All locations

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
B8	Biodiversity impacts	A Biodiversity Management Plan will be prepared and implemented for the duration of construction. The plan is to include (as a minimum): • the location and extent of areas of vegetation clearance and habitat disturbance, and how these will be suitably demarcated on site • the location and extent of areas to be protected (e.g. retained vegetation, hollow-bearing trees, nests, burrows and other habitat features (including applicable buffers to habitat features) located inside the construction or in close proximity to the clearing areas • measures to be implemented on site to clearly demarcate areas to be retained as 'no go areas' with suitable fencing or equivalent exclusion barrier.	Pre-construction To be installed prior to the commencement of clearing works in each construction area. 'No go area' fencing and other tags/marks must be maintained throughout the construction phase.	All locations
B9	Tree protection measures	Tree protection measures are to be installed and maintained in accordance with AS 4970-2009 – Protection of Trees in Development Sites throughout construction.	Pre-construction	Applicable trees
B10	Pre-clearing surveys	Pre-clearing surveys are to be completed prior to clearing at each location by a suitability qualified ecologist. The proposed clearing extents will be marked out on site prior to the pre-clearing surveys. During the surveys, the ecologist will: • survey the proposed clearing extent • identify any fauna that will require relocation prior to clearing, including inspection of any built structures and wooden fence posts to be demolished • 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.	Within 48 hours prior to the commencement of clearing works in each construction area.	All locations
B11	Ecology inductions, toolbox talks, targeted training	All relevant project personnel, including relevant sub-contractors are to be trained on biodiversity management protocols and 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. Inductions and training must be completed prior to commencement of work for all relevant personnel. Toolbox talks will be undertaken daily or as required.	Construction	All locations
B12	Retention of understorey vegetation in riparian areas	Understorey vegetation is to be protected within vegetated riparian zones where reasonable and feasible (within the definition of *Water Management Act 2000*). Vegetation clearing will be limited to the tree stratum and shrubs above two metres in height only, with trunk bases being retained in-situ.	N/A	Riparian environments disturbed as part of construction

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
B13	Rehabilitation of riparian areas	A Riparian Vegetation Management Plan (RVMP) will be developed and implemented for the project to manage activities within vegetated riparian zones to minimise impacts to aquatic environments. The plan will be prepared within 3 months prior to any disturbance to a riparian area. The plan will identify the measures to be implemented to minimise impacts from construction activities (such as temporary and permanent waterway crossings) within riparian and aquatic environments. A schedule of works will be stipulated within the approved RVMP. Riparian areas subject to disturbance will be progressively stabilised and rehabilitated.	Pre-construction/ construction	Riparian environments disturbed as part of construction
B14	Installation of bird diverters	Bird diverters will be installed within one kilometre (at a minimum) of wetland/riverine habitats to reduce impacts on aerial fauna species from collision with transmission lines and infrastructure. The exact position and diverter model will be finalised during detailed design. Installation of the bird diverters will occur within two weeks of transmission line installation or as soon as practical, and will remain in place and/or replaced as required.	Construction	Relevant locations
B15	Vegetation offsets requirements	The predicted clearing of native vegetation by the project identified in Technical paper 4 – Biodiversity Development Assessment Report will be monitored against the recorded clearing. A revised Biodiversity Assessment Method (BAM-C) calculation on the project's final disturbance to biodiversity post construction will be completed. Any additional credit liability identified will be met as part of the biodiversity offset requirements within the biodiversity offset package.	Construction	Construction area
B16	Unexpected finds	A species unexpected finds protocol will be implemented if threatened ecological communities or flora and fauna species, not assessed in the biodiversity assessment, are identified in the disturbance area	Construction	Construction area
B17	Water quality, watercourse geomor-phology and aquatic habitat	Watercourse crossings will be designed to minimise disturbance and harm within riparian corridors and rehabilitate aquatic habitat to achieve a 'no net loss' of habitat within the affected area and catchment as a whole, in accordance with the following guidelines: • *Guidelines for controlled activities on waterfront land* (NRA, 2018) • *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull & Witheridge, 2003) • *Policy and guidelines for fish habitat conservation and management* (DPI, 2013).	Pre-construction and construction	All locations

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
B18	Operational guidelines and procedures	Develop and implement guidelines and procedures for maintenance of the project during operation as part of the OEMP or equivalent. These guidelines and procedures will cover the following: • vegetation clearing and maintenance commitments in the Biodiversity Development Assessment Report and Environmental Impact Statement • avoiding access and disturbance in areas of high biodiversity conservation significance; outside of the areas required for construction and • avoiding maintenance of vegetation that does not need to be maintained during operation.	Prior to operation	Operation area
B19	Minimise indirect impacts from light spill	Lighting designs to be in accordance with the *National Light Pollution Guidelines for Wildlife* (DCCEEW, 2023).	Detailed design	Operation area

The measures provided in Table 10-7 focuses on the residual impacts from the project and seek to further minimise potential adverse impacts of the project. The effectiveness of the measures ranges from low to high, as detailed in section 8.4 of Technical paper 4. The identification of these measures has been done in accordance with subsection 8.4.1 and subsection 8.4.2 of the BAM.

As detailed in Chapter 21 (Environmental management), all mitigation measures described in the EIS would be incorporated into the CEMP, or the Network Operator's operational environmental management plan (or equivalent). These environmental management documents or systems would include:

- processes for managing non-conformances, including identifying and implementing corrective and preventative actions to rectify the non-conformance and prevent recurrence
- processes for demonstrating compliance with the commitments made in the EIS and relevant approval conditions
- the roles and responsibilities of all key personnel
- procedures for the control of environmental records
- a compliance tracking and auditing program.

The timing and responsibility for the implementation of the safeguards would also be outlined in the CEMP or operational environmental management system. EnergyCo will provide oversight to ensure compliance with the conditions of approval. However the Network Operator would be responsible for the environmental management of the project and the implementation of the majority of the mitigation measures. The estimated costs of environmental mitigation measures have been captured in project capital costs.

10.6.3 Biodiversity offset strategy

Chapter 11 of Technical paper 4 provides a summary of the ecosystem credits, species credits and scattered tree credits required for the project. The projects offset obligation for the indicative construction area of the project has been calculated to require the following biodiversity credits:

- 52,165 species credits
- 21,564 ecosystem credits
- 163 ecosystem credits (scattered trees).

The biodiversity offset strategy comprises four options of:

- working with the Credit Supply Taskforce to purchase and retire biodiversity credits
- 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 project
- making a payment into the Biodiversity Conservation Fund, or
- alternative strategic offset outcomes.

EnergyCo's preferred option is to establish biodiversity stewardship agreements with landowners in proximity to the project and has been in discussions with a number of landowners to confirm interest. Subject to ongoing interest and detailed biodiversity surveys, this option would address most of the project's biodiversity offset liability However to provide increased flexibility, EnergyCo is also seeking to purchase available credits through the Credit Supply Taskforce, or on the open market. In this regard, EnergyCo has been in discussions with the Credit Supply Taskforce regarding the type and quantum of required biodiversity credits. These discussions are ongoing.

Payment into the Biodiversity Conservation Fund would occur for any residual credits that have not been secured through Biodiversity Stewardship Agreements or where applicable credits have not been available for purchase.

Determining the appropriate compensation for the impacts to existing mining offset sites is outside the scope of the BAM. As such, EnergyCo is investigating a land-based ratio offset package that takes into consideration the condition of the existing biodiversity values and the required mining offset objectives.

Offsets would be secured in stages to reflect the progressive delivery of the project transmission lines, and the final obligation would be confirmed as during detailed design and based on the final construction area.

11 Aboriginal heritage

This chapter provides an assessment of the potential Aboriginal heritage impacts of the project and identifies mitigation measures to minimise and manage these impacts, as provided in Technical paper 5 – Aboriginal cultural heritage assessment report (Technical paper 5). The Secretary's Environmental Assessment Requirements (SEARs) as they relate to Aboriginal heritage, and where in the Environmental Impact Statement (EIS) these have been addressed, are detailed in Appendix A (SEARs checklist).

11.1 Legislative and policy context

The Aboriginal heritage assessment was undertaken in accordance with SEARs and with reference to the requirements of relevant legislation, policies and assessment guidelines including:

- *Native Title Act 1993 (Cth)*
- *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth)
- *National Parks and Wildlife Act 1974 (NSW)*
- *Aboriginal Land Rights Act 1983 (NSW)*
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (Department of Climate Change, Environment and Water (DECCW), 2010a)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010b)
- Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (Office of Environment and Heritage (OEH), 2011)
- *Burra Charter: The Australia International Council on Monuments and Sites (ICOMOS) Charter for Places of Cultural Significance* (ICOMOS, 2013).

Further discussion on the legislation and policies relevant to the assessment of Aboriginal heritage are provided in Chapter 1 and Chapter 2, Appendix A of Technical paper 5.

11.2 Assessment approach

11.2.1 Study area

The Aboriginal heritage study area (study area) comprises the construction area, and where relevant incorporates the broader areas of the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Local Government Areas (LGAs) to capture the broader cultural and historical context of the region.

11.2.2 Assessment approach

The assessment methodology involved:

- a desktop review of relevant environmental databases and archaeological literature to understand the environmental conditions of the construction area, and to identify previously recorded and listed Aboriginal sites and places within the study area. This included:
  - searches of the Aboriginal Heritage Information Management System (AHIMS), relevant local environmental plans and previous publicly available Aboriginal heritage investigations relevant to the study area
  - a review of geological, soil, elevational, hydrological and vegetation data from various public and project-specific data sources to determine the environmental characteristics of the study area
  - a review of existing ethnographic literature to identify the traditional and contemporary Aboriginal traditional owners of the construction area
- development of a refined predictive model building on the preliminary predictive model prepared as part of the Scoping Report (EnergyCo, 2022). The predictive model was refined using the initial predictions of cultural materials across the study area, combined with the additional information from the desktop review to identify known and/or potential cultural materials, sites and places that may be present in the construction area to be targeted for subsequent field investigations
- consultation with Registered Aboriginal Parties (RAPs), including involvement of key Aboriginal community members and knowledge holders to identify areas and places of cultural value within or in the vicinity of the project (refer to Section 11.2.3 for more detail)
- field investigations to validate the desktop review findings and predictive model, including archaeological field surveys and test excavations (refer to Sections 11.2.4 and 11.2.5 respectively)
- cultural mapping using the input from RAPs and the results of the field investigations
- an assessment of the significance of the identified sites and places within the construction area (refer to Section 11.2.6 for more detail)
- assessing the potential direct and indirect impacts to these sites due to the construction and operation of the project
- identification of mitigation measures to avoid, manage and minimise impacts to Aboriginal cultural heritage.

Further detail on the assessment of Aboriginal heritage is provided in Technical paper 5.

11.2.3 Consultation

Consultation for the project has been carried out in accordance with the methods outlined in Heritage NSW's *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (DECCW, 2010) as well as additional project-specific communication strategies. Consultation has been undertaken in a manner which promotes transparent and frequent two-way dialogue with the Aboriginal community. The consultation process specific to this project has involved the following steps:

- identifying the Aboriginal individuals and/or communities relevant to the study area by:
  - contacting relevant State government agencies, including Heritage NSW
  - placing advertisements in local media, seeking further expressions of interest from Aboriginal individuals and/or communities

- contacting all Aboriginal individuals and/or communities identified through the above steps, and registering those interested in being consulted on the project (referred to as RAPs)
- briefing RAPs about the project and the scope of any Aboriginal heritage assessment through:
  - Aboriginal Focus Group (AFG) meetings held online and in person on separate days (23 and 27 September 2022, and 3 and 4 April 2023)
  - project updates via emails and letters from August 2022 to April 2023
- liaising with RAPs through AFGs, field investigations and direct consultation to identify both tangible and intangible cultural and archaeological sites, places and values to inform the project
- providing the draft technical paper to RAPs on 19 May 2023 for review and input into the overall findings, significance and management of cultural heritage. An AFG was held in person and online on 7 and 8 June 2023 to present the draft technical paper and discuss the key findings and recommendations.

Discussions with the RAPs have been extensive and wide-ranging over the assessment process. Feedback on the project and assessment activities has generally focussed on who speaks for Country as well as the sites and places identified. This includes key sites including rock shelters and grinding grooves identified as part of the field survey. Aboriginal community consultation is described in full in Appendix A of Technical paper 5.

11.2.4 Field surveys

Twelve weeks of field surveys were completed between July 2022 and April 2023, to determine if any Aboriginal objects, places, cultural values areas, or areas of archaeological potential are present (or are likely to be present) within the construction area.

The field survey coverage equates to about 79 per cent of the construction area, or about 3,020 hectares, and was completed with participation by 15 locally based RAPs. About 798 kilometres of pedestrian transects across 15 survey units were completed as part of the field survey program, and included 1,228 individual points of observation and documentation. The remaining 21 per cent of the construction area that was not surveyed as part of this field survey program was primarily a result of landowner access restrictions at the time of the field work being undertaken. Surveys will be undertaken for these areas should access be made available.

11.2.5 Test excavations

A targeted program of test excavations was completed to supplement and support the findings of the field survey and validate the predictive model. The test excavations consisted of a six-week program between November and December 2022, with participation by the 15 RAPs. Test excavations consisted of 128 manually dug test pits (each 0.25 square metres) at selected transmission line tower locations across the construction area. Locations for test excavation were either within or close to areas that were identified as potential archaeological deposits (PAD) during field surveys, or in close proximity to creek lines classified as second to fourth order Strahler streams. The rationale was that while the designs were conceptual and the transmission locations may change, the program would enable:

- an overall predictive model of the cultural material distribution, with tower locations being found in a range of landforms and distances from water courses
- provide a general indication of the cultural materials at a given locale even where transmission towers may be subject to some change.

11.2.6 Significance assessment

An important element of cultural heritage management is determining the significance of cultural heritage places to understand what may be lost and what mitigation measures can be employed.

The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011) provides guidelines for heritage assessment with reference to the *Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (ICOMOS, 2013).

Cultural significance is outlined in Article 1.2 of the Burra Charter as 'aesthetic, historic, scientific, social or spiritual value for past, present or future generations' (Australia ICOMOS 2013). The criteria adopted for this report are defined in Table 11-1. The significance of items/objects and areas identified in the construction area have been assessed against these criteria and ranked as being of high, medium or low significance.

In assessing the significance of sites, aspects such as rarity and representativeness and the integrity must be considered. Generally speaking, a site or object that is rare will have a greater significance, although a site that is suitable for conservation as 'representative' of its type will also be significant. Conversely an extremely rare site may no longer be significant if its integrity has been sufficiently compromised.

Table 11-1 Criteria used to assess the cultural significance (OEH, 2011).

Criterion	Definition
Social value – Does the place have a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons?	Social (or cultural) value refers to the spiritual, traditional, historical or contemporary associations and attachments the place or area has for Aboriginal people. Social or cultural value is how people express their connection with a place and the meaning that place has for them. Social or cultural value can only be identified through consultation with Aboriginal people.
Historic value – Is the place important to the cultural or natural history of the local area and/or region and/or state?	Historic value refers to the association of a place with a historically important person, event, phase or activity. Historic places do not always have physical evidence of their historical importance (such as structures, planted vegetation or landscape modifications). They may have 'shared' historic values with other (non-Aboriginal) communities.
Scientific (archaeological) value – Does the place have potential to yield information that will contribute to an understanding of the cultural or natural history of the local area and/or region and/or state?	Scientific (archaeological) value refers to the importance of a landscape, area, place or object because of its rarity, representativeness and the extent to which it may contribute to further understanding and information. Information about scientific values is gathered through archaeological investigation undertaken in this report.
Aesthetic value – Is the place important in demonstrating aesthetic characteristics in the local, regional, and/or State environment?	Aesthetic value refers to the sensory, scenic, architectural and creative aspects of the place. It is often linked with social value, and can consider form, scale, colour, texture and material of the fabric or landscape, and the smell and sounds associated with the place and its use. This value is only relevant to archaeological sites on only rare occasions, such as rock shelters that contain art, or culturally modified trees in prominent positions, etc.

11.3 Existing environment

11.3.1 Cultural and historical context

The study area is primarily located on land traditionally occupied by people known collectively as the Wiradjuri, who all spoke a related language and shared cultural attributes. The northern extent of the study area also extends into Gamilaroi country (Tindale (1974) recorded over 30 spellings including Kamilaroi, Gomeroi and Gamilaraay). The main mythologies of both Wiradjuri and Gomeroi people involved supreme beings, such as Baiame, Daramulan and Muni Burrebean, with totemic ancestors being of lesser importance. Numerous creation stories and spiritual sites are documented within the region. Burial activities of the Wiradjuri people were observed by early explorers and exhibited complex and highly visibly landscape modifications, including carved trees.

Wiradjuri people lived in small family groups of up to 50 individuals and primarily occupied open camp sites (Greenwood, 2013). Groups travelled around country throughout the year, moving to a new area when resources were diminished, seasons changed or for ceremonies and trade with other groups (Niche Environment and Heritage Pty Ltd, 2015).

The Wiradjuri had already felt the effects of colonisation by the time the first European explorations of the Central Tablelands occurred from 1813 (Go Green Services, 2002). Intensification of settlement throughout the study area over the 1830s and 1840s pushed Wiradjuri further from their traditional lands. A review of historical records for the region shows an extensive interaction with Europeans over the last 200 years, including numerous incidences of frontier violence. Although recorded events occurred near the study area, no incidents appear directly associated with the study area itself. Of note was Joe and Jimmy Governor, two Aboriginal bushrangers in the 1900s, who traversed the study area and had associations with the Wollar township.

From 1883, Wiradjuri camps were broken up by the Aborigines Protection Board and people were forcibly removed from their country to reserves in Eugowra, Forbes, Wellington, or Spring Flat (Extent Heritage Advisors 2017). By the early 1900s the population of the Wiradjuri had been greatly reduced (OzArk Environmental & Heritage Management, 2007). Through the early to mid-twentieth century, Wiradjuri children were removed from their families and residents of reserves were under constant government surveillance (Kass, 2003). After the abandonment of segregationist polices in the 1970s and 1980s, Wiradjuri communities have worked towards a cultural revival built on the legacies of the past (Kass, 2003).

11.3.2 Archaeological context

The south east of the study area has been extensively researched for over 30 years, for several major coal mines near the Ulan township, and more recently and more broadly across the study area, for renewable energy projects across the Central-West Orana region. While data remains constrained (for example, not all research has been completed or made publicly available), these studies provide a robust record of cultural materials that may be expected across the construction area.

Based on the information available across the region, cultural materials are dominated by various stone artefact densities, typically as isolated finds or clusters of more than 20 artefacts, and indicative of ongoing but transient use of much of the study area. There are several notable areas of cultural materials including along the banks of Laheys Creek, the interface between Barneys Reef and the surrounding lowlands near Tallawang, a suite of grinding grooves on discrete sandstone dominated hills in the northwest of Merotherie Energy Hub, and an abundance of diverse sites along Wilpinjong Creek. There are also significant occurrences of culturally modified trees and grinding grooves where remnant vegetation and/or suitable sandstone surfaces are encountered. These sites were observed at moderate sized creek lines, such as Laheys, Sandy and Wilpinjong, but are found in a variety of landforms and contexts.

There is an extensive presence of rock shelters and associated features (such as art and deposits) in the southeast and eastern sections of the construction area. These sites are highly constrained by steep sandstone relief, which is only encountered in this part of the study area.

The construction area has been subject to a range of past disturbances, generally associated with agricultural activities and mining operations in the south-eastern section of the construction area. Such activities are likely to have resulted in localised impacts to cultural materials that were present. This includes potential loss of culturally modified trees and the potential reworking of surface and sub-surface cultural materials due to agricultural activities and erosion.

11.3.3 Aboriginal Heritage Information Management System search results

A review of Heritage NSW's AHIMS database on 22 April 2022 and 16 August 2022 identified 2,809 previously documented sites within the search area centred on the construction area. The most common site types registered in the AHIMS search area included stone artefactual sites (78 per cent), followed by areas of PAD (seven per cent), culturally modified trees (five per cent), rock shelters (five per cent) and grinding grooves (two per cent). Several Aboriginal ceremonial sites and artefact scatters of very high densities (greater than 1,000 objects) are located in the search area but are not within the construction area.

Of the previously documented sites identified in the AHIMS searches, there are 84 recorded as being located within the construction area. These are dominated by various stone artefact sites (87 per cent), with lesser occurrences of culturally modified trees (six per cent), rock shelters (five per cent), an art site and a habitation structure. Seven of these 84 sites were identified as destroyed. Two sites (a rock shelter and the art site) were mis-identified (i.e. the AHIMS record did not accurately record the site features) and are actually stone artefact scatters of various densities.

The AHIMS search results identified two notable patterns, considered reflective of the past use of the landscape:

- rockshelter and art sites are generally found in the eastern and south-eastern portion of the study area, where steep relief and sandstone outcropping – a necessity for such sites – is prevalent
- there are clear clusters of sites along moderate (second to fourth order) creek-lines within the study area, most notably Laheys, Sandy and Wilpinjong Creeks, and which suggests these corridors were a focus of past use.

11.3.4 Predictive model

A preliminary predictive model was developed as part of the Scoping Report (EnergyCo, 2022) to predict the potential presence and location of Aboriginal sites within the construction area. Based on the results of the AHIMS search, a review of previous archaeological studies and consideration of the environmental context (e.g. natural features, geology and topography), the model was refined to include the following predictions:

- grinding grooves and to a lesser extent quarry/stone procurement sites may be present in the west, north and north east of the construction area, including around Elong Elong, Merotherie and Tallawang where suitable geology is present
- culturally modified trees, including scarred and carved trees, may occur where native vegetation has been preserved in the west, north and north east of the construction area

- rockshelters and associated features (including art and cultural deposits) may be found in the south east of the construction area near Wollar, Wilpinjong and Moolarben, where sandstone outcropping and steep reliefs occur
- isolated finds and open artefact scatters may occur across the entire construction area as they are the most common site types within the region and can occur across most landforms, even in disturbed environments
- burials may occur anywhere in the construction area but are more likely to occur on watercourses or under rock ledges. Burials may occur in the construction area near Ulan as several have been recorded in the vicinity.

11.3.5 Cultural mapping

Six places of cultural value and two key travelling routes or song-lines were identified in the study area through cultural mapping. The places of cultural value include bora and corroboree grounds, specific rockshelters of high value, birthing trees and a burial ground. The travelling routes encompass portions of Barney's Reef and Cockabutta Creek and reflect main movement corridors of people in the past. None of the identified places of cultural value are within the construction area. However the travelling routes intersect the construction area at five points near the Elong Elong Energy Hub, Switching Station M9 and Merotherie Energy Hub and two points between Merotherie Energy Hub and the New Wollar Switching Station.

11.3.6 Test excavations

Test pits were excavated across the construction area at 32 proposed tower locations. Test excavations were undertaken at locations where the field surveys identified a discrete area of archaeological interest, either through observed cultural materials or a belief they would be present, with a focus on locations that are in proximity to creeks classified as second to fourth Strahler stream order. The majority of cultural materials that were encountered during the test excavations were within, or in close proximity to these creek corridors. A number of other more disparate tower locations encompassing the remainder of the construction area were also implemented to provide a representative coverage of the project.

The majority of the cultural materials encountered during the test excavations were near the surface of the soil profile, which can be regularly observed in exposures from cultivation and creek erosion and that these deposits are typically shallow. Spatially, the findings continue to demonstrate the importance of creeks across the construction area that are classified as second to fourth Strahler stream order extending.

11.3.7 Identified Aboriginal sites and places in the construction area

The field survey and test excavations further refined the number of Aboriginal sites and places identified within the construction area, and a number of new sites were identified. By combining and ratifying the findings from the desktop reviews and field investigations and removing the sites that have been destroyed by other developments, the overall number of Aboriginal sites in the construction area were identified.

There are 46 identified Aboriginal sites within the construction area as shown in Figure 11-1 and described in Table 11-2. The identified sites include:

- eight rock shelters, including four previously documented sites and four newly identified sites
- nine culturally modified trees, including five previously documented and four newly identified. All of these sites were assigned a tentative classification, and are subject to inspection by a qualified arboriculturist
- eleven newly identified grinding grooves sites
- five high density artefact scatters (defined as having a density of more than 100 artefacts per square metre)
- seven moderate density artefact scatters (defined as having a density of between about 20 to 50 artefacts per square metre)
- six areas of past foci and activity, characterised by moderate to high density sub-surface artefact deposits, including one previously documented site and five new areas identified in field investigations.

A stone artefact background scatter is predicted to occur across the construction area and extending beyond its limits within which low artefact densities of about two to 16 artefacts per square metre may be expected. This includes a large number of the previously recorded isolated and low density stone artefact sites currently documented across the construction area. These sites are typically of low significance and reflect the long-term, transient use of the entire landscape by Aboriginal people in the past.

In addition to these 46 Aboriginal sites and the stone artefact background scatter, zones of archaeological potential were identified throughout the construction area, consisting of all land within the construction area that is within 150 metres of 13 watercourses classified as being second to fourth order streams (using the Strahler stream order classification system), including Prospect Creek, Sandys Creek, Laheys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek and Copes Creek. This zone is expected to have sub-surface archaeological potential for higher densities of stone artefacts and/or other areas of past foci to be present.

Figure 11-1
Aboriginal sites
Page 1 of 4

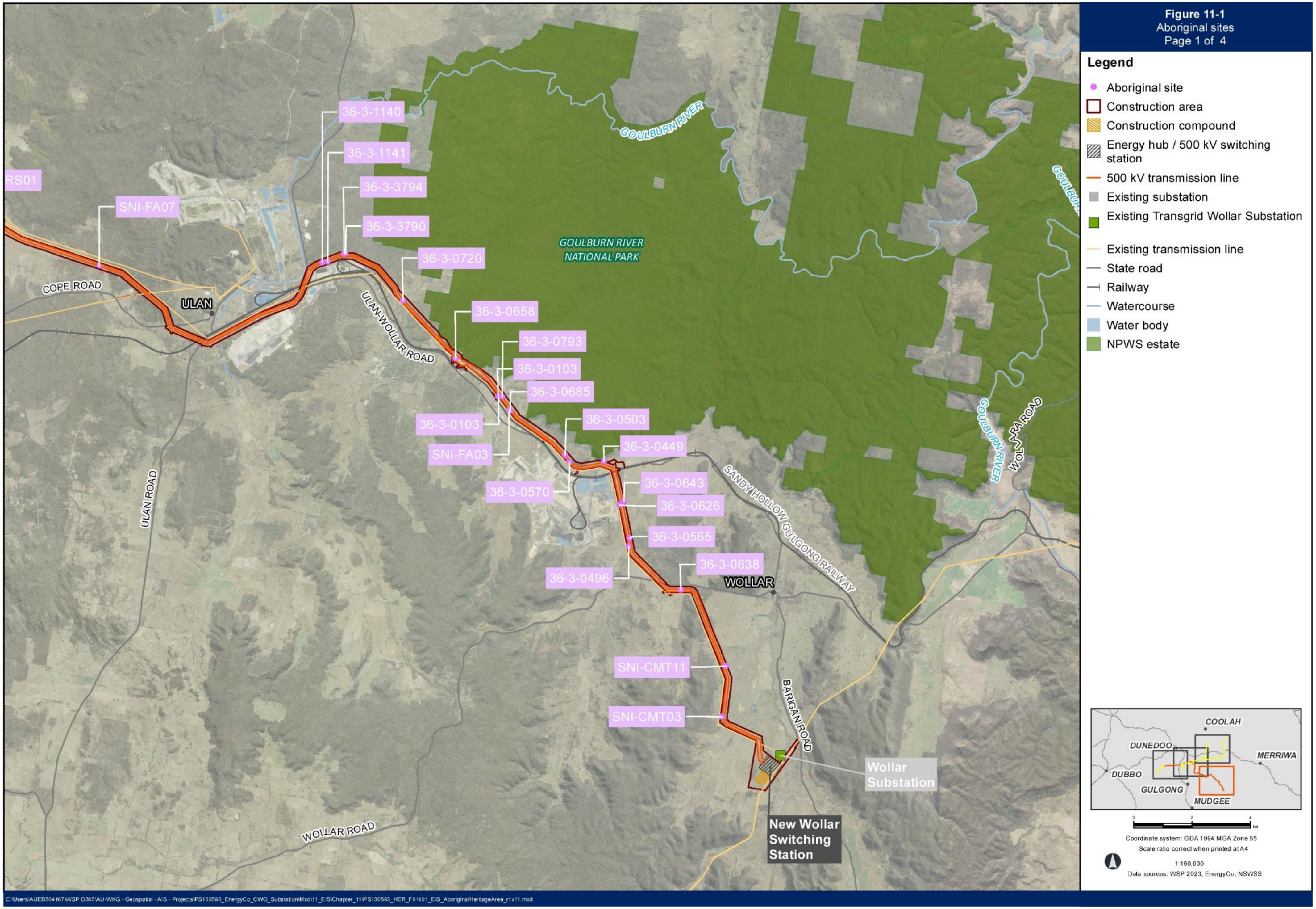

Figure 11-1
Aboriginal sites
Page 2 of 4

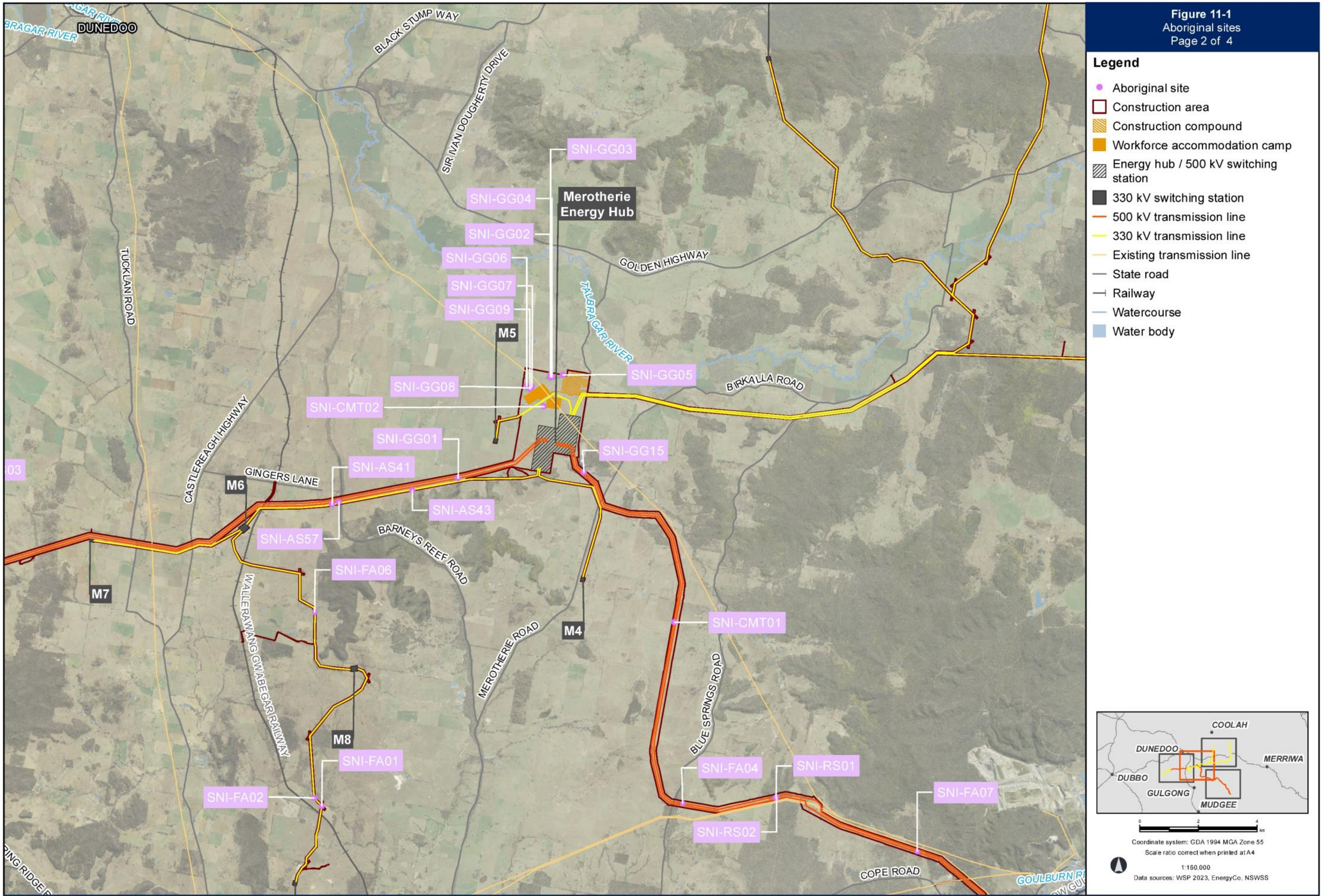

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Figure 11-1
Aboriginal sites
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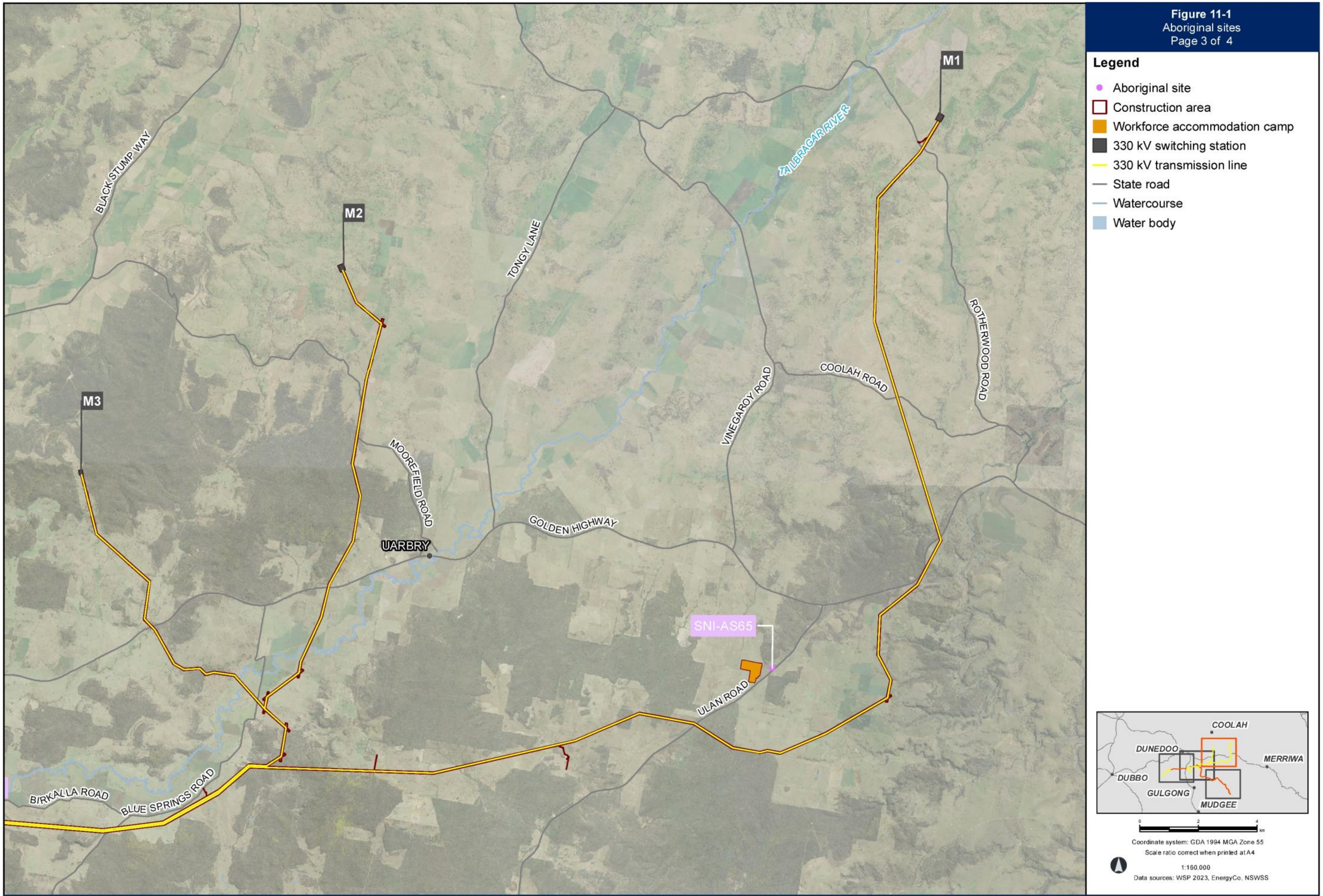

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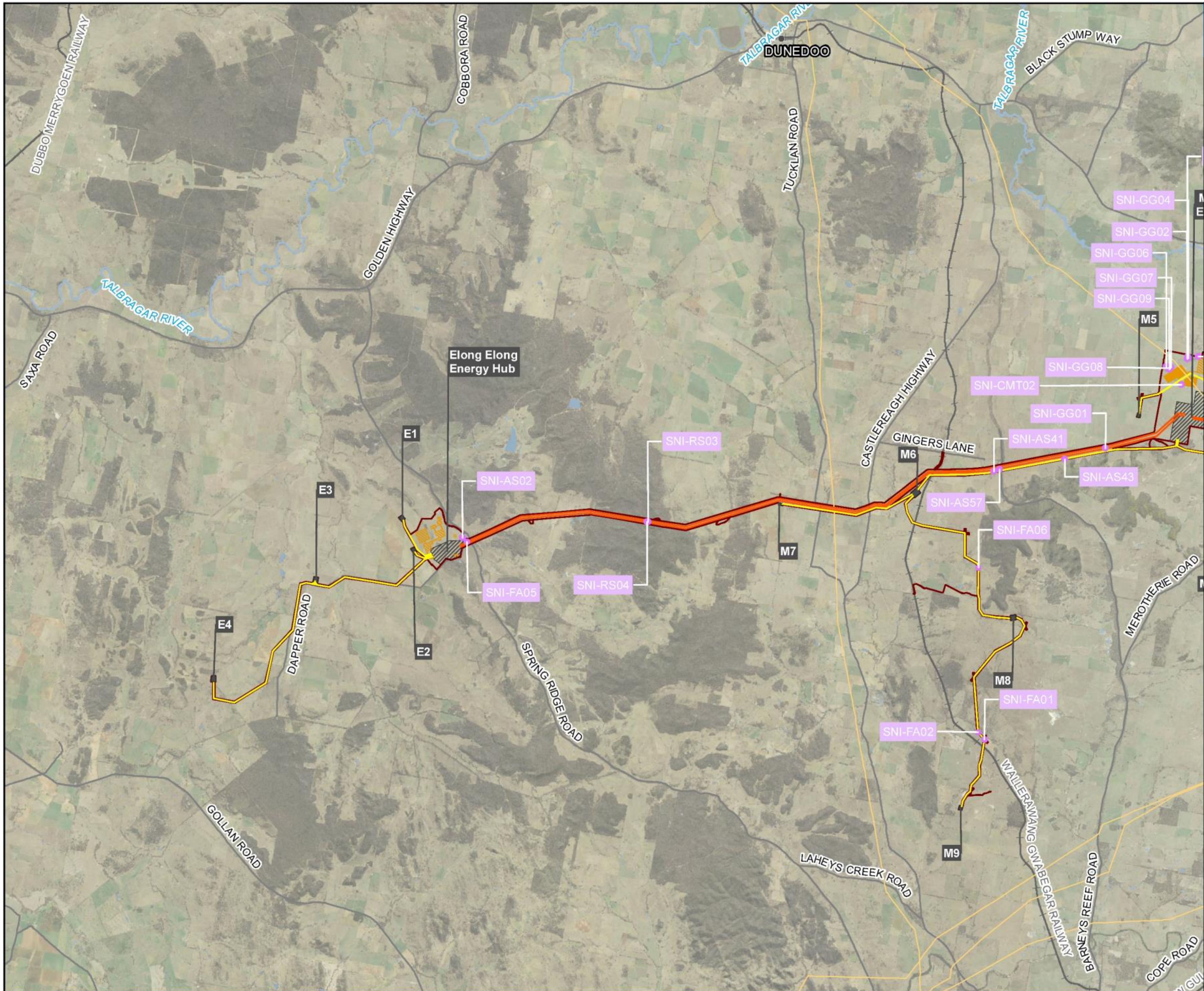
Figure 11-1
Aboriginal sites
Page 4 of 4



Legend

- Aboriginal site
- Construction area
- Construction compound
- Workforce accommodation camp
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing transmission line
- State road
- Railway
- Watercourse
- Water body

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:200,000
Data sources: WSP 2023, EnergyCo, NSWSS

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11.3.8 Significance assessment

A significance assessment of the 46 identified Aboriginal sites and the low density stone artefact background scatter was completed to determine their overall significance based on their assessed scientific, historical, social and cultural, and aesthetic significance as defined in Section 11.2.6. Further detail on the assessment of significance can be found in Technical paper 5.

Scientific significance

Eight sites within the construction area were considered to have high scientific significance and 35 were considered to be of moderate scientific significance with the ability to provide information on the past activities of the study area (research potential). Three Aboriginal sites were considered to have low scientific significance.

One rock shelter (AHIMS ID #36-3-0570) was considered to have high scientific significance as it was observed to be a substantive site with observed cultural materials. High and moderate density artefact scatters that indicate the occupation and/or repeat visitation by people in the past were assigned either a moderate or high scientific significance based on their potential to inform an understanding of past use and behaviour. Seven artefact scatters with substantive observed cultural material and potential for sub-surface deposits were considered to have high scientific significance.

Culturally modified trees (previously recorded and newly recorded) were assigned a moderate scientific significance as they have limited research potential but are increasingly rare in the region due to land clearance. They are also typically important to the local Aboriginal community. Nine culturally modified trees (#36-3-565, #36-3-626, #36-3-0638, #36-3-0103, #36-3-0643, SNI_CMT01, SNI_CMT02, SNI_CMT03, SNI_CMT11) were tentatively assigned a moderate scientific significance value, and further analysis of these sites, including an inspection by a qualified arboriculturist is recommended to determine their cultural origin.

Historical significance

No specific sites or places have been identified within the construction area that meet the criterion of historical significance. While there is an important post-Contact history across the study area, most evident in the Jimmy and Joe Governor bush ranging events, no sites or places with post-Contact historical connections were identified in the construction area.

Social and cultural significance

The social significance of each site was determined based on discussions in the field during field investigations, as well as subsequent meetings and consultation activities. A majority of the Aboriginal sites identified in the construction area were considered to have moderate social significance. Five sites were considered to have a high social significance including a rock shelter and four artefact scatters.

Aesthetic significance

A majority of the Aboriginal sites identified in the construction area have no inherent aesthetic value as they consist of artefact scatters in disturbed rural areas. Fourteen of the sites were identified to have a low aesthetic significance. These include the grinding groove sites that usually require some form of running water required to facilitate sharpening and several of the high-density artefact scatters adjacent creeks in locations that were likely used in the past, at least in part, due to their aesthetic appeal.

Summary

Table 11-2 provides a summary of the significance values for each Aboriginal site and place identified.

Table 11-2 Cultural significance of Aboriginal objects and/or sites within the construction area

Site	AHIMS #	Site type	Cultural significance**				
			Scientific	Aesthetic	Historical	Social	Overall
S1MC487	#36-3-3794	Rockshelter	L	–	–	M	Moderate
UWF SU51/L3	#36-3-0449	Rockshelter	M	–	–	M	Moderate
WCP137	#36-3-0570	Rockshelter	H	–	–	H	High
S1MC488	#36-3-3790	Rockshelter	M	–	–	M	Moderate
SNI-RS01	–	Rockshelter	M	–	–	M	Moderate
SNI-RS02	–	Rockshelter	M	–	–	M	Moderate
SNI-RS03	–	Rockshelter	M	–	–	M	Moderate
SNI-RS04	–	Rockshelter	M	–	–	M	Moderate
WCP129*	#36-3-0565	Culturally modified tree	M	–	–	M	Moderate
WCP52*	#36-6-0626	Culturally modified tree	M	–	–	M	Moderate
WCP64*	#36-3-0638	Culturally modified tree	M	–	–	M	Moderate
Stoney Creek 2*	#36-6-0103	Culturally modified tree	M	–	–	M	Moderate
WCP69*	#36-3-0643	Culturally modified tree	M	–	–	M	Moderate
SNI-CMT01*	–	Culturally modified tree	M	–	–	M	Moderate
SNI-CMT02*	–	Culturally modified tree	M	–	–	M	Moderate
SNI-CMT03 *	–	Culturally modified tree	M	–	–	M	Moderate
SNI-CMT11*	–	Culturally modified tree	M	–	–	M	Moderate
SNI-GG01	–	Grinding groove	M	L	–	M	Moderate
SNI-GG02	–	Grinding groove	M	L	–	M	Moderate
SNI-GG03	–	Grinding groove	M	L	–	M	Moderate
SNI-GG04	–	Grinding groove	M	L	–	M	Moderate
SNI-GG05	–	Grinding groove	M	L	–	M	Moderate
SNI-GG06	–	Grinding groove	M	L	–	M	Moderate
SNI-GG07	–	Grinding groove	M	L	–	M	Moderate
SNI-GG08	–	Grinding groove	M	L	–	M	Moderate
SNI-GG09	–	Grinding groove	M	L	–	M	Moderate
SNI-GG15	–	Grinding groove	M	L	–	M	Moderate
SNI-AS65	–	Grinding groove, low density artefact scatter and PAD	M	L	–	M	Moderate
S1MC303	#36-3-1140	High density artefact scatter	H	–	–	H	High
S1MC304	#36-3-1141	High density artefact scatter	H	–	–	H	High
SNI-AS41	–	High density artefact scatter	H	L	–	M	High
SNI-AS43	–	High density artefact scatter	H	L	–	M	High
SNI-AS57	–	High density artefact scatter	H	L	–	M	High
WCP220	#36-3-0496	Moderate density artefact scatter	L	–	–	L	Low

Site	AHIMS #	Site type	Cultural significance**				
			Scientific	Aesthetic	Historical	Social	Overall
WCP227	#36-3-0503	Moderate density artefact scatter	L	–	–	L	Low
WC OS 17 with PAD	#36-3-0658	Moderate density artefact scatter	M	–	–	M	Moderate
CE-09-OS and SNI-FA03	#36-3-0685	Moderate density artefact scatter, and deposit	M	–	–	M	Moderate
WC1 - WILPINJONG CREEK 1	#36-3-0720	Moderate density artefact scatter	M	–	–	M	Moderate
WCP260	#36-3-0793	Moderate density artefact scatter	M	–	–	M	Moderate
SNI-AS02	–	Moderate density artefact scatter	M	–	–	M	Moderate
SNI-FA01	–	Moderate density artefact scatter, and deposit	M	–	–	M	Moderate
SNI-FA02	–	Moderate density artefact scatter, and deposit	M	–	–	M	Moderate
SNI-FA04	–	Moderate density artefact scatter, and deposit	H	L	–	H	High
SNI-FA05	–	High density artefact scatter, and deposit	M	–	–	M	Moderate
SNI-FA06	–	Moderate density artefact scatter, and deposit	M	–	–	M	Moderate
SNI-FA07	–	High density artefact scatter, and deposit	H	L	–	H	High
SNI-BS1	–	Low density artefact scatter	L	–	–	L	Low

Note: *Cultural modified trees are subject to further investigation to confirm anthropogenic origins and/or values;
** L-Low, M-Moderate, H-High

11.4 Potential impacts

Construction and operation of the project would have direct and indirect impacts on Aboriginal sites in the construction area. Direct impacts would occur from construction activities that result in the disturbance of the ground surface or soil profile such as vegetation removal and earthworks. Indirect impacts may result in environmental changes that would affect cultural material within, or near the project such as changing view-lines to a site where visibility to/from it is part of its values, or an increase in dust being blown into sites such as rock shelters, negatively affecting art motifs (should they be present).

11.4.1 Avoidance and minimisation of impact

The project has sought to balance the various environmental and social features present within the construction area with engineering limitations and project costs (refer to Chapter 2 (Strategic context) of this EIS). This has included avoiding, where possible, impacts on Aboriginal objects and/or sites and/or areas that have or could have Aboriginal heritage value based on the desktop assessment and field survey outcomes.

The project has avoided direct impacts to Aboriginal sites identified through desktop assessments and field surveys including:

- relocation of the construction area to avoid two of the most significant griding groove sites found during field investigations
- shifting of the transmission line alignment in the vicinity of Cockabutta Creek, southeast of the Merotherie Energy Hub following the identification of culturally important places by RAPs
- refinements of the construction area to the east of the Wilpinjong mine to avoid/minimise impacts on documented cultural sites and places.

The assessment of potential impacts to Aboriginal heritage has been undertaken by adopting a ‘worst case impact’. Conducting the impact assessment in this way allows for a level of flexibility to be maintained throughout the continued development of the project design and construction planning processes, while also providing a rigorous level of impact assessment that addresses the SEARs for the project. As a result, the assessment of Aboriginal heritage impacts has conservatively assumed that the construction area in its entirety could potentially be impacted by the project. However, heritage protection zones would be established within the Merotherie and Neely’s Lane workforce accommodation camps to avoid impacts to grinding groove sites SNI-GG02-GG09 inclusive and SNI-AS65, as well as a 150 metre buffer along the eastern bank of Laheys Creek.

The project design and construction methodology would continue to be refined to avoid or reduce impacts to Aboriginal sites. This would include investigating further micrositing of project infrastructure and construction activities to avoid or minimise impacts to sites of high significance, such as rockshelters, grinding grooves, culturally modified trees and areas within 150 metres of second to fourth order Strahler waterways within the construction area.

Mitigation measures in Section 11.5.2 have been identified to address the impacts identified in Section 11.4.2.

11.4.2 Impact assessment

Where impacts have not been avoided through design development and refinement, there is potential for the project to directly or indirectly impact all 46 Aboriginal sites.

Direct impacts to identified Aboriginal sites would primarily be caused by ground disturbance which is conservatively assumed to occur throughout the construction area with the exception of heritage protection zones at the Merotherie Energy Hub and Neeleys Lane Workforce Accommodation Camp and the eastern bank of Laheys Creek that have been identified for avoidance because of their heritage values. Construction activities to establish project infrastructure would result in the modification and/or loss of the upper soil profile and land surface where stone artefacts, grinding grooves, rockshelters, are documented. Vegetation clearance would directly impact culturally modified trees.

Direct impacts are expected to occur at 37 Aboriginal sites, as well as the low density stone artefact background scatter within the construction area, resulting in their complete loss of value. The project would also directly impact about 100 hectares of land within a zone up to 150 metres either side of 13 creek banks classified as second to fourth Strahler stream order, which have been assessed as containing archaeological potential. The potential direct impacts to this zone equates to around 1.93 per cent of the extent of these zones along these river systems.

Indirect impacts from the project are primarily as a result of visual impacts from construction activities and the introduction of new structures. Indirect visual impacts would occur at nine Aboriginal sites within the construction area which are planned to be avoided at Merotherie Energy Hub and Neeleys Lane Workforce Accommodation Camp. Outside the construction area, three places of cultural value and two travelling routes identified during the cultural mapping would be subject to visual impacts from the project.

Other indirect impacts would need to be considered in the event that sites within the construction area are able to be avoided. This may include the increased visibility and exposure of sites, such as rockshelters and/or grinding grooves where vegetation clearance is required.

The potential impacts to Aboriginal sites and places within the construction area from construction and operation of the project are described in Table 11-3.

Table 11-3 Potential impacts to Aboriginal objects and/or sites within the construction area

Site ID	AHIMS #	Site type	Assessed significance	Activity of harm	Consequence of harm
S1MC487	#36-6-0626	Rockshelter	Moderate	Direct impact	Complete loss of value
UWF SU51/L3	#36-3-0638	Rockshelter	Moderate	Direct impact	Complete loss of value
WCP137	#36-3-0103	Rockshelter	High	Direct impact	Complete loss of value
S1MC488	#36-3-0643	Rockshelter	Moderate	Direct impact.	Complete loss of value
SNI-RS01	–	Rockshelter	Moderate	Direct impact	Complete loss of value
SNI-RS02	–	Rockshelter	Moderate	Direct impact	Complete loss of value
SNI-RS03	–	Rockshelter	Moderate	Direct impact	Complete loss of value
SNI-RS04	–	Rockshelter	Moderate	Direct impact	Complete loss of value
WCP129	–	Culturally modified tree	Moderate	Direct impact	Complete loss of value
WCP52	–	Culturally modified tree	Moderate	Direct impact	Complete loss of value
WCP64	–	Culturally modified tree	Moderate	Direct impact	Complete loss of value
Stoney Creek 2	–	Culturally modified tree	Moderate	Direct impact	Complete loss of value
WCP69	–	Culturally modified tree	Moderate	Direct impact	Complete loss of value
SNI CMT01	–	Culturally modified tree	Moderate	Direct impact	Complete loss of value
SNI-CMT02	–	Culturally modified tree	Moderate	Direct impact	Complete loss of value
SNI-CMT03	–	Culturally modified tree	Moderate	Direct impact	Complete loss of value
SNI-CMT11	–	Culturally modified tree	Moderate	Direct impact. This tree is on the periphery of the construction area and may potentially be avoided	Complete loss of value
SNI-GG01	–	Grinding groove	Moderate	Direct impact	Complete loss of value
SNI-GG02	–	Grinding groove	Moderate	None. Indirect visual impact from construction of the Merotherie Energy Hub	Partial loss of value
SNI-GG03	#36-3-1140	Grinding groove	Moderate	None. Indirect visual impact from construction of the Merotherie Energy Hub	Partial loss of value
SNI-GG04	#36-3-1141	Grinding groove	Moderate	None. Indirect visual impact from construction of the Merotherie Energy Hub	Partial loss of value
SNI-GG05	–	Grinding groove	Moderate	None. Indirect visual impact from construction of the Merotherie Energy Hub	Partial loss of value

Site ID	AHIMS #	Site type	Assessed significance	Activity of harm	Consequence of harm
SNI-GG06	–	Grinding groove	Moderate	None. Indirect visual impact from construction of the Merotherie Energy Hub	Partial loss of value
SNI-GG07	–	Grinding groove	Moderate	None. Indirect visual impact from construction of the Merotherie Energy Hub	Partial loss of value
SNI-GG08	#36-3-0496	Grinding groove	Moderate	None. Indirect visual impact from construction of the Merotherie Energy Hub	Partial loss of value
SNI-GG09	#36-3-0503	Grinding groove	Moderate	None. Indirect visual impact from construction of the Merotherie Energy Hub	Partial loss of value
SNI-GG15	#36-3-0658	Grinding groove	Moderate	Direct impact	Complete loss of value
SNI-AS65	#36-3-0685	Grinding groove, low density artefact scatter and PAD	Moderate	None. Indirect visual impact from construction of the Neeleys Lane Workforce Accommodation Camp	Partial loss of value
S1MC303	#36-3-0720	High density artefact scatter	High	Direct impact.	Complete loss of value
S1MC304	#36-3-0793	High density artefact scatter	High	Direct impact.	Complete loss of value
SNI-AS41	–	High density artefact scatter	High	Direct impact	Complete loss of value
SNI-AS43	–	High density artefact scatter	High	Direct impact	Complete loss of value
SNI-AS57	–	High density artefact scatter	High	Direct impact	Complete loss of value
WCP220	–	Moderate density artefact scatter	Low	Direct impact	Complete loss of value
WCP227	–	Moderate density artefact scatter	Moderate	Direct impact	Complete loss of value
WC OS 17 with PAD	–	Moderate density artefact scatter	Moderate	Direct impact	Complete loss of value
CE-09-OS and SNI-FA03	–	Moderate density artefact scatter, and deposit	Moderate	Direct impact	Complete loss of value
WC1 - WILPINJONG CREEK 1	–	Moderate density artefact scatter	Moderate	Direct impact	Complete loss of value
WCP260	#36-6-0626	Moderate density artefact scatter	Moderate	Direct impact	Complete loss of value
SNI-AS02	#36-3-0638	Moderate density artefact scatter	Moderate	Direct impact	Complete loss of value

Site ID	AHIMS #	Site type	Assessed significance	Activity of harm	Consequence of harm
SNI-FA01	#36-3-0103	Moderate density artefact scatter, and deposit	Moderate	Direct impact	Complete loss of value
SNI-FA02	#36-3-0643	Moderate density artefact scatter, and deposit	Moderate	Direct impact	Complete loss of value
SNI-FA04	–	Moderate density artefact scatter, and deposit	High	Direct impact	Complete loss of value
SNI-FA05	–	High density artefact scatter, and deposit	Moderate	Direct impact	Complete loss of value
SNI-FA06	–	Moderate density artefact scatter, and deposit	Moderate	Direct impact	Complete loss of value
SNI-FA07	–	High density artefact scatter, and deposit	High	Direct impact	Complete loss of value
SNI-BS1	–	Low density artefact scatter	Low	Direct impact	Complete loss of value

11.5 Management of impacts

11.5.1 Environmental management

Aboriginal heritage impacts would be managed in accordance with the Construction Environmental Management Plan. This would include the preparation and implementation of an Aboriginal Cultural Heritage Management Plan (ACHMP) sub-plan, developed by a heritage specialist in consultation with the RAPs to provide the framework for managing Aboriginal heritage within the construction area. This would include requirements for:

- archival recording of identified Aboriginal objects, sites and places that may be adversely affected in accordance with Heritage NSW Guidelines
- suitable recovery or relocation, documentation and analysis of any Aboriginal sites directly impacted
- measures to minimise any inadvertent impacts to identified Aboriginal objects and/or sites and areas of archaeological sensitivity.

A heritage-interpretation strategy and plan would also be developed by a heritage specialist, in consultation with RAPs, to identify the interpretive values of the construction area, and specifically Aboriginal heritage values, and to provide direction for interpretive installations and devices.

The contents and guiding principles for the management of the strategy and plan are presented in Appendix G of Technical paper 5. These include the need to incorporate the views of RAPs on traditional and contemporary values, local ethnographic and post-Contact information, and archaeological data developed for the project.

11.5.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to Aboriginal heritage are listed in Table 11-4.

Mitigation measures in other chapters that are relevant to the management of Aboriginal heritage include:

- Chapter 9 (Landscape character and visual amenity), specifically measures which address visual impacts on the landscape
- Chapter 15 (Noise and vibration), specifically measures which address vibration impacts on heritage sites
- Section 19.4 (Air quality), specifically address dust impacts.

Table 11-4 Proposed mitigation measures – Aboriginal heritage

Reference	Impact	Mitigation measure	Timing	Applicable locations
AH1	Impact avoidance and minimisation	The project will avoid impacts to the following identified Aboriginal objects and/or sites within the construction area: • the proposed workforce accommodation camps and construction activities at the Merotherie energy hub will establish a heritage protection zone to avoid SNI-GG02-GG09 inclusive • the proposed workforce accommodation camps and construction activities at Neeley's Lane will establish a heritage protection zone to avoid SNI-AS65. • a protection zone will also be implemented at the Elong Elong energy hub to protect cultural material within 150 m of the eastern bank of Laheys Creek (excluding the unavoidable impacts associated with the crossing of Laheys Creek by the transmission corridor, which will be minimised). Some guiding principles for consideration of avoidance are presented in Appendix F of Technical paper 5 (Aboriginal cultural heritage assessment report)	Pre-construction Construction	SNI-GG02 – GG09 inclusive, SNI-AS65; and 150 m of Laheys Creek
AH2	Impact avoidance and minimisation	The project will investigate the micro-siting of project infrastructure and construction activities in consultation with an Aboriginal heritage specialist to avoid or minimise impacts to: • rockshelters (#36-3-3794, #36-3-0449, #36-3-0570, #36-3-3790, SNI-RS01 – RS04 inclusive) • grinding groove sites (SNI-GG01 and SNI-GG15) • a culturally modified tree (SNI-CMT02) • high-density stone artefact sites (#36-3-1140, #36-3-1141), and • 150 m of Prospect Creek, Sandys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek and Copes Creek. Some guiding principles for consideration of avoidance and/or impact minimisation are presented in Appendix F of Technical paper 5 (Aboriginal cultural heritage assessment report).	Pre-construction Construction	#36-3-3794, #36-3-0449, #36-3-0570, #36-3-3790, SNI-RS01 – RS04 inclusive, SNI-GG01, SNI-GG15, SNI-CMT02, #36-3-1140, #36-3-1141, areas within 150 m of Prospect Creek, Sandys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek and Copes Creek

Reference	Impact	Mitigation measure	Timing	Applicable locations
AH3	Impact avoidance and minimisation	On-Country meetings will be undertaken with participating Elders and key knowledge-holders of the project to discuss any potential view-line impacts of the project and places of cultural value, and their subsequent management.	Pre-construction Construction	SNI-CS4 – CS6 inclusive, and travelling routes #1 and #5 where they intersect the construction area.
AH4	Cultural heritage management	An Aboriginal Cultural Heritage Management Plan (ACHMP) will be developed by an Aboriginal heritage specialist in consultation with the Registered Aboriginal Parties (RAPs) and Heritage NSW. The contents and guiding principles for the management of identified site types for the ACHMP are presented in Appendix F of Technical paper 5 (Aboriginal cultural heritage assessment report), and include: • processes, timing, communication methods and project involvement for maintaining Aboriginal community consultation and participation through the remainder of the project • inputs and content of a cultural heritage induction package for all construction personnel and subcontractors • descriptions and methods for archaeological test/salvage excavations of rockshelters, stone artefact scatters, potential archaeological deposits, and cultural deposits that will be adversely affected by the project • descriptions and methods for surface collection of identified isolated objects and stone artefact scatters that will be adversely affected by the project • descriptions and method for mitigation and/or recovery of grinding grooves and culturally modified trees that will be adversely affected by the project • delineating and protecting Aboriginal and cultural sites within or in close proximity to the construction area, including clear marking, appropriate screen for any gender-specific areas, surface protection, etc • procedures for managing the unexpected discovery of Aboriginal objects, sites and/or human remains during the project • procedures for the curation and long-term management of recovered cultural materials	Pre-construction Construction	Construction area, and all identified Aboriginal objects, sites and deposits in the Chapter 9 of Technical paper 5 that would be adversely impacted by the project.

Reference	Impact	Mitigation measure	Timing	Applicable locations
		• methods of post-excavation analysis and reporting of the archaeological investigations, including suitable collection and processing of stone artefacts, palaeo-environmental, chronological and other soils from archaeological activities; and • a monitoring regime for implementing the above measures.		
AH5	Cultural heritage management	Additional archaeological field survey will be undertaken of the portions of the construction area inaccessible during the Aboriginal cultural heritage assessment. Any identified Aboriginal objects, sites, places and/or deposits during these works will be integrated into the ACHMP (AH04).	Pre-construction	Previously unsurveyed portions of the construction area
AH6	Cultural heritage management	Where construction is unable to avoid areas within 150 m of Prospect Creek, Sandys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek and Copes Creek, archaeological test excavations will be carried out. Test excavations will adopt the methods outlined in Appendix F and/or developed in the ACHMP (AH04). The findings of the test excavations will be integrated into the ACHMP (AH4).	Pre-construction	The construction area, where it is located within 150 m of Prospect Creek, Sandys Creek, Laheys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek, and Copes Creek
AH7	Cultural heritage management	An inspection will be undertaken by a qualified arboriculturist of all tentatively identified culturally modified trees to confirm whether they have formed through anthropogenic or natural processes. Where identified as of cultural formation, they will be integrated into the ACHMP (AH4). The findings of this investigation and subsequent management of the trees confirmed as being culturally modified will be integrated into the ACHMP (AH04) as required.	Pre-construction	#36-3-0565, #36-6-0626, #36-3-0638, #36-3-0103, #36-3-0643, SNI-CMT01, SNI-CMT02, SNI-CMT03, SNI-CMT06, SNI-CMT08, SNI-CMT11, SNI-CMT13, SNI-CMT15
AH8	Cultural heritage management	Archival recording will be undertaken of all rockshelters, grinding grooves, and culturally modified trees that may be adversely impacted by the project. Archival recording will be undertaken in accordance with relevant Heritage NSW guidelines.	Pre-construction	#36-3-3794, #36-3-0449, #36-3-0570, #36-3-3790, SNI-RS01 – RS04 inclusive, SNI-GG01, SNI-GG15, #36-3-1140, #36-3-114; and as required following AH03: #36-3-0565, #36-6-0626, #36-3-0638, #36-3-0103, #36-3-0643, SNI-CMT01, SNI-CMT02, SNI-CMT03, SNI-CMT06, SNI-CMT08, SNI-CMT11, SNI-CMT13, SNI-CMT15

Reference	Impact	Mitigation measure	Timing	Applicable locations
AH9	Heritage interpretation	An Aboriginal heritage-interpretation strategy and plan will be developed by an Aboriginal heritage specialist, in consultation with Registered Aboriginal Parties, which will identify the interpretive values of the construction area (and specifically Aboriginal heritage values) and provide direction for interpretive installations and devices. The contents and guiding principles for the management of the strategy and plan are presented in Appendix F of Technical paper 5 and include the need to incorporate Registered Aboriginal Parties' views on traditional and contemporary values, local ethnographic and post-Contact information, and archaeological data developed for the project.	Construction Post-construction	Construction area
AH10	Aboriginal engagement	Consultation will be maintained with the Registered Aboriginal Parties during the finalisation of the assessment process and subsequent stages of the project where cultural heritage requires management.	Pre-construction Construction	-
AH11	Administrative	A copy of the Aboriginal cultural heritage assessment report and all relevant AHIMS site recording forms and information for the project will be lodged with Heritage NSW and provided to each of the RAPs.	Pre-construction Construction	All Aboriginal objects, sites and places described in Chapter 9 of Technical paper 5.

12 Non-Aboriginal heritage

This section provides an overview of the existing environment of the project as it relates to non-Aboriginal heritage, an assessment of the potential non-Aboriginal heritage impacts of the project and identifies mitigation measures to minimise and manage these impacts. It summarises the assessment provided in Technical paper 6 – Non-Aboriginal heritage (Technical paper 6). The Secretary's Environmental Assessment Requirements (SEARs) as they relate to non-Aboriginal heritage, and where in the Environmental Impact Statement (EIS) these have been addressed, are detailed in Appendix A (SEARs checklist).

12.1 Legislative and policy context

The non-Aboriginal heritage assessment was undertaken in accordance with SEARs and with reference to the requirements of relevant legislation, policies and assessment guidelines, including:

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth)
- *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act)
- *Heritage Act 1977* (NSW) (Heritage Act)
- relevant local environment plans, including:
  - Dubbo Regional Local Environmental Plan 2022
  - Mid-Western Regional Local Environmental Plan 2012
  - Warrumbungle Local Environmental Plan 2013
  - Upper Hunter Local Environmental Plan 2013
- *The Burra Charter: The Australia International Council on Monuments and Sites (ICOMOS) charter for places of cultural significance* (Australia ICOMOS, 2013) (The Burra Charter)
- *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (ICOMOS, 2011)
- *NSW Heritage Manual* (NSW Heritage Branch, 2009) (including the Statement of Heritage Impact Guidelines).

Section 5.23 of the EP&A Act provides that certain authorisations are not required for the planning approval of State significant infrastructure projects, including an approval under Part 4, or an excavation permit under section 139, of the Heritage Act. In addition, Division 8 of Part 6 of the Heritage Act does not apply to prevent or interfere with the carrying out of approved State significant infrastructure under the provisions of section 5.23 of the EP&A Act.

Further discussion on the legislation and policies relevant to the assessment of non-Aboriginal heritage are provided in chapter 2 of Technical paper 6.

12.2 Assessment approach

12.2.1 Study area

The study area for the assessment of potential impacts to non-Aboriginal heritage consists of the construction area of the project with a one kilometre buffer.

12.2.2 Assessment approach

The assessment methodology involved:

- a desktop assessment to develop an understanding of the known and potential historical heritage values of the study area, identify areas of known or potential heritage value for subsequent field inspection and validation, and to provide a context against which the heritage significance of these values were assessed. Background research that formed part of the desktop assessment included:
  - searches of the World Heritage List, National Heritage List, Commonwealth Heritage List, NSW State Heritage Register, NSW State Heritage Inventory, relevant Section 170 Heritage and Conservation Registers, and non-statutory registers (Register of the National Estate and the National Trust Register)
  - analysis of historical maps (cadastral, parish and topographic) and aerial imagery to develop an appreciation of the creation and evolution of the historical landscape of the study area and identify areas of interest
  - literature review of previous heritage studies, as well as general histories of relevance to the study area
- field surveys conducted between September 2022 and April 2023 to validate the findings of the desktop review, record and document the heritage values of items within and adjacent to the construction area that may be potentially impacted by the project and record any additional features of interest that may have heritage significance and would therefore require mitigation and management
- a program of non-intrusive subsurface investigation using Ground Penetrating Radar (GPR), that was undertaken to locate two potential cemetery areas on the corner of Tucklan and Spir Road in Tallawang. Results from these investigations are still pending while processing of the data occurs. The assessment will be updated following receipt of these results.
- an assessment of the heritage significance of potential heritage items identified in the background research and field surveys, to determine if they have world, National, State or local heritage significance based on the Burra Charter and NSW Heritage Manual
- an assessment of the significance of the potential impacts from the project on the heritage values of the heritage items within and adjacent to the construction area, using criteria developed from the *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (ICOMOS, 2011)
- working with the design team in the identification of mitigation measures to avoid, minimise and manage the potential impacts identified.

12.2.3 Impact assessment

Direct impacts occur if a heritage item is located within the construction area and would be physically changed by the project. Indirect impacts, as defined by ICOMOS (2011), are secondary consequences of project activities, and can result in physical loss or changes to the setting of an asset beyond the development footprint. Indirect impacts have the potential to alter the surrounding physical environment in such a way that a heritage item is affected. Examples of indirect impacts include vibration from construction activities causing structural damage, or changes to views to or from a heritage item due to the introduction of new structures or vegetation clearing.

Heritage items can be both directly and indirectly impacted. For the purpose of this assessment, heritage items which have the potential to be both directly and indirectly impacted, were only listed in Section 12.4 as potentially directly impacted (as a worst case impact).

An assessment of the potential significance of impacts from the project on heritage items within the study area was undertaken by:

- using criteria developed from the *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties* (ICOMOS, 2011):
  - to determine the cultural heritage sensitivity of each identified heritage item. Cultural heritage sensitivity was determined by the heritage status of the item. For example, places of national or world heritage are of higher sensitivity than places of local heritage significance (refer to Table 12-1)
  - to determine the magnitude of change that would be experienced for each identified heritage item as a result of the project. Magnitude of change was determined by the nature of the potential impacts that would occur to aspects of the heritage item as a result of the project, as well as the implications of this change to the heritage values of the item, as described in Table 12-2
- combining the cultural heritage sensitivity and magnitude of change to assign a significance of impact heritage item(refer to Table 12-3).

Further detail on the assessment of non-Aboriginal heritage is provided in chapter 3 of Technical paper 6.

Table 12-1 Levels of cultural heritage sensitivity (ICOMOS, 2011)

Sensitivity	Justification	Status
Extreme	Attributes which convey Outstanding Universal Values of World Heritage Place.	Fulfils criteria for local, state, national and international listing.
Very High	Exceptional, rare or outstanding attributes demonstrating important themes in national or international history and heritage.	Fulfils criteria for local, state, national or potentially international listing.
High	Attributes demonstrating important themes in state history and heritage.	Fulfils criteria for local and state listing.
Moderate	Attributes demonstrating important themes in local history and heritage.	Fulfils criteria for local listing and may fulfil criteria for state listing.
Low	Attributes demonstrating minor themes in local history and heritage.	May fulfil criteria for local listing and does not fulfil criteria for state listing.
Negligible	Attributes that have no heritage significance.	Does not fulfil criteria for local or state listing.

Table 12-2 Determining magnitude of change (ICOMOS, 2011)

Magnitude of change	Example criteria
Major	Change to all or most significant aspects of the place, such that its heritage values are substantially reduced or destroyed.
Medium	Change to some significant aspects of the place, such that some of its heritage values are partially reduced.
Low	Minor change to significant aspects of the place, such that some of its heritage values are slightly reduced.
Negligible	Changes to insignificant aspects of the places, such that its heritage values are not reduced.
No change	No change.

Table 12-3 Estimating impact significance (ICOMOS, 2011)

Significance of impact		Magnitude of change				
		Major	Medium	Low	Negligible	No change
Cultural heritage sensitivity	Extreme	Very large	Large/very large	Moderate/large	Slight	Neutral
	Very high	Very large	Large/very large	Moderate/large	Slight	Neutral
	High	Large/very large	Moderate/large	Slight/moderate	Slight	Neutral
	Moderate	Moderate/large	Moderate	Slight	Neutral/slight	Neutral
	Low	Slight/moderate	Slight	Neutral/slight	Neutral/slight	Neutral
	Negligible	Slight	Neutral/slight	Neutral/slight	Neutral	Neutral

12.3 Existing environment

12.3.1 History of the study area

The study area is primarily located on land traditionally occupied by people known collectively as the Wiradjuri people. However, the study area sits at the boundary of the Wiradjuri, Gamilaroi, and Wailwan nations (refer to Appendix C of Technical paper 5 – Aboriginal cultural heritage assessment report). George Evans led the first European expedition into the Central Tablelands of New South Wales in 1813 (Former Mudgee Shire Heritage Committee, 2004). At this time, the Wiradjuri had already felt the effects of colonisation (Go Green Services, 2002). Disease and warfare, most notably the massacres between 1824 and 1826 known as the Bathurst War, rapidly depleted the numbers of Wiradjuri people (Niche Environment and Heritage Pty Ltd, 2015). Further information on Aboriginal cultural heritage in the study area in provided in Chapter 11 (Aboriginal heritage) and Technical paper 6.

Settlers had reached Mudgee by 1822 and in that year, Henry Lawson led an expedition from Mudgee along the upper reaches of the Goulburn River (Niche Environment and Heritage Pty Ltd, 2015). William Lee was the first European settler in the upper Goulburn River region, occupying Bylong in the mid-1820s (Niche Environment and Heritage Pty Ltd, 2015). Initial settlement through the late 1820s and 1830s in the study area focused on reliable water sources (Niche Environment and Heritage Pty Ltd, 2015). A wool boom in the late 1840s, led to the dominance of sheep farming in the Central Tablelands (Kass, 2003). The Gold Rush of the 1850s boosted the economic growth of the Central Tablelands as the increased need for beef shifted cattle routes between northern New South Wales and Victoria through Dubbo (Kass, 2001).

Pastoralism and small-scale agriculture continued as the primary industries in the Central Tablelands until the coming of the railway in the 1870s and 1880s (Monitor Heritage Consultants, 2019). A railway line was constructed from Lithgow to Bathurst in 1876, Wellington the following year, and arriving in Mudgee in 1884 (Former Mudgee Shire Heritage Committee, 2004).

In the early twentieth century, families at Dripstone near Wellington, began producing fruit for the Sydney market (Kass, 2001). Coal and shale seams were also discovered in the region at this time and the intermittent mining of coal began in Ulan in 1930 and shale deposits were mined on Barigan Station from 1932 (Niche Environment and Heritage Pty Ltd, 2015). Shale seams were also mined at Wilpinjong between 1929 to 1933. Mining and agricultural pursuits continue to operate as important industries in the area today.

12.3.2 Listed heritage items

The database and register searches identified two locally listed non-Aboriginal heritage items within the study area, one of which is partially located within the construction area (refer to Table 12-4). There are no heritage items within the construction area listed on the Commonwealth Heritage List, National Heritage List, Register of National Estate, State Heritage Register and Section 170 Registers.

Wandoona Homestead (I996) is a local heritage item listed under the Mid-Western Regional Local Environmental Plan 2012. It is located to the north of the proposed New Wollar Switching Station and the curtilage of this item is partially located within the construction area (see Figure 12-1). The homestead and other associated buildings, which form the basis of the heritage listing are located in the eastern area of the heritage item, and about 1.9 kilometres east of the construction area.

The Goulburn River National Park (I994) is a local heritage item that is listed under the Mid-Western Regional Local Environmental Plan 2012. It is located adjacent to the construction area in the south eastern section of the study area near Ulan (see Figure 12-1). Parts of the Goulburn River National Park are being considered for inclusion on the National Heritage List as part of an extension to the Greater Blue Mountains Area.

An assessment of significance and determined cultural heritage sensitivity of the locally listed heritage items in the study area are described in Table 12-4.

Table 12-4 Listed non-Aboriginal heritage items in the study area

ID	Item name	Within construction area	Heritage register/ place of listing	Description	Assessed heritage significance	Cultural heritage sensitivity
CWO-22-HH22	Wandoona Homestead	Yes (partial)	Mid-Western Regional Local Environmental Plan 2012 (I996)	The property is associated with Richard Fitzgerald, who was the earliest settler to the area. The homestead group of buildings are situated at the eastern end of the property (about 1.9 kilometres east of the construction area) and faces Wollar Creek. The majority of the lot is cleared farmland except for the western end, which is heavily vegetated, with steep topography and an existing power line oriented to the north-west. Refer to page 1 of Figure 12-1.	Local	Moderate
CWO-22-HH23	Goulburn River National Park	No (adjacent)	Mid-Western Regional Local Environmental Plan 2012 (I994)	The National Park was established in 1983 following proposals to construct the Kerrabee Dam. It has primarily natural, historic and Aboriginal heritage values. Refer to page 1 of Figure 12-1.	National (potentially)*	Moderate

Note: *The Mid-Western Regional Local Environmental Plan 2012 identifies this item as having local significance. As parts of the Goulburn River National Park are being considered for inclusion on the National Heritage List, this assessment has assigned this item as having national heritage significance.

12.3.3 Unlisted heritage items

Based on a review of historical mapping, previous heritage studies and field surveys, 24 unlisted heritage items were identified within and adjacent to the construction area. A significance assessment of each unlisted heritage item was undertaken to determine heritage significance and cultural heritage sensitivity. A description of these items, and a summary of the significance assessment is provided in Table 12-5 and these items are shown in Figure 12-1. The significance assessments are provided in full (including a statement of significance) in chapter 6 of Technical paper 6.

All of the unlisted heritage items have been assessed as having local heritage significance, and the majority of these areas comprise potential archaeological deposits. Potential archaeological deposits were identified from the desktop assessment only and may have limited or no potential for subsurface heritage finds.

The cultural heritage sensitivity of these heritage items range from negligible to low sensitivity.

Table 12-5 Unlisted heritage items within the study area

ID	Item name	Within construction area	Description	Assessed heritage significance	Cultural heritage sensitivity
CWO-22-HH01	Dapper homestead group	No	Originally part of the Wooloowoolonly Run, the Dapper Homestead Group has been continuously occupied for close to 150 years and is one of the earliest established properties of the region. Refer to page 4 of Figure 12-1.	Local	Low
CWO-22-HH02	Dapper hut and shed	No	Hut identified on Crown Plan (about 1876) predates the current Dapper Homestead Group. Potential archaeological site with no structures remaining. Refer to page 4 of Figure 12-1.	Local	Low
CWO-22-HH03	Avondale House archaeological site	Yes (partial)	Site of the former Avondale house (last recorded in 1878). Potential archaeological site with no structures remaining. Refer to page 4 of Figure 12-1.	Local	Low
CWO-22-HH04	Avondale Homestead (current)	No	A 100 year old homestead, likely built in early 20th century. Refer to page 4 of Figure 12-1.	Local	Low
CWO-22-HH05a	Laheys Creek archaeological site (house and hut)	Yes	Site of a former house and hut (last recorded in 1866) and associated with the settlement of the district and one of the earliest European families in the area (Falconer). Field survey found two surface heaps of rubble of dressed and rough stones and metal items including machinery. Refer to page 4 of Figure 12-1.	Local	Low
CWO-22-HH05b	Laheys Creek Archaeological Site (Stockyards)	Yes	Site of stockyards (last recorded in 1866) and associated with CWO-22-HH05a. Potential archaeological site with no structures remaining. Refer to page 4 of Figure 12-1.	Local	Low
CWO-22-HH06	Laheys Creek Cemetery	Yes	A cemetery for about 40 people from the area, most being members and relations of the Falconer family. An easily recognisable link to the settlement of the district. Refer to page 4 of Figure 12-1.	Local	Low
CWO-22-HH07	Brampton Park Homestead	No	An approximately 100-year-old homestead comprising a house, sheep stockyards, water tank and corrugated tin sheds for the Brampton Park property. Refer to page 4 of Figure 12-1.	Local	Low
CWO-22-HH08	Spir Road Cottage	Yes (partial)	A single storey, multi-room vertical slab and asbestos building. Oral evidence identified that the vertical slab section was relocated from nearby Tucklan in the mid-20th century. Refer to page 2 of Figure 12-1.	Local	Low
CWO-22-HH09a	Tallawang (Upper) Public School	Yes	Site of a school residence dating from the late 19th century, which was relocated to Tucklan. Potential archaeological site with no structures remaining. Refer to page 2 of Figure 12-1.	Local	Low
CWO-22-HH09b	Tallawang Union Church	Yes (partial)	Site of an early 20th century church since removed. Potential archaeological site with no structures remaining. Refer to page 2 of Figure 12-1.	Local	Low

ID	Item name	Within construction area	Description	Assessed heritage significance	Cultural heritage sensitivity
CWO-22-HH09c	Tallawang Catholic Churches	Yes (partial)	Site of a church since removed. Potential archaeological site with no structures remaining. Refer to page 2 of Figure 12-1.	Local	Low
CWO-22-HH10	Tallawang Creek Archaeological Site 01	Yes (partial)	An iron water tank and standing concrete meat safe half filled with complete bottles indicate the site dates from the early 1900s and was probably abandoned in the early 1950s. Potential archaeological site. Refer to page 2 of Figure 12-1.	Local	Low
CWO-22-HH11	Tallawang Creek Archaeological Site 02	No	Mid 1960s historic aerial map shows three structures on the southern bank of Tallawang Creek. Potential archaeological site with no structures remaining. Refer to page 2 of Figure 12-1.	Local	Low
CWO-22-HH12	Puggoon Rail Siding	No	Demolished railway siding identified from parish maps (1916) and historical aerials (1964). Originally named Stubbo Railway Station, it was renamed to Puggoon Railway Station by the mid-20th century. The site has been destroyed. Refer to page 2 of Figure 12-1. This site appears to have been destroyed and is not considered to meet any of the criteria for local heritage significance.	None	Negligible
CWO-22-HH13	Merotherie Archaeological Site	Yes	Archaeological site with scattered bottles estimated to be from the 1930s at the earliest. Refer to page 2 of Figure 12-1.	Local	Low
CWO-22-HH14	Cope Road archaeological site	No	A large house since removed fringed by mature vegetation (identified from aerial imagery from mid-1960s). Potential archaeological site with no structures remaining. Refer to page 1 of Figure 12-1.	Local	Low
CWO-22-HH15	Moolarben Archaeological Site	No	A large house since removed fringed by mature vegetation (identified from aerial imagery from mid-1960s). Potential archaeological site with no structures remaining. Refer to page 1 of Figure 12-1.	Local	Low
CWO-22-HH16	Moolarben Coal Project (MCP) Site 10	Yes (partial)	Original residence described as a gunyah on 1884 Crown Plan. Remaining structures comprise a few posts and exotic trees. Potential archaeological site. Refer to page 1 of Figure 12-1.	Local	Low
CWO-22-HH17	Mittaville Archaeological site	Yes (partial)	Site of one structure thought to have been built in the early 20th century. Demolished prior to construction of current electrical transmission line easement. Potential archaeological site with no structures remaining. Refer to page 1 of Figure 12-1.	Local	Low
CWO-22-HH18	Road Embankment (Site 4)	Yes	A stone embankment supports the unsealed Wilpinjong Road. It was built in the drystone technique using sandstone blocks and plausible that it dates from the late 1920s when a shale seam was discovered at Wollar and a syndicate was put together to mine the product. Refer to page 1 of Figure 12-1.	Local	Low

ID	Item name	Within construction area	Description	Assessed heritage significance	Cultural heritage sensitivity
CWO-22-HH19	Pine Park Woolshed	Yes (partial)	A simple slab shed believed to date to the 1930s. It has a corrugated galvanised iron roof and end-walls on a round-post frame. The slabs are said to have come from the old house on the property. Refer to page 1 of Figure 12-1.	Local	Low
CWO-22-HH20	Tallawang Creek Archaeological Site 03	Yes	Site of a house (recorded in 1884) since removed. The property is associated with Edward Milton, the original pioneers of the Birriwa area. Potential archaeological site with no structures remaining. Refer to page 2 of Figure 12-1.	Local	Low
CWO-22-HH21	MCP Site 12	Yes (partial)	A house likely dated to 1912 with associated outbuildings and sheds. Refer to page 1 of Figure 12-1.	Local	Low

Figure 12-1
Non-Aboriginal heritage items
Page 1 of 4

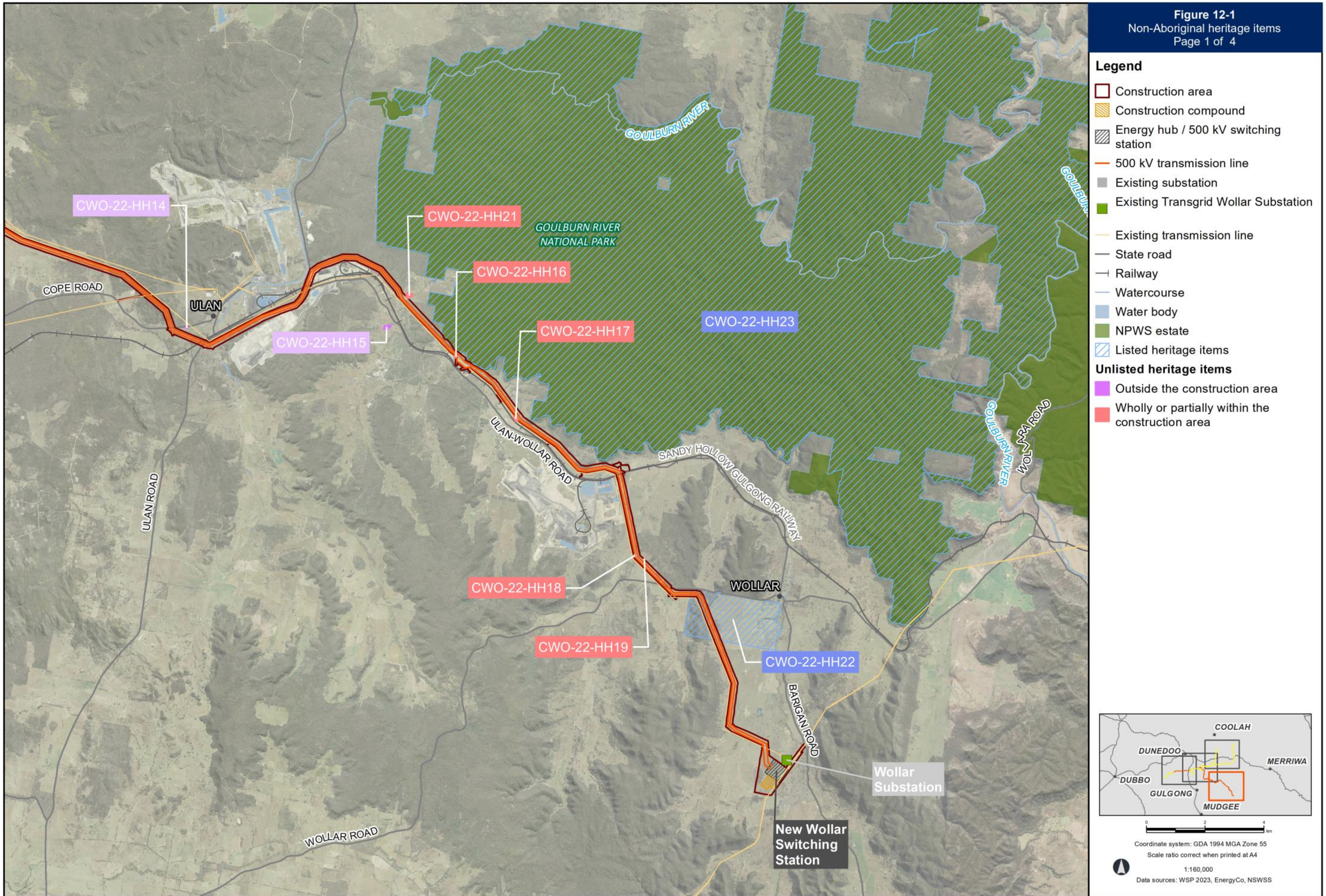


Figure 12-1
Non-Aboriginal heritage items
Page 2 of 4

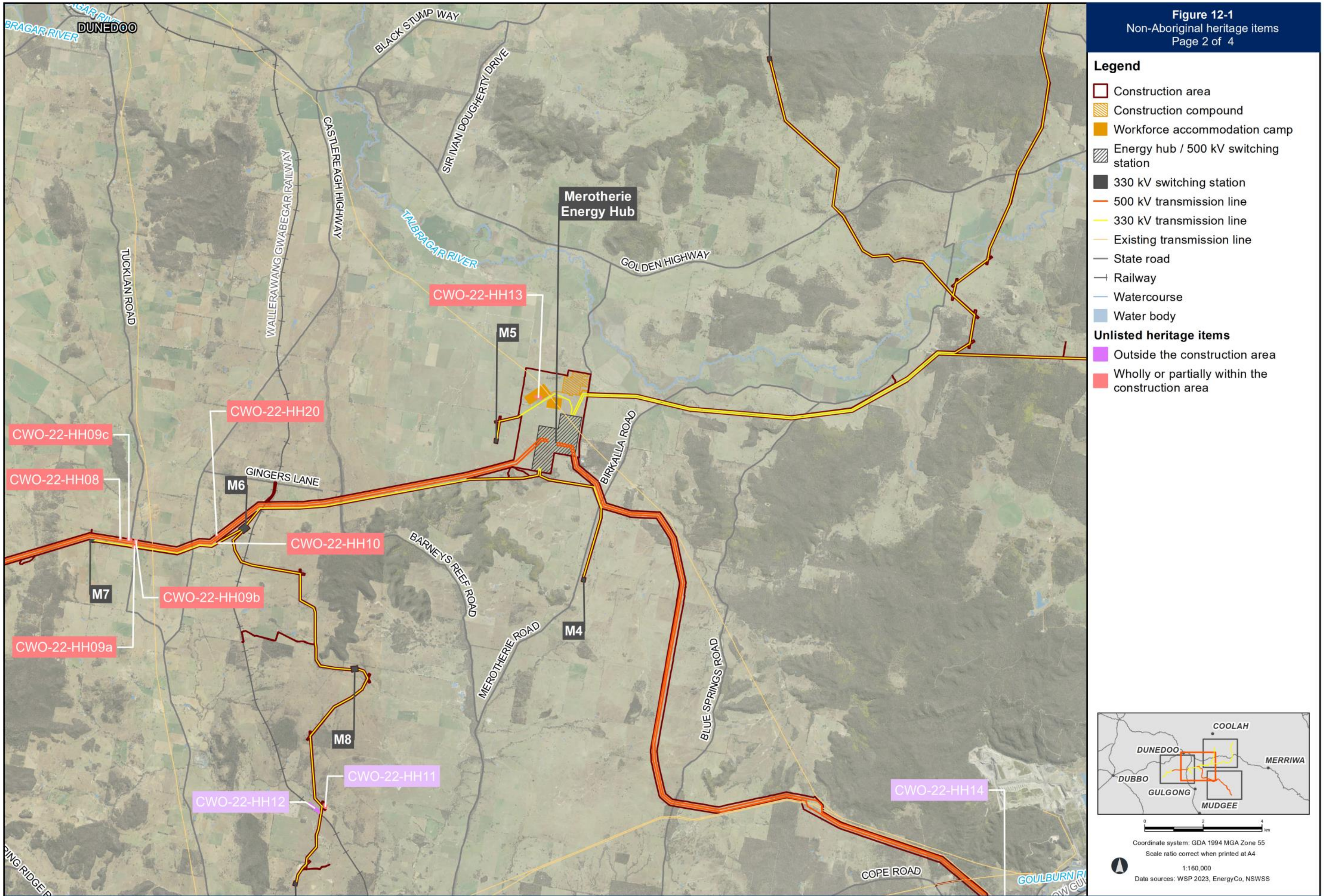
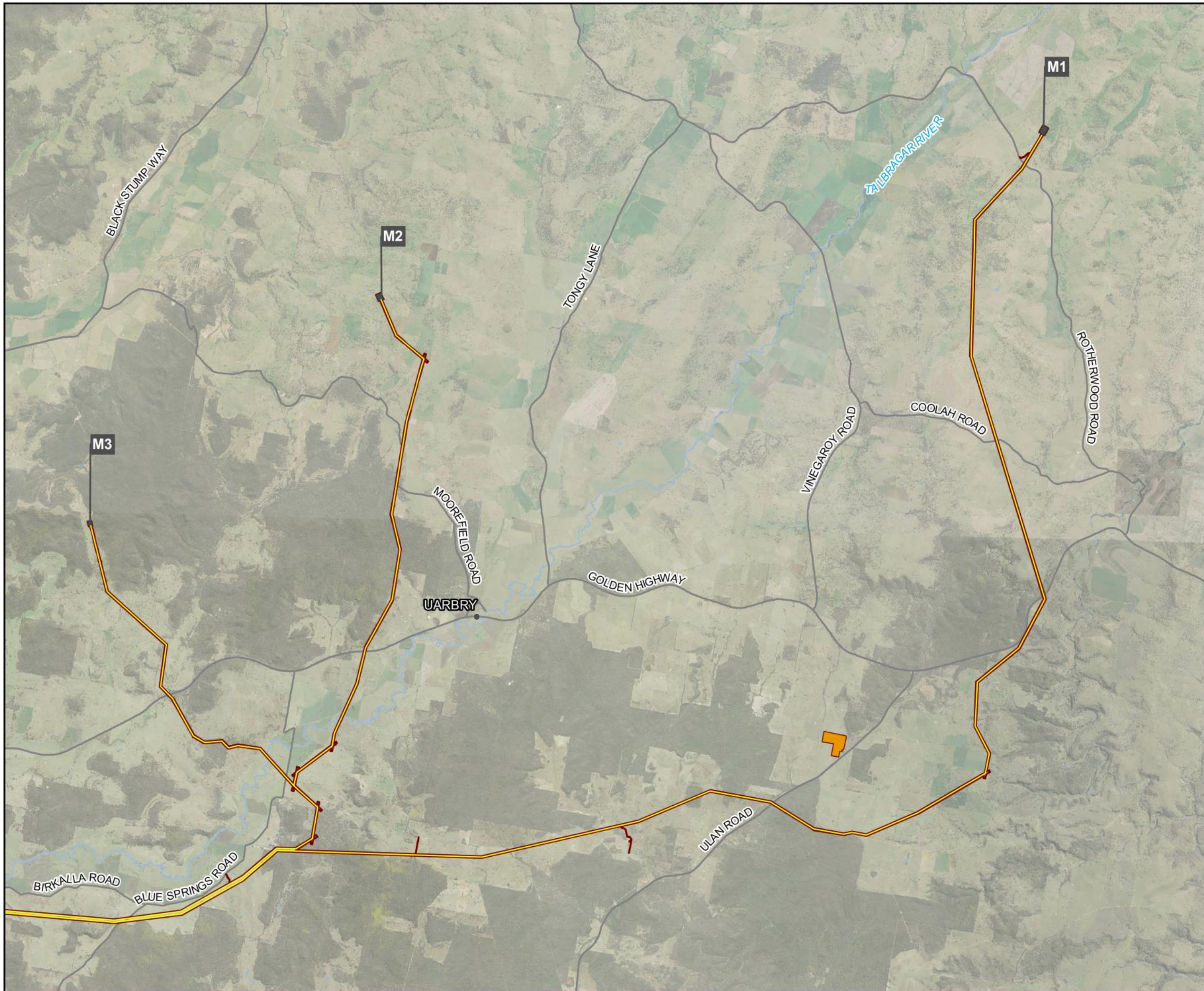


Figure 12-1
Non-Aboriginal heritage items
Page 3 of 4



Legend

- Construction area
- Workforce accommodation camp
- 330 kV switching station
- 330 kV transmission line
- State road
- Watercourse
- Water body

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:160,000
Data sources: WSP 2023, EnergyCo, NSWSS

C:\Users\AUJB505996\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\11_EIS\Chapter_12\PS130593_HER_F01201_EIS_NonAboriginalHeritageArea_r1v8.mxd

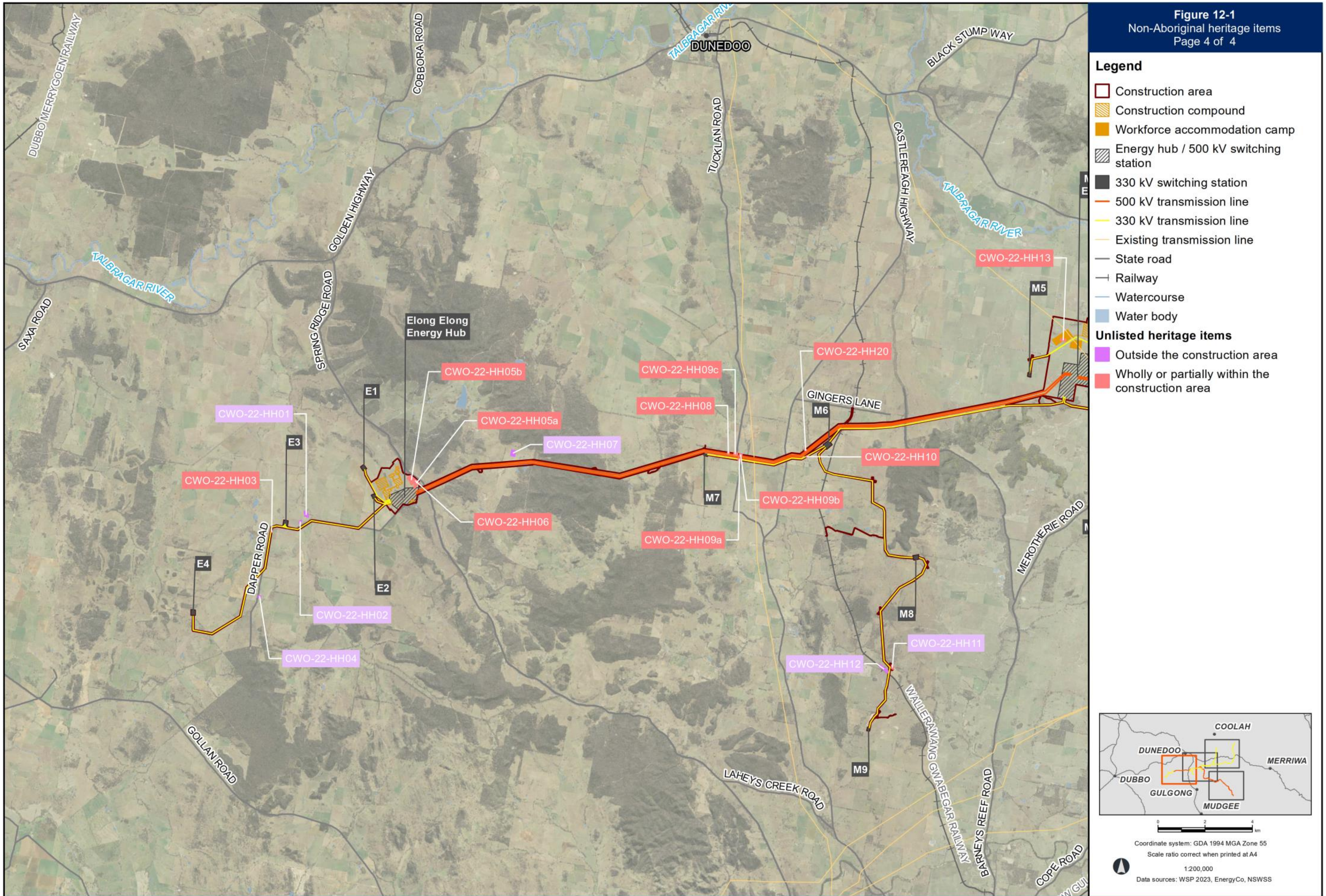


Figure 12-1
Non-Aboriginal heritage items
Page 4 of 4
Legend
Construction area
Construction compound
Workforce accommodation camp
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing transmission line
State road
Railway
Watercourse
Water body
Unlisted heritage items
Outside the construction area
Wholly or partially within the construction area
DUNEDOO
TALBRAGAR RIVER
DUBBO MERRYGOEN RAILWAY
COBBORA ROAD
TUCKLAN ROAD
CASTLEREAGH HIGHWAY
BLACK STUMP WAY
GOLDEN HIGHWAY
SPRING RIDGE ROAD
SAXA ROAD
DAPPER ROAD
GOLLAN ROAD
LAHEYS CREEK ROAD
WALLERAWANG GWABEGAR RAILWAY
BARNEYS REEF ROAD
COPE ROAD
MEROTHERIE ROAD
GINGERS LANE
Elong Elong Energy Hub
E1
E2
E3
E4
M5
M6
M7
M8
M9
CWO-22-HH01
CWO-22-HH02
CWO-22-HH03
CWO-22-HH04
CWO-22-HH05a
CWO-22-HH05b
CWO-22-HH06
CWO-22-HH07
CWO-22-HH08
CWO-22-HH09a
CWO-22-HH09b
CWO-22-HH09c
CWO-22-HH10
CWO-22-HH11
CWO-22-HH12
CWO-22-HH13
CWO-22-HH20
COOLAH
DUNEDOO
MERRIWA
DUBBO
GULGONG
MUDGEE
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:200,000
Data sources: WSP 2023, EnergyCo, NSWSS

12.4 Potential impacts

Potential direct impacts to non-Aboriginal heritage may occur during construction of the project. Once operational, the project would be unlikely to have any direct impacts to non-Aboriginal heritage items as activities would primarily involve routine inspection and maintenance of transmission lines, towers and easements. During construction, the project may potentially result in direct impacts to 17 heritage items and indirect impacts to three heritage items (inclusive of the two locally listed heritage items). The development of the project design has been able to avoid direct impacts to seven potential, unlisted non-Aboriginal heritage items within and next to the construction area.

Potential direct impacts to heritage items that would occur during construction include:

- demolition or substantial alteration of a heritage structure such as the Spir Road Cottage (CWO-22-HH08), the stone road embankment (CWO-22-HH18) and the Pine Park Woolshed (CWO-22-HH19)
- the disturbance of archaeological sites during site establishment or earthworks.

Indirect impacts have the potential to alter the surrounding physical environment in such a way that a heritage item is affected. Potential indirect impacts from the project that would occur during construction and operation include:

- visual impacts from new transmission line infrastructure changing the landscape character during operation
- damage to a heritage structure from ground borne vibration generated by construction activities such as earthworks
- potential for accidental damage to a heritage structure from construction activities in close proximity such as moving vehicles and machinery.

Dust from vehicles using unsealed roads and noise from construction and maintenance activities are expected to have a negligible impact.

A summary of the potential impacts (unmitigated) to the two listed heritage items and the 24 unlisted heritage items within and next to the construction area is provided in Table 12-6. The significance of direct impacts ranges from neutral to slight/moderate, with impacts of slight/moderate significance occurring at 13 heritage items of local heritage significance. Of these, nine heritage items are potential archaeological sites and would be potentially directly disturbed by construction. None of the impacts identified are significant enough to diminish cultural significance in the study area to a degree where it is no longer recognisable, but direct and indirect impacts could occur, which will require management to avoid the loss of important historical data.

Table 12-6 Assessment of impacts

ID	Description	Within construction area	Cultural heritage sensitivity	Impact type	Potential impact	Magnitude of change	Significance of impact
CWO-22-HH01	Dapper homestead group	No	Low	None	No impact due to distance from the construction area.	No change	Neutral
CWO-22-HH02	Dapper hut and shed	No	Low	None	No impact due to distance from the construction area.	No change	Neutral
CWO-22-HH03	Avondale House	Yes (partial)	Low	Direct	Partial disturbance of the potential archaeological site.	Medium	Slight
CWO-22-HH04	Avondale Homestead (current)	No	Low	None	No impact due to distance from the construction area.	No change	Neutral
CWO-22-HH05a	Laheys Creek Archaeological Site (House and Hut)	Yes	Low	Direct	Partial disturbance of the potential archaeological site.	Major	Slight/moderate
CWO-22-HH05b	Laheys Creek Archaeological Site (Stockyards)	Yes	Low	Direct	Partial disturbance of the potential archaeological site.	Major	Slight/moderate
CWO-22-HH06	Laheys Creek Cemetery	Yes	Low	Direct	Disturbance of the entire item. Mitigation measures have been identified to prevent direct impacts to this item. Visual amenity impacts from transmission line infrastructure and Elong Elong Energy Hub would also occur.	Major	Slight/moderate
CWO-22-HH07	Brampton Park Homestead	No	Low	Indirect	Visual impacts from transmission line infrastructure.	Low	Neutral/slight
CWO-22-HH08	Spir Road Cottage	Yes (partial)	Low	Direct	Partial disturbance of item.	Major	Slight/moderate
CWO-22-HH09a	Tallawang (Upper) Public School	Yes	Low	Direct	Disturbance of entire potential archaeological site.	Major	Slight/moderate
CWO-22-HH09b	Tallawang Union Church	Yes (partial)	Low	Direct	Disturbance of entire potential archaeological site.	Major	Slight/moderate

ID	Description	Within construction area	Cultural heritage sensitivity	Impact type	Potential impact	Magnitude of change	Significance of impact
CWO-22-HH09c	Tallawang Catholic Church	Yes (partial)	Low	Direct	Disturbance of entire potential archaeological site.	Major	Slight/moderate
CWO-22-HH10	Tallawang Creek Archaeological Site 01	Yes (partial)	Low	Direct	Disturbance of entire potential archaeological site. Surface features, including water tank and meat safe, may be removed.	Major	Slight/moderate
CWO-22-HH11	Tallawang Creek Archaeological Site 02	Yes (partial)	Low	Direct	Partial disturbance of item. However there are no known heritage items (including potential relics) in the immediate area of disturbance. Mitigation measures have been identified to prevent direct impacts to this item.	No change	Neutral
CWO-22-HH12	Puggoon Rail Siding	No	Negligible	None	No impact. The item is located outside the construction area and was assessed as having no potential heritage significance.	N/A	N/A
CWO-22-HH13	Merotherie archaeological site	Yes	Low	Direct	Disturbance of entire potential archaeological site.	Major	Slight/moderate
CWO-22-HH14	Cope Road archaeological site	No	Low	None	No impact due to distance from the construction area.	No change	Neutral
CWO-22-HH15	Moolarben Archaeological Site	No	Low	None	No impact due to distance from the construction area.	No change	Neutral
CWO-22-HH16	MCP Site 10	Yes (partial)	Low	Direct	Disturbance of entire potential archaeological site.	Major	Slight/moderate
CWO-22-HH17	Mittaville Archaeological Site	Yes (partial)	Low	Direct	Partial disturbance of potential archaeological site.	Low	Neutral/slight
CWO-22-HH18	Road Embankment (Site 4)	Yes	Low	Direct	Disturbance of entire item.	Major	Slight/moderate

ID	Description	Within construction area	Cultural heritage sensitivity	Impact type	Potential impact	Magnitude of change	Significance of impact
CWO-22-HH19	Pine Park Woolshed	Yes (partial)	Low	Direct	Physical impact to the heritage structure and visual impacts from transmission line infrastructure in close proximity to the item. Vibration from construction activities may also impact stability of structure.	Major	Slight/moderate
CWO-22-HH20	Tallawang Creek Archaeological Site 03	Yes	Low	Direct	Disturbance of entire potential archaeological site.	Major	Slight/moderate
CWO-22-HH21	MCP Site 12	Yes (partial)	Low	Direct	A small portion of the heritage item intersects with the construction area and would potentially be subject to disturbance. Visual amenity impacts from transmission line infrastructure would also occur.	Negligible	Neutral/slight
CWO-22-HH22	Wandoona Homestead	Yes (partial)	Moderate	Indirect	Visual impacts from transmission line infrastructure would be negligible given distance (around 2.3 kilometres) between the group of buildings associated with the heritage item and the transmission line.	Negligible	Neutral/slight
CWO-22-HH23	Goulburn River National Park	No	Moderate	Indirect	Visual impacts from transmission line infrastructure would be negligible as there are no significant views from the park to the direction of the transmission lines and existing transmission lines are already present along the southern boundary of the site.	Negligible	Neutral/slight

12.5 Management of impacts

12.5.1 Environmental management

Non-Aboriginal heritage impacts would be managed in accordance with the Construction Environmental Management Plan (CEMP). As part of the CEMP, a historical heritage management sub-plan (HHMP) will be prepared. The HHMP will include as a minimum:

- measures that would be implemented to manage potential impacts on items of heritage significance
- inclusion of heritage awareness and management training within the site induction process for relevant personnel involved in site works
- details regarding the conservation and curation of any non-Aboriginal heritage artefacts recovered during works.

12.5.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to non-Aboriginal heritage are listed in Table 12-7.

Mitigation measures in other chapters that are relevant to the management of non-Aboriginal heritage include:

- Chapter 9 (Landscape character and visual amenity), specifically measures which address visual impacts on the landscape
- Chapter 11 (Aboriginal heritage), specifically measures which address impacts on aboriginal cultural heritage
- Chapter 15 (Noise and vibration), specifically measures which address vibration impacts on heritage items
- Section 19.4 (Air quality), specifically address dust impacts.

Table 12-7 Proposed mitigation measures – Non-Aboriginal heritage

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
HH1	Avoidance of direct impacts to Tallawang Creek Archaeological Site 02	Prior to construction, an exclusion barrier (e.g. fencing or suitable alternative) will be installed to prevent construction activities or access into the portion of CWO-22-HH11 which extends into the construction area. The barrier would be maintained for the duration of construction.	Pre-construction Construction	CWO-22-HH011
HH2	Minimisation of direct impacts	Construction methodologies will be refined to avoid and/or minimise direct impacts to listed and potential historic heritage items where reasonable and feasible.	Pre-construction Construction	CWO-22-HH03 CWO-22-HH05a CWO-22-HH05b CWO-22-HH08 CWO-22-HH09a CWO-22-HH09b[1] CWO-22-HH09c[1] CWO-22-HH10 CWO-22-HH13 CWO-22-HH16 CWO-22-HH18 CWO-22-HH19 CWO-22-HH20 CWO-22-HH21
HH3	Minimisation and management of indirect impacts	Construction methodologies will be refined to avoid and/or minimise indirect impacts to listed and potential historic heritage items where reasonable and feasible.	Pre-construction Construction	CWO-22-HH06 CWO-22-HH22 CWO-22-HH23
HH4	Cultural heritage management	**Archival recording** If avoidance cannot be established during the detail design stage, an archival recording will be completed in accordance with the following guidelines, and be lodged with the Heritage NSW and local councils for access to researchers: • photographic recording of heritage items using film or digital capture (Heritage Office, 2006), and • how to prepare archival records of heritage items (NSW Heritage Office, 1998).	Pre-construction	CWO-22-HH08 CWO-22-HH10 CWO-22-HH18 CWO-22-HH19

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
HH5	Cultural heritage management	**Archaeological test excavation** If direct impacts to a heritage item cannot be reasonably and feasibly avoided during the detailed design stage, a program of archaeological test excavation will be undertaken (where the extent of the archaeological deposit is not known). This will include development of: • a detailed archaeological research design • consultation with Heritage NSW • systematic test excavation of historical archaeological sites that meet the 'relics' threshold identified for impact • where archaeological deposits are uncovered, sampled recovery of historic heritage relics will occur prior to disturbance. Once recorded and analysed artefacts will be offered to local heritage society/museum. A detailed excavation method and research design for this process will be included in the Historical Heritage Management sub-plan (HHMP).	Pre-construction Construction	CWO-22-HH03 CWO-22-HH05a CWO-22-HH13 CWO-22-HH16
HH6	Cultural heritage management	**Archaeological salvage excavation** Salvage excavation will be undertaken on archaeological sites subject to direct impacts where the extent of the archaeological deposit is known. This will include development of: • a detailed archaeological research design • consultation with Heritage NSW • systematic salvage excavation of historical archaeological sites. Once recorded and analysed, salvaged artefacts will be offered to local heritage society/museum. A detailed excavation method and research design for this process will be included in the HHMP.	Pre-construction	CWO-22-HH03 CWO-22-HH05a CWO-22-HH09a CWO-22-HH09b[1] CWO-22-HH09c[1] CWO-22-HH13 CWO-22-HH16
HH7	Cultural heritage management	**Unexpected finds procedure** Any items of potential heritage conservation significance or human remains discovered during construction and operation will be managed in accordance with an Unexpected Finds Procedure. Work in the vicinity of the find will stop if objects such as bonded bricks, timber or stones appearing in formation indicating a wall or floor for instance are found, or if soil with artefacts concentrations, is excavated. A description of the types of finds that will stop works within the vicinity of the finds will be determined prior to construction as part of the HHMP and staff involved in excavation work will be informed about how to apply it. The unexpected finds procedure will include actions such as: • stop work procedures and exclusion buffers • utilising the advice of a technical specialist • consultation with Heritage NSW • protocols for continuing work in the area after assessment.	Pre-construction Construction	CWO-22-HH03 CWO-22-HH05a CWO-22-HH05b CWO-22-HH09a CWO-22-HH09b[1] CWO-22-HH09c [1] CWO-22-HH10 CWO-22-HH11 CWO-22-HH17 CWO-22-HH20 CWO-22-HH21

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
HH8	Laheys Creek Cemetery	• A structural assessment of the standing headstones will be undertaken to determine if additional conservation works may be required to mitigate nearby construction works. • A vibration monitor will be installed within the cemetery at the closest point to construction works to confirm that vibration levels are compliant with applicable criteria.	Pre-construction Construction	CWO-22-HH06
HH9	Avoidance of direct and indirect impacts to Laheys Creek Cemetery	• Prior to construction, an exclusion barrier (e.g. fence or suitable alternative) will be installed to provide a minimum 100 metre exclusion buffer around CWO-22-HH06 (Laheys Creek Cemetery) to ensure direct and indirect impacts to the cemetery are avoided. • The nominated exclusion buffer for CWO-22-HH06 may be reduced on the following basis: • a report from a structural engineer assesses the stability of the headstones in the cemetery; and • the report can certify that a reduced buffer is unlikely to cause damage; and/or • the headstones identified as being at risk of collapse are stabilised and conserved; and/or • the report can provide and certify vibration criteria, vibration monitoring equipment is installed and vibration criteria are not exceeded; and • any damage sustained to the cemetery during construction or in the succeeding 12 month period is repaired and conserved by the proponent.	Pre-construction Construction	CWO-22-HH06

1. The final mitigation measure for the Tallawang Union and Catholic Churches (HH09b and HH09c) and cemetery depend on the outcome of the non-intrusive geophysical investigations.

13 Social

This chapter provides an assessment of the potential social impacts of the construction and operation of the project and identifies mitigation measures to be adopted to avoid, minimise and manage these impacts. The full assessment is provided in Technical paper 7 – Social (Technical paper 7). The Secretary's Environmental Assessment Requirements (SEARs) as they relate to social impacts, and where in the Environmental Impact Statement (EIS) these have been addressed, are detailed in Appendix A (SEARs checklist).

13.1 Legislative and policy context

The social impact assessment was undertaken in accordance with the SEARs and with consideration of the requirements of relevant legislation, plans and assessment guidelines specific to social impact assessment, including:

- *Social Impact Assessment Guideline* (New South Wales (NSW) Department of Planning and Environment (DPE), 2023b) (SIA guideline)
- *Undertaking Engagement Guidelines for State Significant Projects* (DPE, 2022h)
- *Social Impact Assessment Practice Notes: Practice Note – Engaging with Aboriginal Communities* (DPE, 2022l)
- *State significant infrastructure guidelines – preparing a scoping report: Appendix A to the state significant infrastructure guidelines* (State Significant Infrastructure Guidelines) (DPE, 2022k)
- *Central West and Orana Regional Plan 2041* (NSW DPE (DPE), 2022a)
- relevant Community Strategic Plans for the Dubbo Regional, Mid-Western Regional, Warrumbungle, Upper Hunter and Liverpool Plains local government areas (LGAs), and Local Strategic Planning Statements for the Narromine, Gilgandra, Muswellbrook and Cabonne LGAs.

13.2 Assessment approach

13.2.1 Introduction

Social impacts refer to the potential direct and/or indirect consequences, either positive or negative, of an activity on people (DPE, 2023b), including impacts on:

- way of life: how people live, get around, work, play and interact each day
- community: composition, cohesion, character, how the community functions, resilience and people's sense of place
- accessibility: how people access and use infrastructure, services and facilities, whether provided by a public, private or not-for-profit organisation
- culture: both Aboriginal and non-Aboriginal, including shared beliefs, customs, practices, obligations, values and stories, and connections to Country, land, waterways, places and buildings
- health and wellbeing: physical and mental health, especially for people vulnerable to social exclusion or substantial change, psychological stress resulting from financial or other pressures, access to open space and effects on public health

- surroundings: ecosystem services such as shade, pollution control, erosion control, public safety and security, access to and use of the natural and built environment, and aesthetic value and amenity
- livelihoods: people's capacity to sustain themselves through employment or business
- decision-making systems: extent to which people can have a say in decisions that affect their lives, and have access to complaint, remedy and grievance mechanisms.

For the purpose of the project social impact assessment, 'people' has been used to refer to individuals, households, groups, communities or organisations.

To establish what is important to people, and how they may potentially be impacted by construction and/or operation of the project, information and insights from a range of data sources have been used to inform the social impact assessment for the project, including:

- consultation with Aboriginal stakeholders and the local community, including interviews, community workshops or focus groups, written stories and community surveys
- consultation with local councils and State government agencies
- findings of technical specialist assessments completed for the project
- environmental impact assessments of other relevant projects, including previous community engagement reports
- published research
- data from the Australian Bureau of Statistics (ABS)
- local, State and Australian government strategic plans and policies
- engagement with relevant stakeholder groups.

13.2.2 Social locality

The social locality for the social impact assessment comprised a local social locality and regional social locality, determined in accordance with the SIA guideline, including consideration of who is most likely to experience direct and indirect social impacts and where those groups of people are located.

The local social locality is the area expected to experience the most social change as a result of the project during construction and/or operation. It includes the people living and/or accessing services within, or in close proximity, to the project. Suburbs and localities that spatially intersect the project form part of the local social locality. Given the scale of the project and the number of identified suburbs, the local social locality has been divided into four subsections, the western section, the northern section, the eastern section and the southern section, to represent the different areas of the project. The majority of the 42 suburbs identified are located in the southern section.

The regional social locality is the area expected to experience indirect benefits or effects as a result of the project during construction and/or operation. The regional social locality comprises nine LGAs, including Dubbo Regional (previously known as Western Plains Regional LGA until 2016), Narromine, Mid-Western Regional, Upper Hunter, Warrumbungle, Gilgandra Shire, Liverpool Plains, Muswellbrook and Cabonne.

The local and regional social localities are shown in Figure 13-1 and Figure 13-2, respectively.

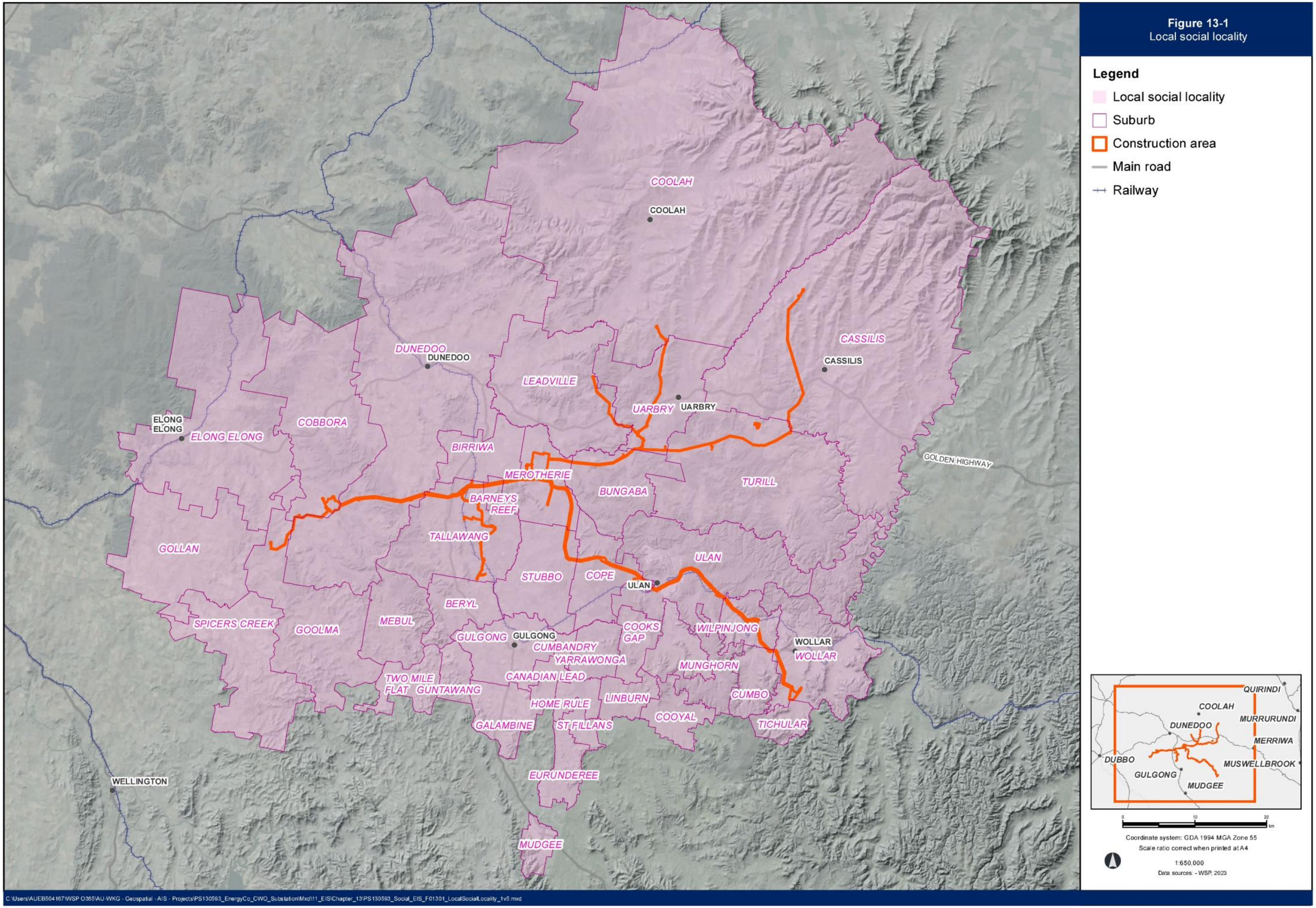


Figure 13-1
Local social locality

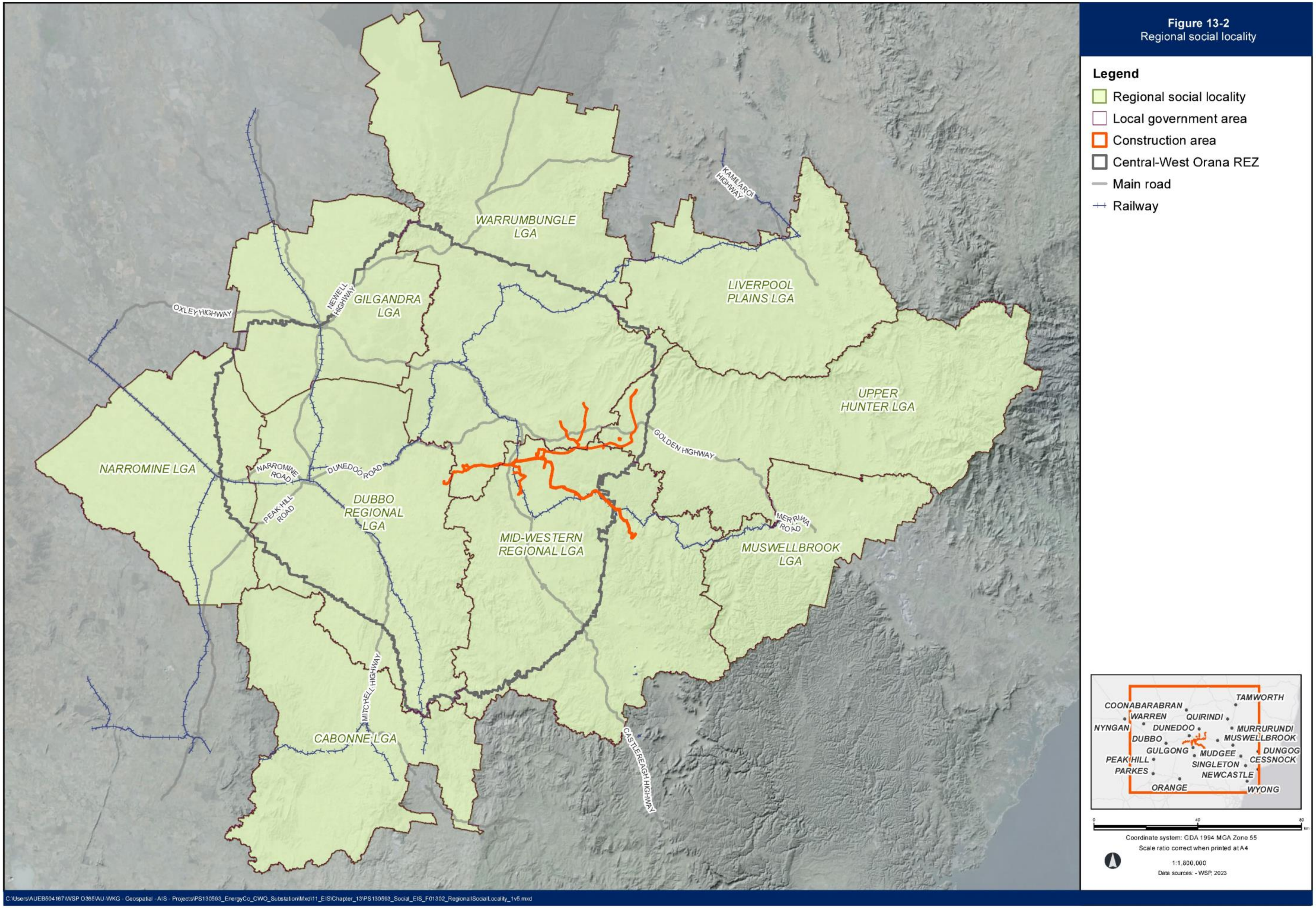


Figure 13-2
Regional social locality

13.2.3 Methodology

The social impact assessment (SIA) for the project has been undertaken across three phases. This assessment represents Phase 2 of the SIA which builds on the Phase 1 SIA, which was completed as part of the *Central-West Orana Renewable Energy Zone Transmission project – Scoping Report* (EnergyCo, 2022c). The Phase 1 SIA applied the State Significant Infrastructure Guidelines to identify the potential social impacts and recommended level of assessment for the Phase 2 SIA.

The approach for this assessment included the following key tasks, in accordance with the requirements of the SIA guideline for a Phase 2 SIA:

- further refinement of the social locality defined in the Phase 1 SIA, to respond to feedback received from DPE and account for refinements to the project design
- community and stakeholder engagement to inform the assessment, including:
  - reviewing engagement carried out by Transgrid between December 2020 and September 2021 and engagement carried out by EnergyCo for the EIS since early 2022
  - targeted SIA engagement between October 2022 and May 2023, including face to face, phone and online interviews. An online survey was also distributed among stakeholders to capture general inputs and to identify potential impacts
- describing the existing social environment from information gathered by desktop research and feedback received from community and stakeholder engagement
- refining and assessing social impacts identified in the Phase 1 SIA by:
  - defining the five dimensions of social impact magnitude that demonstrate the material effect of the potential impact (extent, duration, severity, sensitivity and level of concern), in accordance with the SIA guideline
  - considering feedback received from community and stakeholder engagement
  - considering the findings of technical studies completed for the project
  - identifying who specifically may be affected, directly, indirectly or cumulatively, and the level of concern they may feel about the matter (high, medium, low), recognising that impacts may affect population groups or individuals differently
  - identifying when the potential impact is expected to occur (pre-construction, construction and operation)
  - identifying the magnitude level of each impact as per Table 13-1, in accordance with the SIA guideline
  - establishing the likelihood level of each impact through an understanding of the project context as outlined in Table 13-2, in accordance with the SIA guideline
  - determining the significance of the potential impact pre-mitigation as per the social impact significance matrix in Table 13-3, in accordance with the SIA guideline
- identifying mitigation measures to avoid, minimise and manage the potential impacts identified, considering feedback received from community and stakeholder engagement
- assessing the potential residual impacts following the implementation of the mitigation measures.

Data from the 2021 ABS Census of Population and Housing has been used to describe the existing social environment, conditions and trends (social baseline). Further detail on the assessment of social impacts is provided in Chapter 3 of Technical paper 7.

Table 13-1 Magnitude levels for social impacts (DPE, 2023b)

Magnitude level	Definition
Transformational	Substantial change experienced in community wellbeing, livelihood, amenity, infrastructure, services, health, and/or heritage values; permanent displacement or addition of at least 20% of a community.
Major	Substantial deterioration/improvement to something that people value highly, either lasting for an indefinite time, or affecting many people in a widespread area.
Moderate	Noticeable deterioration/improvement to something that people value highly, either lasting for an extensive time, or affecting a group of people.
Minor	Mild deterioration/improvement, for a reasonably short time, for a small number of people who are generally adaptable and not vulnerable.
Minimal	Little noticeable change experienced by people in the locality.

Table 13-2 Likelihood levels of social impacts (DPE, 2023b)

Likelihood level	Definition
Almost certain	Definite or almost definitely expected (e.g. has happened on similar projects)
Likely	High probability
Possible	Medium probability
Unlikely	Low probability
Very unlikely	Improbable or remote probability

Table 13-3 Social impact significance matrix (DPE, 2023b)

		Magnitude level				
		1 Minimal	2 Minor	3 Moderate	4 Major	5 Transformational
Likelihood level	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

13.3 Engagement

Social impacts identified in the phase 1 SIA (completed as part of the Scoping Report) were further refined as part of the EIS social impact assessment, based on the results of engagement activities undertaken by EnergyCo, as part of the broader development of the EIS, and targeted SIA engagement specifically as part of the social impact assessment. The community and stakeholders' feedback and suggestions to address concerns and maximise benefits raised as part of these engagement activities, were considered when identifying appropriate mitigation measures to avoid, minimise and manage the potential social impacts identified as part of this assessment (outlined in Section 13.7.2).

13.3.1 EIS engagement

Engagement with the community and stakeholders about the project, including community information sessions and targeted engagement with landowners, councils, community representative groups and First Nations stakeholder groups, has been ongoing since 2020.

Between December 2020 and September 2021, community engagement was carried out by Transgrid on the preliminary study area for new transmission network infrastructure in the Central-West Orana Renewable Energy Zone (REZ). Feedback received during this engagement was considered in the refinement of the project study area. Since early 2022, following the appointment of EnergyCo as the Infrastructure Planner for the Central-West Orana REZ, EnergyCo has continued a comprehensive program of community and stakeholder engagement on the revised study area to enable stakeholder participation and consider community and stakeholder feedback. Further detailed information about the engagement objectives, activities, communication methods and publicly available information is provided in Chapter 5 (Community and stakeholder engagement).

Engagement carried out for the EIS has identified a number of community views, concerns, aspirations and questions relating to the project. Key issues raised during this engagement that are relevant to the SIA are summarised in section 5.2 of Technical paper 7. Further detail about the engagement activities carried out and feedback received is provided in Chapter 5 (Community and stakeholder engagement).

Engagement activities for the project are ongoing and will continue during the exhibition of the EIS to ensure the community and stakeholders receive comprehensive updates about the project and have the opportunity to provide feedback on the project.

13.3.2 Targeted SIA engagement

Targeted engagement was carried out for the social impact assessment between October 2022 and May 2023, which included face to face, phone and online interviews, as well as the distribution of an online survey.

The online survey to invite feedback about the project was distributed to 80 landowners hosting project infrastructure, neighbouring the project and not hosting project infrastructure, and was subsequently shared amongst the community. A total of 104 responses to the online survey were received between 10 November and 8 December 2022.

Forty-four face to face, phone and online interviews were conducted between November 2022 and May 2023 to invite further feedback about the project, which included interviews with councils, landowners hosting infrastructure, neighbouring the project and not hosting project infrastructure, community organisations, First Nations organisations and public services (emergency services and health services).

A summary of the interview and online survey questions is provided in Appendix B of Technical paper 7.

Key themes raised during the targeted SIA engagement include:

- the potential saturation of services and social infrastructure due to the influx of a temporary workforce during construction
- changes to community cohesion and sense of community
- potential impacts on the community's way of life and health and wellbeing due to construction activities and proximity to project infrastructure
- changes to the landscape
- potential impacts on agricultural land and operations, including biosecurity risks and constraints to farming and residential activities
- potential decreases in property values
- bushfire and flooding risk during project operation
- a desire for additional project information and engagement
- economic opportunities, including local employment and procurement
- involvement of First Nations stakeholders and communities
- benefits of renewable energy delivery.

Further detail about these key themes are provided in Section 5.2 of Technical paper 7. Detailed feedback is provided in Appendix F of Technical paper 7.

Issues raised in relation to public road upgrades are not within the scope of this assessment and will be considered as part of separate planning and approval processes (refer to Section 1.4). Feedback associated with cumulative impacts is addressed in Chapter 20 (Cumulative impacts).

13.4 Existing environment

13.4.1 Community

Community refers to the composition, cohesion, character and resilience of the community, how the community functions and people's sense of place (DPE, 2023b).

The total resident populations and dwellings of the local and regional social localities are presented in Table 13-4. The southern section of the social locality has the largest population and number of dwellings (an indicator of population size and density), as it consists of 30 suburbs, including Gulgong and Mudgee which have comparatively large resident populations compared to other areas within the social locality. There is a relatively even proportion of men and women within the local and regional social localities.

Within the local and regional social localities there is a comparatively high proportion of people who identify as Aboriginal and/or Torres Strait Islander, at 17 per cent and 12.1 per cent respectively, in comparison to NSW more broadly, where 3.4 per cent of the population identifies as Aboriginal and/or Torres Strait Islander.

Overall, the populations in the regional and local social localities have grown by six per cent and nine per cent (respectively) in the ten years from 2011 to 2021. The LGA with the largest population growth in the local social locality over 10 years was Dubbo Regional, which saw a 13 per cent increase.

Table 13-4 Population and dwellings in the local and regional social localities (ABS, 2021)

	Local social locality					Total regional social locality
	Eastern section	Northern section	Southern section	Western section	Total local social locality	
Population	278	2,939	16,916	306	20,449	152,418
Dwellings	171	1,468	6,815	138	8,592	142,728

When compared to NSW more broadly, the resident population in both the local and regional social localities has a comparatively higher proportion of age groups that are 50 and over, and a slightly lower proportion of age groups between 20 to 50. This may indicate a heightened need for easily accessible services, infrastructure, and health care within the local area, including aged care facilities, hospitals, general practitioners and specialists.

13.4.2 Way of life

Way of life looks refers to how people live, work, get around, play and interact with each other on a daily basis within the community (DPE, 2023b).

Results from the online survey showed the majority of respondents (around 63 per cent) used their land only for agricultural purposes, whereas 19 per cent of respondents use their land for agricultural and residential purposes and 15 per cent of respondents use their land only for residential purposes.

Around 80 per cent of respondents reported to have derived their primary source of income from their property. The majority of residential properties (around 67 per cent) contained one dwelling, while other properties contained two dwellings (around 25 per cent) or three dwellings (one property). Two respondents noted they have heritage homes located on their properties.

Further information on land use in the area is provided in Chapter 7 (Land use and property).

Community values are diverse across the local and regional social localities. Most of the respondents value the views, natural landscape, surroundings and agricultural potential of their properties. Other valuable factors include sense of community and safety, privacy, nature and the serenity of the social locality.

Another notable community value that was raised by multiple stakeholders during SIA consultation is community cohesion. The rural, close-knit nature of the community is an important aspect of life for residents living in the local social locality, particularly given the challenging recent history of bushfires and flooding in the region. Furthermore, the long-standing multigenerational connection many families have to their properties and the local community has also contributed to many residents valuing community cohesion.

13.4.3 Livelihoods

Livelihoods refer to the community's and individual's access to economic resources, including income, assets, employment and industry within a community (DPE, 2023b).

Employment

The ABS defines the labour force as people 15 years and over who are employed (has work) and unemployed (without work, actively looking for work or available to start work). Those 'not in the labour force' are defined by the ABS as people aged 15 years and over, who are neither employed nor unemployed, including retirees or voluntary inactive people, people performing home duties or caring for children, students, people experiencing long or short term health conditions or disability and their carers, volunteers, people in institutions (hospitals, jails), people who are travelling, on holiday or on a leisure activity and those that are permanently unable to work.

Just under half of the labour force in the local and regional social localities (45.5 per cent and 44.9 per cent respectively) were employed (including those who were employed part time, full time or were away from work), which is slightly higher than the employed population in NSW (43.7 per cent). It is noted that employment data excludes residents younger than 15, and those who did not state their employment status or participation in the labour force.

The proportion of unemployed people in the local social locality was around 2.5 per cent, which is about half of the proportion of unemployed residents in NSW (4.9 per cent). There were no people in the western section of the local social locality who stated they were unemployed. This is likely due to the larger proportion of residents in the local and regional social localities who stated they were not in the labour force (27 per cent and 26 per cent respectively).

Key employment industries in the local social locality include agriculture, forestry and fishing (8.1 per cent of employment) and mining (15.9 per cent of employment). Agriculture, forestry and finishing was the dominant industry of employment in the northern, western and eastern sections, whereas mining represented a large proportion of employment in the southern section.

Income

The weekly household income in the regional social locality ranged from a median of $1,308 in the Narromine LGA to a median of $1,597 in the Dubbo Regional LGA.

Within the local social locality, household incomes varied significantly. Uarbry and Dunedoo had particularly low median household incomes whereas Cumbandry and Guntawang had notably high median household incomes when compared to NSW.

In both the northern and western sections of the local social locality, around 30 per cent of residents had a median weekly household income that was less than $650. This included around half of households in Merotherie and Two Mile Flat, and around 66 per cent of households in Moolarben.

Around a quarter of the population in the local social locality (23.6 per cent) had a lower middle household income between $650 to $1,500.

Around 19 per cent of residents in the southern section, and a small proportion of residents in the northern, western and eastern sections of the local social locality, had high median household weekly incomes ($2,500 or more).

Socio-economic advantage and disadvantage

The Index of Relative Socio-economic Advantage and Disadvantage (IRSAD) provides an overview of the socio-economic conditions of residents and households within an area, including relative advantage and disadvantage. A low IRSAD score indicates higher levels of disadvantage, while a high score will indicate high levels of advantage and relatively low levels of disadvantage.

Overall, populations within the regional and local social localities are likely to experience heightened levels of socio-economic disadvantage, due to:

- more households with low incomes, or more people in unskilled occupations
- less households with high incomes, or less people in skilled occupations.

Within the local social locality, communities that are likely to experience the highest level of relative disadvantage (low IRSAD scores) are located within the southern and northern sections, in areas such as Bugaba, Cope, Dunedoo and Cobbora. Communities with high levels of advantage (high IRSAD scores) are located within the southern and western sections, in areas such as Goolma, Two Mile Flat, Spicers Creek and Elong Elong.

Within the regional social locality, the Gilgandra, Liverpool Plains and Warrumbungle LGAs are likely to experience the highest level of relative disadvantage. Cabonne, Upper Hunter and Dubbo Regional LGAs demonstrates a notably higher level of advantage when compared to other LGAs in the regional social locality.

Local business, industry and economy

The Central-West and Orana regions have a diverse economy with an opportunity for growth by major investments in the Inland Rail project, Parkes Special Activation Precinct and the Central-West Orana REZ (DPE, 2022a). Agricultural production occurs from the vast plains of Orana in the north and west to the sub-alpine areas of the Central-West in the east, ranging from intensive and irrigated crops (including vegetables, fodder, stone fruits, grapes and cotton) to extensive broadacre cropping, meat and wool production and forestry (DPE, 2022a). Key agricultural activities within the local social locality include livestock production and management (sheep and cattle for meat and wool), cropping (cash crops, and stock feed) and shearing.

The mining industry is the largest employer in the local social locality (15.9 per cent), and comprises 7.4 per cent of employment sectors in the regional social locality. Suburbs with the highest proportion of residents employed by the mining industry include Ulan (63.6 per cent), St Fillans (47.9 per cent) and Galambine (45.5 per cent).

The project intersects with three major mining operations in the local social locality; the Ulan Coal Mine Complex, the Wilpinjong Coal Mine and Moolarben Coal Mine. These mining operations are located within the southern section of the local social locality, which had the highest proportion of residents employed in the mining industry (17.4 per cent).

Renewable energy

A study on potential skilled labour in the renewable energy sector surrounding the Central-West Orana REZ (EnergyCo, 2023b) identified several challenges for workforce development, including:

- training facilities and access to training is inadequate and there are variations in access to training across the REZ. For example, Dubbo is considered to be well serviced, but there is reduced access to training in smaller centres such as Dunedoo, Gilgandra and Warren
- peak workforce demand for renewable energy and transmission projects is projected at around two-thirds of the existing workforce in common occupations, which underlines the challenges in sourcing local labour from adjacent sectors for the renewable energy and transmission sectors
- limited surplus labour capacity within the Central-West Orana REZ due to low unemployment rates.

The study also identifies skill shortages in a range of key occupations within the renewable energy sector, including construction managers, mechanical technicians, electrical and civil engineers, electricians, transmission line workers, riggers and crane operators.

13.4.4 Accessibility

Accessibility refers to 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 (DPE, 2023b).

Housing and tenure

The median house price and weekly rental price across the social locality has increased in the last year.

Engagement with landowners, community members and community organisations revealed that housing and tenure in the local social locality was limited, with the availability of rental housing being a key concern from communities, specifically in Dunedoo, Gulgong, Coolah and Mudgee. This is partly due to short term tourist accommodation taking away some of the capacity of the local housing and rental market, which leads to a notable proportion of private dwellings being unoccupied during the year.

Significant accommodation and housing supply constraints have been identified in the regional social locality, including:

- a limited supply of medium density housing in the region
- a shortage of short term housing stock
- outpaced demand for short term accommodation versus supply.

The Dubbo Regional, Warrumbungle and Mid-Western Regional LGAs were identified as potential locations to support temporary and long term accommodation needs within the Central-West Orana REZ region.

Social infrastructure

The population of the regional social locality lives in a diverse network of centres and rural localities, which range in size from large regional centres to smaller towns and villages.

The regional social locality has relatively good access to infrastructure, education, goods and services, including retail, health, medical, and emergency services.

However, there are limited services available within the local social locality, and residents need to travel to other regional hubs to access specialist services. Community feedback from the SIA engagement indicated a perception that health services within the local social locality were severely under resourced and at capacity.

Transport and travel networks

As identified during SIA engagement, the local road networks are frequently used by local residents, businesses, farmers and mines in the region. A major concern within the community is the quality of the local roads and highways, which have been severely damaged due to rain and flooding conditions, as well as a long term lack of maintenance and upkeep.

Telecommunications

The local social locality has limited mobile reception and connectivity, however houses in the area are eligible to connect to the National Broadband Network. Mobile phone coverage is fragmented across the local social locality, with large coverage gaps, particularly in the eastern portion of the local social locality. During engagement, it was raised that the community of Turill in the Mid-Western Regional LGA is a connectivity 'black spot' and relies on satellite connections for phone and internet services. Other communities that do not have mobile connectivity include Wollar, Uarbry, Tichular, Cumbo and Moolarben.

13.4.5 Health and wellbeing

Health and wellbeing refer to the community's physical and mental health, especially for people vulnerable to social exclusion or substantial change, psychological stress resulting from financial or other pressures, access to open space and effects on public health (DPE, 2023b).

Vulnerable groups

The local and regional social localities have a comparatively high proportion of elderly residents, which was confirmed during SIA engagement. Many of the long term residents in the region have a deep personal and familial connection to the land, due largely to the prominence of multigenerational farming, and as such a notable proportion of older people choose to stay on their properties. However, given the lack of accessible health services in the local social locality, older residents may be less likely to seek out appropriate treatment and support, and could be considered more vulnerable in the local social locality.

People requiring assistance, which may include those with a disability or the elderly, make up 6.3 per cent of residents in the southern section, 6.6 per cent in the northern section, 4.6 per cent in the western section, and 6.1 per cent of residents in the eastern section. This was in line with the broader NSW proportion of those requiring assistance (six per cent).

Other potentially vulnerable groups identified during engagement included homeless residents, or those struggling to seek rental accommodation.

Pre-existing health conditions

Long term health conditions, including asthma and mental health, were both comparatively common conditions in the local social locality (nine per cent and 9.4 per cent respectively), which was in line with NSW more broadly (9.9 per cent and 9.2 per cent).

The western section had the highest proportion of residents with asthma (11.8 per cent) and mental health conditions (12.4 per cent) within the local social locality. There was a higher prevalence of residents with long term lung conditions in the northern and eastern sections (three per cent and 3.6 per cent) when compared to NSW (2.4 per cent).

13.4.6 Culture

Culture refers to a community's shared beliefs, customs, practices, obligations, values and stories, and connections to Country, land, waterways, places and buildings, both Aboriginal and non-Aboriginal (DPE, 2023b).

Aboriginal culture

The project is located on Wiradjuri and Gomeroi/Kamilaroi Country.

Wiradjuri Country encompasses the land to the southwest of the project and includes the township of Dubbo. The Wiradjuri Nation is geographically the largest Indigenous Nation within NSW, extending from around Coonabarabran in the North, along the Great Dividing Range down to the Murray River and out to western NSW.

Kamilaroi (also known as Gamilaraay or Gomeroi) Country is located to the north of the project, encompassing towns such as Dunedoo and Coolah, which are acknowledged to be on traditional land of both the Wiradjuri and Kamilaroi peoples. The Kamilaroi is the second largest Aboriginal nation by area in NSW.

The project would intersect the Mudgee, Gilgandra, Dubbo and Walhallow Local Aboriginal Land Councils (LALCs), as shown in Figure 13-3.

The majority of the project is located in the Mudgee LALC area which encompasses the Mid-Western LGA and parts of the Upper Hunter and Warrumbungle LGAs. The Mudgee LALC recognises the Wiradjuri peoples as the Traditional Owners of the land on which they operate. Mudgee LALC offers heritage assessments, including Aboriginal Cultural Heritage surveys and monitoring, and cultural workshops and program facilitation.

A portion of the project to the north intersects the Gilgandra LALC area. Amongst a number of services, the Gilgandra LALC provides affordable accommodation for local Aboriginal families and individuals who are members of the Land Council, through the Gilgandra Aboriginal Housing Services. Gilgandra means 'long water hole', and the traditional custodians of the land describe Gilgandra as being a meeting place between the Wiradjuri, Kamilaroi and Wailwan nations.

A small portion of the northern end of the project intersects with the Walhallow LALC area which encompasses parts of the Liverpool Plains, Gunnedah, Warrumbungle and the Upper Hunter LGAs. Walhallow is the site of a former Aboriginal reserve and was previously known as "Caroona" mission.

The project intersects the Dubbo LALC area to the west, which encompasses the Dubbo Regional LGA and parts of the Warrumbungle LGA. The Tubbagah People of the Wiradjuri Nation are Dubbo's Traditional Owners. There are many iconic events, sites and landmarks across Dubbo City that represent Aboriginal tradition and heritage. The Red Ochre Festival is an annual celebration of Aboriginal culture and heritage, including music, arts and children's activities. The museum and galleries of the Western Plains Cultural Centre, Dubbo, showcase indigenous artworks and capture the history of the Tubbagah People. Traditions of the First Nations people can be seen at the Terramungamine Reserve, including examples of Aboriginal grinding grooves.

There are three active native title claims that intersect the project alignment, as shown in Figure 13-3. The Warrabinga-Wiradjuri #7 claim (NC2018/002) is located to the south and the Gomeroi People claim (NC2011/006) is located to the north. The Warrabinga Wiradjuri #6 claim (NC2016/005) encompasses a small area within the #7 claim around Wilpinjong and Wollar.

Non-Aboriginal culture

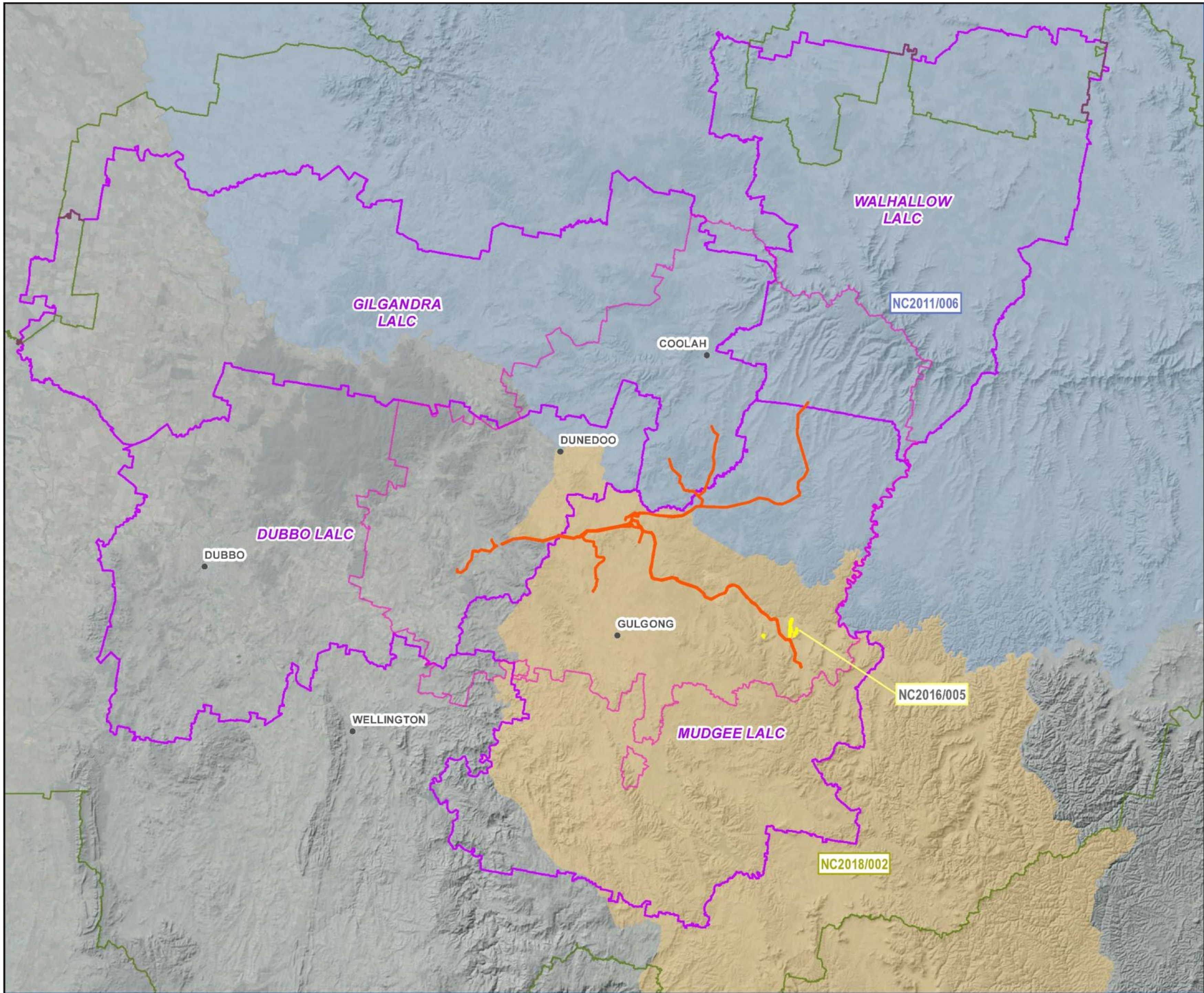
The project is located in a landscape that retains evidence of the Australian colonial period to the present day.

There are only two listed local heritage items (Wandoona Homestead and Goulburn River National Park, listed in the Mid-Western Regional Local Environmental Plan 2012) within one kilometre of the construction area. Parts of the Goulburn River National Park are being considered for inclusion on the National Heritage List (NHL: 105696 – Nominated Place) as part of an extension to the Greater Blue Mountains Area (World Heritage List – WHL: 105127 and NHL: 105999).

A review of historical aerial maps and field survey identified a further 21 unlisted local heritage items within one kilometre of the construction area (refer to Chapter 12 (Non-Aboriginal heritage)).

There are no heritage items listed on the World Heritage List, National Heritage List, Commonwealth Heritage List, State Heritage Register, State Heritage Inventory or section 170 registers located within one kilometre of the construction area.

Figure 13-3
Local Aboriginal Land Councils and native title claims



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13.4.7 Surroundings

Surroundings looks to understand the built and natural environment that the community inhabit, including ecosystem services such as shade, pollution control, erosion control, public safety and security, access to and use of the natural and built environment, and aesthetic value and amenity (DPE, 2023b).

Landscape and natural environment

The Central-West Orana region is characterised by a diverse natural landscape, including rugged mountains, floodplains, wide valleys, wetlands, agricultural land and vineyards (near Mudgee) (refer to Chapter 9 (Landscape character and visual amenity)). The Central-West Orana region therefore supports a variety of flora and fauna across diverse natural ecosystems, including the western edge of the Great Dividing Range and the semi-arid floodplains of western NSW.

During engagement, residents and stakeholders in the local social locality expressed a significant attachment to the aesthetic beauty of the natural landscape and its associated environmental values.

Climate

The regional social locality has experienced overall temperature increases over the last 50 years and currently experiences considerable rainfall variability across areas, seasons and from year-to-year.

The local and regional social localities are vulnerable to flooding, with recent major flash flooding occurring in and around Gulgong in October 2022. Flooding within the local social locality has historically led to traffic disruptions and road closures, including the inundation of the Castlereagh Highway.

The local and regional social localities have also been severely impacted by some of the worst bushfires in NSW over the past five years, including the Sir Ivan Fire in February 2017 and the Gospers Mountain Fire in December 2019.

During engagement, the local community reported a loss of farming infrastructure, crops, stock and dwellings and continuing experiences of grief and trauma from these events.

13.4.8 Decision making systems

Decision making systems refer to the extent to which the community can have a say in decisions that affect their lives, and have access to complaint, remedy and grievance mechanisms (DPE, 2023b).

Within the Central-West Orana REZ area, consultation for renewable energy projects in the region has likely been consistent in the local social locality over the past 10 years, with each project requiring its own consultation and engagement process. Engagement with the community to date revealed that residents of the local and regional social localities have experienced significant consultation fatigue, as each of these renewable energy projects have required some level of community and stakeholder consultation.

13.5 Potential impacts – construction

Social impacts have been assessed according to the social impact significance matrix defined in Table 13-3. 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 13.7.

13.5.1 Community

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. Potential impacts on community during construction of the project include:

- **Detrimental effects to community cohesion:** Potential changes to community cohesion as a result of the project are associated with the perception that there is a lack of more detailed information about, and the unequal distribution of, impacts and benefits of the project, especially in regard to visual impacts.
- **Reduced short term accommodation and housing availability and affordability:** The need to provide accommodation for construction workers has the potential to contribute to diminished housing availability and affordability within the local social locality. Stakeholders raised concerns that the required construction workforce could exceed project estimates and that the workforce accommodation camps would not be able to accommodate all the workers. The two temporary workforce accommodation camps proposed as part of the project (at Merotherie and Cassilis) would provide sufficient accommodation for all construction workers, including during the peak construction period. However, some staff such as project managers and technical specialists (up to 30 staff) may occasionally choose to reside off-site in short term accommodation such as hotels and motels (if available), during the peak construction period. Given the limited availability of short term accommodation in the local social locality, it is unlikely that staff would choose to reside off-site.
- **Impacts to sense of safety due to an influx of non-resident workforce:** The influx of a large non-resident workforce could lead to perceived impacts to safety within the local social locality, specifically for vulnerable groups such as the elderly, women and children. While the construction workforce would reside in the workforce accommodation camps where food services and entertainment would be provided, workers would be permitted to visit the social and regional localities during resting time. Perceived impacts to safety would be experienced to a higher degree by the communities in Merotherie and Cassilis where the workforce accommodation camps are located. However, workers may choose to visit other locations within the local and regional social localities, and would be required to abide by a code of conduct under their employment terms.

A summary of the potential impacts on the community during construction prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-5.

Table 13-5 Potential impacts on the community during construction (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Detrimental effects to community cohesion			
Landowners hosting infrastructure and adjacent neighbours	Likely	Moderate	High
Local social locality	Possible	Moderate	Medium
Regional social locality	No impacts anticipated		
Reduced short term accommodation and housing availability and affordability			
Local social locality	No impacts anticipated		
Regional social locality	No impacts anticipated		
Impacts to sense of safety due to an influx of non-resident workforce			
Merotherie and Cassilis communities	Likely	Moderate	High
Local social locality	Possible	Minor	Medium
Regional social locality	No impacts anticipated		

13.5.2 Way of life

Potential impacts on way of life during construction of the project include:

- **Reduced sense of place due to construction related amenity impacts:** Construction activities would potentially result in the generation of noise, vibration, dust and impacts on visual amenity and landscape character, which would impact sense of place and the natural 'peace and quiet' of the surrounding landscape for landowners hosting infrastructure and neighbouring the project. The potential noise, vibration and air quality impacts of the project during construction were assessed as negligible to moderate impacts, as these impacts would generally be temporary and short term as work progresses. The potential impacts of the project on visual amenity and landscape character during construction were assessed as negligible to moderate, with moderate visual impacts mainly associated with construction activities at the energy hubs and the presence of the Neeleys Lane workforce accommodation camp.
- **Changes to the way people move and work due to potential road delays and reduced sense of safety:** Increased traffic movements are expected in the local and regional social localities during construction of the project, which may result in changes to the way people move around due to perceived road delays and reduced sense of safety on the roads. While overall traffic and transport impacts have been assessed as minor, residents rely heavily on the public road network for everyday activities, due to the remoteness and size of some properties within the local social locality. Concerns were raised by the community about the potential impact of traffic delays and impaired mobility on public roads on farming operations (movement of farming equipment and animals to and from paddocks), daily activities (commuting to and from work and school and to access goods and services) and community events. Traffic, mobility and sense of safety impacts would mostly be concentrated around the construction compounds and workforce accommodation camps within the local social locality. These impacts would likely be experienced to a lesser degree along haulage routes within the local social locality more broadly, due to the scale of this locality.

A summary of the potential impacts on way of life during construction prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-6.

Table 13-6 Potential impacts on way of life during construction (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Reduced sense of place due to construction related amenity impacts			
Landowners hosting infrastructure	Likely	Moderate	High
Landowners neighbouring transmission infrastructure	Likely	Minor	Medium
Local social locality	Possible	Minimal	Low
Regional social locality	No impacts identified		
Changes to the way people move and work due to perceived road delays and reduced sense of safety			
Suburbs surrounding construction compounds and workforce accommodation camps (Merotherie, Cassilis, Wollar and Elong Elong)	Possible	Minor	Medium
Other suburbs within the local social locality (including those near construction routes)	Possible	Minimal	Low
Regional social locality	No impacts anticipated		

13.5.3 Livelihoods

Potential impacts on livelihoods during construction of the project include:

- **Local business opportunities and economic stimulus due to procurement opportunities and increased demand for goods and services:** Opportunities for local businesses to provide goods and services to the project could result in enhanced livelihoods, contribute to increased employment, and the overall strengthening of local and regional economies. Under the NSW Aboriginal procurement policy, it is expected that at least 1.5 per cent of the contract value would contribute towards First Nations businesses, workforce employment, education, training or capability building, which may lead to enhanced opportunities for Indigenous livelihoods, businesses and employment in the local and regional social localities.
- **Improved livelihoods due to increased local employment opportunities:** Employment opportunities associated with construction of the project could potentially improve the livelihoods of those employed and result in improved access to goods and services. Flow-on benefits associated with increased employment and economic stimulus in the local and regional social localities could also potentially benefit other local businesses and social services and increase the overall wellbeing and level of socio-economic advantage within the area.
- **Diminished availability of employees due to increased competition with the project amongst local employers:** An increased demand in the local labour market due to workforce requirements for the project may result in reduced workforce availability and increased labour cost for local employers, due to the limited available workforce within the local and regional social localities. This may impact the livelihoods of local employers. EnergyCo has assumed that up to 10 per cent of the workforce could consist of local residents during the peak construction period (depending on the availability of workers in the local social locality), which would equate to up to an estimated 180 local employees during peak construction. Although this represents a relatively small proportion of local workers, areas where there are no unemployed residents, such as the western section of the local social locality, could experience diminished workforce availability.

- **Impacts on livelihoods due to increased biosecurity threats:** Machinery, vehicles and people entering properties during construction of the project would increase biosecurity threats to local agricultural businesses and farmers, which may significantly affect livelihoods in the local social locality, given the importance of the agricultural industry to local employment and income (refer to Section 13.4.3). Landowners hosting project infrastructure would likely experience the most significant threats to biodiversity, while landowners neighbouring project infrastructure and within the local social locality more broadly would experience biosecurity threats to a lesser degree. No livelihood impacts are anticipated in the regional social locality.

A summary of the potential impacts on livelihoods during construction prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-7.

Table 13-7 Potential impacts on livelihoods during construction (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Local business opportunities and economic stimulus due to procurement opportunities and increased demand for goods and services			
Businesses within the local social locality	Possible	Moderate	Medium (positive)
First Nations businesses within the regional social locality	Possible	Major	High (positive)
Businesses within the regional social locality	Likely	Minor	Medium (positive)
Improved livelihoods due to increased local employment opportunities			
Active workforce within the local social locality	Possible	Minimal	Low (positive)
First Nations within the regional social locality	Possible	Major	High (positive)
Active workforce within the regional social locality	Possible	Minor	Medium (positive)
Diminished availability of employees due to increased competition with the project amongst local employers			
Suburbs with no unemployed residents (western section of project – Elong Elong, Gollan and Spicers Creek)	Possible	Moderate	Medium
Local social locality	Possible	Minor	Medium
Regional social locality	Unlikely	Minor	Low
Impacts on livelihoods due to increased biosecurity threats			
Landowners hosting project infrastructure	Likely	Major	High
Landowners neighbouring project infrastructure	Possible	Major	High
Local social locality (excluding landowners hosting and neighbouring project infrastructure)	Unlikely	Minor	Low
Regional social locality		No impacts anticipated	

13.5.4 Accessibility

Potential impacts on accessibility during construction of the project include:

- **Impacted capacity of health, food (supermarkets, bakeries, delis) and social services to meet increased demand caused by project workforce:** The influx of a temporary construction workforce may place demand on health, food and social services that have limited capacity within the local and regional social localities, which may limit access to these services for residents within the local social locality. Most of the construction workforce would stay in temporary workforce accommodation camps established for the project, where on-site first aid facilities, a full time medical practitioner or paramedic, food and recreation facilities would be provided. However, some members of the workforce may use health, food or social services within the local or regional social localities outside the camps. This would include the potential use of hospitals in Dubbo, Mudgee, Merriwa or Scone for more specialised or severe injuries and health conditions.
- **Potential disruption to essential services (communications, gas and electricity):** Adjustments or relocations of existing utilities (including communications, gas and electricity) during construction may result in temporary disruptions and outages of utilities for residents living near the construction area. Disruptions to utilities may impact the ability to undertake everyday tasks and business activities within the local social locality, especially due to the remoteness of the locality. However, it is anticipated that any disruptions to these services would likely be temporary and be resolved quickly.

A summary of the potential impacts on accessibility during construction prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-8.

Table 13-8 Potential impacts on accessibility during construction (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Impacted capacity of health, food (supermarkets, bakeries, delis) and social services to meet increased demand caused by project workforce			
Service hubs within the local social locality (Dubbo, Mudgee, Merriwa, Scone, Coolah and Gulgong)	Possible	Moderate	Medium
Local social locality	Unlikely	Minimal	Low
Regional social locality	Unlikely	Minimal	Low
Potential disruption to essential services (communications, gas and electricity)			
Local social locality	Possible	Minimal	Low
Regional social locality	No impacts anticipated		

13.5.5 Health and wellbeing

Potential impacts on health and wellbeing during construction of the project include:

- **Diminished mental health amongst landowners:** Uncertainty around the potential impacts of acquisition of interests in private property for the project may result in anxiety and stress for landowners, especially those with a strong attachment to their properties and lifestyle. Landowners neighbouring the project are likely to experience these impacts to a higher degree, as they may be less frequently engaged than landowners directly impacted by the project (i.e. hosting project infrastructure), experience diminished capacity to make or influence decisions regarding the changes that may affect them, and have concerns of an unequal distribution of impacts and benefits.

- **Diminished health and wellbeing due to amenity impacts, such as construction noise and vibration:** Amenity impacts due to the generation of noise and vibration may impact the way of life, sense of place and health and wellbeing of residents within the local social locality. Groups that are particularly vulnerable to these impacts include the elderly, young children, residents that live and work on their properties and residents experiencing long term health conditions including mental health conditions and dementia. While the project would aim to undertake construction activities near sensitive receivers during standard working hours, there may be some instances in which work is undertaken outside of these hours, which could result in frustration, stress, lack of sleep and diminished wellbeing among landowners within the local social locality.

A summary of the potential impacts on health and wellbeing during construction prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-9.

Table 13-9 Potential impacts on health and wellbeing during construction (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Diminished mental health amongst landowners			
Landowners hosting project infrastructure	Possible	Minor	Medium
Landowners subject to compulsory acquisition and neighbouring project infrastructure	Likely	Moderate	High
Other residents of local and regional social localities		No impacts identified	
Diminished health and wellbeing due to amenity impacts, such as construction noise and vibration			
Landowners hosting project infrastructure	Almost certain	Minor	Medium
Landowners neighbouring project infrastructure	Possible	Minor	Medium
Local social locality	Unlikely	Minor	Low
Regional social locality		No impacts identified	

13.5.6 Culture

Potential impacts on culture during construction of the project include:

- **Impacts on First Nations cultural values:** Potential impacts on First Nations cultural values and wellbeing in the local social locality due to changes to the landscape, access and sites of cultural heritage significance could affect sense of place and cultural connection to Country. The project would result in direct and indirect impacts to 37 discrete Aboriginal sites and places, resulting in their complete loss. In addition, the project would directly impact about 100 hectares of creek banks identified as having subsurface Aboriginal cultural heritage potential. The project would result in some intergenerational/cumulative impacts to cultural materials.

A summary of the potential impacts on Aboriginal culture during construction prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-10.

Table 13-10 Potential impacts on First Nations cultural values during construction (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Impacts on First Nations cultural values			
Local First Nations communities, organisations and individuals within the local and regional social localities	Possible	Major	High

13.5.7 Surroundings

Potential impacts on surroundings during construction of the project include:

- **Changes to the way people enjoy and connect with the environment:** Residents with a significant attachment to the natural landscape and biodiversity could experience a change in the way they enjoy and connect with the environment, due to disturbances to the natural environment as a result of construction activities within the local social locality. Landowners raised concerns about the potential flow-on impacts of these disturbances on future regenerative farming practices and tourism within the locality.

A summary of the potential impacts on surroundings during construction prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-11.

Table 13-11 Potential impacts on surroundings during construction (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Changes to the way people enjoy and connect with the environment			
Landowners hosting and neighbouring project infrastructure	Likely	Minor	Medium
Local social locality	Unlikely	Minor	Low
Regional social locality	No impacts identified		

13.5.8 Decision making systems

Potential impacts on decision making systems during construction of the project include:

- **Diminished capacity to make or influence decisions regarding changes that may affect people's own lives:** Landowners and residents within the local and regional social localities may perceive and/or experience diminished capacity to influence or make decisions regarding changes that may impact their lives, due to a perceived lack of transparency and engagement in the development of the project.

A summary of the potential impacts on decision making systems during construction prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-12.

Table 13-12 Potential impacts on decision making systems during construction (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Diminished capacity to make or influence decisions regarding changes that may affect people's own lives			
Landowners neighbouring project infrastructure	Likely	Moderate	High
Landowners hosting project infrastructure and residents within the local social locality	Possible	Moderate	Medium
Regional social locality	Unlikely	Minor	Low

13.6 Potential impacts – operation

Social impacts have been assessed according to the social impact significance matrix defined in Table 13-3. 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 13.7.

13.6.1 Community

Potential impacts on community during operation of the project include:

- **Unequal distribution of impacts and benefits:** Landowners of neighbouring properties may experience an unequal distribution of impacts and benefits, as they would not be eligible for the NSW Government's Strategic Benefit Payments (SBP) Scheme, but would still be impacted by the project. This may result in stress and a diminished sense of belonging for these landowners. The SBP Scheme is discussed further in Section 13.6.3.

A summary of the potential impacts on livelihoods during operation prior to mitigation, as well as the assessed likelihood, magnitude and significance of the impact, is provided in Table 13-13.

Table 13-13 Potential impacts on community during operation (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Unequal distribution of impacts and benefits			
Landowners neighbouring infrastructure	Almost certain	Moderate	High

13.6.2 Way of life

Potential impacts on way of life during operation of the project include:

- **Changes to the way landowners use and enjoy their properties:** Physical changes to properties hosting infrastructure may result in changes to the way resident landowners use and enjoy their properties within the local social locality, as landowners highly value the agricultural use of their land, farming lifestyle and views, peace, quiet, beauty and nature of the landscape. It is anticipated that most landowners hosting infrastructure would largely be able to continue to use their land for the same agricultural and residential purposes during operation as they do under existing conditions, and that there would only be a small proportion of landowners hosting transmission line infrastructure who would have a reduced overall area to undertake higher intensity agricultural activities such as cropping or horticulture. While neighbouring landowners would not experience physical changes to their properties, it is possible that they would experience changes to the way they enjoy and use their properties, depending on transmission infrastructure being visible from their properties.

A summary of the potential impacts on way of life during operation prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-14.

Table 13-14 Potential impacts on way of life during operation (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Changes to the way landowners use and enjoy their properties			
Landowners hosting infrastructure	Likely	Minor	Medium
Landowners neighbouring switching station and energy hub sites	Possible	Moderate	Medium
Other residents within local and regional social localities	No impacts anticipated		

13.6.3 Livelihoods

Potential impacts on livelihoods during operation of the project include:

- **Enhanced landowner social and economic livelihoods associated with the Strategic Benefit Payments Scheme:** Under the NSW Government's SBP Scheme, private landowners hosting new high voltage transmission projects would be paid a set rate per kilometre of transmission hosted, paid out in annual instalments over 20 years. These benefit sharing payments are in recognition of the critical supporting role these landowners would have in hosting the new energy infrastructure that would power the State into the future and to ensure they share directly in the benefits of this significant economic investment. The SBP Scheme payments would be in addition to any compensation that is paid to landowners for transmission easements on their land in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.
- **Livelihood impacts due to property management restrictions or alterations:** Limitations placed on activities or uses within transmission line easements for safety and operational reasons could potentially decrease productivity on some portions of land or perceived property values, resulting in impacts on livelihoods within the local social locality. Although neighbouring landowners may be subject to limitations to aerial operations near easements, no concern was raised during engagement about limits to this type of activity.

A summary of the potential impacts on livelihoods during operation prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-15.

Table 13-15 Potential impacts on livelihoods during operation (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Enhanced landowner social and economic livelihoods associated with the Strategic Benefit Payments Scheme			
Landowners hosting infrastructure	Almost certain	Moderate	High (positive)
Local social locality		No impacts anticipated	
Regional social locality		No impacts anticipated	
Livelihood impacts due to property management restrictions or alterations			
Landowners hosting infrastructure	Possible	Minimal	Low
Neighbouring landowners to project construction area	Unlikely	Minimal	Low
Other farming properties in the local and regional social localities		No impacts anticipated	

13.6.4 Accessibility

Potential impacts on accessibility during operation of the project include:

- **Potential disruption to telecommunications (including radio, internet and television) in the vicinity of transmission infrastructure:** Transmission lines could interfere with radio frequencies and impact telecommunications (including internet and phone reception) and television signals, where the signals are already weak in the local social locality. However, the project would be designed to minimise this interference, and would not interfere with Global Positioning Systems (GPS), internet or television signals.
- **Increased access to renewable energy sources:** EnergyCo is investigating opportunities to benefit communities in the regional social locality, including community energy schemes, power purchasing agreements and other initiatives. This includes potential opportunities to provide lower electricity costs for local Aboriginal community-owned properties. Landowners also identified that the project would contribute to lower carbon emissions, promote the delivery of renewable energy and provide cheaper energy.

A summary of the potential impacts on the accessibility during operation prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-16.

Table 13-16 Potential impacts on accessibility during operation (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Potential disruption to telecommunications (including radio, internet and television) in the vicinity of transmission infrastructure			
Communities without mobile network coverage (Turill, Wollar, Uarbry, Tichular, Cumbo and Moolarben)	Possible	Minimal	Low
Local social locality		No impacts anticipated	
Regional social locality		No impacts anticipated	
Increased access to renewable energy sources			
Local Aboriginal community owned properties within the local and regional social localities	Likely	Moderate	High (positive)
Local and regional social localities	Possible	Moderate	Medium (positive)

13.6.5 Health and wellbeing

Potential impacts on health and wellbeing during operation of the project include:

- **Stress due to perceived health and safety risks associated with electromagnetic fields:** Landowners located near or hosting transmission infrastructure within the local social locality could experience stress and anxiety due to perceived health and safety risks associated with high voltage transmission lines electromagnetic fields. The electromagnetic field assessment completed for the project (Technical paper 11 – Preliminary hazard analysis (Technical paper 11)) indicates that the electric and magnetic fields levels at the boundary of the operation area would be compliant with the reference levels (set by the International Commission for Non-Ionizing Radiation Protection in 2020) within which a person may be exposed without any adverse health effects. The World Health Organisation concluded that current scientific evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields (refer to section 2.1 of Technical paper 11).

- **Stress due to potential bushfire risk associated with operation of transmission lines:** Landowners and residents within the local social locality could experience stress due to concerns about increased bushfire risk and the capacity of services to respond to emergencies, considering recent major bushfire events (refer to Section 13.4.7). The bushfire risk assessment completed for the project (Technical paper 10 – Bushfire) identifies the aerial and on-ground energy transmission infrastructure (transmission lines, switching stations and energy hubs) as potential sources of ignition that would pose a high bushfire risk (following implementation of mitigation). EnergyCo would develop and implement various strategies to prevent or minimise the occurrence of fire ignition from its energy network assets, including asset condition monitoring and maintenance. Transmission lines are designed to prevent the risk of starting fires from fallen conductors, and are operated remotely so they can be shut down quickly in the event of a bushfire. Fire cannot travel along transmission lines as they are not made from flammable materials. Transmission lines would not prevent aerial fire fighting activities from being carried out. EnergyCo would work with landowners during the easement acquisition process to understand individual property constraints in relation to fire management, including existing aerial operations and air strip locations (refer to Section 13.6.3).
- **Stress due to perceived uncertainty in the local property market:** Landowners hosting infrastructure within the local social locality could experience stress due to concerns about changes to property values as a result of changes to the landscape and potential constraints to farming and residential activities within properties, including future planned property developments. While there are perceptions about transmission lines which can have implications to property values (Elliot & Wadley, 2002), the proximity to transmission lines may have little impact on dynamic changes in house prices over time (Han & Elliott, 2013). No residential dwellings would be subject to acquisition for the project, however there may be the requirement to adjust infrastructure on private residential properties within which the project would be located (such as agricultural sheds, fencing and gates) (refer to Chapter 7 (Land use and property)). Residential development would not be permitted within the transmission line easements.

A summary of the potential impacts on health and wellbeing during operation prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-17.

Table 13-17 Potential impacts on health and wellbeing during operation (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Stress due to perceived health and safety risks associated with electromagnetic fields			
Neighbouring landowners and landowners subject to compulsory acquisition	Likely	Moderate	High
Landowners subject to acquisition of easements by mutual agreement and residents in local social locality	Possible	Minimal	Low
Regional social locality		No impacts anticipated	
Stress due to perceived bushfire risk associated with operation of transmission lines			
Hosting and neighbouring landowners	Likely	Moderate	High
Residents within the local social locality	Possible	Minor	Medium
Regional social locality		No impacts anticipated	
Stress due to perceived uncertainty in the local property market			
Neighbouring landowners	Likely	Moderate	High
Landowners hosting infrastructure and residents in local social locality	Unlikely	Minimal	Low
Local and regional social localities		No impacts anticipated	

13.6.6 Surroundings

Potential impacts on surroundings during operation of the project include:

- **Diminished sense of belonging due to loss of aesthetic values and perceived loss of biodiversity:** Landowners and community representatives with high values and attachment to current aesthetics and vistas could experience a diminished sense of belonging due to concerns about potential and perceived visual, landscape character and biodiversity impacts and industrialisation of the local and regional social localities (i.e. the cumulative impact of the Central-West Orana REZ). Landowners subject to acquisition of easements by mutual agreement would likely experience a low magnitude of change given their comparatively greater participation during the design process.
- **Diminished sense of safety due to perceived flooding and drainage changes:** Landowners may experience a diminished sense of safety due to concerns about how the project infrastructure could change water courses and impact flooding within the local social locality, and whether the impacts of climate change, such as more intense windstorms and flooding events, have been considered in the project design. The flood assessment for the project (Technical paper 15 – Flooding) found that the New Wollar Switching Station and energy hubs would generally have only a minor, localised impacts on flood behaviour in areas outside the operation area.

A summary of the potential impacts on surroundings during operation prior to mitigation, as well as the assessed likelihood, magnitude and significance of each impact, is provided in Table 13-18.

Table 13-18 Potential impacts on surroundings during operation (prior to mitigation)

Potential impact	Likelihood	Magnitude	Significance (pre-mitigation)
Diminished sense of belonging due to loss of aesthetic values and perceived loss of biodiversity			
Neighbouring landowners and landowners subject to compulsory acquisition	Likely	Moderate	High
Landowners subject to acquisition of easements by mutual agreement and residents in local social locality	Possible	Minor	Medium
Local and regional social localities		No impacts anticipated	
Diminished sense of safety due to perceived flooding and drainage changes			
Landowners hosting project infrastructure	Possible	Minimal	Low
Landowners neighbouring the New Wollar Switching Station, Merotherie Energy Hub, Elong Elong Energy Hub and 330 kV switching stations	Possible	Minor	Medium
Local and regional social localities		No impacts anticipated	

13.7 Management of impacts

13.7.1 Environmental management

Social impacts during construction would be managed in accordance with the Construction Environmental Management Plan (CEMP). The CEMP includes management objectives to minimise potential noise and vibration, air quality, traffic and visual and landscape character impacts on sensitive receivers, which may lead to social impacts. The CEMP will also outline a complaints management system that will be implemented during construction to handle and respond to project related matters. Further details of the CEMP are provided in Chapter 21 (Environmental management).

Social impact management plan

In addition to the CEMP, a comprehensive Social Impact Management Plan will be prepared prior to construction and developed through consultation with key stakeholders. The purpose of the SIMP will be to manage and monitor the implementation of the social mitigation measures and plans detailed in Table 13-19. Further detail on the SIMP is provided in Table 13-19.

13.7.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential social impacts are listed in Table 13-19.

Mitigation measures in other chapters that are relevant to the management of social impacts include:

- Chapter 7 (Land use and property), specifically measures which address property and land use impacts
- Chapter 9 (Landscape character and visual amenity), specifically measures which address visual impacts on the landscape
- Chapter 14 (Economic), with respect to economic impacts, including workforce and local businesses
- Chapter 15 (Noise and vibration), specifically measures which address noise and vibration impacts
- Chapter 16 (Hazard and risk), specifically measures which address impacts associated with electric and magnetic fields, bushfire and biosecurity risks
- Chapter 17 (Traffic and transport), specifically measures which address traffic, transport and access impacts
- Section 19.1 (Hydrology, flooding and water quality), specifically measures which address flooding impacts
- Section 19.4 (Air quality), specifically measures which address dust impacts.

Through the implementation of these mitigation measures, residual social impacts are anticipated to be appropriately managed.

Table 13-19 Proposed mitigation measures – Social

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
SI1	Property acquisition	A Landowner Engagement Strategy will be developed and implemented for the project which will include the following: • appointment of a dedicated Land Acquisition Manager to oversee the implementation of the strategy • ensure personnel appointed to engage with landowners have been suitably trained to undertake engagement with vulnerable people and those potentially affected by mental health issues.	Pre-construction/ Construction	Properties hosting infrastructure
SI2	Workforce management	A Workforce Management Plan will include: • a code of conduct for workers, which will include a zero-tolerance policy relating to anti-social behaviour • cultural awareness training for the workforce • measures for the workforce residing at the workforce accommodation camps including recreation areas, internet connections etc. The plan will include strategies to promote wellbeing of the workforce and a positive interaction with local community, which may include promoting workforce participation in community life (sports, events, volunteering), providing healthy food options, implementing health and safety assessments, among others. The plan will be reviewed every six months to identify and manage any unanticipated impacts.	Pre-construction/ Construction	Regional social locality
SI3	Local workforce participation	A Local Workforce Participation Strategy will be prepared and implemented. It will include the following initiatives: • identification of local skills gaps and potential workforce skills and training requirements • investigate opportunities for the delivery of training and upskilling programs for local labour force • strategies for maximising local training and employment opportunities for residents, especially for First Nations People • initiatives to promote local employment, such as early engagement with local employment agencies and council, communication of employment opportunity via relevant local mediums of information, contract workers through existing local businesses, etc.	Pre-construction	Regional social locality

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
SI4	Industry participation	An Industry Participation Plan will be prepared and implemented which will: • identify services and goods that could be sourced locally (quarry materials, catering, transport, cleaning, stationery) • identify the capacity of local and Indigenous businesses and suppliers to be ready for potential additional demand • provide local and Indigenous procurement targets • identify tailored 'meet-the-contractor' events for local and Aboriginal businesses to learn about potential opportunities associated with the delivery of the project • monitor the availability of key goods and services to the local community when procured locally.	Pre-construction/ Construction	Regional social locality
SI5	Community engagement	A pre-construction and construction Communication and Engagement Plan will be prepared to ensure: • landowners, businesses and local residents with the potential to be affected by construction activities are notified in a timely manner about the timing of activities and potential for impacts, and the measures that will be implemented to minimise the potential for impacts on individual properties • include proactive methods of communication with affected parties and strategies to reach vulnerable members of the community such as doorknocking, text messages, newsletters and or phone calls • ensure receivers identified as eligible for noise mitigation treatments in Technical Paper 9 – Noise and vibration are supported and engaged through the delivery process • provide further information in the local social locality about the regional energy strategy, including about community energy schemes, power purchasing agreements and other initiatives. • enquiries and complaints are managed, and a timely response is provided for concerns raised and information about how solutions are being investigated is provided to the community.	Pre-construction/ Construction	Local social locality

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
SI6	First Nations liaison	A First Nations liaison group will be established. It will focus on identifying and implementing strategies to enhance and maximise opportunities for employment, procurement, education and other potential project related benefits. Members of the First Nations liaison group will be identified through collaboration with the existing Central-West Orana REZ Aboriginal Working Group, and will include local and regional members including: • Local Aboriginal Land Councils • Aboriginal Representative Organisations • relevant Aboriginal social, health and support services • educational organisations and services • employment agencies • Aboriginal business organisations/groups.	Pre-construction/ Construction	Regional social locality
SI7	Complaints management	A complaints management system will be maintained throughout the construction period and for a minimum of 12 months after the completion of construction. The complaints management system will include the following (at a minimum): • contact details for a 24-hour response line and email address for ongoing stakeholder contact throughout the project • details of all complaints received will be recorded • verbal and written responses describing what action will be taken will be provided to the complainant (or as otherwise agreed by the complainant).	Construction Initial 12 months of operation	Regional social locality

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
SI8	Social impact	A Social Impact Management Plan (SIMP) will be prepared that will: • describe the social impact mitigation measures to be implemented and the impacts that they are intended to address • set out how the community and stakeholders can provide feedback on the mitigation measures and the effectiveness of their implementation. Monitoring findings will be presented to the project's Community Reference Groups meetings (if active) and to an annual community meeting where feedback will be sought on the monitoring program and whether actions or targets require revision. EnergyCo will track implementation of the SIMP and review performance measures quarterly, to facilitate continual improvement. The SIMP will be reviewed annually and updated based on monitoring data and community and stakeholder feedback. In addition to the monitoring review, proposed mitigation measures will also be reviewed to assess whether they are still applicable and on track to meet the residual risk rating applied in the EIS. Any new issues or initiatives that have emerged and that should be included in ongoing mitigations and/or monitoring will be addressed. The results of SIMP reviews will be published on the EnergyCo website.	Pre-construction/ Construction	Regional social locality
SI9	Operational communications	An Operational Communication Plan will be developed and implemented, which will address the following: • maintaining communications with those located in close proximity to the transmission line to provide updated information and monitor experience and concerns. The Operational Communication Plan will be reviewed and updated on an annual basis.	Operation	Local social locality

13.7.3 Residual impacts

A 'residual risk rating' has been applied to identify the significance of each potential social impact identified in the social impact assessment for the project, after the implementation of the proposed mitigation measures detailed in Table 13-19. The potential impacts and their residual risk ratings are summarised in Table 13-20 and Table 13-21. These tables are presented according to the requirements of the SIA guideline.

Colour coding has been applied to the table below for ease of interpretation. Blue shaded cells represent benefits (positive impacts) and orange, yellow and green shading are applied to negative impacts to identify high, medium and low levels of significance respectively.

Table 13-20 Potential residual social impacts from construction of the project

Potential impact	Extent	Significance (pre-mitigation)	Mitigation measures	Post-mitigation		
				Likelihood	**Magnitude**	**Significance**
Community						
Detrimental effects to community cohesion	Landowners hosting infrastructure and adjacent neighbours	High	• Pre-construction and Construction Communication and Engagement Plan • Complaints management system (CMP) • Social Impact Management Plan.	Possible	Moderate	Medium
	Local social locality	Medium		Possible	Minimal	Low
Impacts to sense of safety due to an influx of non-resident workforce	Merotherie and Cassilis communities	High	• Workforce Management Plan • Pre-construction and Construction Communication and Engagement Plan • Complaints management system (CMP) • Social Impact Management Plan • Chapter 17 (Traffic and transport) measures, including traffic control plans, road safety audits, driver code of conduct and Driver Fatigue Management Plan.	Possible	Minor	Medium
	Local social locality	Medium		Unlikely	Minimal	Low
Way of life						
Reduced sense of place due to construction related amenity impacts	Landowners hosting infrastructure	High	• Landowner Engagement Strategy • Pre-construction and Construction Communication and Engagement Plan • Complaints management system (CMP) • Chapter 8 (Agriculture) measures, including: — engagement with landowners and the development of Property Management Plans and pre-condition assessments • Chapter 9 (Landscape character and visual amenity) measures, including: — identifying opportunities for the retention and protection of existing trees — refined vegetation clearance within the construction area	Possible	Minimal	Low
	Landowners neighbouring transmission infrastructure	Medium		Possible	Minor	Medium
	Local social locality	Low		Unlikely	Minimal	Low

Potential impact	Extent	Significance (pre-mitigation)	Mitigation measures	Post-mitigation		
				Likelihood	Magnitude	Significance
			• Chapter 19.4 (Air quality) measures, including: — dust management measures across construction area — speed limits for project heavy vehicles on unsealed roads, with further speed limit reduction during windy conditions • Chapter 7 (Land use and property) measures, including: — disturbed areas would be stabilised and appropriately rehabilitated back to pre-construction condition where practical, or as agreed in consultation with the relevant landowner and documented in Property Management Plans.			
Changes to the way people move and work due to perceived road delays and reduced sense of safety	Suburbs surrounding construction compounds and workforce accommodation camps (Merotherie, Cassilis, Wollar and Elong Elong)	Medium	• Pre-construction and Construction Communication and Engagement Plan • Complaints management system (CMP) • Chapter 17 (Traffic and transport) measures, including: — traffic management and traffic control plans — Driver Fatigue Management Plan and code of conduct regarding use of construction routes — Vehicle Movement Plan will be prepared that will include details of activities of adjoining land uses and awareness of public safety measures (e.g. entering urban areas from the highways) — property access will be maintained throughout construction where feasible. Where no feasible alternative access will be provided, information will be provided prior.	Possible	Minimal	Low
	Other suburbs within the local social locality (including those near construction routes)	Low		Unlikely	Minimal	Low

Potential impact	Extent	Significance (pre-mitigation)	Mitigation measures	Post-mitigation		
				Likelihood	Magnitude	Significance
Livelihoods						
Local business opportunities and economic stimulus due to procurement opportunities and increased demand for goods and services	Businesses within the local social locality	Medium (positive)	• Industry Participation Plan • First Nations liaison group • Pre-construction and Construction Communication and Engagement Plan.	Likely	Moderate	High (positive)
	First Nations businesses within the regional social locality	High (positive)		Likely	Major	High (positive)
	Businesses within the regional social locality	Medium (positive)		Likely	Moderate	High (positive)
Improved livelihoods due to increased local employment opportunities	Active workforce within the local social locality	Low (positive)	• Local Workforce Participation Strategy • Industry Participation Plan • First Nations liaison group • Pre-construction and Construction Communication and Engagement Plan.	Possible	Minor	Medium (positive)
	First Nations within the regional social locality	High (positive)		Likely	Major	High (positive)
	Active workforce within the regional social locality	Medium (positive)		Likely	Moderate	High (positive)
Diminished availability of employees due to increased competition with the project amongst local employers	Suburbs with no unemployed residents (western section of project – Elong Elong, Gollan and Spicers Creek)	Medium	• Industry Participation plan • Local Workforce Participation Strategy • Pre-construction and Construction Communication and Engagement Plan • Complaints management system (CMP) • Social Impact Management Plan.	Possible	Minor	Medium
	Local social locality	Medium		Possible	Minimal	Low
	Regional social locality	Low		Very unlikely	Minor	Low
Impacts on livelihoods due to increased biosecurity threats	Landowners hosting project infrastructure	High	• Pre-construction and Construction Communication and Engagement Plan • Complaints management system (CMP) • Social Impact Management Plan • Chapter 8 (Agriculture) measures, including: — biosecurity controls, including the development of Biosecurity Management Plans — engagement with landowners and the development of Property Management Plans.	Possible	Moderate	Medium
	Landowners neighbouring project infrastructure	High		Unlikely	Moderate	Medium
	Local social locality (excluding landowners hosting and neighbouring project infrastructure)	Low		Very unlikely	Minor	Low

Potential impact	Extent	Significance (pre-mitigation)	Mitigation measures	Post-mitigation		
				Likelihood	Magnitude	Significance
Accessibility						
Impacted capacity of health, food (supermarkets, bakeries, delis) and social services to meet increased demand caused by project workforce	Service hubs within the local social locality (Dubbo, Mudgee, Merriwa, Scone, Coolah and Gulgong)	Medium	• Pre-construction and Construction Communication and Engagement Plan • Complaints management system (CMP) • Community Wellbeing Strategy • Industry Participation Plan • Social Impact Management Plan.	Possible	Moderate	Medium
	Local social locality	Low		Unlikely	Minimal	Low
	Regional social locality	Low		Unlikely	Minimal	Low
Potential disruption to essential services (communications, gas and energy)	Local social locality	Low	• Pre-construction and Construction Communication and Engagement Plan • Complaints management system (CEMP) • Community Wellbeing Strategy • Chapter 7 (Land use and property) measures, including: — location of all services and utilities within the construction area will be confirmed during detailed design, and any required protection or relocation would be designed in consultation with utility providers.	Unlikely	Minimal	Low

Potential impact	Extent	Significance (pre-mitigation)	Mitigation measures	Post-mitigation		
				Likelihood	Magnitude	Significance
Health and wellbeing						
Diminished mental health amongst landowners	Landowners hosting project infrastructure	Medium	• Landowner Engagement Strategy • Pre-construction and Construction Communication and Engagement Plan • Complaints management system (CMP) • Social Impact Management Plan • Chapter 8 (Agriculture) measures, including: — biosecurity controls, including the development of Biosecurity Management Plans — engagement with landowners and the development of Property Management Plans • Chapter 7 (Land use and property) measures, including: — pre-condition assessments of properties located within the construction area would be undertaken to determine the existing condition of assets, infrastructure, utilise and the general condition of the land. This would inform requirements for rehabilitation within Property Management Plans established with landowners.	Unlikely	Minor	Low
	Landowners subject to compulsory acquisition and neighbouring project infrastructure	High		Possible	Moderate	Medium
Diminished health and wellbeing due to amenity impacts, such as construction noise and vibration	Landowners hosting project infrastructure	Medium	• Landowner Engagement Strategy • Pre-construction and Construction Communication and Engagement Plan • Complaints management system (CMP) • Social Impact Management Plan • Chapter 15 (Noise and vibration) measures • Chapter 8 (Agriculture) measures, including engagement with landowners and the development of Property Management Plans.	Unlikely	Minimal	Low
	Landowners neighbouring project infrastructure	Medium		Possible	Minimal	Medium
	Local social locality	Low		Very unlikely	Minimal	Low

Potential impact	Extent	Significance (pre-mitigation)	Mitigation measures	Post-mitigation		
				Likelihood	Magnitude	Significance
Culture						
Impacts on First Nations cultural values	Local First Nations communities, organisations and individuals within the local and regional social localities	High	• First Nations liaison group • Chapter 11 (Aboriginal heritage) measures, including: — avoid or minimise impacts to identified Aboriginal objects and/or sites identified within the construction area and areas of significant buried cultural material — develop and implement an Aboriginal Cultural Heritage Management Plan — develop an Aboriginal heritage interpretation strategy and plan.	Unlikely	Moderate	Medium
Surroundings						
Changes to the way people enjoy and connect with the environment	Landowners hosting and neighbouring project infrastructure	Medium	• Landowner Engagement Strategy • Property Management Plan • Pre-construction and Construction Communication and Engagement Plan • Complaints management system (CMP) • Social Impact Management Plan • Chapter 9 (Landscape character and visual amenity) measures, including seeking to maximising retention of existing vegetation screening • Chapter 10 (Biodiversity) measures, including avoidance of biodiversity sensitive areas.	Possible	Minor	Low
	Local social locality	Low		Unlikely	Minimal	Low

Potential impact	Extent	Significance (pre-mitigation)	Mitigation measures	Post-mitigation		
				Likelihood	Magnitude	Significance
Decision making systems						
Diminished capacity to make or influence decisions regarding changes that may affect people's own lives	Landowners neighbouring project infrastructure	High	• Landowner Engagement Strategy • Property Management Plan • Pre-construction and Construction Communication and Engagement plan • Complaints management system (CMP).	Possible	Minor	Medium
	Landowners hosting project infrastructure and residents within the local social locality	Medium		Possible	Minor	Medium
	Regional social locality	Low		Very unlikely	Minor	Low

Table 13-21 Potential residual social impacts from operation of the project

Potential impact	Extent	Significance (pre-mitigation)	Mitigation measures	Post-mitigation		
				Likelihood	Magnitude	Significance
Community						
Unequal distribution of impacts and benefits	Landowners neighbouring infrastructure	High	• Social Impact Management Plan • Chapter 9 (Landscape character and visual amenity) measures, including investigating potential vegetation screening and other options at affected receivers.	Likely	Moderate	High
Way of life						
Changes to the way landowners use and enjoy their properties	Landowners hosting infrastructure	Medium	• Operational Communication Plan • Social Impact Management Plan • Chapter 9 (Landscape character and visual amenity) measures, including investigating potential vegetation screening and other options at affected receivers.	Possible	Minimal	Low
	Landowners neighbouring switching station and energy hub sites	Medium		Possible	Minor	Medium
Livelihoods						
Enhanced landowner social and economic livelihoods associated with the Strategic Benefit Payments Scheme	Landowners hosting infrastructure	High (positive)	N/A	Almost certain	Moderate	High (positive)
Livelihood impacts due to property management restrictions or alterations	Landowners hosting infrastructure	Low	• Operational Communication Plan • Social Impact Management Plan • Chapter 8 (Agriculture) measures, including engagement with landowners and the development of Property Management Plans.	Unlikely	Minimal	Low
	Neighbouring landowners to project construction area	Low		Very unlikely	Minimal	Low

Potential impact	Extent	Significance (pre-mitigation)	Mitigation measures	Post-mitigation		
				Likelihood	Magnitude	Significance
Accessibility						
Potential disruption to telecommunications (including radio, internet and television) in the vicinity of transmission infrastructure	Communities without mobile network coverage (Turill, Wollar, Uarbry, Tichular, Cumbo and Moolarben)	Low	• Operational Communication Plan • Social Impact Management Plan.	Possible	Minimal	Low
Increased access to renewable energy sources	Local Aboriginal community owned properties within the local and regional social localities	High (positive)	N/A	Likely	Moderate	High (positive)
	Local and regional social localities	Medium (positive)		Possible	Moderate	Medium (positive)
Health and wellbeing						
Stress due to perceived health and safety risks associated with electromagnetic fields	Neighbouring landowners and landowners subject to compulsory acquisition	High	• Operational Communication Plan • Social Impact Management Plan.	Possible	Moderate	Medium
	Landowners subject to acquisition of easements by mutual agreement and residents in local social locality	Low		Very unlikely	Minimal	Low
Stress due to perceived bushfire risk associated with operation of transmission lines	Hosting and neighbouring landowners	High	• Operational Communication Plan • Social Impact Management Plan • Chapter 16 (Hazard and risk) measures, including: — Asset Protection Zones (APZs) established during construction and maintained during operation — access for fire fighting appliances will be provided in accordance with Section 2 of the NSW Rural Fire Service Fire Trails Standards.	Possible	Moderate	Medium
	Residents in the local social locality	Medium		Unlikely	Minor	Low

Potential impact	Extent	Significance (pre-mitigation)	Mitigation measures	Post-mitigation		
				Likelihood	Magnitude	Significance
Stress due to perceived uncertainty in the local property market	Neighbouring landowners and landowners subject to compulsory acquisition	High	• Operational Communication Plan • Social Impact Management Plan.	Possible	Moderate	Medium
	Landowners subject to acquisition of easements by mutual agreement and residents in local social locality	Low		Very unlikely	Minimal	Low
Surroundings						
Diminished sense of belonging due to loss of aesthetic values and perceived loss of biodiversity	Neighbouring landowners and landowners subject to compulsory acquisition	High	• Operational Communication Plan • Social Impact Management Plan • Chapter 9 (Landscape character and visual amenity) measures, including investigating potential vegetation screening and other options at affected receivers • Chapter 10 (Biodiversity) measures, including vegetation maintenance and management during operation.	Possible	Moderate	Medium
	Landowners subject to acquisition of easements by mutual agreement and residents in local social locality	Medium		Possible	Minimal	Low
Diminished sense of safety due to perceived flooding and drainage changes	Landowners hosting project infrastructure	Low	• Operational Communication Plan • Social Impact Management Plan • Chapter 19.1 (Hydrology, flooding and water quality) measures, including confirming the impact of the project on flood behaviour during detailed design and design accordingly to minimise adverse flood related impacts. This would include consideration of future climate change.	Unlikely	Minimal	Low
	Landowners neighbouring the New Wollar Switching Station, Merotherie Energy Hub, Elong Elong Energy Hub and 330 kV switching stations	Medium		Possible	Minimal	Low

14 Economic

This chapter provides an assessment of the potential economic impacts of the project, which are largely positive, and identifies mitigation measures to minimise these impacts to the extent they are negative, as provided in Technical paper 8 – Economic (Technical paper 8). The Secretary's Environmental Assessment Requirements (SEARs) as they relate to economic impacts, and where in the Environmental impact Statement (EIS) these have been addressed, are detailed in Appendix A (SEARs checklist).

14.1 Assessment approach

14.1.1 Study area

The study area for the economic assessment comprises the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter Local Government Areas (LGA). This area has the potential to provide inputs to, and derive economic benefits from, the construction and operation of the project. While the study area is the focus of the analysis, impacts on the wider NSW economy are also assessed.

14.1.2 Assessment approach

The economic impacts were assessed using input-output (IO) analysis. IO analysis is used to assess the direct and indirect impacts of the construction and operation of the project on the regional and NSW economy.

The assessment methodology for the economic assessment involved:

- research on the economic environment at regional and NSW scales considering data from public databases
- development of IO tables for the regional and NSW economy that can be used to identify the economic structures of the region and NSW and the multipliers for each existing sector of the economy. The IO tables were developed using the Generation of Regional Input Output Tables (GRIT) procedure developed by the University of Queensland and recognised internationally (Bayne & West, 1988)
- identification of the direct effects or stimulus of the project so that the IO multipliers and flow-on effects can then be estimated (West, 1993). The multiplier was calculated and applied in the assessment as it summarises the total impact on all industries in an economy from changes in the demand for the output of any industry
- analysis of the impacts of the project on the economy in terms of four main indicators:
  - gross regional output – the gross value of business turnover in a region
  - value-added – the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output. These costs exclude wage costs

  - income – the wages paid to employees including wages for self-employed and business owners
  - employment – the number of people employed (including self-employed, full-time, and part-time).
- identification of management measures to address impacts.

14.2 Existing environment

This section characterises the economy of the study area from two perspectives, residents of the region and employment in the region.

14.2.1 Residents and employment in the study area

Based on the Australian Bureau of Statistics (ABS) 2021 Census of Population and Housing, the study area had a population of 104,089 and a labour force of 48,854. The Dubbo Regional LGA and Mid-Western Regional LGA account for 77 per cent of the regional population and 78 per cent of the regional labour force. In 2021, there were 1,861 people identified as being unemployed within the study area with the majority of these located in Dubbo Regional LGA.

The main occupations of residents were professionals (16.4 per cent) followed by technicians and trades workers (15.3 per cent) and managers (14.4 per cent, which includes farm managers). The percentage of residents employed as professionals was greatest in Dubbo Regional LGA. The percentage of residents employed as technicians and trades workers was greatest in Upper Hunter LGA and Mid-Western Regional LGA, while the percentage of residents employed as managers was greatest in Warrumbungle LGA.

Coal mining was the most significant employment sector for residents of the study area overall as well as for the Mid-Western Regional and Upper Hunter LGAs individually (noting that most residents employed by this sector in these LGAs commute outside the study area to work). The role of Dubbo Regional LGA as a regional service centre is reflected by the most significant employment sectors for residents being hospitals, social services, aged care residential services, primary education and state government administration. The rural nature of the Warrumbungle LGA is reflected in beef cattle farming being the most significant employment sector for residents.

Population changes can be an indication of the health of an economy. This theory of regional economic growth suggests that places that can attract immigration create increased demand for goods and services and therefore more jobs. This growth leads to increasing local multiplier effects, scale economies and an increase in the rate of innovation and capital availability (Sorensen, 1990). Conversely, population losses can contribute to decline whereby reduced populations results in closure of services, which in turn makes it difficult to attract immigration (Sorensen, 1990).

The population of the study area has been growing, at an average annual rate of 1.1 per cent since 2006. All LGAs within the study area are experiencing population growth, except for the Warrumbungle LGA where the population has been declining at an average annual rate of -0.4 per cent since 2006. The greatest rate of population growth was experienced in the Mid-Western Regional LGA with an average annual rate of 1.5 per cent.

14.2.2 Economic activity in the study area

An indication of the nature of the regional economy can be gained by examining place of work employment by industry data using the Australian and New Zealand Standard Industry Classification (ANZSIC) (ABS, 2006). The main employment in the region varies across LGAs as shown in Figure 14–1. Health Care and Social Assistance, Education and Training, Retail Trade and Agriculture, Forestry and Fishing sectors are the most prominent industries in terms of employment.

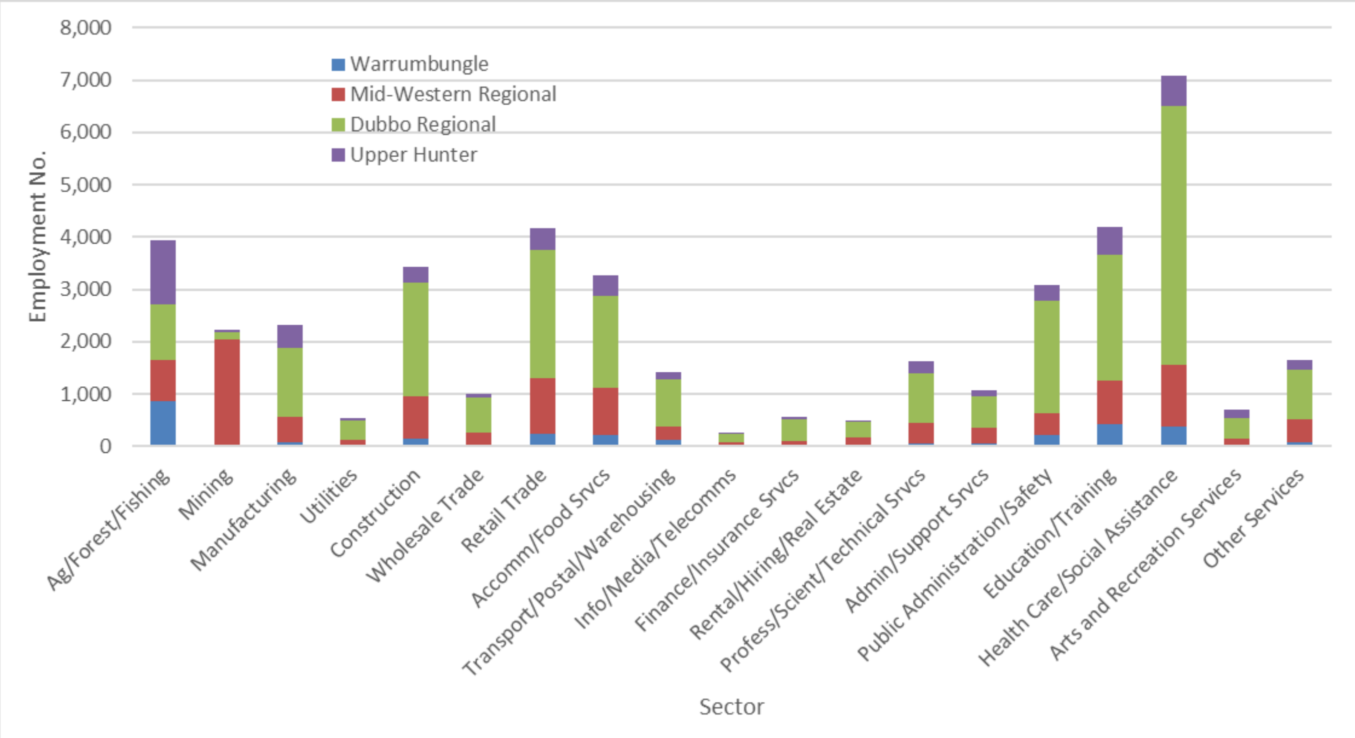


Figure 14–1 Place of work employment by industry (One-digit Industry of Employment ANZSIC Sectors)

Exporting sectors are key drivers of regional economies and reflect a region's capabilities and competitive advantages. The regional economy is a net exporter, with exports out of the region totalling about $4,625 million and imports into the region of $4,597 million. Using the IO industry classifications, the largest exporting industries by value from the regional economy are:

- Coal Mining ($3,142 million)
- Sheep, Grains, Beef and Dairy Cattle Farming ($460 million)
- Meat and Meat Products Manufacturing ($417 million)
- Basic Non-Ferrous Metal Manufacturing ($202 million)
- Wine, Spirits and Tobacco Manufacturing ($58 million).

Coal mining; sheep, grains, beef and dairy cattle farming; residential care and social assistance services; primary and secondary school education services; and public administration were the highest value-added industries in the regional economy as presented in Table 14-1.

Table 14-1 Gross value added for the five largest industries in the regional economy (IO Sectors)

Industry sector	Gross Value Added ($million)	Proportion of regional economy (per cent)	Proportion of regional employment (per cent)
Coal Mining	1,813	26%	5%
Sheep, Grains, Beef and Dairy Cattle Farming	325	5%	7%
Residential Care and Social Assistance Services	316	5%	8%
Primary and Secondary Education Services (including preschool and special schools)	306	4%	9%
Public Administration	276	4%	5%
Total	3,036	44%	33%

14.3 Potential impacts – construction

Construction of the project would generate economic activity within the regional and NSW economy. Construction would also result in some contraction in agricultural activity in the construction area.

14.3.1 Construction expenditure and workforce

Construction expenditure is associated with the following three construction sectors of the IO industry classification (ABS, 2022):

- the heavy and civil engineering construction sector which includes businesses involved in engineering, construction and project management services for a diverse range of activities including construction of electricity transmission towers
- the construction services sector which includes businesses involved in earthmoving work such as levelling of construction sites, excavation of foundations, trench digging, concreting services, electrical services, and the hire of plant
- the non-residential building construction sector which includes businesses engaged in the construction of non-residential buildings.

The construction workforce would vary depending on the stage of construction and associated activities. During the peak construction period, it is expected around 1,800 full time equivalent construction workers would be employed. Average annual construction employment is estimated at a maximum of 1,507 workers in 2026 during peak construction and an average construction workforce over around four years of 934 workers. Conservatively, all machinery (plant and equipment) manufacturing was assumed to occur outside the region and NSW.

The annual average construction workforce and annual construction expenditure is summarised in Table 14-2.

Table 14-2 Average annual construction expenditure across the three construction sectors and workforce numbers

Construction year	Annual expenditure ($million)	Construction workforce (annual average)
2024	44	138
2025	476	1,480
2026	484	1,507
2027	196	611
Average	300	934

In estimating the average annual regional economic impacts of the project, the flow-on effects that are associated with firms buying goods and services from each other (production-induced effects) are separated from the flow-on effects that are associated with employing people who subsequently buy goods and services as households (consumption-induced effects). This is because these two effects operate in different ways and have different geographical impacts.

Production-induced effects are generally proportional to the direct inputs into the region, whereas the consumption-induced flow-on effects only occur in a proportional way if workers and their families reside in the region. Where workers commute from outside the region, some of the consumption-induced flow-on effects are lost from the region. Approximately 10 per cent of the construction workforce is expected to be from the study area and the remaining workforce is expected to come from within NSW. This assessment assumed that 90 per cent of the required direct construction workforce for the project would reside in the workforce accommodation camps and that none of the wages of these people would be spent in the regional economy. In reality, some construction workforce wages may be spent in the regional economy.

Flow-on effects from the construction of the project are likely to affect several different sectors of the regional economy and NSW economy as shown in Table 14-3.

Table 14-3 Industries most likely to have flow-on effects from construction

Construction flow-on effects	Production induced	Consumption-induced
Most impacted sectors of the regional economy	• Professional, scientific and technical services • Wholesale and retail trade • Structural metal product manufacturing • Road transport • Employment, travel agency and other administrative services • Cement, lime and ready-mixed concrete manufacturing.	• Retail and wholesale trade • Food and beverage services • Health care services • Primary and secondary education • Residential care and social assistance services • Road transport • Professional, scientific and technical services.
Most impacted sectors of the NSW economy	• Residential building construction • Non-residential property operators and real estate services • Finance.	• Finance • Insurance and superannuation • Non-residential property operators and real estate services • Employment, travel agency sectors.

The average annual construction impacts of the project on the regional economy for four years are estimated to be up to:

- $512 million in annual direct and indirect output
- $181 million in annual direct and indirect value-added
- $111 million in annual direct and indirect household income
- 1,364 direct and indirect jobs.

The direct and indirect regional economic impact of the average annual level of expenditure in the regional economy are presented in Table 14-4.

Table 14-4 Direct and indirect regional impact of the average annual expenditure of the project during construction

	Direct	Indirect (flow-on)			Total effect (direct and indirect)
		Production induced	Consumption induced	Total indirect	
Output ($million)	300	202	10	212	512
Value added ($million)	129	46	6	52	181
Income ($million)	80	28	3	31	111
Employment (number)	934	383	46	429	1,363

The average annual construction impacts of the project on the NSW economy are estimated at up to:

- $969 million in annual direct and indirect output
- $420 million in annual direct and indirect value added
- $265 million in annual direct and indirect household income
- 2,994 direct and indirect jobs created.

The direct and indirect regional economic impact of the average annual level of expenditure in the NSW economy are presented in Table 14-5. The impacts are larger for the NSW economy because there is less leakage of direct and indirect expenditure out of the NSW economy compared to the regional economy.

Table 14-5 Direct and indirect impact of the average annual expenditure of the project during construction on the NSW economy

	Direct	Indirect (flow-on)			Total effect (direct and indirect)
		Production induced	Consumption induced	Total indirect	
Output ($million)	300	337	332	669	969
Value added ($million)	129	106	185	291	420
Income ($million)	97	74	94	168	265
Employment (number)	934	792	1,268	2,060	2,994

14.3.2 Agricultural land displacement

Construction of the project would result in a reduction in the land available for agricultural activity within the construction area. As identified in Chapter 8 (Agriculture) and Technical paper 2 – Agriculture, the direct impact of construction on gross agricultural production is estimated to be about $1.35 million per year of construction. Using revenue, expenditure and employment ratios in the sheep, grain, beef and dairy cattle sector of the regional and NSW IO tables, the annual direct and indirect impact of this level of gross regional production is summarised in Table 14-6.

The agricultural impacts of the project during construction are less than 0.3 per cent of agricultural economic activity in the region and a fraction of the economic activity gains from the project. This is slightly higher than the estimated impact in Chapter 8 (Agriculture) and Technical paper 2 – Agriculture, because this estimate includes direct and indirect impacts across all the economic indicators rather than only agricultural output.

Table 14-6 Annual regional economic impacts of displaced agricultural land during construction

	Direct	Indirect (flow-on)			Total effect (direct and indirect)
		Production induced	Consumption induced	Total indirect	
Output ($million)	1.35	0.69	0.35	1.04	2.39
Value added ($million)	0.50	0.30	0.21	0.51	1.01
Income ($million)	0.20	0.16	0.09	0.25	0.45
Employment (number)	3.98	2.73	1.57	4.30	8.28

14.3.3 Other potential impacts

Increases in labour demand from a project can potentially lead to short term increases in construction wages and associated labour shortages in other areas of the economy and rising inflation as firms pass wage costs onto consumers. The extent of these impacts in a regional economy would depend on the balance of labour supply from inside and outside the region as well as adjustment of the overall labour market to response to increased demand. In addition, the excess demand for resources for construction, such as quarry materials, concrete, and other construction materials, can result in rising costs for these resources and potentially shortages for other uses.

The extent to which these types of effects would arise from an individual project is uncertain. For instance, a study by Deloitte Access Economics (2011) for the Singleton LGA, in the Hunter region of NSW, found no evidence of price rises (house prices, rents, or groceries) in the Singleton economy relative to non-mining regional economies. In any case, this represents the operation of the market system where scarce resources are reallocated to where they are most highly valued and where society will benefit the most from them.

14.4 Potential impacts – operation

Operation of the project would result in economic activity in the electricity transmission, distribution, on selling and electricity market operation sector. Operation would also result in some contraction in agricultural activity in part of the operation area.

14.4.1 Operational outputs, expenditure and workforce

The estimated project operational workforce of 50 is assumed to reside in the region and an output and expenditure profile is estimated as per the coefficients in the electricity transmission, distribution, on selling and electricity market operation sector of the regional and NSW IO models.

Flow-on impacts from the project are likely to affect several different sectors of the regional and NSW economy. The sectors most likely to be impacted by output, value-added and income flow-ons are shown in Table 14-7.

Table 14-7 Industries most likely to have flow-on effects from operation

Operation flow-on effects	Production induced	Consumption-induced
Most impacted sectors of the regional economy	• Electricity generation • Electricity transmission, distribution, on selling and electricity market operation • Construction services • Professional, scientific, and technical services • Finance • Auxiliary finance and insurance services • Wholesale and retail trade • Employment, travel agency and other administrative services.	• Retail and wholesale trade • Food and beverage services • Health care services • Primary and secondary education • Residential care and social assistance services • Road transport • Professional, scientific, and technical services.
Most impacted sectors of the NSW economy	• Non-residential property operators and real estate services • Road transport • Transport support services and storage • structural metal product manufacturing.	• Finance • Insurance and superannuation • Non-residential property operators and real estate services • Employment, travel agency.

The average annual economic impacts of the project on the regional and NSW economy (in 2022 dollars) during operation is shown in Table 14-8.

The project is estimated to make up to the following total annual contribution to the regional economy:

- $134 million in annual direct and indirect regional output
- $54 million in annual direct and indirect regional value-added
- $17 million in annual direct and indirect household income
- 189 direct and indirect jobs.

Table 14-8 Annual economic impacts of the project on the regional economy during operation ($2022)

	Direct	Indirect (flow-on)			Total effect
		Production induced	Consumption induced	Total indirect	(direct and indirect)
Output ($million)	70	51	13	64	134
Value added ($million)	26	20	8	28	54
Income ($million)	6	8	3	11	17
Employment (number)	50	79	60	139	189

The average annual economic impacts of the project on the NSW economy (in 2022 dollars) are shown in Table 14-9. The project is estimated to make up to the following total annual contribution to the NSW economy:

- $186 million in annual direct and indirect regional output
- $81 million in annual direct and indirect regional value-added
- $34 million in annual direct and indirect household income
- 356 direct and indirect jobs.

Table 14-9 Annual economic impacts of the project on the NSW economy during operation ($2022)

	Direct	Indirect (flow-on)			Total effect
		Production induced	Consumption induced	Total indirect	(direct and indirect)
Output ($million)	70	73	43	116	186
Value added ($million)	26	31	24	55	81
Income ($million)	6	16	12	28	34
Employment (number)	50	142	164	306	356

14.4.2 Agricultural land displacement

The project would result in a reduction in the land available for agricultural activity due to establishment of infrastructure such as transmission line towers, energy hubs and switching stations within the operation area. As identified in Chapter 8 (Agriculture) and Technical paper 2 – Agriculture, the direct impact of operation on gross agricultural production during operation is estimated to be about $317,550 over a year based on the 2022 economic environment.

The agricultural impacts of the project during operation are less than 0.06 per cent of agricultural economic activity in the region and a fraction of the economic activity gains from the project. This is slightly higher than the estimated impact in Chapter 8 (Agriculture) and Technical paper 2 – Agriculture, as this estimate includes direct and indirect impacts across all economic indicators rather than only agricultural output.

The annual direct and indirect impact of this level of gross regional agricultural production is summarised in Table 14-10.

Table 14-10 Annual regional economic impacts of displaced agricultural land during operation

	Direct	Indirect (flow-on)			Total effect
		Production induced	Consumption induced	Total indirect	(direct and indirect)
Output ($million)	0.32	0.16	0.08	0.24	0.56
Value added ($million)	0.12	0.07	0.05	0.12	0.24
Income ($million)	0.05	0.04	0.02	0.06	0.11
Employment (number)	0.94	0.64	0.37	1.01	1.95

14.4.3 Other potential impacts

The project would create a small demand for regional labour resources and regional inputs to production. Consequently, no other effects on other industry sectors are anticipated during operation.

14.5 Management of impacts

14.5.1 Environmental management

The project would result in a number of economic impacts as outlined in Section 14.3 and 14.4. Where these impacts cannot be avoided, a range of mitigation measures would be implemented, including a Workforce Management Plan and Industry Participation Plan. This is detailed in Chapter 13 (Social).

14.5.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to the local and regional economy and resource use are detailed in the following chapters:

- Chapter 7 (Land use and property), specifically measures which address impacts to land use
- Chapter 8 (Agriculture), specifically measures which address impacts to agricultural land capability
- Chapter 13 (Social), specifically measures which address social impacts and include measures relating to business and workforce participation to maximise social benefits of the project.

15 Noise and vibration

This chapter provides an assessment of the potential noise and vibration impacts of the project and identifies mitigation measures to minimise these impacts, as provided in Technical paper 9 – Noise and vibration (Technical paper 9). This includes airborne noise (including road traffic noise) and vibration impacts of the project, as well as overpressure and groundborne vibration impacts due to blasting activities during construction. The Secretary's Environmental Assessment Requirements (SEARs) as they relate to noise and vibration, and where in the Environmental Impact Statement (EIS) these have been addressed, are detailed in Appendix A (SEARs checklist).

15.1 Legislative and policy context

The noise and vibration assessment was undertaken in accordance with SEARs and with reference to the requirements of relevant policies, assessment guidelines and standards including:

- *Interim Construction Noise Guideline* (NSW Department of Environment, Climate Change and Water (DECCW), 2009) (ICNG)
- *NSW Road Noise Policy* (DECCW, 2011) *(*RNP)
- *Noise Policy for Industry* (NSW Environment Protection Authority, 2017) (NPfI)
- *Australian Standard AS 1055: Description and measurement of environmental noise* (Standards Australia, 2018a)
- *ISO 8297 – Determination of Sound Power Levels of Multisource Industrial Plants for Evaluation of Sound Pressure Levels in the Environment* (International Organisation for Standardisation (ISO), 1994) (Engineering Method)
- *Construction Noise and Vibration Guideline* (Transport for NSW, 2022c) (CNVG)
- *Assessing Vibration: A Technical Guideline* (NSW Department of Environment and Conservation, 2006) (AVTG)
- *DIN 4150-3 Structural Vibration Part 3: Effects of Vibration on Structures* (Deutsches Institut für Normung, 1999) (DIN 4150-3)
- *Australian Standard AS2187.2-2006 Explosives – Storage, Transport and Use provides guidance for the assessment of cosmetic damage to buildings caused by vibration* (Standards Australia, 2006b)
- *British Standard BS 7385-2:1993 – Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration* (British Standard Institution, 1993) (BS 7385)
- *Australian and New Zealand Environment Conservation Council's (ANZECC) Technical Basis for Guidelines to Minimise Annoyance Due to Blast Overpressure and Ground Vibration* (ANZECC, 1990).

15.2 Assessment approach

15.2.1 Study area

The study area for the noise and vibration assessment consists of the construction area of the project and areas within three kilometres of the construction area (refer to Figure 15-1). The study area reflects the possible distance from which noise and vibration sensitive receivers may experience noise and vibration impacts from the project.

15.2.2 Assessment approach

The assessment methodology involved:

- desktop review and field investigations to understand the existing noise and vibration environment including:
  - identification of potential noise and vibration sensitive receivers within the study area based on aerial imagery
  - division of the study area into noise catchment areas (NCA). NCAs are areas where sensitive receivers have a similar land use and ambient noise environment, and are likely to experience similar impacts from the project
  - attended and unattended noise monitoring at multiple locations within the study area in November 2022 to determine rating background levels (RBL) in each NCA. The RBL is the background noise level used for the purpose of assessment
  - review of the existing meteorological conditions of the study area using data from the Bureau of Meteorology (BOM) (described in section 2.5.3 of Technical paper 9)
  - identification of the applicable noise and vibration criteria with reference to relevant guidelines, standards and the noise monitoring results completed for the project (refer to Section 15.3)
- for construction noise:
  - noise modelling of representative 'realistic worst-case' scenarios that are based on likely construction stages and plant and equipment during standard and non-standard construction hours (as defined by the ICNG). This assumed certain equipment would be used simultaneously at the boundary of the construction area
  - preliminary assessment of helicopter noise impacts associated with aerial stringing of transmission lines – while the results of this assessment do not form part of the quantitative noise impact assessment results in Section 15.5.2 (as the impact would be infrequent and short term), they are used to identify typical noise levels associated with the use of helicopters and likely exceedances of relevant criteria where helicopters or drones are used
  - assessment of sleep disturbance impacts where construction work would occur outside standard construction hours
  - identification of standard and additional site-specific noise mitigation where exceedances of applicable Noise Management Level (NML) occur (refer to Section 15.4.1)
- assessment of construction traffic noise impacts on sensitive receivers based on existing traffic volumes and traffic volumes being generated by the project along construction routes
- assessment of construction vibration impacts through the identification of structures or sensitive receivers within minimum vibration working distances identified in the CVNG

- a qualitative assessment of blasting during construction with regard to the *Technical Basis for Guidelines to Minimise Annoyance Due to Blast Overpressure and Ground Vibration* (ANZECC, 1990) and *AS 2187.2 Explosives – Storage, Transport and use Part 2: Use of Explosives* (AS2187.2)
- for operational noise, the assessment of:
  - corona noise discharges from proposed transmission lines. This assumed transmission lines are carrying a full load and has been informed by data collected from similar transmission projects
  - noise generated through the operation of plant (e.g. fans) at energy hubs
  - sleep disturbance impacts during the operation of circuit breaker switches at energy hubs and switching stations
  - noise generated from maintenance activities
- identification of feasible and reasonable construction measures to mitigate predicted exceedances of the noise criteria or where vibration-intensive activities occur within minimum working distances
- identification of feasible and reasonable operational mitigation measures based on predicted exceedances of the noise criteria at sensitive receivers from operation of transmission infrastructure.

Further detail on the noise and vibration assessment methodology is provided in chapter 2 of Technical paper 9.

15.3 Existing environment

15.3.1 Sensitive receivers

Noise

There are approximately 190 noise sensitive receivers within the study area (see Figure 15-1). These are predominantly residential receivers consisting of dwellings on agricultural properties throughout the study area. Ulan Public School is the only non-residential noise sensitive receiver located within the study area. The six individual buildings associated with Ulan Public School have each been considered a receiver.

At the time of finalising the noise assessment, one residential receiver is an approved development application (DA) for a house which does not currently exist. It also became known that there is a newly constructed dwelling at 121 Cliffdale Road, Uarbry in proximity to the construction area. As these were identified in the final stages of the preparation of the noise assessment, they have not been included. To address this issue, a revised impact assessment will be carried out and the results presented in the submissions report following exhibition of the EIS. This will include conducting a search to confirm if any there are any newly approved DAs for dwellings in the study area that need to be included in the assessment.

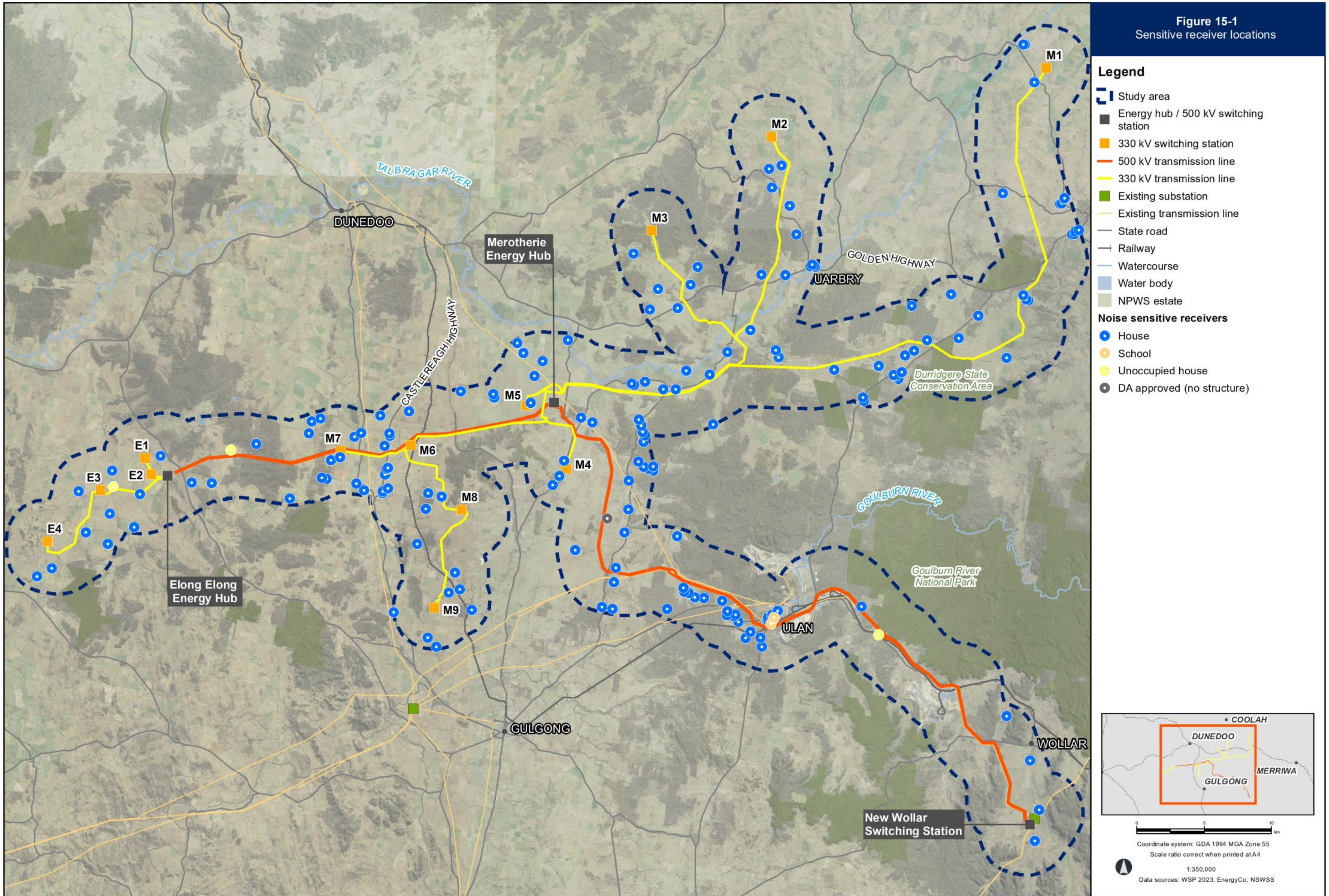
Vibration

Vibration sensitive receivers include all regularly occupied buildings and sensitive structures within the study area. At sufficient levels, vibration can lead to cosmetic (and possibly structural) building damage as well as cause disturbance to occupants (human comfort). For this assessment, all identified noise sensitive receivers are also considered potentially vibration sensitive.

Sensitive structures can include heritage sites. Two unlisted non-Aboriginal heritage sites in the vicinity of the construction area are identified as potentially vibration sensitive including Laheys Creek Cemetery and Pine Park Woolshed. However, only the Pine Park Woolshed is located within the minimum working distances provided in Table 15-9. These non-Aboriginal heritage sites are described in further detail in Chapter 12 (Non-Aboriginal heritage) and Technical paper 6 – Non-Aboriginal heritage.

The Aboriginal heritage sites identified within and near the construction area primarily comprise artefact scatters, artefact deposits, culturally modified trees, rock shelters and grinding grooves. Of these sites, rock shelters and grinding grooves are potentially vibration sensitive, subject to the local geological conditions. Aboriginal heritage sites are described in further detail in Chapter 11 (Aboriginal heritage) and Technical paper 5 – Aboriginal cultural heritage assessment report.

Figure 15-1
Sensitive receiver locations



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:350,000
Data sources: WSP 2023, EnergyCo, NSWSS

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15.3.2 Noise catchment areas

During attended noise monitoring, background noise levels were generally observed to be low during the daytime period and dominated by rural and natural sounds, typical of the rural land uses in the study area. This was consistent with the unattended noise monitoring results.

The features of the NCAs and RBLs measured by the unattended noise loggers are provided in Table 15-1. Unattended and attended noise monitoring was not undertaken at NCA 8 due to site access restrictions and unattended noise monitoring was not undertaken at in NCA 11 due to nearby construction noise dominating the noise environment. Publicly available noise monitoring reports for Wilpinjong Coal Mine were used to estimate RBLs in these NCAs. The NCAs and associated monitoring locations are presented in Figure 15-2.

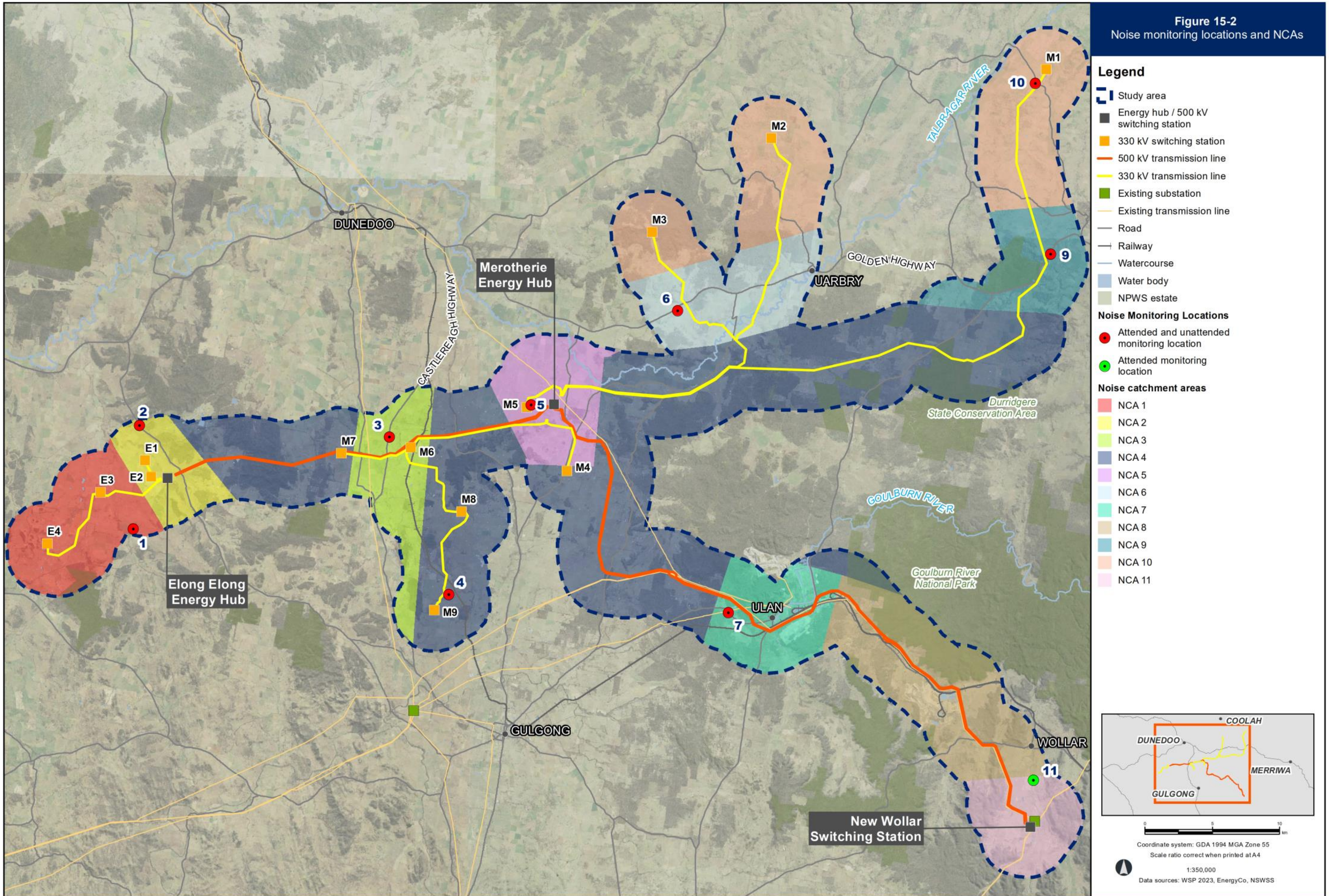
Table 15-1 Noise catchment areas

NCA	Monitoring location	Approximate number of receivers	Location and description of noise environment	Noise observations from attended monitoring	RBL (dBA)		
					Day[1]	Evening[1]	Night[1]
NCA 1	1	12	Goolma region, sparsely populated farmland.	Rural noises including livestock and wind.	35[2]	30[2]	30[2]
NCA 2	2	3	Elong Elong region, open farmland and bushland of Tuckland State Forest. Road noise from Spring Ridge Road.	Rural noises including birds, wind and the occasional vehicle passing on Spring Ridge Road.	35[2]	30[2]	30[2]
NCA 3	3	17	Orana region, sparsely populated farmland dominated by Castlereagh Highway.	Road traffic noise including mainly vehicle traffic, and in absence of traffic wind noise from vegetation.	35[2]	30[2]	30[2]
NCA 4	4	79	Very low density rural areas throughout project, consisting of either farmland or state conservation areas.	Rural noises including livestock, birds, insects and wind.	35[2]	30[2]	30[2]
NCA 5	5	10	Merotherie region, very low density rural area/farmland.	Rural noises including livestock and wind, distant road traffic on Castlereagh Highway in absence of other sources.	35[2]	30[2]	30[2]
NCA 6	6	15	Uarbry region, sparsely populated farmland dominated by Golden Highway (west).	Dominated by wind noise and traffic on the Golden Highway.	35[2]	32[3]	32
NCA 7	7	26	Township and surrounding area of Ulan, dominated by mining and rail operations.	Quiet rural area, occasional road traffic on Cope Road and wind in vegetation noise.	37[3]	37[3]	37
NCA 8	–	4	Township and surrounding area of Wollar, dominated by mining and rail operations.	N/A	35[2]	30[2]	30[2]
NCA 9	9	10	Cassilis region, sparsely populated farmland dominated by Golden Highway (east).	Frequent road traffic and wind in vegetation noise.	35[2]	30[2]	30[2]

NCA	Monitoring location	Approximate number of receivers	Location and description of noise environment	Noise observations from attended monitoring	RBL (dBA)		
					Day[1]	Evening[1]	Night[1]
NCA 10	10	12	Very low density rural area north of Golden Highway, with Coolah township on northern border.	Rural noises including livestock and wind.	35[2]	30[2]	30[2]
NCA 11	11	2	Wollar/Tichular region, very low density rural area/farmland, and existing substation.	N/A	35[2]	30[2]	30[2]

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 monitored background levels were below the minimum assumed RBLs outlined in the NPfI, these have been adjusted to 35 dBA during the day period, and 30 dBA during the evening and night periods

Figure 15-2
Noise monitoring locations and NCAs



15.4 Assessment criteria

15.4.1 Construction noise

Noise management levels

In accordance with the ICNG, feasible and reasonable work practices to minimise noise emissions are to be investigated where construction noise levels are predicted or measured to be above the relevant Noise Management Levels (NMLs) (the noise levels above which management measures are required to be considered). The NML are set with reference to the time of day and RBLs. The ICNG NMLs for residential sensitive receivers are provided in Table 15-2.

The ICNG also sets a highly noise affected level for residential sensitive receivers (75 $L_{eq\ 15\ min}$ dB(A)) above which further mitigation needs to be considered. This includes additional consultation and notification and additional respite periods.

Table 15-2 NMLs for residential receivers (ICNG)

Time of day	Applicable noise management level ($L_{Aeq\ (15\ min)}$)
Standard construction hours: • 7 am to 6 pm Monday to Friday and 8 am to 1 pm Saturday • no work on Sundays or public holidays.	RBL + 10 dB
Outside standard construction hours (out of hours) or (OOH)): • Day: 1 pm to 6 pm Saturday and 8 am to 6 pm Sunday • Evening: 6 pm to 10 pm Monday to Sunday • Night: 10 pm to 7 am Monday to Saturday and 10 pm to 8 am Sunday.	RBL + 5 dB

The project specific NMLs for residential receivers are outlined in Table 15-3 and are based on the RBLs identified for each NCA in Table 15-1. The location of NCAs is shown in Figure 15-2. The OOH NMLs for each NCA are consistent across the day (outside standard construction hours), evening and night-time periods as detailed in Table 15-3.

The only non-residential sensitive receiver within the study area is Ulan Public School. For the classrooms or other educational institutions, the NML is set by the ICNG as an internal noise level of 45 $L_{eq\ 15\ min}$ dBA. This equates to an external noise level of 55 $L_{eq\ 15\ min}$ dBA.

Table 15-3 Project-specific NMLs for residential receivers

NCA	NMLs, $L_{eq(15min)}$ dBA			
	Standard construction hours	OOH periods		
	Day	Day (OOH)	Evening (OOH)	Night (OOH)
NCA 1	45	35	35	35
NCA 2	45	35	35	35
NCA 3	45	35	35	35
NCA 4	45	35	35	35
NCA 5	45	35	35	35
NCA 6	45	37	37	37
NCA 7	47	42	42	42

NCA	NMLs, $L_{eq(15min)}$ dBA			
	Standard construction hours	OOH periods		
	Day	Day (OOH)	Evening (OOH)	Night (OOH)
NCA 8	45	35	35	35
NCA 9	45	35	35	35
NCA 10	45	35	35	35
NCA 11	45	35	35	35

Perception of noise impacts at a receiver relates to the noise level above the RBL and assists with determining the level of mitigation applied. The perception of exceedances considered in relation to NMLs is described in Table 15-4.

Table 15-4 Perception of NML exceedances

Perception	dB(A) above NML	
	Standard hours	OOH
Noticeable	0	0 to 5
Clearly audible	< 10	5 to 15
Moderately intrusive	10 to 20	15 to 25
Highly intrusive	> 20	> 25

Sleep disturbance

The assessment of sleep disturbance during construction has applied the maximum noise level event criteria established by the NPfI being:

- $L_{eq(15min)}$ 40 dBA or the RBL plus 5 dB, whichever is the greater, and/or
- L_{Fmax} 52 dBA or the RBL plus 15 dB, whichever is the greater.

Maximum noise impacts may cause awakening events (L_{AFmax} criteria), while maintained elevated noise levels may reduce the quality of sleep ($L_{eq(15min)}$ criteria). The sleep disturbance criteria for the project are shown in Table 15-5 and are based on the RBLs identified for each NCA in Table 15-5.

Table 15-5 Sleep disturbance criteria

Location	Night-time RBL dBA	$L_{Aeq(15min)}$ criteria dB (sleep disturbance)	L_{AFmax} criteria dB (awakening)
NCA 1, 2, 3, 4, 5, 8, 9, 10 and 11	30	40	52
NCA 6	32	40	52
NCA 7	37	42	52

Construction road traffic noise

Potential impacts from construction traffic noise associated with the project has been assessed using guidance from the RNP. The assessment compares the predicted construction traffic volumes from the project against existing traffic volumes on the road network to determine potential changes in noise levels.

The RNP makes a distinction between the assessment criteria for road traffic noise from freeway/arterial/sub-arterial roads and local roads. Mitigation measures would be investigated where the road traffic noise levels increase by more than 2 dBA as a result of the proposed construction traffic and the relevant noise level criteria are exceeded, as described in Table 15-6.

Table 15-6 Road traffic noise criteria for receivers on existing roads affected by the additional traffic from land use developments

Road type	External road traffic noise criteria	
	Day (7 am – 10 pm)	Night (10 pm – 7 am)
Freeway/arterial/sub-arterial roads	60 dBA $L_{eq\ (15hr)}$ and increase >2 dBA	55 dBA $L_{eq(9hr)}$ and increase >2 dBA
Local roads	55 dB $L_{Aeq\ 1hr}$	50 dB $L_{Aeq\ 1hr}$

15.4.2 Operation noise

Project noise trigger level

Noise impacts from energy hubs and transmission lines were assessed against the NPfI which includes both intrusiveness and amenity criteria. The assessment procedure for industrial noise sources outlines two components:

- controlling intrusive noise impacts in the short-term for residences
- maintaining noise level amenity for particular land uses for residences and other land uses.

The intrusiveness criterion aims to minimise noise increases from a single new development by applying a criterion of 5 dB(A) above RBL, while the amenity criteria aims to limit continuing increases in ambient noise by applying recommended levels for certain receiver types. The more stringent of the two applies to determine the project noise trigger level (PNTL). If the PNTL is exceeded, proponents are required to consider feasible and reasonable noise mitigation.

The PNTL for each NCA is summarised in Table 15-7.

Table 15-7 Summary of PNTL for receivers

Receiver location	Receiver type	Assessment type	PNTL (dBA $L_{eq(15\ min)}$)[1]		
			Day[2]	Evening[2]	Night[2]
NCA 1, 2, 3, 4, 5, 8, 9, 10 and 11	Residential	Intrusiveness	40	35	35
		Amenity	48	43	38
		PNTL	40	35	35
NCA 6	Residential	Intrusiveness	40	37	37
		Amenity	48	43	38
		PNTL	40	37	37
NCA 7	Residential	Intrusiveness	42	42	42
		Amenity	48	43	38
		PNTL	42	42	38
	Non-residential (Ulan Public School)	Amenity/PNTL	35	–	–

1. $L_{eq,\ 15min} = L_{eq,\ period} + 3$ dB
2. Day: the period from 7:00 am to 6.00 pm Monday to Saturday; or 8.00 am to 6.00 pm on Sundays and public holidays; Evening: the period from 6.00 pm to 10.00 pm; Night: the remaining periods.

Sleep disturbance

At switching stations and energy hubs, circuit breaker switches would activate infrequently and result in short term impulsive noise events. These noises do not typically affect the background noise environment so the assessment has therefore been considered against the L_{Amax} noise criteria during the night-time period as detailed in the NPfI (refer to sleep disturbance criteria in Section 15.4.1). The maximum noise level event criteria for the project is the awakening trigger level of 52 L_{Amax} dB.

Where exceedances are predicted, additional assessment may be required. The NPfI refers to the RNP for further guidance on sleep disturbance impacts, which states that maximum internal noise levels below 50-55 dBA are unlikely to awaken people from sleep, and one to two noise events per night, with maximum internal noise levels of 65–70 dBA not likely to affect health and wellbeing.

Noise control

Following consideration of all feasible and reasonable noise mitigation measures, the NPfI allows for property treatment at affected sensitive receivers to be considered for any residual noise impacts. The NPfI states that receiver-based treatment is typically only applicable for isolated residences in rural areas and may include upgrade of various construction elements of the dwellings and voluntary property acquisition.

In accordance with NPfI, receivers with a residual noise impact are considered receivers with exceedances of the project noise trigger levels under the best-achievable acoustic outcome from a development. The significance of project-related residual noise impacts experienced by receivers is determined in accordance with NPfI, as summarised in Table 15-8.

Table 15-8 Definition of the significance of residual noise impacts

If the predicted noise level minus the PNTL is:	And the total cumulative industrial noise level is:	Then the significance of residual noise level is:	Example of potential treatment
≤ 2 dB	Not applicable	Negligible	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.
≥ 3 but ≤ 5 dB	< recommended amenity noise level or > recommended amenity noise level, but the increase in total cumulative industrial noise level resulting from the development is less than or equal to 1 dB	Marginal	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.
≥ 3 but ≤ 5 dB	> recommended amenity noise level and the increase in total cumulative industrial noise level resulting from the development is more than 1 dB	Moderate	As for ‘marginal’, but also upgraded façade elements, such as windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.
> 5 dB	≤ recommended amenity noise level		
> 5 dB	> recommended amenity noise level	Significant	May include suitable commercial agreements where considered feasible and reasonable.

15.4.3 Vibration

Vibration criteria relate to:

- cosmetic building damage (and structural damage in extreme cases)
- loss of amenity due to perceptible vibration, termed human comfort
- impacts on the condition and structural integrity of sensitive structures.

Cosmetic damage is considered minor in nature as it is readily repairable and does not affect a building's structural integrity. If there is no significant risk of cosmetic building damage, then structural damage is not considered a significant risk and is not assessed.

The CNVG summarises the relevant minimum working distances for certain vibration intensive plant and equipment with regard to cosmetic damage and human comfort impacts. These distances have been calculated according to the BS 7385 for cosmetic damage and AVTG for human comfort impacts.

In relation to human comfort, the nominated minimum working distances relate to continuous vibration. For most construction activities, vibration emissions are intermittent and higher vibration levels over shorter periods are acceptable. Additional assessment should be undertaken where the human comfort criteria are exceeded.

Guidance for more sensitive structures or vibration sensitive activities is outlined in the German Guideline, DIN 4150-3. For the assessment purposes at this stage, DIN 4150-3 will be considered. With regard to heritage structures, BS 7385 states that 'a building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive' and therefore items should not be assumed to be sensitive to vibration on the basis of being classified a heritage site alone. Item specific vibration criteria would be developed following conditions inspection of each identified heritage site and incorporated into the Construction Noise and Vibration Management Plan when developed.

Table 15-9 indicates the minimum working distances for typical items of vibration intensive plant and equipment applicable to this project. The minimum working distances presented are indicative and would vary depending on the item of plant and local geotechnical conditions. The cosmetic damage thresholds apply to typical buildings under typical geotechnical conditions.

Table 15-9 Minimum working distances for vibration intensive plant

Plant item	Rating/description	Minimum working distance (metres)		
		Cosmetic damage (BS7385)	Heritage (DIN 4150-3)	Human comfort (AVTG)
Small hydraulic hammer	300 kg – 5 to 12 tonne excavator	2	5	7
Medium hydraulic hammer	900 kg – 12 to 18 tonne excavator	7	15	23
Large hydraulic hammer	1600 kg – 18 to 34 tonne excavator	22	44	73
Pile boring	≤800 mm diameter	2	5	n/a
Vibratory roller	< 100 kilonewton (typically 2-4 tonnes)	6	16	20
	> 300 kilonewton (typically 13-18 tonnes)	20	54	100

Blasting

The relevant criteria outlined in *Technical Basis for Guidelines to Minimise Annoyance due to Blasting Overpressure and Ground Vibration* (ANZECC, 1990) are presented in Table 15-10. The guidelines also provide a long-term goal of two millimetres per second for peak particle vibration velocity. The criteria for ground vibration is designed to preserve amenity and is more stringent than relevant criteria designed to protect against structural damage for most structures.

Table 15-10 ANZECC recommended vibration and air blast criteria

Issue	Measure	Criterion for 95 per cent of blasts	Criterion for 100 per cent of blasts
Vibration	mm/s (peak particle velocity)	5	10
Air blast	dBL Peak	115	120

Where blasting is to occur in the vicinity of vibration sensitive heritage structures, relevant ground vibration criteria would be adopted based on German Standard DIN 4150-3. Item specific vibration criteria would be developed following conditions inspection of each heritage item and incorporated into the Construction Noise and Vibration Management Plan when developed.

15.5 Potential impacts – construction

15.5.1 Construction hours and noise sources

Construction of the project would result in potential noise and vibration impacts to surrounding sensitive receivers. The potential impacts would vary across the construction area depending on timing, intensity and location of construction activities. Noise levels generated by the project would be influenced by RBLs, topography and the weather conditions. Construction noise and vibration sources from the project include:

- operation of mobile and stationary plant and equipment such as drones (or helicopters), cranes, piling rigs and excavators
- operation of construction compounds, workforce accommodation camps and other ancillary facilities (which are considered fixed noise sources)
- construction vehicle movements
- controlled blasting to loosen and break up existing rock at energy hubs, switching stations and small areas along the transmission line alignment.

The majority of construction activities would generally be undertaken across a seven-day work week between 7 am and 7 pm, consisting of a mixture of both standard and non-standard construction hours as defined in the ICNG. Standard construction hours are defined by the ICNG as:

- Monday to Friday between 7 am and 6 pm
- Saturday between 8 am and 1 pm
- no work on Sundays or public holidays.

The extended hours are proposed due to the remote nature of the work, and the requirement to accommodate a rostered fly-in fly-out (FIFO) and drive-in drive-out (DIDO) workforce.. To support construction activities during these extended hours, operation of the main construction compounds would also be required. The workforce accommodation camps would be operational 24 hours a day, seven days a week.

Where sensitive receivers are noise affected during extended construction hours (that is, where construction noise is above the noise management level), and the works cannot be undertaken during standard work hours, measures would be implemented through an OOH work protocol (refer to Section 15.7.2). The protocol would specify the process to assess OOH work against noise management levels, selection and implementation of mitigation measures for residual impacts, taking into account the frequency and duration of works.

Chapter 3 (Project description) of the EIS provides a detailed description of construction activities (Section 3.5.6) and construction hours (Section 3.5.5).

15.5.2 Airborne noise

During construction, airborne noise impacts would be minor for most construction activities at energy hubs and switching stations. Noise levels are predicted to comply with NMLs during daytime (standard) hours at the majority of noise sensitive receivers in the study area, however when works are undertaken outside standard working hours, noise levels are predicted to be more noticeable and predicted to exceed NMLs at more receivers. The predicted noise levels also represent the worst-case scenario in which the loudest equipment is operating at the closest point to receivers within the relevant section of the construction area. In practice, actual construction noise levels at individual receivers would be lower for most of the construction period as noise generating activities are undertaken at varying locations within the construction area.

An overview of construction components is provided in Table 15-11 and predicted NML exceedances are summarised for each NCA in the following sections. Generally earthworks associated with establishing transmission line tower foundations, energy hubs and switching stations are identified as the nosiest work stage during construction. Use of drones or helicopters for stringing transmission lines between towers may be required for short periods and would progress along the alignment. Where required, this activity would result in exceedances of NMLs during the daytime (including OOH daytime) as noise levels would be approximately 4 dB greater than the noisiest earthworks. However these impacts would be short term and this activity would not be undertaken during evening or night-time hours.

The potential for construction noise impacts from concurrent construction activities would occur where sensitive receivers are in proximity to two or more components of the project. For example, sensitive receivers in the vicinity of energy hubs have the potential to be subject to noise impacts arising from concurrent construction activities associated with the energy hub itself alongside transmission lines and nearby switching station(s) as well as the use of construction compounds and/or the operation of workforce accommodation camp (Merotherie Energy Hub only).

Based on the proximity of the nearest receivers to the construction area, 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 impacts from individual construction activities.

Table 15-11 Summary of each construction components and the noisiest work stage

Construction components	Relevant NCAs	Noisiest work stage	
		Type	Description
Construction of transmission lines and access tracks	All	Foundations	Construction of the transmission line tower foundations would involve excavation and piling work. This work stage would occur progressively along the alignment.
Construction of energy hubs and New Wollar Switching Station	1, 2, 5 and 11	Earthworks	Bulk earthworks to establish the landform (or pads) for the energy hubs and switching station would be undertaken in the early stages of construction at each site.
Construction of 330 kV switching stations	1, 2, 3, 4, 5, 10 and 11	Earthworks	Bulk earthworks to establish the landform (or pads) would be undertaken in the early stages of construction at each site.

Construction components	Relevant NCAs	Noisiest work stage	
		Type	Description
Construction and operation of construction compounds	2, 5 and 11	Operation of the construction compound	Each construction compound is a base for construction activities, usually for the storage of plant, equipment and materials, and/or construction site offices and worker facilities. It can also comprise concrete batching plant, crushing, grinding and screening plant, testing laboratory and wastewater treatment plant.
Construction and operation of workforce accommodation camps	4, 5 and 9	Construction of the workforce accommodation camps	Establishment of workforce accommodation camps would include surface preparation and installation facilities. The construction of the workforce accommodation facilities would take about four months.

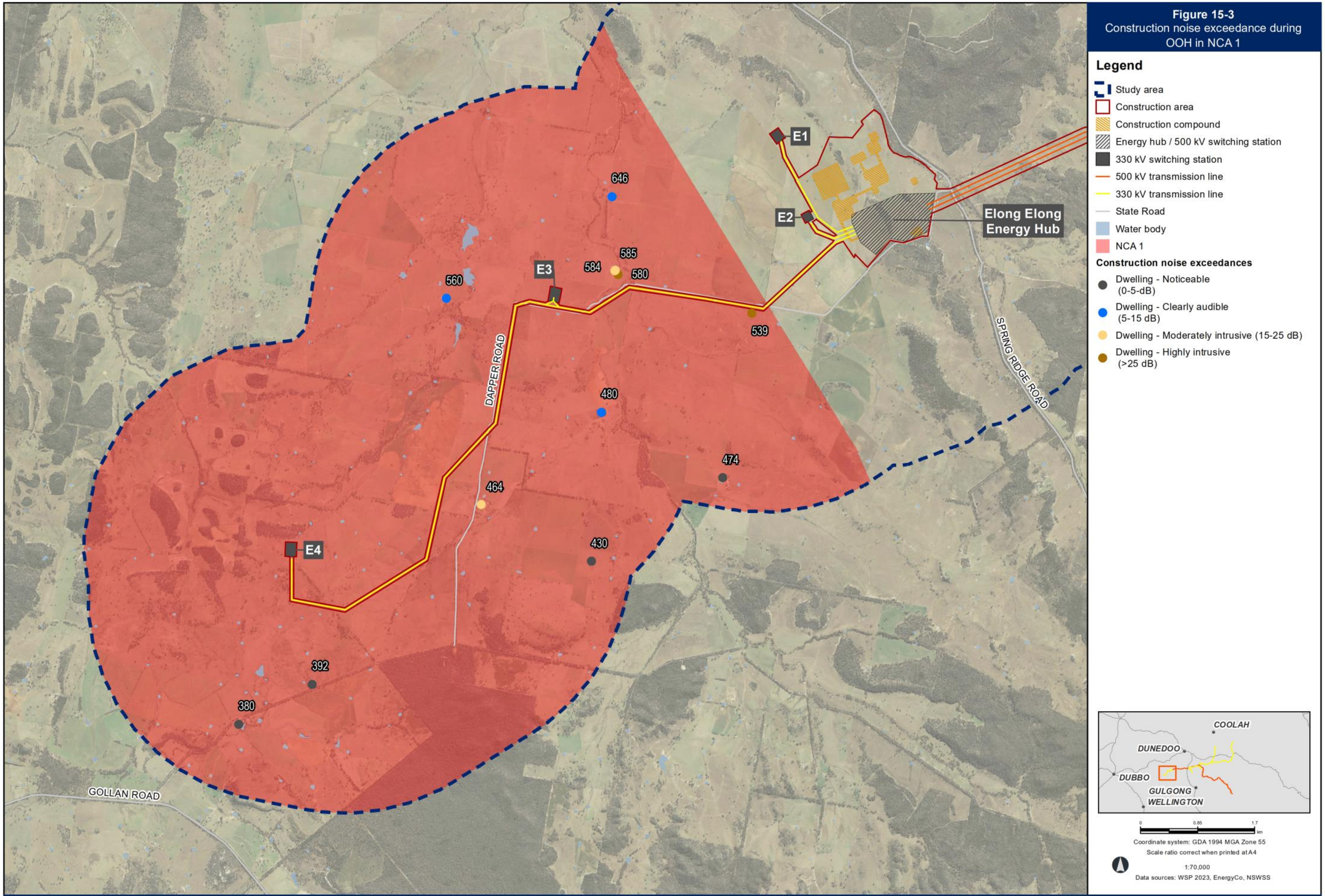
NCA 1

The predicted exceedances of NMLs in NCA 1 are summarised in Table 15-12 and the maximum exceedances at receivers are shown in Figure 15-3.

Table 15-12 Summary of predicted noise exceedances in NCA 1 during construction

Component	Summary of predicted exceedances of NMLs		Summary of sleep disturbance exceedances
	Standard hours	Out of hours	
Transmission lines	Exceedances are predicted at up to six residential receivers during multiple construction stages. During the noisiest works (foundations), exceedances are predicted to be: • up to 10 dB at two receivers • up to 20 dB at three receivers • greater than 75 dB are predicted at one receiver (highly noise affected).	Exceedances are predicted at up to 12 receivers during multiple construction stages. During the noisiest works (foundations), the exceedances are predicted to be: • up to 5 dB at four receivers • up to 15 dB at three receivers • up to 25 dB at three receivers • greater than 25 dB at one receiver • greater than 75 dB at one receiver (highly noise affected).	Exceedances of the sleep disturbance criterion is predicted at up to eight receivers during the noisiest works.
Elong Elong Energy Hub	No exceedances are predicted.	Exceedances of up to 5 dB are predicted at one receiver during earthworks.	No exceedances are predicted.
Switching station E1	No exceedances are predicted.	Exceedances of up to 5 dB at two receivers are predicted during earthworks.	No exceedances are predicted.
Switching station E2	No exceedances are predicted.	Exceedances of up to 5 dB are predicted at one receiver during multiple construction stages.	Exceedances of the sleep disturbance criterion is predicted at one receiver during earthworks.
Switching station E3	Predicted exceedance at one receiver by up to 10 dB during earthworks.	Exceedances are predicted at up to four receivers during multiple construction stages. During the noisiest works (earthworks), the exceedances are predicted to be up to 15 dB at these receivers.	Exceedances of the sleep disturbance criterion is predicted at up to four receivers during the noisiest works.
Switching station E4	No exceedances predicted.	Exceedances of up to 5 dB at one receiver are predicted during earthworks.	No exceedances are predicted.

Figure 15-3
Construction noise exceedance during OOH in NCA 1



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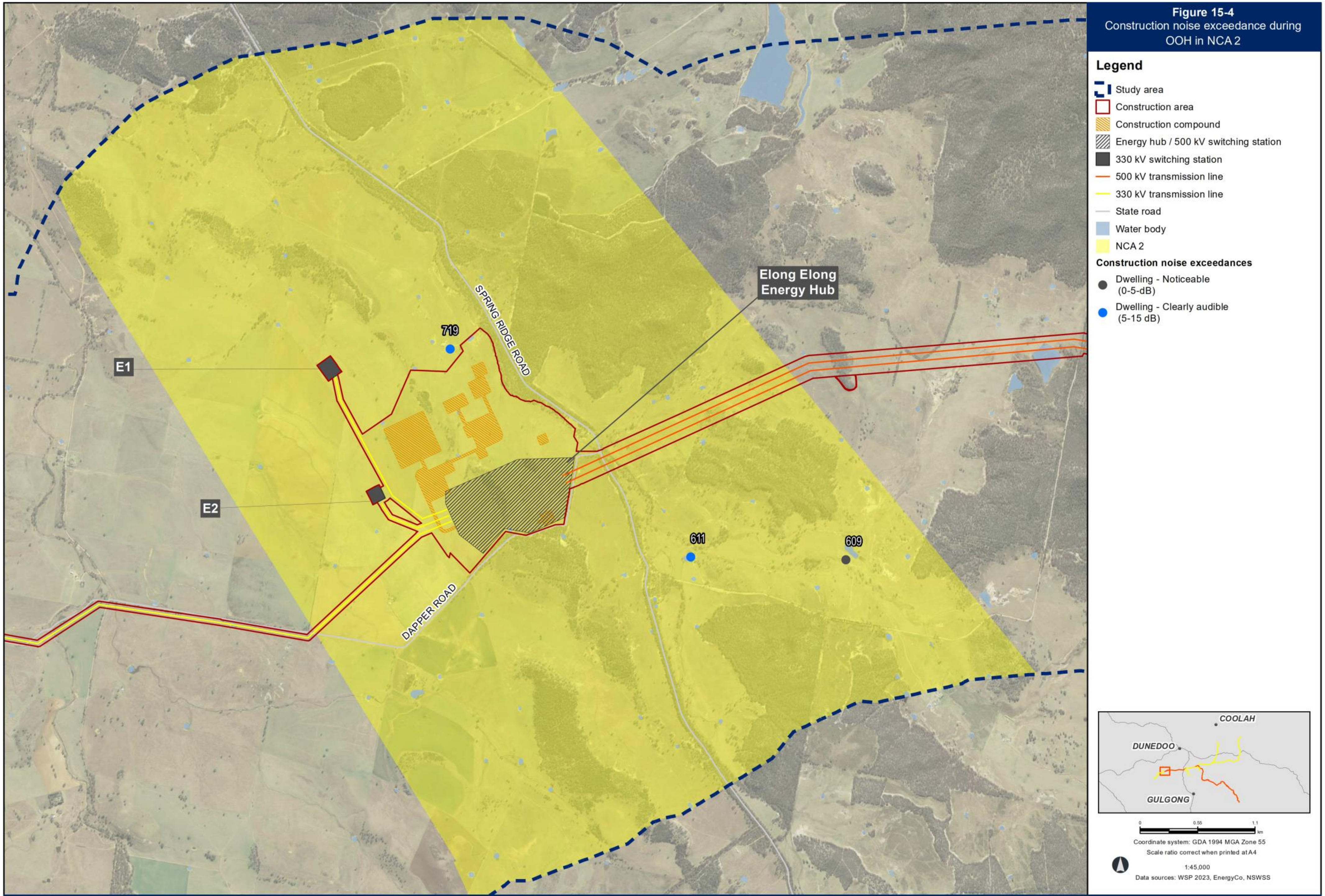
NCA 2

The predicted exceedances of NMLs in NCA 2 during construction are summarised in Table 15-13 and the maximum exceedances at receivers are shown in Figure 15-4.

Table 15-13 Summary of predicted noise exceedances in NCA 2 during construction

Component	Summary of predicted exceedances of NMLs		Summary of sleep disturbance exceedances
	Standard hours	Out of hours	
Transmission lines	No exceedances are predicted.	Exceedances are predicted at up to three receivers during multiple construction stages. During the noisiest works (foundations), the exceedances are predicted to be up to 15 dB.	Exceedances of the sleep disturbance criterion is predicted at three receivers during the noisiest works.
Elong Elong construction compound	No exceedances are predicted.	Exceedances are predicted at up to two receivers during multiple construction stages. During the noisiest works (operation of the compound), the exceedances are predicted to be: • up to 5 dB at one receiver • up to 15 dB at one receiver.	Exceedances of the sleep disturbance criterion is predicted at two receivers during the noisiest works.
Elong Elong Energy Hub	No exceedances are predicted.	Exceedances are predicted at up to three receivers during multiple construction stages. During the noisiest works (earthworks), the exceedances are predicted to be: • up to 5 dB at one receiver • up to 15 dB at two receivers.	Exceedances of the sleep disturbance criterion is predicted at two receivers during the noisiest works.
Switching station E1	An exceedance of up to 10 dB at one receiver is predicted during earthworks.	Exceedances of up to 15 dB at one receiver are predicted during multiple construction stages.	Exceedances of the sleep disturbance criterion is predicted at one receiver during the noisiest works.
Switching station E2	No exceedances are predicted.	Exceedances of up to 15 dB are predicted at one receiver during multiple construction stages.	Exceedances of the sleep disturbance criterion is predicted at one receiver during the noisiest works.

Figure 15-4
Construction noise exceedance during OOH in NCA 2



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NCA 3

The predicted exceedances of NMLs in NCA 3 are summarised in Table 15-14 and the maximum exceedances at receivers are shown in Figure 15-5.

Table 15-14 Summary of predicted noise exceedances in NCA 3 during construction

Component	Summary of predicted exceedances of NMLs		Summary of sleep disturbance exceedances
	Standard hours	Out of hours	
Transmission lines	Exceedances are predicted at up to four receivers during multiple construction stages. During the noisiest works, foundations, the exceedances are predicted to be up to 10 dB.	Exceedances are predicted at up to 15 receivers during multiple construction stages. During the noisiest works (foundations), the exceedances are predicted to be: • up to 5 dB at five receivers • up to 15 dB at seven receivers • up to 25 dB at one receiver.	Exceedances of the sleep disturbance criterion is predicted at eight receivers during the noisiest works.
Switching station M6	No exceedances are predicted.	Exceedances are predicted at seven receivers. During the noisiest works (earthworks), the exceedances are predicted to be: • up to 5 dB at five receivers • up to 15 dB at two receivers.	Exceedances of the sleep disturbance criterion is predicted at three receivers during the noisiest works.
Switching station M7	No exceedances are predicted.	Exceedances are predicted at one receiver. During the noisiest works (earthworks), the exceedances are predicted to be up to 5 dB at two receivers.	Exceedances of the sleep disturbance criterion is predicted at one receiver during the noisiest works.

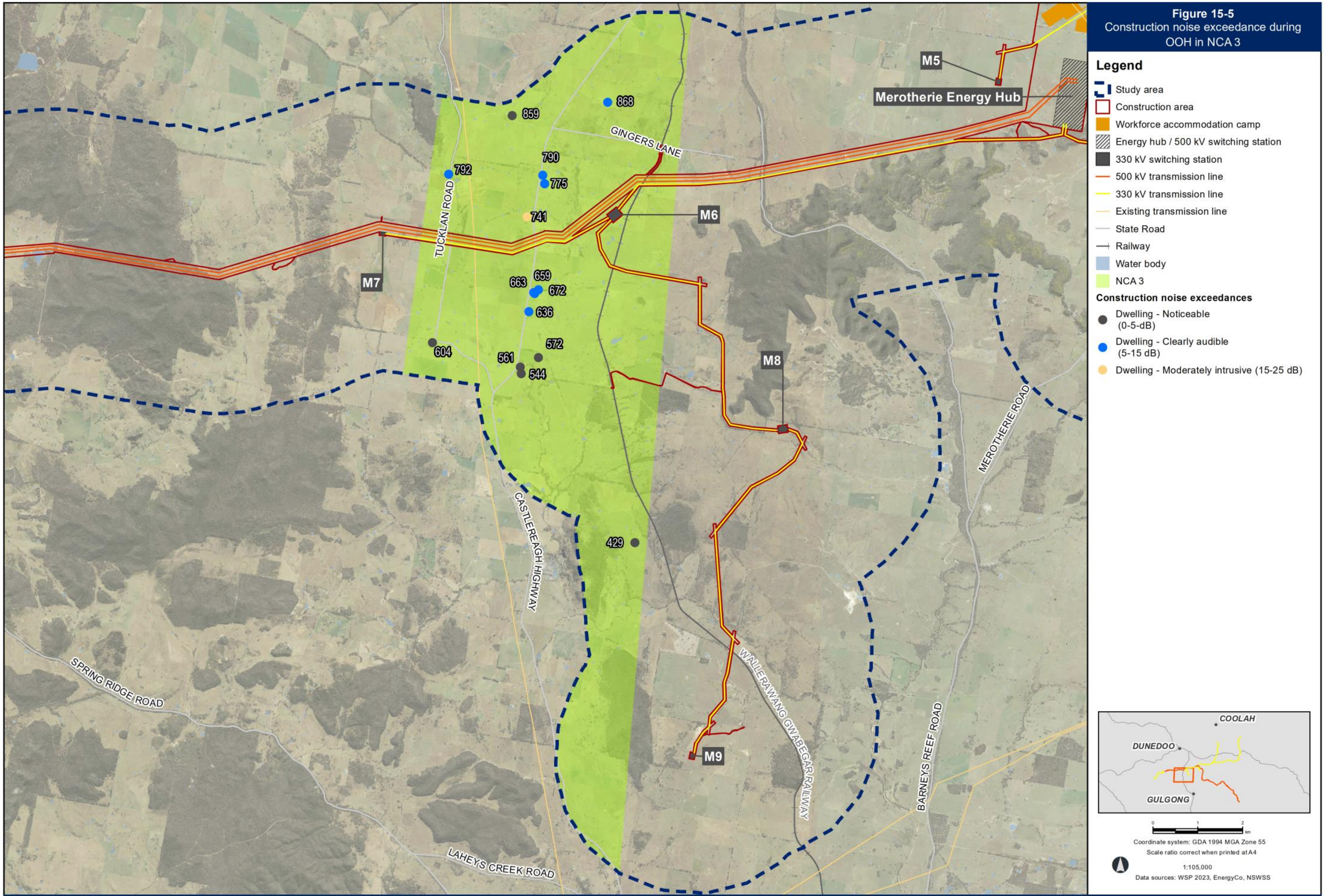
Figure 15-5
Construction noise exceedance during OOH in NCA 3
Legend
Study area
Construction area
Workforce accommodation camp
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing transmission line
State Road
Railway
Water body
NCA 3
Construction noise exceedances
Dwelling - Noticeable (0-5-dB)
Dwelling - Clearly audible (5-15 dB)
Dwelling - Moderately intrusive (15-25 dB)
M5
Merotherie Energy Hub
M6
M7
M8
M9
868
859
GINGERS LANE
790
792
775
741
TUCKLAN ROAD
659
663
672
636
604
572
561
544
429
CASTLEREAGH HIGHWAY
MEROTHERIE ROAD
SPRING RIDGE ROAD
WALLERAWANG GWABEGAR RAILWAY
BARNEYS REEF ROAD
LAHEYS CREEK ROAD
COOLAH
DUNEDOO
GULGONG
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:105,000
Data sources: WSP 2023, EnergyCo, NSWSS

NCA 4

The predicted exceedances of NMLs in NCA 4 are summarised in Table 15-15 and the maximum exceedances at receivers are shown in Figure 15-6.

Table 15-15 Summary of predicted noise exceedances in NCA 4 during construction

Component	Summary of predicted exceedances of NMLs		Summary of sleep disturbance exceedances
	Standard hours	Out of hours	
Transmission lines	Exceedances are predicted at up to 30 residential receivers during multiple construction stages. During the noisiest works (foundations), exceedances are predicted to be: • up to 10 dB at 19 receivers • up to 20 dB at 10 receivers • greater than 20 dB at one receiver.	Exceedances are predicted at up to 58 receivers during multiple construction stages. During the noisiest works (foundations), the exceedances are predicted to be: • up to 5 dB at 19 receivers • up to 15 dB at 18 receivers • up to 25 dB at 15 receivers • greater than 25 dB at six receivers.	Exceedances of the sleep disturbance criterion is predicted at 44 receivers during the noisiest works.
Neeleys Lane workforce accommodation camp	Exceedances of up to 10 dB are predicted at one receiver during construction of the facility.	Exceedances of up to 15 dB are predicted at two receivers during construction of the facility.	Exceedances of the sleep disturbance criterion is predicted at two receivers during construction.
Switching station M4	Exceedances of up to 10 dB are predicted at one receiver during all construction stages except utility works and commissioning.	Two receivers are predicted to have exceedances during multiple construction stages. During the noisiest works (earthworks), the exceedances are predicted to be: • up to 15 dB at one receiver • up to 25 dB at one receiver.	Exceedances of the sleep disturbance criterion is predicted at these two receivers during the noisiest works.
Switching station M5	No exceedances are predicted.	Exceedances of up to 5 dB are predicted at two receivers during earthworks.	No exceedances are predicted.
Switching station M7	Two receivers are predicted to have exceedances during multiple construction stages. During the noisiest works (earthworks), the exceedances are predicted to be: • up to 10 dB at one receiver • up to 20 dB at one receiver.	Six receivers are predicted to have exceedances during multiple works. During the noisiest works (earthworks), the exceedances are predicted to be: • up to 5 dB at three receivers • up to 15 dB at two receivers • up to 25 dB at one receiver.	Exceedances of the sleep disturbance criterion is predicted at three receivers during the noisiest works.
Switching station M8	No exceedances are predicted.	Exceedances of up to 5 dB are predicted at one receiver during earthworks.	No exceedances are predicted.
Switching station M9	No exceedances are predicted.	Four receivers are predicted to have exceedances during multiple construction stages. During the noisiest works (earthworks), the exceedances are predicted to be: • up to 5 dB at three receivers • up to 15 dB at one receiver.	Exceedances of the sleep disturbance criterion is predicted at one receiver during the noisiest works.

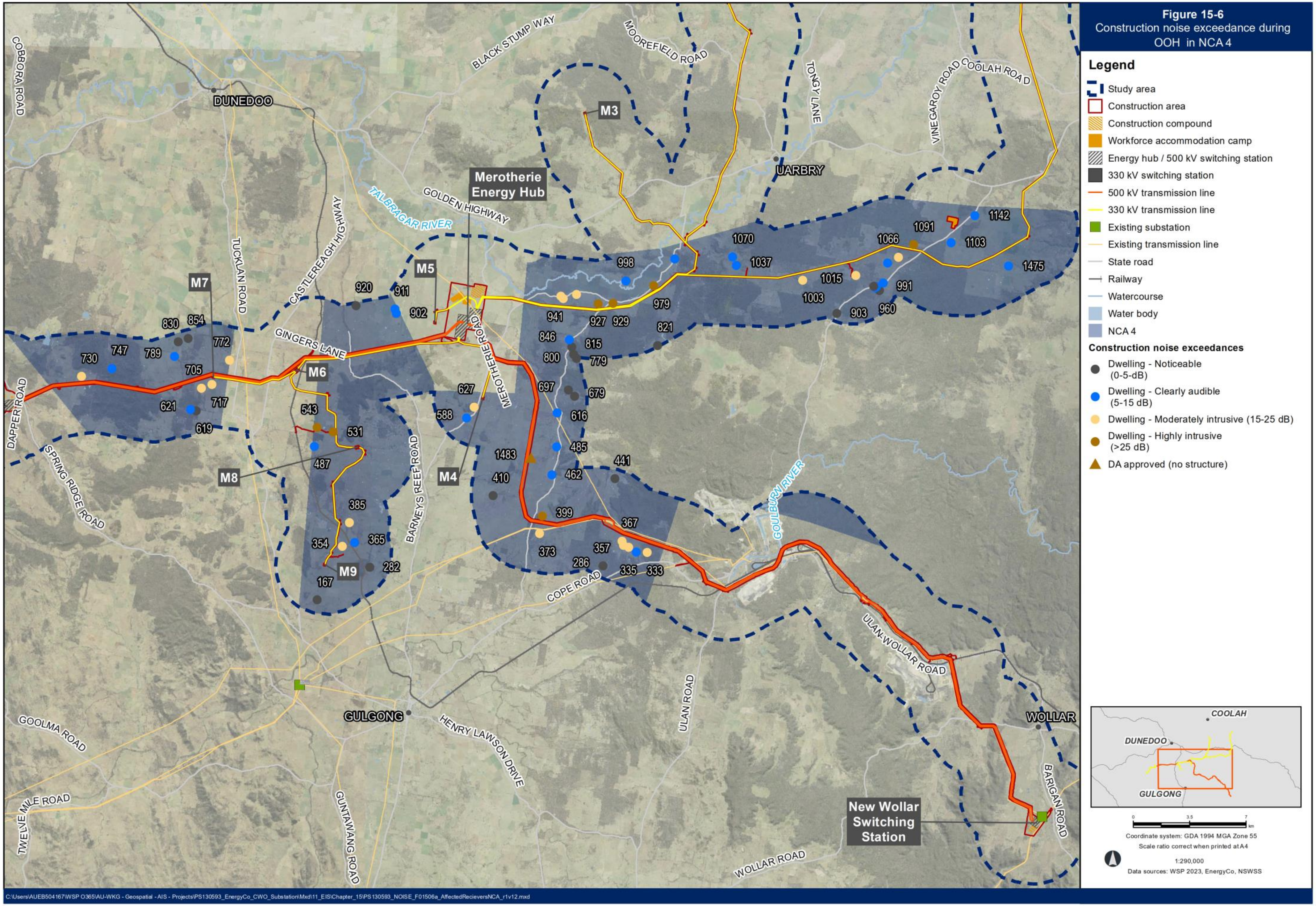
Figure 15-6
Construction noise exceedance during OOH in NCA 4
Legend
Study area
Construction area
Construction compound
Workforce accommodation camp
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing substation
Existing transmission line
State road
Railway
Watercourse
Water body
NCA 4
Construction noise exceedances
Dwelling - Noticeable (0-5-dB)
Dwelling - Clearly audible (5-15 dB)
Dwelling - Moderately intrusive (15-25 dB)
Dwelling - Highly intrusive (>25 dB)
DA approved (no structure)
Merotherie Energy Hub
New Wollar Switching Station
DUNEDOO
UARBRY
GULGONG
WOLLAR
COOLAH
M3
M4
M5
M6
M7
M8
M9
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:290,000
Data sources: WSP 2023, EnergyCo, NSWSS
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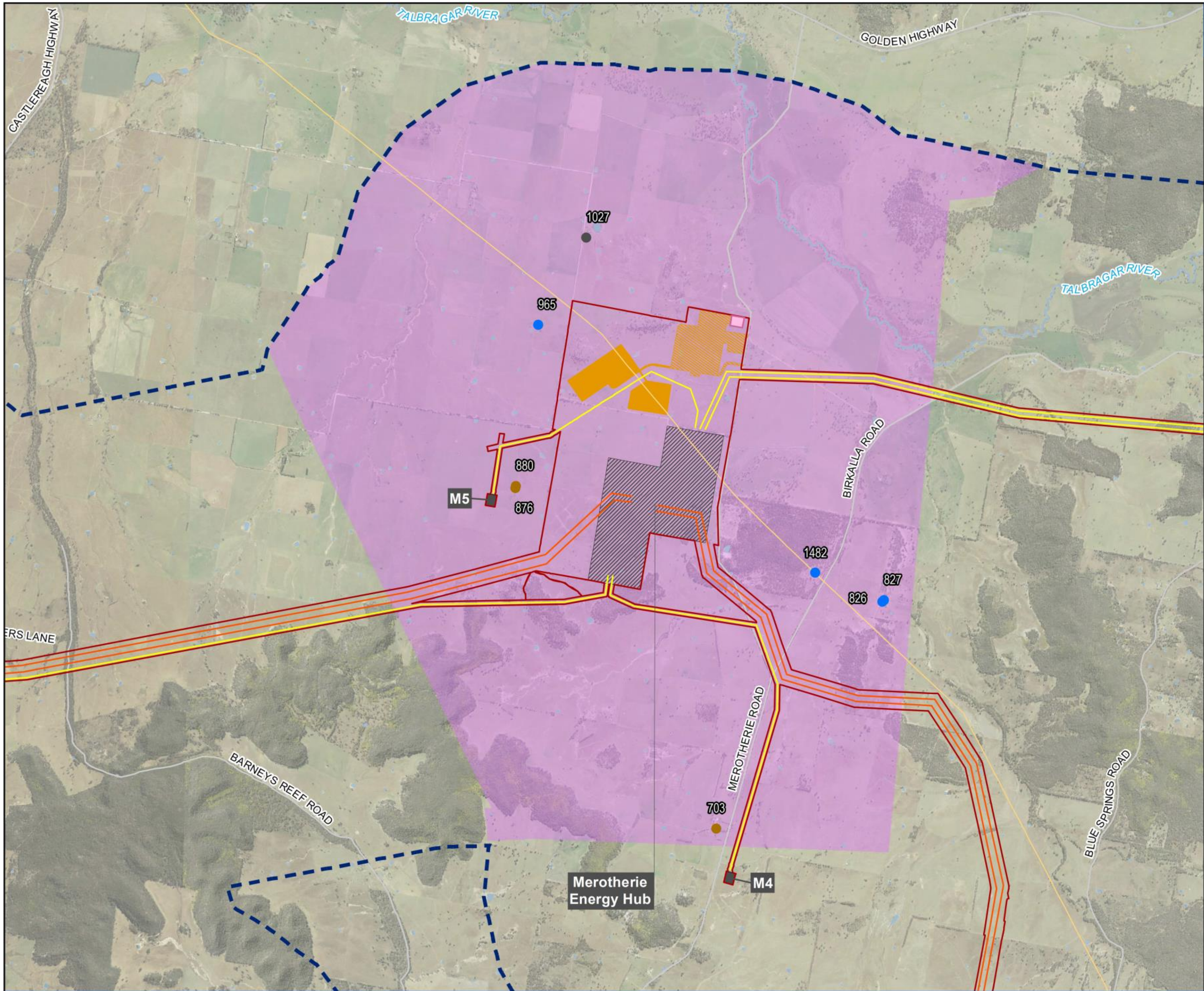
NCA 5

The predicted exceedances of NMLs in NCA 5 are summarised in Table 15-16 and the maximum exceedances at receivers are shown in Figure 15-7.

Table 15-16 Summary of predicted noise exceedances in NCA 5 during construction

Component	Summary of predicted exceedances of NMLs		Summary of sleep disturbance exceedances
	Standard hours	Out of hours	
Transmission lines	Exceedances are predicted at up to four residential receivers during multiple work stages. During the noisiest works (foundations), exceedances are predicted to be: • up to 10 dB at one receiver • up to 20 dB at three receivers.	Exceedances are predicted at up to eight receivers during multiple construction stages. During the noisiest works (foundations), the exceedances are predicted to be: • up to 5 dB at one receiver • up to 15 dB at four receivers • up to 25 dB at three receivers.	Exceedances of the sleep disturbance criterion is predicted at seven receivers during the noisiest works.
Merotherie Energy Hub	Exceedances of up to 10 dB are predicted at two receivers during earthworks.	Exceedances are predicted at up to seven receivers during multiple construction stages. During the noisiest works (earthworks), the exceedances are predicted to be: • up to 5 dB at four receivers • up to 15 dB at three receivers.	Exceedances of the sleep disturbance criterion is predicted at three receivers.
Merotherie construction compound	No exceedances are predicted.	Exceedances are predicted at five receivers during multiple stages. During the noisiest works (operation of the compound), the exceedances are predicted to be: • up to 5 dB at four receivers • up to 15 dB at one receiver.	Exceedances of the sleep disturbance criterion is predicted at two receivers during the noisiest works.
Merotherie workforce accommodation camp	Exceedances of up to 10 dB are predicted at one receiver during construction of the camp.	Exceedances are predicted at up to four receivers during construction. The exceedances are predicted to be: • up to 5 dB at one receiver • up to 15 dB at three receivers.	Exceedances of the sleep disturbance criterion is predicted at four receivers during the noisiest works.
Switching station M4	Exceedances of up to 10 dB are predicted at one receiver during multiple construction stages.	Exceedances of up to 25 dB are predicted at one receiver during all construction stages.	Exceedances of the sleep disturbance criterion is predicted at one receiver.
Switching station M5	Two receivers are predicted to have exceedances of up to 20 dB during multiple construction stages.	Exceedances are predicted at up to three receivers during multiple construction stages. During the noisiest works (earthworks), the exceedances are predicted to be: • up to 5 dB at one receiver • greater than 25 dB at two receivers.	Exceedances of the sleep disturbance criterion is predicted at two receivers during the noisiest works.

Figure 15-7
Construction noise exceedance during OOH in NCA 5



Legend

- Study area
- Construction area
- Construction compound
- Workforce accommodation camp
- Energy hub / 500 kV switching station
- Maintenance facility
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing transmission line
- State road
- Watercourse
- Water body
- NCA 5

Construction noise exceedances

- Dwelling - Noticeable (0-5-dB)
- Dwelling - Clearly audible (5-15 dB)
- Dwelling - Highly intrusive (>25 dB)

0 0.8 1.6 km

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4

1:65,000

Data sources: WSP 2023, EnergyCo, NSWSS

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NCA 6

The predicted exceedances of NMLs in NCA 6 are summarised in Table 15-17 and the maximum exceedances at receivers are shown in Figure 15-8.

Table 15-17 Summary of predicted noise exceedances in NCA 6 during construction

Component	Summary of predicted exceedances of NMLs		Summary of sleep disturbance exceedances
	Standard hours	**Out of hours**	
Transmission lines	Exceedances are predicted at up to five residential receivers during multiple construction stages. During the noisiest works (foundations), exceedances are predicted to be: • up to 10 dB at four receivers • up to 20 dB at one receiver.	Exceedances are predicted at up to nine receivers during multiple construction stages . During the noisiest works (foundations), the exceedances are predicted to be: • up to 5 dB at three receivers • up to 15 dB at four receivers • up to 25 dB at two receivers.	Exceedances of the sleep disturbance criterion is predicted at nine receivers during the noisiest works.

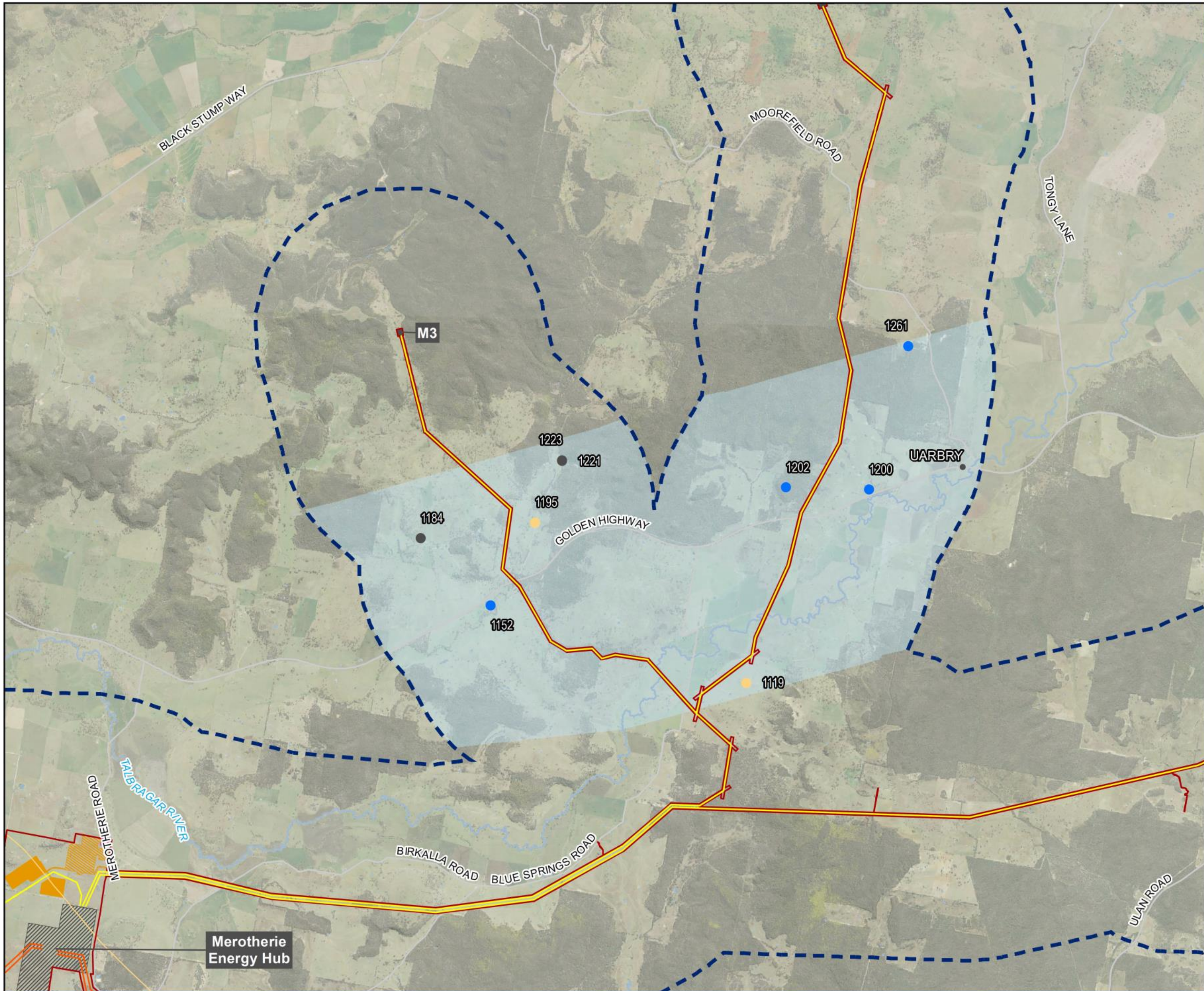
NCA 7

The predicted exceedances of NMLs in NCA 7 are summarised in Table 15-18 and the maximum exceedances at receivers are shown in Figure 15-9.

Table 15-18 Summary of predicted noise exceedances in NCA 7 during construction

Component	Summary of predicted exceedances of NMLs		Summary of sleep disturbance exceedances
	Standard hours	**Out of hours**	
Transmission lines	Exceedances are predicted at up to 14 residential receivers during multiple construction stages. During the noisiest works (foundations), exceedances are predicted to be: • up to 10 dB at 13 receivers • up to 20 dB at one receiver. In addition to residential receivers, Ulan Public School (receiver ID 211) is predicted to have an exceedance of up to 5 dB during foundation works.	Exceedances are predicted at up to 18 receivers during multiple construction stages. During the noisiest works (foundations), the exceedances are predicted to be: • up to 5 dB at four receivers • up to 15 dB at 13 receivers • up to 25 dB at one receiver.	Exceedances of the sleep disturbance criterion is predicted at 19 receivers during the noisiest works.

Figure 15-8
Construction noise exceedance during OOH in NCA 6



Legend

- Study area
- Construction area
- Construction compound
- Workforce accommodation camp
- Energy hub / 500 kV switching station
- Maintenance facility
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing transmission line
- State road
- Watercourse
- Water body
- NCA 6

Construction noise exceedances

- Dwelling - Noticeable (0-5-dB)
- Dwelling - Clearly audible (5-15 dB)
- Dwelling - Moderately intrusive (15-25 dB)

0 1 2 km

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:110,000
Data sources: WSP 2023, EnergyCo, NSWSS

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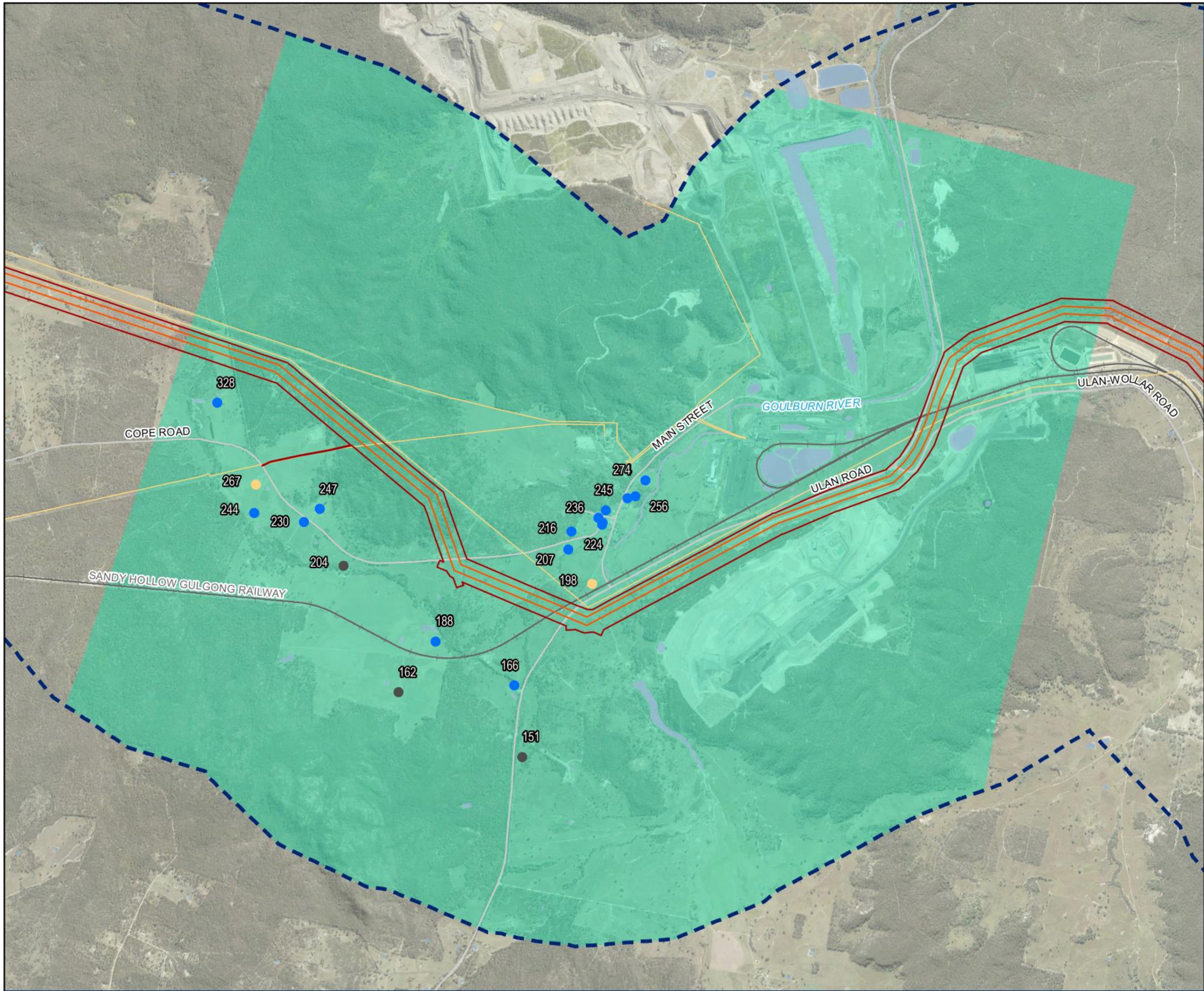
Figure 15-9
Construction noise exceedance during OOH in NCA 7

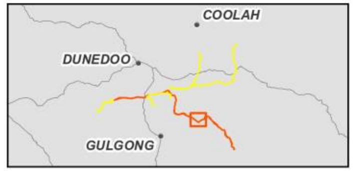


Legend

- Study area
- Construction area
- 500 kV transmission line
- Existing transmission line
- State road
- Railway
- Watercourse
- Water body
- NCA 7

Construction noise exceedances

- Dwelling - Noticeable (0-5-dB)
- Dwelling - Clearly audible (5-15 dB)
- Dwelling - Moderately intrusive (15-25 dB)



0 0.6 1.2 km

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A4

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Data sources: WSP 2023, EnergyCo, NSWSS

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NCA 8

The predicted exceedances of NMLs in NCA 8 are summarised in Table 15-19 and the maximum exceedances at receivers are shown in Figure 15-10.

Table 15-19 Summary of predicted noise exceedances in NCA 8 during construction

Component	Summary of predicted exceedances of NMLs		Summary of sleep disturbance exceedances
	Standard hours	Out of hours	
Transmission lines	Exceedances are predicted at up to two residential receivers during multiple construction stages. During the noisiest works (foundations), exceedances are predicted to be: • up to 20 dB at one receiver • greater than 20 dB at one receiver.	Exceedances are predicted at up to four receivers during multiple construction stages. During the noisiest works (foundations), the exceedances are predicted to be: • up to 5 dB at two receivers • greater than 25 dB at two receivers.	Exceedances of the sleep disturbance criterion is predicted at two receivers during the noisiest works.

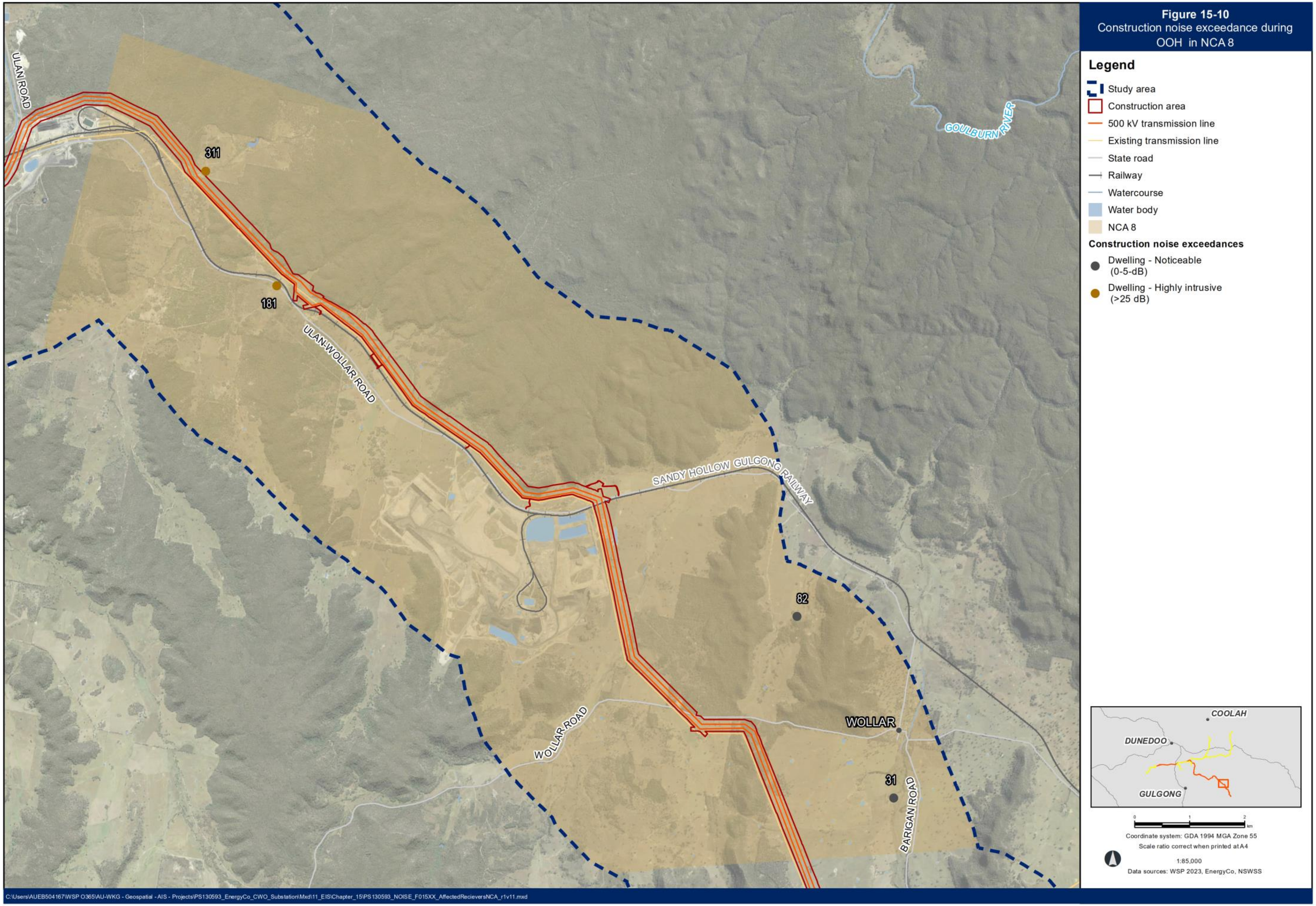
NCA 9

The predicted exceedances of NMLs in NCA 9 are summarised in Table 15-20 and the maximum exceedances at receivers are shown in Figure 15-11.

Table 15-20 Summary of predicted noise exceedances in NCA 9 during construction

Component	Summary of predicted exceedances of NMLs		Summary of sleep disturbance exceedances
	Standard hours	Out of hours	
Transmission lines	Exceedances are predicted at up to four residential receivers during multiple construction stages. During the noisiest works (foundations), exceedances are predicted to be: • up to 10 dB at three receivers • greater than 20 dB at one receiver.	Exceedances are predicted at seven receivers during multiple construction stages. During the noisiest works (foundations), the exceedances are predicted to be: • up to 5 dB at three receivers • up to 25 dB at three receivers. • greater than 25 dB at one receiver.	Exceedances of the sleep disturbance criterion is predicted at four receivers during the noisiest works.
Neeleys Lane workforce accommodation camp	No exceedances are predicted.	Exceedances of up to 5 dB are predicted at one receiver during construction of the camp.	Exceedances of the sleep disturbance criterion is predicted at this receiver during construction.

Figure 15-10
Construction noise exceedance during OOH in NCA 8



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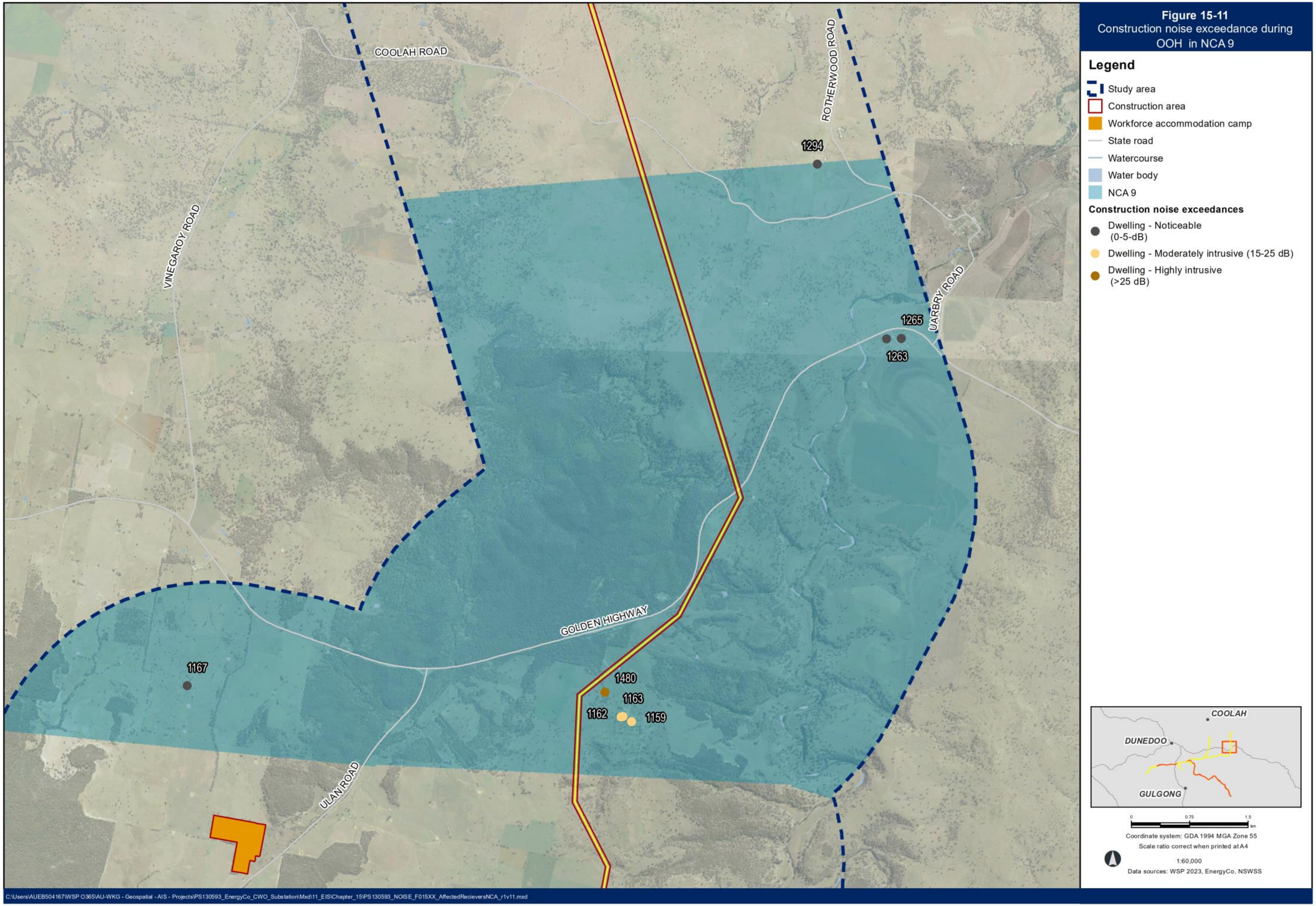
Figure 15-11
Construction noise exceedance during OOH in NCA 9
Legend
Study area
Construction area
Workforce accommodation camp
State road
Watercourse
Water body
NCA 9
Construction noise exceedances
Dwelling - Noticeable (0-5-dB)
Dwelling - Moderately intrusive (15-25 dB)
Dwelling - Highly intrusive (>25 dB)
COOLAH ROAD
ROTHERWOOD ROAD
VINEGAROY ROAD
UARBRY ROAD
GOLDEN HIGHWAY
ULAN ROAD
1294
1265
1263
1167
1480
1163
1162
1159
COOLAH
DUNEDOO
GULGONG
0
0.75
1.5
km
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Data sources: WSP 2023, EnergyCo, NSWSS
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NCA 10

The predicted exceedances of NMLs in NCA 10 are summarised in Table 15-21 and the maximum exceedances at receivers are shown in Figure 15-12.

Table 15-21 Summary of predicted noise exceedances in NCA 10 during construction

Component	Summary of predicted exceedances of NMLs		Summary of sleep disturbance exceedances
	Standard hours	Out of hours	
Transmission lines	Exceedances are predicted at up to four receivers during multiple construction stages. During the noisiest works (foundations), exceedances are predicted to be: • up to 10 dB at three receivers • up to 20 dB at one receiver.	Exceedances are predicted at up to 10 receivers during multiple construction stages. During the noisiest works (foundations), the exceedances are predicted to be: • up to 5 dB at four receivers • up to 15 dB at three receivers • up to 25 dB at two receivers • greater than 25 dB at one receiver.	Exceedances of the sleep disturbance criterion is predicted at seven receivers during the noisiest works.
Switching station M1	No exceedances are predicted.	Exceedances are predicted at three receivers. During the noisiest works (earthworks), the exceedances are predicted to be: • up to 5 dB at two receivers • up to 15 dB at one receiver.	Exceedances of the sleep disturbance criterion is predicted at one receiver.
Switching station M2	No exceedances are predicted.	Exceedances of up to 5 dB are predicted at two receivers during earthworks including piling and blasting.	No exceedances are predicted.
Switching station M3	No exceedances are predicted.	No exceedances are predicted.	No exceedances are predicted.

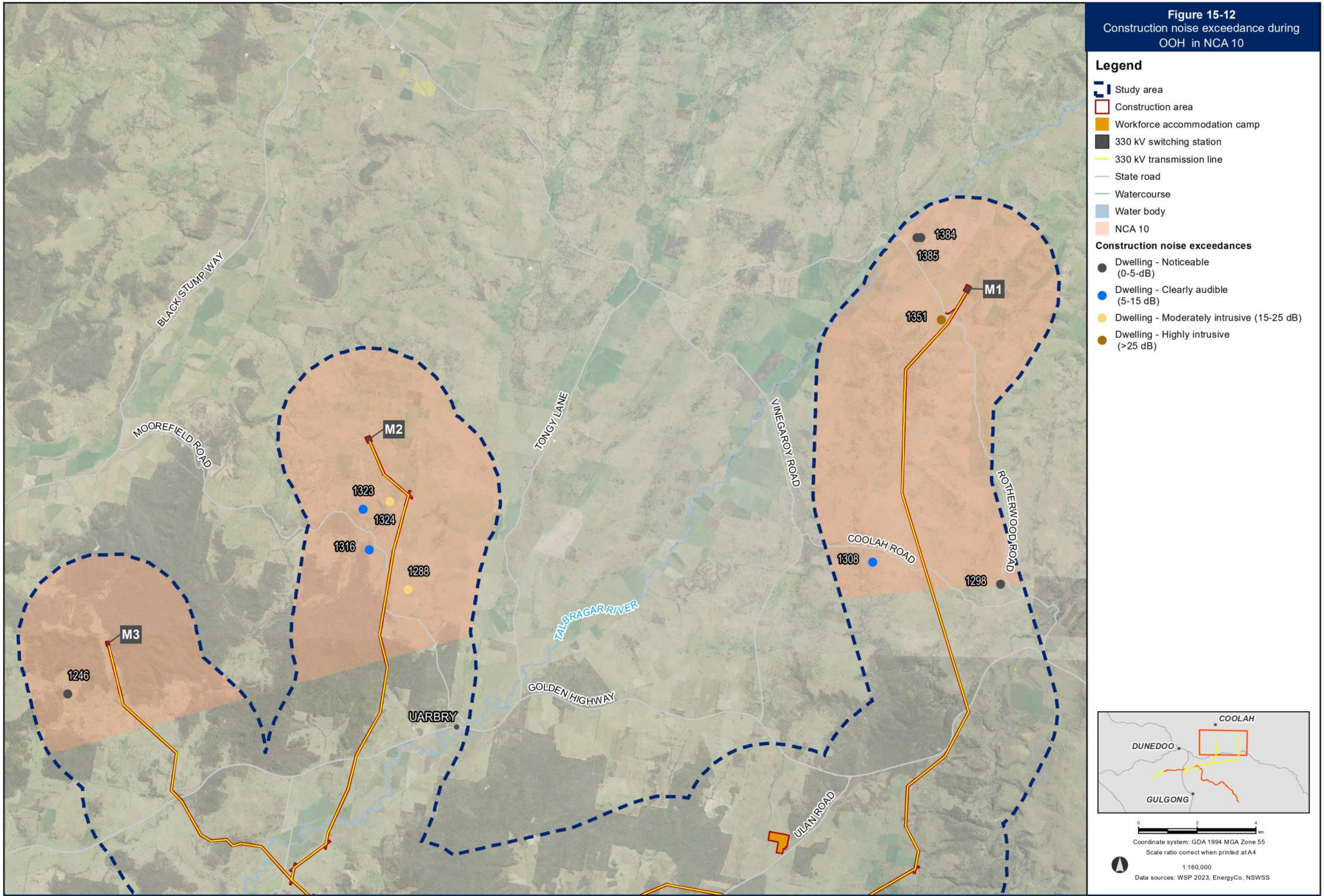
NCA 11

The predicted exceedances of NMLs in NCA 11 are summarised in Table 15-22 and the maximum exceedances at receivers are shown in Figure 15-13.

Table 15-22 Summary of predicted noise exceedances in NCA 11 during construction

Component	Summary of predicted exceedances of NMLs		Summary of sleep disturbance exceedances
	Standard hours	Out of hours	
Transmission lines	Exceedances are predicted at one receiver during multiple construction stages. During the noisiest works (foundations), exceedances of up to 10 dB are predicted.	Exceedances are predicted at two receivers during multiple construction stages. During the noisiest works (foundations), the exceedances are predicted to be up to 15 dB.	Exceedances of the sleep disturbance criterion is predicted at two receivers during the noisiest works.
New Wollar Switching Station	Exceedances are predicted at two receivers. Exceedances of up to 10 dB predicted, primarily during earthworks.	Exceedances are predicted at two receivers. Exceedances of up to 15 dB are predicted during all construction stages.	Exceedances of the sleep disturbance criterion is a predicted at two receivers during all construction stages.
Wollar construction compound	Exceedances of up to 10 dB are predicted at one receiver during all construction stages except vegetation clearing.	Exceedances are predicted at two receivers during multiple construction stages. During the noisiest works (operation of the compound), the exceedances are predicted to be • up to 5 dB at one receiver • up to 15 dB at one receiver.	Exceedances of the sleep disturbance criterion is predicted at two receivers during multiple construction stages.

Figure 15-12
Construction noise exceedance during OOH in NCA 10



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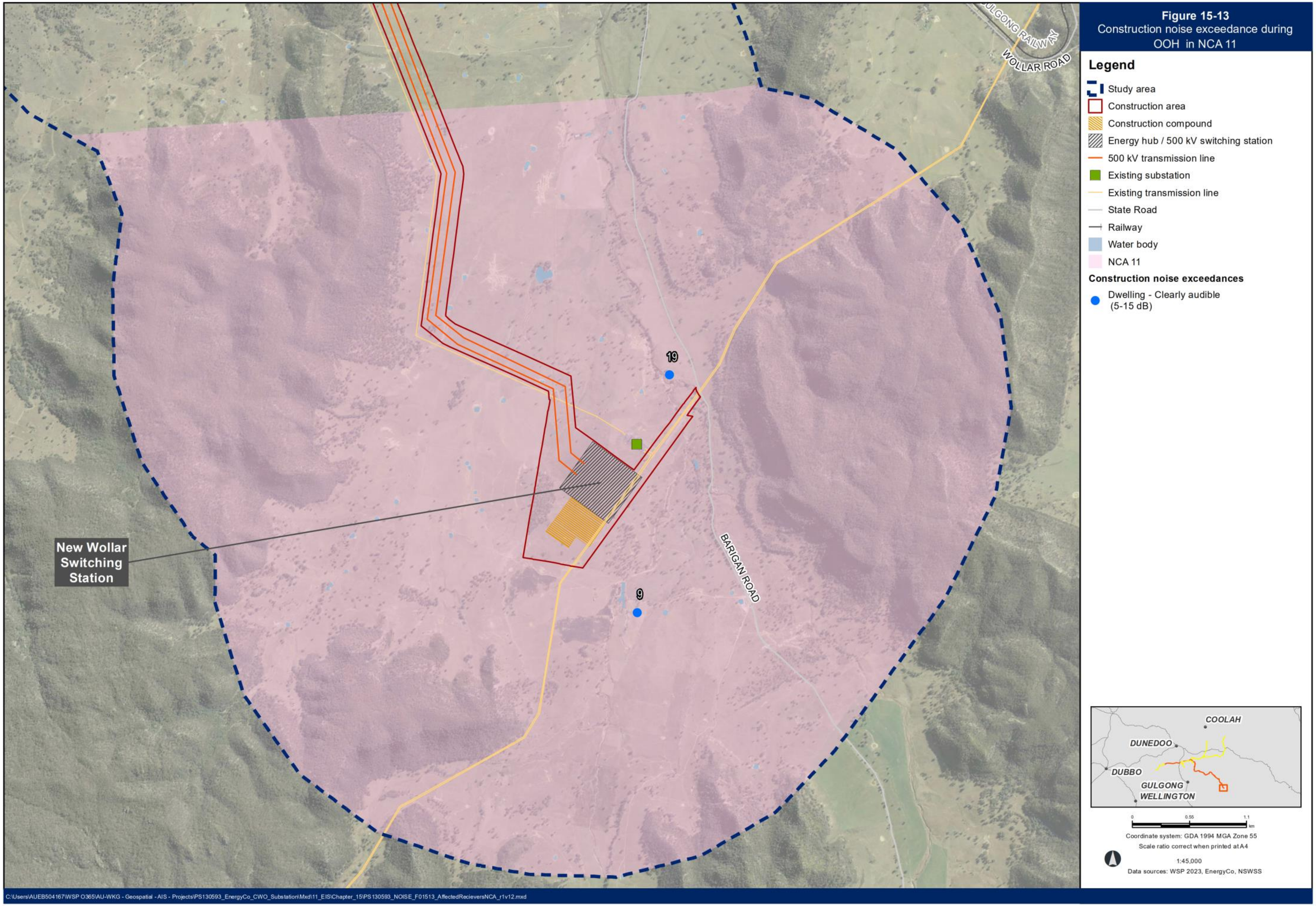

Figure 15-13
Construction noise exceedance during OOH in NCA 11
Legend
Study area
Construction area
Construction compound
Energy hub / 500 kV switching station
500 kV transmission line
Existing substation
Existing transmission line
State Road
Railway
Water body
NCA 11
Construction noise exceedances
Dwelling - Clearly audible (5-15 dB)
GULGONG RAILWAY
WOLLAR ROAD
BARIGAN ROAD
New Wollar Switching Station
19
9
COOLAH
DUNEDOO
DUBBO
GULGONG
WELLINGTON
0
0.55
1.1
km
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15.5.3 Road traffic noise

Road traffic generated by construction of the project would generate increases in traffic noise on existing roads. In order to assess the construction traffic noise impact on receivers, existing traffic levels in each direction and predicted construction traffic volume levels on key construction routes were considered. Receivers along the construction routes, both inside and outside the study area, were assessed.

Hourly movements of construction vehicles would vary depending on the road and would likely be up to 30 light vehicles and nine heavy vehicles during the day and up to eight light vehicles and up to two heavy vehicle movements during the night. Further detail regarding the construction routes and construction traffic volume is provided in Chapter 17 (Traffic and transport).

The majority of receivers along the construction routes are not predicted to experience exceedances of the traffic noise criteria (see Section 15.4.1) as a result of the project. However, around 32 receivers are predicted to exceed the road noise criteria primarily during night-time hours. A summary of the predicted impacts in relation to the roads forming part of the construction route is provided in Table 15-23 and the locations of predicted exceedances are shown in Figure 15-14.

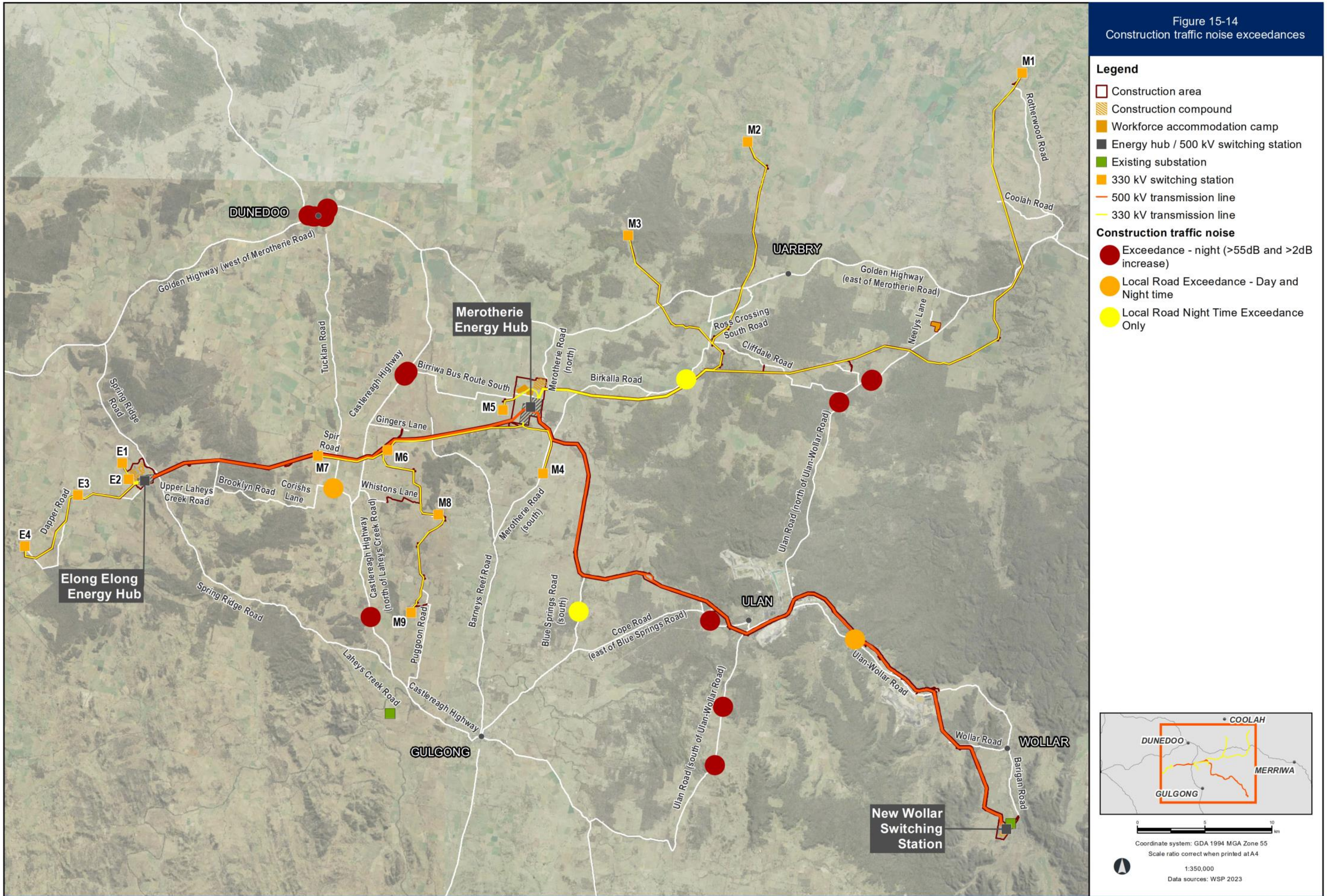
The predicted noise exceedances, particularly during the night-time on local roads, are high as existing traffic volumes are low and the addition of even low volumes of construction vehicles can result in a relatively large increase in road traffic noise. Typical noise levels are likely to be lower than the predicted exceedances, as construction traffic would vary according to the stage of construction and the location of construction activity in the construction area. The predicted noise levels from construction traffic represent a worst-case scenario. Nonetheless, noise management measures would be employed to minimise the potential for noise disturbance from construction traffic including limiting traffic movements to daytime periods as far as reasonable and feasible (refer to Section 15.7).

Table 15-23 Predicted impacts of construction traffic noise along key construction routes

Construction route section	Highest impacted receiver noise level (and increase on existing) (dBA)		Summary of noise impacts
	Daytime	Night-time	
Golden Highway west of Merotherie Road	59 (+3)	57 (+3)	In the township of Dunedoo, 12 receivers are predicted to exceed the night-time traffic noise criteria. The exceedances in Dunedoo are limited to properties directly on the Golden Highway. No other exceedances are predicted on the Golden Highway west of Merotherie Road.
Merotherie Road, Blue Springs Road (North section), and Golden Highway (Merotherie Road to Blue Springs Road)	51 (+13)	52 (+9)	Exceedances were predicted at one receiver along Blue Springs Road during the night-time. No other exceedances are predicted on Merotherie Road and Golden Highway from Merotherie Road to Blue Springs Road.
Golden Highway (Blue Spring Road to Cassilis)	56 (+1)	55 (+1)	No exceedances are predicted along the Golden Highway between Blue Springs Road and Cassilis.
Wollar township and surrounding area	54 (+8)	55 (+16)	No exceedances are predicted in the Wollar township or surrounding area.
Cope Road and Blue Springs Road	56 (+1)	56 (+2)	Two receivers are predicted to exceed the road noise criteria along Blue Springs Road and Cope Road.

Construction route section	Highest impacted receiver noise level (and increase on existing) (dBA)		Summary of noise impacts
	Daytime	Night-time	
Ulan Road (Mudhut Creek Rd to Main Street, Ulan) and Main Street, Ulan	58 (+2)	57 (+2)	Two receivers directly adjacent to Ulan Road are predicted to exceed the road noise criteria during night-time hours.
Ulan Road (Main Street, Ulan to Golden Highway)	60 (+3)	58 (+4)	Three receivers are predicted to exceed the road noise criteria during night-time hours, all of which are directly adjacent to Ulan Road. No other exceedances are predicted in this area.
Castlereagh Highway (Golden Highway to Birriwa Road, Birriwa)	58 (+2)	56 (+5)	10 receivers are predicted to exceed road noise criteria during night-time. Exceedances are limited to the receivers directly adjacent to the highway in township of Birriwa. No other exceedances are predicted in this area.
Castlereagh Highway (Birriwa Road, Birriwa to Tucklan Road, Orana)	54 (+2)	52 (+5)	No exceedances are predicted on the Castlereagh Highway between Birriwa Road to Tucklan Road.
Tucklan Road and Castlereagh Highway (Tucklan Road, Orana to Laheys Creek Road, Beryl)	59 (+3)	56 (+2)	Two receivers are predicted to exceed the road noise criteria. One receiver located on Castlereagh Highway was predicted to exceed the road noise criteria during the night-time, and one receiver located on Corishs Lane was predicted to exceed road noise criteria during the day and night-time.
Laheys Creek Road and Spring Ridge Road	51 (+8)	51 (+18)	No exceedances are predicted along Spring Ridge Road or Laheys Creek Road.

Figure 15-14
Construction traffic noise exceedances



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15.5.4 Vibration

Vibration intensive plant such as vibratory rollers, hydraulic hammers, bored piling rigs or jackhammers have the potential to generate vibration which can cause damage to buildings and other structures or discomfort to people.

Based on the potential vibration generating plant identified for construction of the project, the minimum working distances from the construction area were identified (refer to Section 15.4.1). Vibration sensitive receivers and structures were identified within the minimum working distances of construction components as shown Table 15-24.

Table 15-24 Predicted vibration impacts

Component	NCA	Predicted number of receivers within minimum working distances		
		Cosmetic damage (BS 7385)	Heritage (DIN 4150-3)	Human comfort (DECCW)
Transmission lines	NCA 1	0	0	1
	NCA 4	1	0	1
	NCA 8	4	1	0
Access tracks	NCA 4	2	0	2
	NCA 8	6	0	0

Up to nine structures have been identified within the recommended minimum working distances for potential cosmetic damage. Of these structures, four are within close proximity to both the transmission line alignment and the access track works. All nine are unoccupied structures such as sheds and unoccupied houses. Where cosmetic damage minimum distances are complied with, damage to structures, utilities, pipelines and infrastructure is considered highly unlikely.

There is one unlisted non-Aboriginal heritage item (the Pine Park Wool shed) identified within the minimum working distances, which has potential to be impacted by vibration from construction activities. Another non-Aboriginal heritage item (Lahey's Creek Cemetery) is located outside the minimum working distances for heritage items, however due to the condition of some items within the cemetery, this site has been identified as potentially highly vibration sensitive. Potentially vibration sensitive Aboriginal sites (rock shelters and grinding grooves) are unlikely to occur withing minimum working distances of construction activities. However, impacts to heritage sites due to vibration would be confirmed prior to any vibration generating works occurring in proximity to the relevant item. If required, specific criteria will be developed and management responses may include alternative methods or monitoring to manage this risk (refer to Section 15.7.2).

Potential human comfort impacts may be experienced at up to four sensitive receivers located within 100 metres of the construction area. These impacts are due to construction of transmission lines and access tracks which would be transient and short term.

In the event that the power rating of the proposed plant and equipment are higher than assessed, further review would be completed prior to construction to identify any required mitigation.

15.5.5 Blasting

Blasting may also be required during earthworks to loosen and break up existing rock at the energy hubs, switching stations and the transmission line towers. These areas would be confirmed during detailed design, once further geotechnical investigations are complete. This would most likely include the transmission line from Merotherie Energy Hub towards switching stations M1, M2 and M3, and the transmission line between the Merotherie and Elong Elong energy hubs.

For this type of activity there is the potential for blast overpressure and groundborne vibration at the nearest sensitive receivers, which can result in impacts on human amenity or structural impacts to buildings and infrastructure.

Specific blasting and seismic details would be assessed on a site- and blast- specific basis, once a detailed construction methodology is available, to limit overpressure and vibration to acceptable levels at sensitive receivers.

15.6 Potential impacts – operation

Noise would be generated from the operation of energy hubs, switching station and transmission lines and maintenance activities once the project has been commissioned. The following operational noise sources were assessed:

- corona discharges from transmission lines
- maintenance of transmission lines
- energy hub operations
- switching station operations
- maintenance of energy hubs and switching stations.

The predicted noise levels from transmission line corona discharges, fan units at energy hub and maintenance works were compared against the PNTLs and the noise levels from circuit breaker switches were compared to the maximum noise level criteria described in Section 15.4.2. A detailed summary of the operational noise sources and the predicted noise levels at receivers are provided in Technical paper 9.

15.6.1 Transmission lines

Corona noise from transmission lines

The operation of high voltage transmission lines may generate audible noise as a result of the 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'.

Audible corona noise would not be a constant occurrence but would be present during mild, wet and misty conditions. Based on the meteorological conditions identified for the study area, the expected annual frequency of these conditions is between 16 and 24 per cent of the time. Noise disturbance under heavier rain events is likely to be low risk as the background noise levels would likely be higher and therefore potentially have a masking effect over any possible corona discharge noise.

Exceedances of the PNTLs are predicted at two receivers (refer to Table 15-25). The impact at these receivers have been categorised as negligible, moderate or significant as per the definition provided in Section 15.4.2. The affected receivers are shown in Figure 15-15.

Table 15-25 Transmission line corona noise – predicted number of exceedances

NCA	Summary of predicted exceedances of the PNTLs		Summary of sleep disturbance exceedances
	Day time	Evening and night-time	
NCA 1	No exceedances are predicted.	Moderate exceedances are predicted at one receiver.	No exceedances are predicted.
NCA 4	No exceedances are predicted.	Negligible exceedances are predicted at one receiver.	No exceedances are predicted.

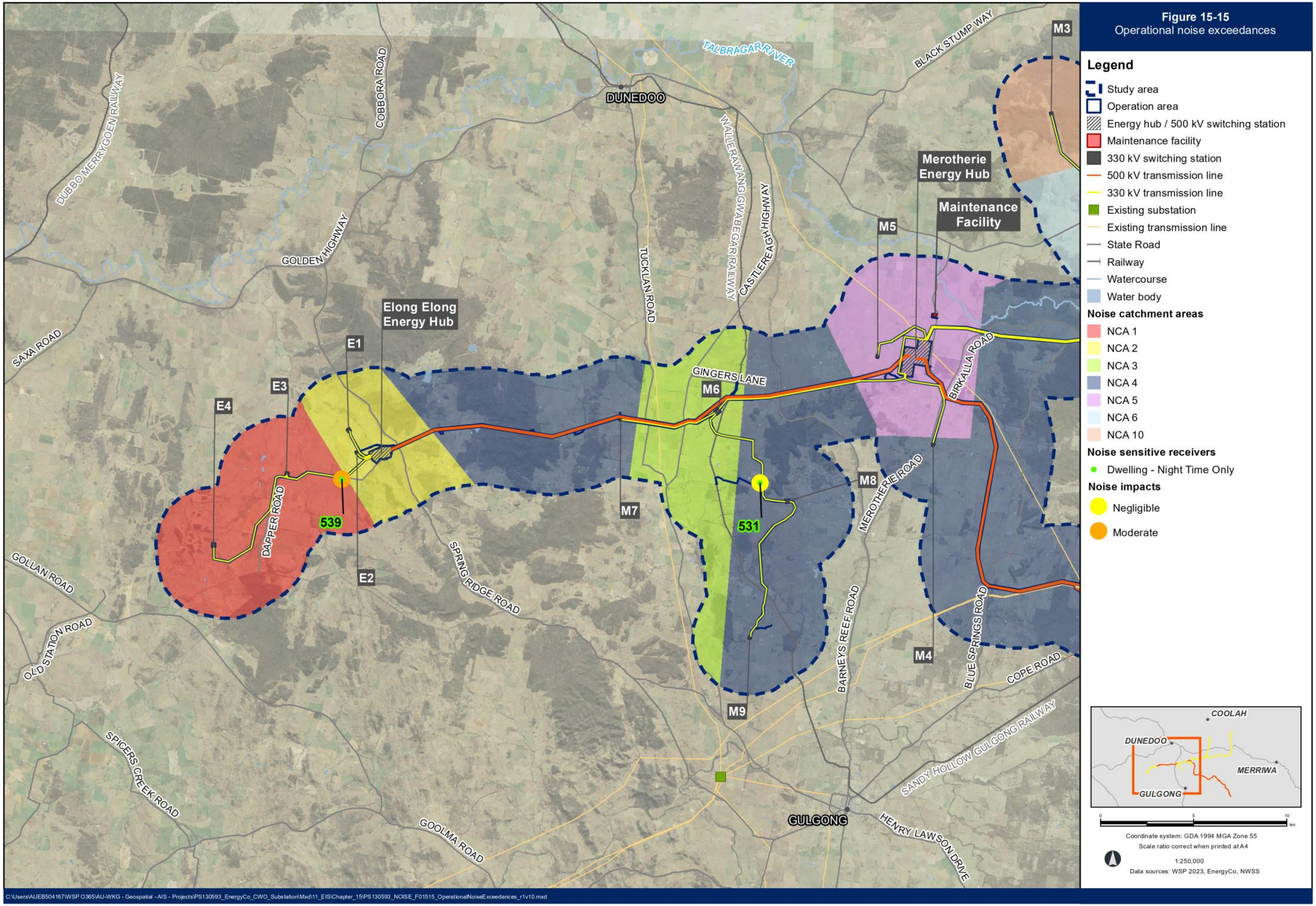

Figure 15-15
Operational noise exceedances
Legend
Study area
Operation area
Energy hub / 500 kV switching station
Maintenance facility
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing substation
Existing transmission line
State Road
Railway
Watercourse
Water body
Noise catchment areas
NCA 1
NCA 2
NCA 3
NCA 4
NCA 5
NCA 6
NCA 10
Noise sensitive receivers
Dwelling - Night Time Only
Noise impacts
Negligible
Moderate
Elong Elong Energy Hub
Merotherie Energy Hub
Maintenance Facility
DUNEDOO
GULGONG
TALBRAGAR RIVER
E1
E2
E3
E4
M3
M4
M5
M6
M7
M8
M9
539
531
DUBBO MERRYGOEN RAILWAY
COBBORA ROAD
GOLDEN HIGHWAY
TUCKLAN ROAD
WALLERAWANG GWABEGAR RAILWAY
CASTLEREAGH HIGHWAY
BLACK STUMP WAY
GINGERS LANE
BIRKALLA ROAD
MEROTHERIE ROAD
SAXA ROAD
DAPPER ROAD
GOLLAN ROAD
SPRING RIDGE ROAD
OLD STATION ROAD
SPICERS CREEK ROAD
GOOLMA ROAD
BARNEYS REEF ROAD
BLUE SPRINGS ROAD
COPE ROAD
SANDY HOLLOW GULGONG RAILWAY
HENRY LAWSON DRIVE
COOLAH
MERRIWA
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:250,000
Data sources: WSP 2023, EnergyCo, NWSS
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Transmission line maintenance

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

- regular inspection and maintenance of transmission line infrastructure including routine inspection and maintenance activities and an annual fly over as part of seasonal bushfire prevention surveys
- ad hoc and emergency maintenance including flyovers to assess infrastructure condition should an unplanned outage occur
- vegetation removal to maintain appropriate distances between ground vegetation and transmission lines.

During works, there is potential for noise impacts when works occur in the vicinity of sensitive receivers. These maintenance activities are expected to be infrequent (approximately 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 operation area. Possible risk of noise impacts associated with these activities is therefore expected to be minimal. Most predicted noise impacts are related to the use of a helicopter during aerial surveys of the transmission lines. However it is noted that this activity is only predicted to occur once per year and as such is not considered a substantial noise impact.

15.6.2 Energy hubs and switching stations

General operations

The noise sources at each energy hub would consist of circuit breakers, transformers and fan units. Additionally Merotherie Energy Hub would have noise from the potential Battery Energy Storage System (BESS) as detailed in Section 3.2.4 in Chapter 3 (Project description).

Synchronous condensers would also produce noise at these sites, however cumulative noise emissions from the fan units are expected to form the loudest components of plant and would dominate the noise environment. Fan units would produce more continuous noise during operation whereas the activation of circuit breaker switches is an infrequent emergency response which is essential to protecting the integrity of the transmission network. Based on attended noise monitoring at other NSW substation sites, this results in short term impulsive noise events that generate noise levels in the order of 115 dB L_{Amax}.

Circuit breaker switches are the main noise source at switching stations. As circuit breaker switches would activate infrequently and do not typically affect the background noise environment, the assessment of switching stations has therefore only considered the awakening trigger level criteria (refer to section 15.4.2) during the night-time period.

No exceedances of the PNTLs or the sleep disturbance and awakening trigger levels are predicted at energy hubs. Exceedances of the awakening trigger level are predicted at three receivers near proposed switching stations as presented in Table 15-26. Where the predicted exceedances are adjusted for internal noise levels, they are unlikely to exceed the RNP additional guidance of 50–55 dB at these receivers and considering the switches would be triggered infrequently, these levels are not expected to result in sleep disturbance impacts.

Table 15-26 Predicted exceedances at surrounding receivers from the operation of switching stations

NCA	Switching station	Summary of exceedance of the awakening trigger level
NCA 4	M7	One receiver is predicted to have exceedances of up 2 dB.
NCA 5	M5	Two receivers would have exceedances of up 8 dB.

Maintenance of energy hubs and switching stations

Maintenance activities at these sites would typically include:

- routine infrastructure inspection and maintenance of equipment and property and switchyard areas on a scheduled basis
- ad hoc fault and emergency work for repair of any damaged infrastructure.

These activities are likely to require access via light vehicles or small to medium sized plant. Equipment 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 sites to be extended. Use of the proposed maintenance facility at Merotherie Energy Hub would also generate intermittent noise during operation.

Based on these factors, noise impact risk associated with ongoing operation and maintenance of these facilities is expected to be minor.

15.7 Management of impacts

15.7.1 Environmental management

Construction

There is the potential for construction noise impacts at the nearest sensitive receivers, particularly from earthworks and transmission line stringing activities (when helicopters are in use). The construction schedule and equipment are subject to further refinement as detailed planning progresses. However, a Construction Noise and Vibration Management sub-plan (CNVMP) is to be prepared as part of the Construction Environmental Management Plan (CEMP), which would identify feasible and reasonable measures to reduce the potential for noise impacts.

The CNVMP would consider the following as a minimum:

- confirm nearby residences and other sensitive land uses
- confirm applicable NMLs consistent with the ICNG
- develop vibration limits consistent with AVTG and other relevant guidelines
- assess the potential impacts from the proposed construction methods and staging, including road traffic noise
- where NMLs are exceeded examine feasible and reasonable noise mitigation and develop associated noise and vibration monitoring programs, as required
- develop reactive and proactive strategies for dealing with any noise complaints
- develop an out of hours protocol
- assign roles and responsibilities for the management of noise complaints.

Furthermore, construction traffic noise management measures would be included as part of the CNVMP to mitigate predicted road noise impacts at locations where exceedances are predicted including:

- driver training and measures to ensure driver awareness and adherence to speed limits and designated routes
- limiting traffic movements to daytime periods as far as reasonable and feasible
- minimising traffic movements by ensuring full loads
- restriction of heavy vehicle movements to standard (daytime) hours where feasible.

Operation

Due to the predicted exceedances of the PNTLs associated with the operation of the project, mitigation strategies to reduce the likely noise impact have been considered. The strategies considered to mitigate noise are presented in Table 15-27. Due to the rural nature of the study area and generally isolated nature of affected receivers, noise control at the receiver is considered feasible and reasonable to manage audible noise from the project.

Table 15-27 Strategies to mitigate noise impact during operation

Strategy	Consideration
Noise control at the noise source	Generally, noise control at the source is considered as most effective in improving the overall acoustic outcomes at sensitive receivers. Noise control options for transmission lines are, however, limited. The implementation of specific types of transmission line conductors (larger conductors) can in some circumstances reduce noise impacts, however for the project these options are not currently identified as feasible and reasonable.
Noise control along the noise transfer path (e.g. noise barriers, mounds)	Noise barriers are not considered feasible and reasonable for the proposed transmission lines for the following reasons: • all identified exceeding receivers are generally isolated in nature • the transmission line is an elevated noise source with long horizontal extent.
Noise control at the receiver	Due to the rural nature of the study area and generally isolated nature of receivers, receiver-based noise treatment is considered feasible and reasonable to manage audible noise from transmission lines.

The significance of project-related noise impacts experienced by receivers determined in accordance with NPfI and the correlating levels of receiver-based treatment, is summarised in Table 15-28. Based on these predicted noise exceedances, operational noise mitigation options to reduce potential noise impacts would potentially be investigated at two receivers (noting some of these receivers are currently unoccupied and may be subject to demolition).

Upon finalisation of the locations of the project infrastructure within the operation area, the predicted noise impact from the project would be confirmed. If at-property treatments are found to be required, they would be determined in consultation with the landowner and informed by a detailed building condition survey and final predicted noise levels. Building condition surveys would determine if the internal noise target is met based on current building conditions or if treatment is required, and if reasonable and feasible noise treatment would provide any meaningful reduction in internal noise levels.

Table 15-28 Significance of residual noise impacts

Significance of residual noise impacts	Example of potential treatment	Receiver(s) affected
Negligible	The exceedances would not be discernible by the average listener and therefore would not warrant receiver-based treatments or controls.	One receiver in NCA 4 (ID 531).
Marginal	Provide mechanical ventilation/comfort condition systems to enable windows to be closed without compromising internal air quality/amenity.	N/A
Moderate	As for 'marginal', but also upgraded façade elements, such as windows, doors or roof insulation, to further increase the ability of the building façade to reduce noise levels.	One receiver in NCA 1 (ID 539).
Significant	May include suitable commercial agreements where considered feasible and reasonable.	N/A

15.7.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential noise and vibration impacts are listed in Table 15-29. Additional construction noise mitigation measures based on exceedance levels is also provided in Table 15-30.

Mitigation measures in other chapters that are relevant to the management of noise and vibration include:

- Chapter 9 (Traffic and transport), specifically measures which address construction traffic impacts
- Chapter 12 (Non-Aboriginal heritage) specifically measures which address impacts to heritage structures.

Table 15-29 Proposed mitigation measures – Noise and vibration

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV1	Construction noise (source controls)	As part of development of the detailed design and construction methodology, all reasonable and feasible mitigation measures will be considered, confirmed and implemented to minimise construction noise impacts and to avoid exceedances of the applicable noise goals at adjacent sensitive receivers where practicable. Measures that may achieve this outcome may include, but are not limited to the following: • Portable temporary noise screens will be erected adjacent to stationary or long term static noise sources, or noise generating items, where reasonable and feasible. • Spotters, "smart" reversing alarms, or broadband reversing alarms will be used in place of traditional tonal beeper reversing alarms, particularly on equipment where reversing alarms are frequently in use such as rollers, loaders or compactors. • Noise source controls, such as the use of residential class mufflers, will be used reduce noise from all plant including cranes, excavators and trucks. • The offset distance between noisy plant items and sensitive receivers will be maximised, where reasonable and feasible. • Machinery will be operated in a manner which reduces maximum noise level events such as shaking excavator buckets, dropping materials into trucks from a, height or steel on steel contact. • Construction plant and equipment will be turned off when not in use. • Helicopters will not be operated during evening and night-time periods. Where the use of drones is proposed during evening and/or night-time periods, an additional assessment(s) will be undertaken to identify appropriate operational limits to ensure that noise impacts to nearby sensitive receivers are acceptable.	Detailed design Pre-construction Construction	All locations where exceedances of the applicable construction noise criteria are predicted at sensitive receivers

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV2	Construction noise (administrative controls)	Opportunities to reduce exceedances of the applicable construction noise goals through the implementation of administrative controls will be examined, confirmed and implemented where reasonable and feasible. Controls to be considered will include, but not limited to the following: • Environmental awareness training and inductions for site personnel will include noise mitigation techniques/measures to be implemented when on site and accessing the site. • The avoidance of simultaneous construction activities during transmission line construction in the vicinity of the Energy Hubs will be investigated to minimise potential cumulative noise impacts • Plant and equipment will be selected based on noise emission levels. This will include the consideration of alternative stringing methods, such as the use of drones instead of helicopters. • Noise-intensive works will be limited to less sensitive construction hours (i.e. away from early morning and late afternoon periods) as far as practicable, when working in the vicinity of sensitive receivers. • Plant and equipment will be well maintained to ensure that excessive noise is not generated. • The provision of respite periods for helicopter take off/landing will be considered at the construction compounds. • A blasting vibration and overpressure assessment will be required as part of any potential blast design. This assessment will determine the Maximum Instantaneous Charge to achieve the recommended ground vibration and overpressure limits. In addition, a Blast Management Strategy will be prepared in accordance with Section 4 of AS 2187.2-2006 for inclusion in the CNVMP. • Any works undertaken outside standard working hours will be further assessed in accordance with the ICNG and the CNVG during detailed design and an Out of hours works protocol will be developed to mitigate any identified impacts.	Detailed design Pre-construction Construction	All locations where exceedances of the applicable construction noise criteria are predicted at sensitive receivers.

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV3	Construction noise	Opportunities to reduce the impacts associated with construction noise levels through the implementation of proactive community consultation will be examined, confirmed and implemented where reasonable and feasible. Controls to be considered will include, but not limited to the following: • Sensitive receivers potentially affected by the works will be notified of the commencement of construction activities at least five days prior to works starting. The notification will inform potentially impacted sensitive receivers of the nature of and duration of works, expected noise levels and contact details of where sensitive receivers can contact can project representatives. • The community will be kept regularly informed of noise intensive activities in the immediate area. • If noise complaints are received, the complainant will be offered the opportunity for noise monitoring to be carried out to confirm the noise level at the receiver. Where the noise monitoring confirms that the applicable noise predictions are being exceeded, the construction methodology will be reviewed and changes implemented to reduce construction noise levels to be compliant with noise predictions where reasonable and feasible. Additional mitigation measures such as respite periods have been outlined in Table 15-30 of Chapter 15 (Noise and Vibration) of the EIS.	Pre-construction	All locations where exceedances of the applicable construction noise criteria are predicted at sensitive receivers.
NV4	Construction vibration	Where construction is likely to result in vibration levels that exceed relevant criteria at sensitive receivers, mitigation and management will be implemented where practicable and appropriate. This will include (but is not limited to) the following measures: • Avoid the use of vibration-intensive plant at distances where human discomfort will 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. • Inform and consult with potentially affected receivers about upcoming vibration-intensive activities.	Detailed design Pre-construction	All locations where exceedances of the applicable construction vibration criteria are predicted at sensitive receivers.

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV5	Heritage vibration impacts	Vibration sensitive Aboriginal and non-Aboriginal heritage items which have potential to be impacted by the project works will be confirmed prior to the commencement of vibration generating works in proximity to relevant structures. Suitable, item specific criteria will be developed for heritage items and vibration impacts at these locations will be managed before commencement of construction. This may include the use of alternative construction methods which generate lower levels of ground vibration and the installation of vibration monitors while vibration intensive activities are conducted.	Detailed design	All locations where exceedances of the applicable construction vibration criteria are predicted at sensitive heritage receivers.
NV6	Operational noise	An Operational Noise Review will be prepared to confirm the predicted noise impacts from the project (based on the final infrastructure locations). Where necessary, the operational mitigation measures to be implemented below will be revised so operational noise impacts are compliant with the project noise trigger levels, where feasible and reasonable. Where exceedances of the project specific noise trigger levels are predicted (i.e. transmission lines audible noise), feasible and reasonable operational noise and vibration mitigation measures will be further investigated prior to construction, in consultation with the affected receivers. This will include: • Transmission lines — Scheduling of maintenance activities during less sensitive times of day. — Noise control at the receiver, such as 'at property' treatment to upgrade aspects of the dwellings including the façade or ventilation systems. — Monitoring after the commissioning of the project to be conducted at each residence where potential operational noise levels are predicted to exceed project trigger levels. — If additional measures are found to be required during the compliance monitoring, these will be implemented as soon as practicable. • Energy hubs and switching stations — Adoption of lower generating noise equipment (where practicable). — Site layout designed to minimise noise impacts. — Restriction of operational parameters such as cooling fans where meteorological conditions are favourable. — Noise control at the receiver, such as 'at property' treatment to upgrade aspects of the dwellings including the façade or ventilation systems.	Pre-construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
		— Monitoring after the commissioning of the project to be conducted at each residence where potential operational noise levels are predicted to exceed project trigger levels. — If additional measures are found to be required during the compliance monitoring, these will be implemented as soon as practicable.		

Additional construction noise mitigation

Following the implementation of the standard ICNG mitigation measures presented in Table 15-29, additional mitigation measures outlined in Table 15-30 would be implemented where residual noise impacts remain.

Table 15-30 Additional noise mitigation measures

Perception	Predicted airborne $L_{Aeq(15min)}$ noise level at receiver	Additional mitigation measures	Mitigation level
All hours			
–	75 dB(A) or greater	• Verification • Notification • Phone calls • Respite offers	Highly affected
Standard hours			
Noticeable	0 above NML	N/a	NML
Clearly audible	< 10 dB(A) above NML	N/a	NML
Moderately intrusive	10 to 20 dB(A) above NML	• Verification • Notification	NML + 10 dB(A)
Highly intrusive	> 20 dB(A) above NML	• Verification • Notification	NML + 20 dB(A)
OOH			
Noticeable	0 to 5 dB(A) above NML	• Notification	NML
Clearly audible	5 to 15 above NML	• Verification • Notification • Respite offers	NML + 5 dB(A)
Moderately intrusive	15 to 25 above NML	• Verification • Notification • Respite offers • Phone calls • Specific notifications	NML + 15 dB(A)
Highly intrusive	> 25 above NML		NML + 25 dB(A)

16 Hazard and risk

This section provides an assessment of the potential hazards and risks of the project during construction and operation and identifies mitigation measures to be implemented to avoid, minimise and manage these impacts, where practicable. This section is informed by the following technical papers:

- Technical paper 1 – Aviation
- Technical paper 10 – Bushfire
- Technical paper 11 – Preliminary Hazard Analysis (PHA)
- Technical paper 12 – Electro Magnetic Field Assessment.

The Secretary's Environmental Assessment Requirements (SEARs) as they relate to hazards and risks, and where in the Environmental Impact Statement (EIS) these have been addressed, are detailed in Appendix A (SEARs checklist).

16.1 Legislative and policy context

The assessment of hazard and risks was undertaken in accordance with SEARs and with reference to the requirements of relevant legislation, policies, standards and assessment guidelines including:

- *Environmental Planning and Assessment Act 1979* (NSW)
- *Electricity Supply Act 1995* (NSW) and Electricity Supply (Safety and Network Management) Regulation 2014 (NSW)
- State Environmental Planning Policy (Resilience and Hazards) 2021
- Specifically for bushfire:
  - *Rural Fires Act 1997* (NSW) and Rural Fires Regulation 2022
  - *Planning for Bushfire Protection 2019* (NSW Rural Fire Service (RFS), 2019)
  - *Councils of Standards Australia AS3959 Construction of buildings in bushfire-prone areas* (Standards Australia, 2018b)
  - Standards for Asset Protection Zones (NSW RFS, undated)
  - Bushfire Risk Management Plans relevant to the project prepared by:
    - Cudgegong Bush Fire Management Committee (2020)
    - Orana Bush Fire Management Committee (2021)
    - Castlereagh Bush Fire Management Committee (2013)
    - Liverpool Range Bush Fire Management Committee (2010)
- Specifically for aviation:
  - *Civil Aviation Act 1988* (Cth) and Civil Aviation Safety Regulation 1998
- Specifically for mine subsidence
  - *Coal Mine Subsidence Compensation Act 2017* (NSW)

- Specifically for electric and magnetic fields:
  — *International Commission for Non-Ionizing Radiation Protection (ICNIRP) Guidelines For Limiting Exposure To Electromagnetic Fields* (ICNIRP, 2020)
- Specifically for hazardous materials and dangerous goods:
  — *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (NSW Department of Planning (DoP), 2011a) ('Applying SEPP 33')
  — *Hazardous Industry Planning Advisory Paper No. 6 – Guideline for Hazard Analysis* (NSW DoP, 2011b)
  — *Assessment Guideline – Multi-Level Risk Assessment* (NSW Department of Planning and Infrastructure (DoPI), 2011)
  — *Hazardous Industry Planning Advisory Paper No. 2 'Fire Safety Study' guideline* (DoP, 2011c)
  — *Dangerous Goods (Road and Rail Transport) Act 2008* (NSW) and Dangerous Goods (Road and Rail Transport) Regulation 2014
  — Australian Standards AS1940: 2017 *The storage and handling of flammable and combustible liquids* (Standards Australia, 2017)
  — Australian/New Zealand Standard AS/NZS 5139:2019 *Electrical installations – Safety of battery systems for use with power conversion equipment* (Standards Australia, 2019b)
  — Australian Standard AS 1670: 2018 *Fire detection, warning, control and intercom systems* (Standards Australia, 2018c)
  — Australian Standard AS 3745: 2010 *Planning for emergencies in facilities* (Standards Australia, 2010)
  — *Australian Code for the Transport of Dangerous Goods by Road & Rail* (National Transport Commission, 2023) ('the Australian Dangerous Goods Code').

16.2 Assessment approach

16.2.1 Study area

The study area for the purposes of the hazards assessment varies according to the hazard and risk being considered. For the purposes of initially identifying potential hazards and risks applicable to the project, the construction area plus up to one kilometre radius was considered. The study areas for specific potential hazards and risks relevant to the project were then determined on an issue-by-issue basis. For example:

- the electric and magnetic field assessment considered the operation area and sensitive receivers within set distances to certain project infrastructure (refer to Section 16.5.4)
- the bushfire risk assessment covered the Warrumbungle, Mid-Western Regional, Upper Hunter and Dubbo Regional Local Government Areas (LGAs)
- the preliminary risk assessment and hazard analysis for hazardous materials considered the operation area and a one kilometre radius
- the aviation impact assessment considers aviation facilities and operations up to 30 nautical miles (or around 56 kilometres) from the operation area.

16.2.2 Assessment approach

A summary of the hazards and risk assessment methodologies is provided in Table 16-1. As part of the assessment methodologies, mitigation measures for the project were identified to manage the identified potential hazards and risks, where relevant.

Table 16-1 Summary of hazard and risks methodology per aspect of assessment

Aspect of assessment	Summary of assessment methodology
General	• Undertaking a desktop assessment of existing publicly available land uses and planning layers to determine existing hazards and risks relevant to each assessment in this table.
Preliminary hazard analysis	• Identifying sensitive receivers in the study area • Undertaking a preliminary risk screening, which involved reviewing the quantities and types of hazardous materials and dangerous goods that would be stored and handled on-site during the operational phase of the project, and the frequency of transport of these materials against the screening threshold quantities defined in Applying SEPP 33 • Applying the preliminary hazard analysis (PHA) process to the potential battery energy storage system (BESS) that may be constructed and operated at the Merotherie Energy Hub, in addition to the risk screening process for the project. Due to the remote location of the project (distance from nearest sensitive receiver) and the low potential for harm, a Level 1 PHA has generally been followed as described in *Assessment Guideline – Multi-Level Risk Assessment* (DoPI, 2011). Level 1 is an essentially qualitative approach based on comprehensive hazard identification to demonstrate that the activity does not pose a significant risk. The key steps undertaken in the Level 1 PHA process included hazard identification, consequence analysis of the key risks, determination of the level of analysis required for the PHA and an evaluation of the risks against qualitative criteria (refer to Table 16-2, Table 16-3 and Table 16-4).
Bushfire risk assessment	• Reviewing landscape scale risks including the bushfire history and bushfire prone nature of the study area • Assessing the potential for construction and operational activities to be ignition sources and cause a bushfire risk to public safety • Assessing the bushfire risk to project infrastructure from external ignition sources, including an assessment of the applicable bushfire attack levels • Determining the asset protection zone (APZ) for each construction compound, accommodation workforce camp, switching station and energy hub in accordance with *Planning for Bushfire Protection 2019* (NSW RFS, 2019).
Electric and magnetic fields assessment	• Determining the Reference Levels from ICNIRP (2020) as presented in Table 16-5 • Reviewing the location and layout of project infrastructure, including areas with interaction between transmission lines, especially where they run in parallel or intersect proposed or existing transmission lines • Predicting the electric and magnetic fields from the project based on the maximum electrical load and determining field levels at the ground level at the edge of easement.
Aviation impact assessment	• Establishing the appropriate compliance framework for the assessment considering regulations and standards administered by Civil Aviation Safety Authority, Airservices Australia and National Airports Safeguarding Advisory Group (NASAG) • Assessing the likely impacts of the location of project infrastructure to aircraft landing areas (ALAs), air route protection surfaces, aeronautical navigation aids and air traffic control surveillance systems • Identifying civil aviation safety requirements/standards that are relevant to this project with respect to existing airport conditions and whether these standards are met, especially in relation to whether obstacle lighting or marking may or may not be required.

The hazards and risk assessment does not provide a detailed account of potential health and safety risks to on-site workers for the project. Potential risks to on-site workers during construction and operation are regulated by workplace health and safety legislation (including the *Work Health and Safety Act 2011* (NSW)) and are not relevant to project determination. Site management would be the responsibility of the construction contractor, who would be required (under the *Work Health and Safety Act 2011*) to manage the site in accordance with relevant regulatory requirements.

Risk criteria for the preliminary hazard analysis

The risk assessment method followed for the PHA involved identifying risks; evaluating the probability of an event tied to an identified risk occurring; and determining the severity of the consequence of the event occurring. The risk assessment has been conducted using the likelihood (Table 16-2) and consequence (Table 16-3) definitions and a risk matrix (Table 16-4).

Table 16-2 Definition of likelihood

Likelihood	Definition
Almost certain	Highly likely to happen and may occur multiple times per year (greater than 90 per cent chance of occurring).
Likely	Will probably occur in most circumstances when the activity is undertaken (51 to 90 per cent chance of occurring).
Possible	Might occur when the activity is undertaken (21 to 50 per cent chance of occurring).
Unlikely	Could happen at some time when the activity is undertaken (1 to 20 per cent chance of occurring).
Rare	May happen only in exceptional circumstances when the activity is undertaken (less than one per cent chance of occurring).

Table 16-3 Definition of consequence

Consequence	Definition
Catastrophic	Death and/or catastrophic effect on environment that may take longer than a year to restore and cost more than $1,000,000. Regulator notification mandatory.
Major	Life threatening injury or multiple injuries requiring admission to hospital and/or significant effect on environment that may take up to a year to restore and cost up to $1,000,000. Regulator notification mandatory.
Moderate	Injury requiring admission to hospital and/or effect on environment that may take one to two months to restore and requiring Regulator notification.
Minor	Minor illness or injury requiring medical treatment (e.g. first aid) and/or minor effect on environment that can be cleaned up. Any potential damage remediation likely to cost less than $5,000. Regulator notification unlikely to be required.
Insignificant	Illness or injury that doesn't require medical attention. No adverse effect on environment and regulator notification not required.

For the purposes of this risk assessment, risk levels as shown in in the risk matrix in Table 16-4 are defined as:

- Extreme – Must not proceed until suitable mitigation measures have been adopted to minimise the risk.
- High – Should not proceed without consideration of alternative options or additional controls to minimise risk.
- Medium – Acceptable with formal review. A documented action plan or standard is required.
- Low – Acceptable with review.

Where identified risks with a low to medium risk rating can be managed with controls to be as low as reasonably practicable, the risk is considered adequately controlled.

Table 16-4 Risk matrix

Likelihood	Consequence				
	Catastrophic	Major	Moderate	Minor	Insignificant
Almost certain	Extreme	Extreme	Extreme	High	Medium
Likely	Extreme	Extreme	High	Medium	Medium
Possible	Extreme	High	High	Medium	Low
Unlikely	High	High	Medium	Low	Low
Rare	Medium	Medium	Low	Low	Low

Electric and magnetic fields criteria

The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), an Australian Government agency, is responsible for the regulation of electric and magnetic fields with the aim of protecting people and the environment from harm. In 2020, electric and magnetic field standards and guidelines were updated by the ICNIRP and were adopted by ARPANSA.

The ICNIRP (2020) set the limits on electrical and magnetic fields induced in the body by electric and magnetic fields. Reference Levels are defined by ICNIRP (2020) as '…the electric and magnetic fields and contact currents to which a person may be exposed without an adverse health effect and with acceptable safety factors'. Reference Levels relevant to members of public are presented in Table 16-5.

Table 16-5 ICNIRP electric and magnetic fields and Reference Body Exposure Limits (general public)

Electric and magnetic fields component	Reference level
Electric field	5,000 volts per metre (V/m)
Magnetic field	2,000 milli-Gauss (mG) or 159 ampere per meter (A/m)

16.3 Existing environment

The study area contains inherent hazards and risks associated with:

- bushfire
- aviation safety
- mining subsidence
- hazardous materials
- telecommunication and utilities.

Sensitive receivers are located adjacent, and in close proximity, to the construction area in several locations. The sensitive receivers are primarily residences on farming properties scattered throughout the study area.

Other risks which are present in the study area that are relevant to the project and considered in other sections of the EIS include:

- traffic and transport risks associated with the existing rail corridor and roads (refer to Chapter 17 (Traffic and transport))
- flooding (refer to Section 19.1 (Hydrology, flooding and water quality))
- exposure of contaminated soils (refer to Section 19.2 (Soils and contamination)).

16.3.1 Bushfire prone land and history of large bushfires

The broader landscape has a history of large bushfires. The most significant fires relevant to the study area in recent history were in 2011–2012 and 2016–2017. The fire season in the central west of NSW generally corresponds with high temperatures, low rainfall and low humidity from September to April. Bushfires are a common occurrence in the central west region and climate change modelling predicts increasing frequency and severity of bushfire events related to altered drought patterns and increasing numbers of severe and intense heat events (Miller et al, 2017).

Bushfire Risk Management Plans applicable to the study area identify the main sources of bushfire ignition as:

- lightning
- escape from legal burns
- campfires
- accidental ignitions by machinery (including farm machinery), equipment and vehicles
- intentionally lit fires (arson).

Bushfire prone lands are located within parts of the study area, being land identified by local councils which can support a bushfire or is subject to bushfire attack. The NSW RFS Guide for bushfire prone land mapping (NSW RFS, 2015) identifies three categories of bushfire prone land including Category 1 (highest bushfire risk), Category 3 (medium bushfire risk) and Category 2 (lower bushfire risk than Category 1 and Category 3). Excluded from this category includes vegetation such as gardens and agricultural lands used for annual and/or perennial cropping. The study area intersects each of the vegetation categories at various locations as shown in Figure 16–1. Some areas have not been mapped as being bushfire prone land, however these areas may also be prone to bushfires.

16.3.2 Mine subsidence

Moolarben Coal Mine, Wilpinjong Coal Mine and Ulan Coal Mine are located in the southeastern section of the study area along the New Wollar to Merotherie connection and consists of both surface and underground mining operations. The project intersects with rehabilitated mining areas as well as active operational mining areas.

The project is partly located within the Mudgee mine subsidence district (refer to Figure 16–1). Mine subsidence is a risk in areas which have been subject to underground coal mining, as the land above can sink and fill the voided mine drifts causing tilts and strains on the ground surface. In areas where coal extraction has taken place, subsidence generally occurs within a relatively short time after extraction.

Consultation undertaken with Subsidence Advisory NSW between May 2022 and May 2023 identified that the risk of subsidence impacts to the project within the Mudgee mine subsidence district is negligible. There are no other mine subsidence areas of relevance to the project that require consideration.

16.3.3 Aviation facilities and activities

Aviation operations undertaken in the airspace around the project include:

- scheduled and non-scheduled air transport operations
- emergency services – Royal Flying Doctor Service/Air Ambulance/NSW RFS
- aerial application operations including such activities as fertiliser, pest and crop spraying
- high-speed low-level military jet aircraft and helicopter operations
- aerial baiting to control pests in NSW national parks using helicopters.

Mudgee Airport and Dubbo Airport are located within 30 nautical miles of the project. Scheduled air transport services regularly operate into and out of these certified airports from Canberra, Melbourne and Sydney. Three active ALAs used for private aircraft operations are located within three nautical miles of the project at Dalkeith, Tongy and Merotherie.

16.3.4 Hazardous materials and dangerous goods

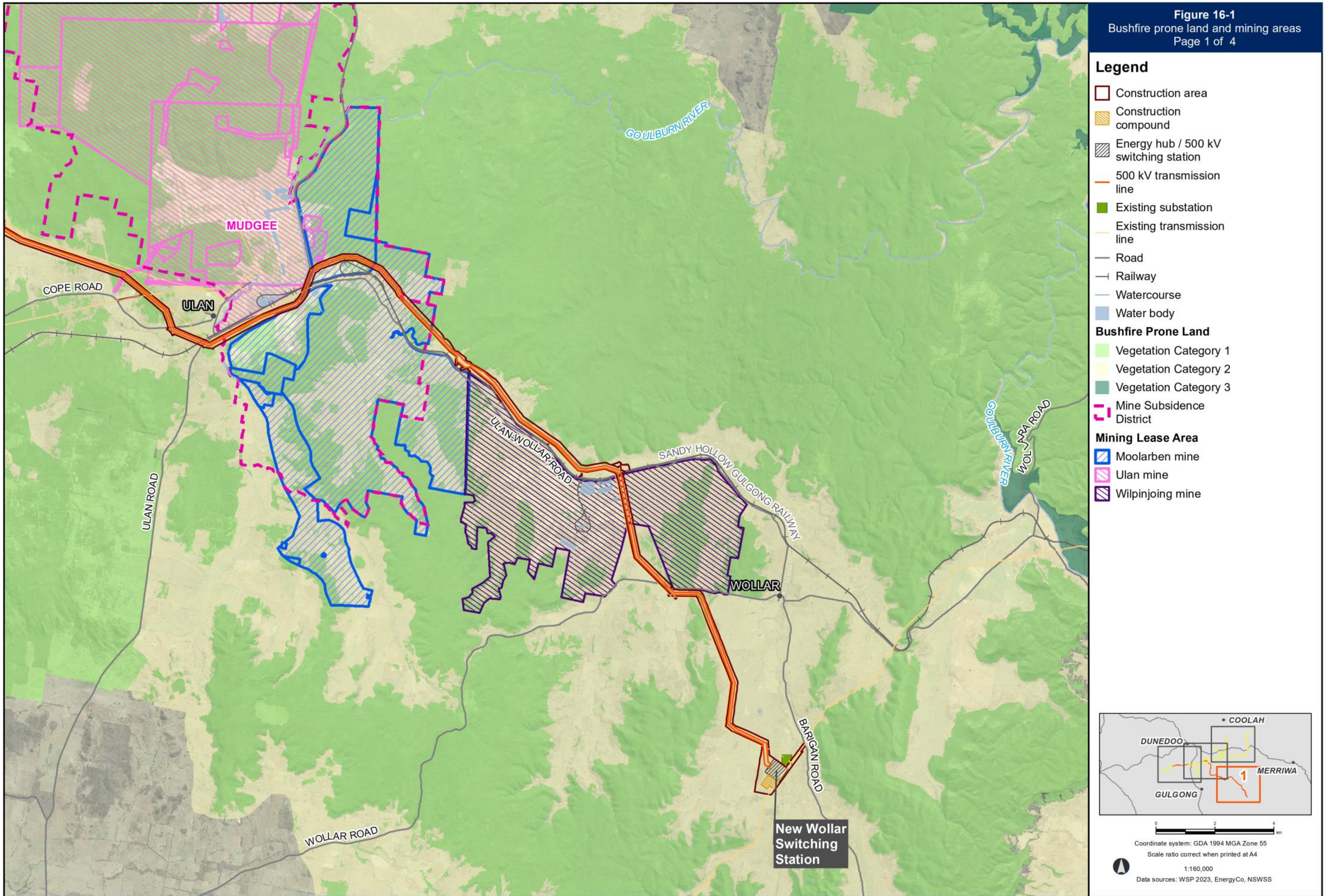
The study area primarily consists of agricultural land which is likely to contain minimal storage of hazardous materials and dangerous goods. There is potential for hazardous material to be present within the mining areas.

High carbon material (HCM) is likely to be encountered at a depth greater than one metre below the ground surface. Spontaneous combustion is a recognised hazard associated with HCM, and therefore HCM must be buried within specific areas in accordance with the Spontaneous combustion management plan for the Wilpinjong Coal Mine (Peabody, 2021). The location of HCM within remediated areas, such as Pit 4 is unknown as it was not surveyed by mine operators during placement. Areas of potentially contaminated land have also been identified within and near the construction area. Further detail on contaminated soils is provided in Section 19.2 (Soils and contamination).

16.3.5 Utilities

Due to the location of the study area in a largely rural context remote from urban areas, the extent of underground utilities, such gas, water, sewer, and electrical infrastructure, are limited. The project intersects existing overhead high voltage transmission lines in multiple locations and runs parallel to the existing Transgrid Line 79 transmission line along the New Wollar to Merotherie connection as shown in Figure 16–1. The New Wollar Switching Station would be located adjacent to the existing Transgrid Wollar substation (refer to Figure 16–1).

No petroleum or high pressure gas pipelines intersect or are adjacent to the study area.


MUDGEE
COPE ROAD
ULAN
ULAN ROAD
GOULBURN RIVER
ULAN-WOLLAR ROAD
SANDY HOLLOW GULGONG RAILWAY
WOLLAR
WOLLAR ROAD
BARIGAN ROAD
WOLLARA ROAD
New Wollar Switching Station
Legend
Construction area
Construction compound
Energy hub / 500 kV switching station
500 kV transmission line
Existing substation
Existing transmission line
Road
Railway
Watercourse
Water body
Bushfire Prone Land
Vegetation Category 1
Vegetation Category 2
Vegetation Category 3
Mine Subsidence District
Mining Lease Area
Moolarben mine
Ulan mine
Wilpinjoing mine
COOLAH
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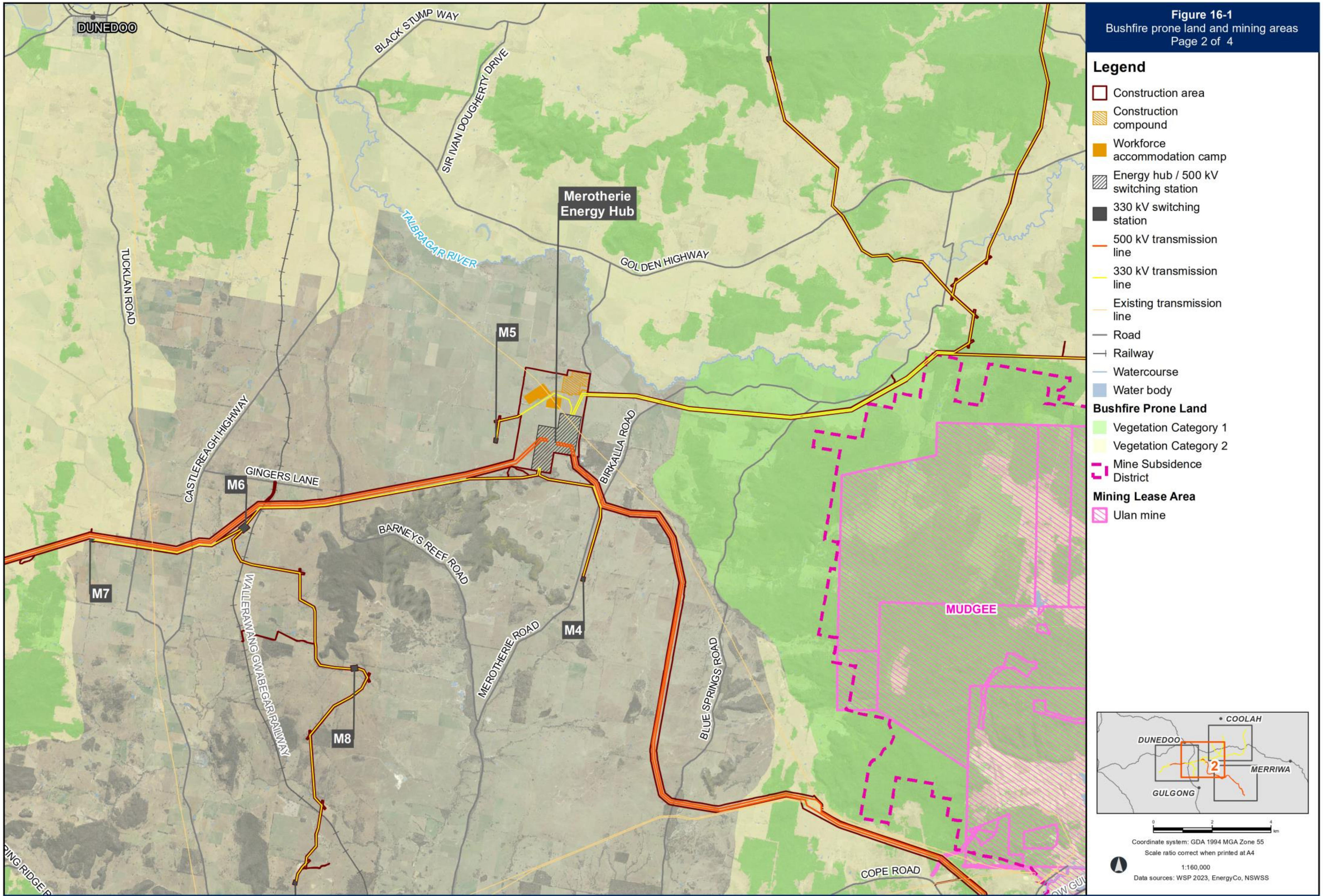

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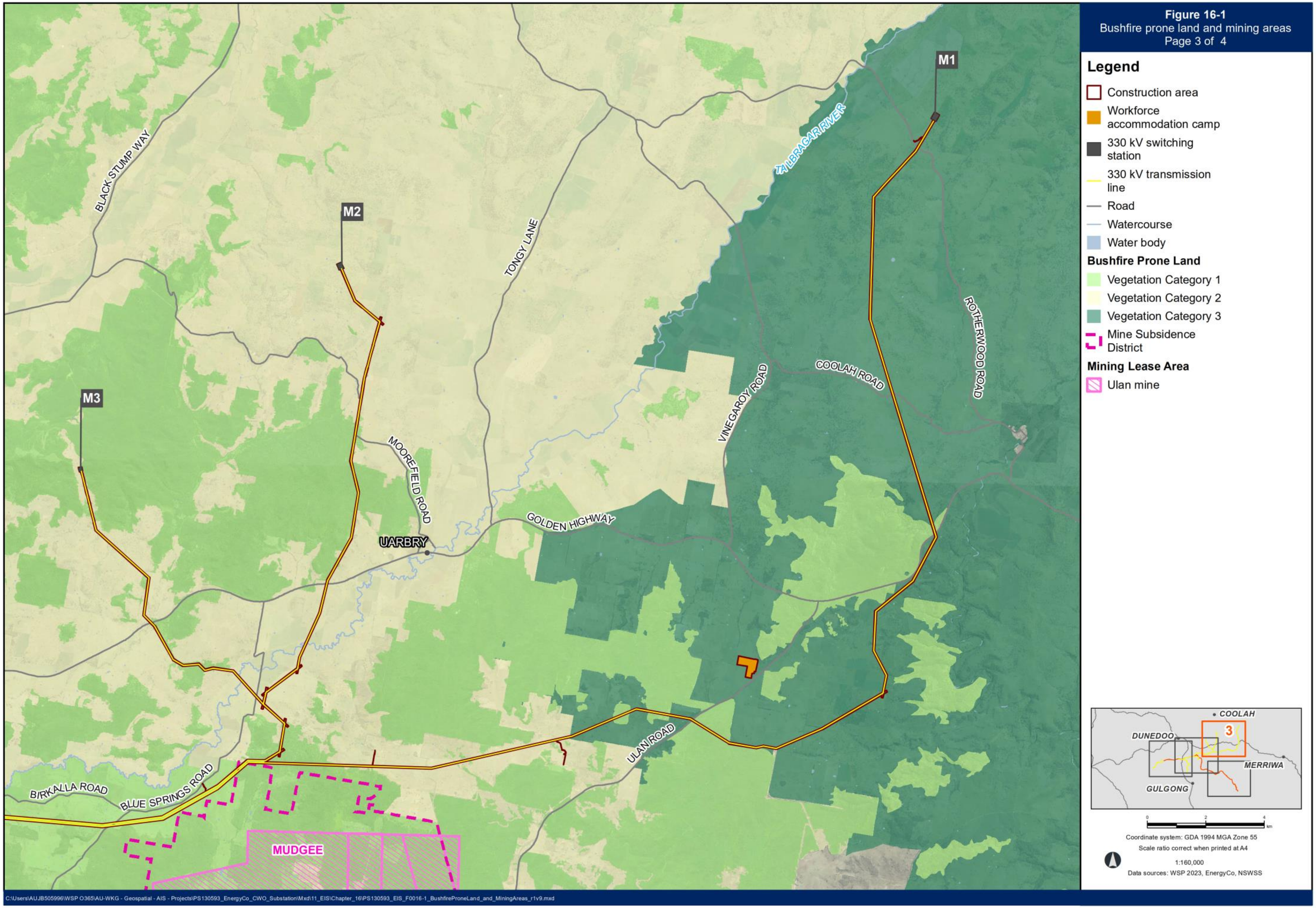
Figure 16-1
Bushfire prone land and mining areas
Page 3 of 4
Legend
Construction area
Workforce accommodation camp
330 kV switching station
330 kV transmission line
Road
Watercourse
Water body
Bushfire Prone Land
Vegetation Category 1
Vegetation Category 2
Vegetation Category 3
Mine Subsidence District
Mining Lease Area
Ulan mine
M1
M2
M3
BLACK STUMP WAY
TONGY LANE
TALBRAGAR RIVER
ROTHERWOOD ROAD
COOLAH ROAD
VINEGAROY ROAD
MOOREFIELD ROAD
GOLDEN HIGHWAY
UARBRY
ULAN ROAD
BIRKALLA ROAD
BLUE SPRINGS ROAD
MUDGEE
COOLAH
DUNEDOO
MERRIWA
GULGONG
3
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:160,000
Data sources: WSP 2023, EnergyCo, NSWSS
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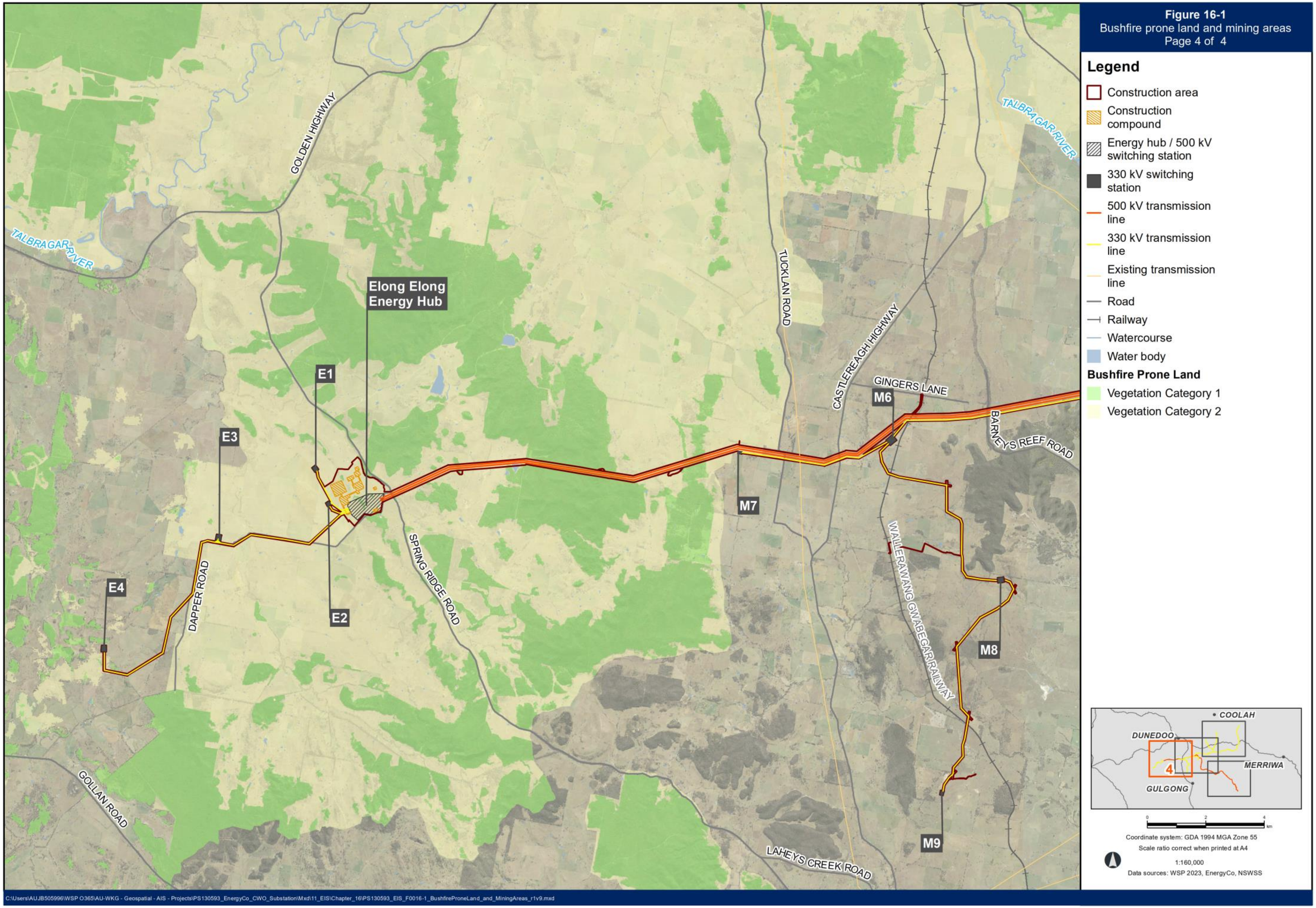

Figure 16-1
Bushfire prone land and mining areas
Page 4 of 4

16.4 Potential impacts – construction

Potential hazards during construction would be temporary and primarily associated with:

- bushfire
- mine subsidence
- aviation safety
- the on-site storage, use and transport of dangerous goods and hazardous materials
- impacts to utilities.

16.4.1 Bushfire

Risk of bushfire from the project

The project is located in an area with significant potential to carry large scale and intense bushfires, and construction activities within the construction area have the potential to cause a bushfire and therefore a risk to public safety. The potential sources of ignition resulting from the construction of the project include:

- accidental ignitions such as cigarettes
- sparks from construction plant including bulldozers, excavators and cranes
- sparks from motor vehicles
- vegetation removal including mulching
- hot works such as welding and grinding
- electrical faults in equipment
- chemical fires
- activities undertaken at construction compounds and accommodation workforce camps such as cooking
- blasting (if required).

The risk of a bushfire from project construction activities has been assessed as extreme. APZs, which are fuel-reduced areas surrounding a built assets or structures to provide a buffer zone between a bushfire hazard and an asset, would be established during the construction phase of the project. APZs would be provided at the construction compounds and workforce accommodation camps to reduce the risk of fire spreading from these locations as well as minimising the risk of bushfire impacting the facilities. The width of the APZs has been determined to be up to 11 metres for the proposed construction compounds and accommodation camps.

Mitigation measures would be implemented to minimise bushfire risk and provide emergency protocols, however the risk of fire starting and spreading would remain high.

Risk to the project from bushfire

Bushfires that are not associated with the project have potential to spread into the construction area, isolating the construction workforce and causing damage to construction equipment and facilities. With the implementation of the proposed APZs at the construction compounds and workforce accommodation camps, the potential bushfire risk to these locations is considered to be low to moderate. The risk to personnel in a majority of the construction area (along transmission line easements) has been assessed as extreme.

During the bushfire danger period (typically between September and April), the risk of bushfires impacting construction of the project would be managed with the implementation of a Bushfire Emergency Management and Evacuation Plan, including monitoring the weather and any ignition that starts within proximity to the project. Any fires that have the potential to isolate or impact part or all of the construction area would trigger the Bushfire Emergency Management and Evacuation Plan.

16.4.2 Mine subsidence

Earthworks, including bored piling, would be undertaken to enable construction of transmission line towers within the Mudgee mine subsidence district. Subsidence within the Mudgee mine subsidence district is not expected to impact or affect the project's infrastructure during construction. Consultation with the Subsidence Advisory NSW has been undertaken as part of this process, and will continue throughout construction planning and design development. Any subsidence risks would be managed through the selection of appropriate construction methods.

16.4.3 Aviation safety

Construction of the project would involve the use of tall cranes to install transmission line towers up to 72 metres high. Cranes are expected to be about 15 metres taller than transmission line towers being constructed and may present an obstacle to aviation operations in the study area. Relevant stakeholders will be notified of the scheduling of the use of cranes, drones and helicopters for the construction of the project, prior to the commencement of relevant works.

Helicopters or drones may be used for stringing of the transmission lines. The helicopter operations are considered to be a normal aviation activity and would be undertaken in compliance with the Civil Aviation Safety Regulations applicable to the type of operation. Use of drones would also be undertaken in accordance with Civil Aviation Safety Regulations and is unlikely have an adverse impact to flight safety in the area of the stringing operations.

16.4.4 Dangerous goods and hazardous materials

During construction, various dangerous good and hazardous materials would be used and/or stored in the construction area. The storage of these materials at the construction compounds would be sited and arranged so that hazardous materials are stored appropriately and at a suitable distance from any nearby sensitive receivers. Typical hazardous materials and dangerous goods that would be used during construction include (but are not limited to):

- oxyacetylene
- adhesives, glues, epoxies etc.
- concrete and concrete additives
- cleaning agents
- cold-galvanising spray
- oils, lubricants, hydraulic fluids
- fuels (petrol and diesel)
- small quantities of explosives for blasting (if required).

The preliminary risk screening for the project has identified that hazardous materials and dangerous goods associated with the construction of the project are not expected to be required in significant quantities and would not exceed the threshold quantities outlined in Applying SEPP 33 at each construction compound.

Dangerous goods and hazardous substances would be stored within the construction area in accordance with the supplier's instructions, and would comply with applicable legislation, guidelines and *Australian Standards AS1940: The storage and handling of flammable and combustible liquids*. This includes the *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 study area in accordance with the *Dangerous Goods (Road and Rail Transport) Act 2008* and Dangerous Goods (Road and Rail Transport) Regulation 2014.

16.4.5 Impacts to utilities

Construction of the project would require adjustments to a number of existing utilities. Damage and/or failure to shut down, isolate or otherwise appropriately manage utilities during construction has the potential to result in the accidental release of electrical currents, mains gas or sewage. The project would require adjustments to existing electrical infrastructure and works in close proximity to existing overhead powerlines, which could pose a hazard to the workforce and general community if not properly managed.

16.5 Potential impacts – operation

Potential hazards during operation would be associated with:

- bushfire
- mine subsidence
- aviation safety
- electric and magnetic fields from transmission infrastructure
- the on-site storage, use and transport of dangerous goods and hazardous materials
- telecommunications inference.

16.5.1 Bushfire

Risk of bushfire from the project

Ignition of bushfires as a result of the project's operation has the potential to occur during maintenance of project infrastructure and from the infrastructure itself. The project would be designed and managed in accordance with the *Electricity Supply Act 1995* and Electricity Supply (Safety and Network Management) Regulation 2014 which requires a network operator to take all reasonable steps to ensure that all aspects of its network are safe. Bushfire risk management must be part of an operator's safety management system. This includes ensuring the infrastructure is safe in its design, construction, and operation and to support the:

- safety of members of the public
- safety of persons working on networks
- protection of property
- management of safety risks arising from the protection of the environment (for example, preventing bushfires that may be ignited by network assets).

Potential ignition sources from high voltage transmission infrastructure during operation includes:

- 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
- wind causing transmission lines to contact each other
- arc to ground and arc between conductors caused by ionised particles in dense bushfire smoke
- periods of high heat/temperatures causing power lines to sag and connect with the ground/ vegetation/structures
- lightning strikes
- human error – faulty installation
- failure of power lines, 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 towers.

The risk of ignition from any one of these sources has been assessed as extreme, particularly during periods of drought when large amounts of combustible fuels are available. To manage these risks, project infrastructure would be regularly inspected and maintained to minimise risk of failure or incident. APZs would also be provided at the switching stations and energy hubs, which would be regularly maintained to manage the risk of fire spreading from these locations.

It was noted in a recent Standing Committee on State Development held by the Parliament of NSW on the feasibility of undergrounding the transmission infrastructure for renewable energy projects (Parliament NSW, 2023) that the risk of a bushfire being ignited by high voltage transmission lines is low. Transgrid, as part of it submission to the inquiry reported that bushfires in Australia caused by electricity infrastructure were usually ignited by distribution powerlines or equipment below 66 kilovolts (kV), rather than transmission equipment in voltage ranges of 110 kV and above. As part of their participation in the hearings during the inquiry, it was reported that Transgrid could not find a record of a bushfire being started in Australia by a Transgrid transmission line operating at over 66 kV.

Vegetation within transmission line easements would be managed as APZs to ensure safe electrical clearances would be achieved during operation. Easement widths would be finalised during detailed design; however, would typically be:

- 140 metres for twin 500 kV transmission lines
- 60 metres for a single 330 kV transmission line
- 120 metres for twin 330 kV transmission lines.

Maintenance activities would have similar potential ignition sources to those that would occur during construction (as identified in Section 16.4.1), such as hot works, sparks from construction plant, machinery and motor vehicles and cigarette use, however on a smaller scale. Mitigation measures would be implemented to minimise bushfire risk from maintenance activities, including emergency protocols in accordance with a Bushfire Emergency Management and Evacuation Plan. However, the bushfire risk would remain high.

Risk to the project from bushfire

Bushfires that occur from an ignition source not associated with the project have the potential to isolate operational staff and cause damage to project infrastructure. The risk to infrastructure is considered extreme during operation. The risk to personnel during the operation is considered low as the operation area would not be occupied full time by staff.

APZs would be established at switching stations and energy hubs, and an easement would be applied to transmission lines. Safe access for firefighting operations within the APZs and water tanks for firefighting at switching stations and energy hubs would be provided as part of the project. Difficulties in accessing and suppressing fires within the operation area have not been identified. Despite these measures and implementation of a Bushfire Emergency Management and Evacuation Plan, the bushfire risk to project infrastructure would remain high.

16.5.2 Mine subsidence

Twin 500 kV transmission lines would be established area with the Mudgee mine subsidence district. The project infrastructure within areas of subsidence risk have been designed to manage the risk from existing and past mining activities. This includes use of cruciform foundations for towers instead of piles. Consultation with the Subsidence Advisory NSW has been undertaken as part of design development and will continue through detailed design.

16.5.3 Aviation safety

The transmission line and transmission line towers would not infringe any certified airport Obstacle Limitation Surfaces (OLS) and is unlikely to impact take-off and landing operations at the ALAs assessed in close proximity to the transmission line alignment. Establishment of transmission lines and towers up to 72 metres high would introduce a new obstacle into the airspace. However additional project transmission lines are unlikely to impact aviation safety as they would be published on aeronautical charts and advised to aviation stakeholders prior to construction.

For agricultural aerial activities, the transmission lines and towers would reduce the area available for aerial application as aircraft would not be able to operate under the transmission lines. To manage risks due to the introduction of new obstacles, landowners that host project infrastructure would be required to supply details of the project to any pilot prior to conducting aerial services on these properties. Transmission towers should be readily identifiable at a sufficient distance and in line with relevant safety margins approved by the Civil Aviation Safety Authority (CASA). However, transmission lines would be less visible and mitigation measures to address such risks are provided in Section 16.6.2.

The project is located near the Goulburn River National Park and aerial baiting is used by NSW National Parks and Wildlife Service (NPWS) to control pests. These aerial baiting practices occur in the vicinity of existing transmission line towers that are similar in nature to the project. The project would be unlikely to have an adverse impact on its operations.

16.5.4 Electric and magnetic fields

Electric and magnetic fields would be produced by the project infrastructure, in particular by the operational transmission lines. Electric and magnetic fields would typically be higher where transmission lines run in parallel or intersect each other.

Magnetic fields would be produced by the flow of an electric current though the project infrastructure. These magnetic fields would be highest closest to the source (i.e. project infrastructure) but would reduce quickly with distance. The magnetic fields from the transmission lines, energy hubs and switching stations would not reach the ICNIRP Reference Levels at any location within the operation area.

The strength of the force associated with an electric field is related to the voltage. The higher the voltage, the stronger the electric field. Electric fields produced by the project would be strongest closest to the source but reduce quickly with distance. In addition, most materials act as a barrier to shield electric fields. The electric fields produced by the project do not exceed reference levels outside of the operation area as shown in Table 16-6.

As the predicted electric and magnetic fields levels at the boundary of the operation area are compliant with the current standards and guidelines administered by ARPANSA, no mitigation or modifications specific to the management of electric and magnetic fields are required for the project.

Table 16-6 Assessment of electric fields against the reference level by project component

Infrastructure	Distance at which the electric field dissipates to below reference level
500 kV transmission line operating at 500 kV	Less than 20 metres from the centre of the transmission line within the easement.
500 kV transmission line operating at 330 kV	Less than 10 metres from the centre of the transmission line within the easement.
Two 500 kV transmission lines operating in parallel	Less than 20 metres from the centre of the respective transmission line within the easement.
330 kV transmission line operating at 330 kV	Reference level not reached at any location along the easement.
Two 500 kV transmission lines operating parallel to a 330 kV transmission line	Less than 20 metres from the centre of the respective transmission line within the easement.
Interface/crossing of the 500 kV transmission line with the 330 kV Transgrid transmission lines	Reference level not reached at any location along the easement.
Energy hubs and switching stations[1]	Reference level not reached at any location within the operation area.

1. Includes consideration of electric fields associated with energy hub and switching station infrastructure (such as power transformers and synchronous condensers) but excludes electric fields for sections of transmission line located within the boundaries of energy hubs and switching stations, as these have been considered as part of the preceding items of this table.

16.5.5 Dangerous goods and hazardous materials

Risk screening

During operation, dangerous goods and hazardous materials would be used throughout the operation area and stored on site at energy hubs and switching stations. The expected types of dangerous goods and hazardous materials and their purpose are described in Table 16-7. The quantity of each of these materials to be stored within the operation area would be below the risk thresholds in the Applying SEPP 33 guideline. The transport of dangerous goods to the operation area are also expected to be below the Applying SEPP 33 thresholds with regards to both load quantity and movement thresholds. Therefore, the project is not considered to meet the definition of potentially hazardous development under the State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP). Further detail on the dangerous goods and hazardous materials and Applying SEPP 33 thresholds are provided in Technical paper 11 – PHA.

Storage of dangerous goods and hazardous materials would be in accordance with the supplier's instructions, and would comply with applicable legislation, guidelines and Australian Standards. Dangerous goods would be transported to and from the project in accordance with the *Dangerous Goods (Road and Rail Transport) Act 2008* and Dangerous Goods (Road and Rail Transport) Regulation 2014.

Table 16-7 Hazardous materials proposed to be used and stored at the switching stations and energy hubs

Material	Purpose
Lithium-ion battery pack containers	Forms part of the potential BESS at Merotherie Energy Hub.
Fuel Pod (diesel or petrol)	Back up electricity generation for operations and maintenance.
Oils, lubricants, hydraulic fluids	General maintenance of plant, vehicles and equipment.
Oxyacetylene	Welding and hot works for maintenance and emergency works.
Degreasers/cleaning agent	Washing of parts and equipment.
Biocides, algaecides and bio dispersants	Treatment of the cooling water for switching station equipment.
Corrosion/Scale inhibiters	Treatment of the cooling water for switching station equipment.
Disinfection treatment (including chlorination and chlorine dioxide)	Treatment of the cooling water for switching station equipment.
Insulator cleaning solvent	Insulator cleaning in energy hubs.
Oxygen and acetylene	Steel cutting needed for maintenance or emergency works.
Liquefied petroleum gas (LPG)	Steel cutting needed for maintenance or emergency works.
Pesticides and herbicides	Weed control

Preliminary hazard analysis

There is the potential for the project to include a BESS at the Merotherie Energy Hub that would replace one synchronous condenser. The potential BESS would consist of lithium-ion or lithium-iron phosphate batteries and have a capacity of 200 MW/400 MWh. Should this option proceed, the design and layout of the BESS would be subject to detailed design.

Additional hazards that do not form part of the preliminary risk screening, in particular those relating to the potential BESS at the Merotherie energy hub, have been identified as described in Table 16-8. Smoke, fire and fumes from on-site hazards have the potential for impact to receivers off site. However due to the remote location of the project with nearest sensitive receiver to the BESS being over one kilometre away, there are no potential hazards with significant off-site consequences, and societal risk is negligible.

Hazards with low to medium risk levels would be managed through detailed design in accordance with relevant standards, guidelines and codes. Further detail on the PHA are provided in Technical paper 11 – PHA.

The findings of the risk screening are that the project is not considered potentially hazardous in accordance with the Resilience and Hazards SEPP, based on the storage and transport of dangerous goods and hazardous materials. Potential hazards from the project are predominantly associated with the risk of a fire event affecting the batteries, thermal runaway leading to fire and environmental pollution from a spill of oil or other pollutant from the project, with other risks associated with electricity.

BESS and transformer fires do have the potential to propagate to areas outside of the battery enclosure and potentially initiate a bushfire in the surrounding grass land if the risk of propagation is not managed. Toxic combustion products may evolve and could technically affect the nearby resident and emergency services personnel. As such mitigated controls would be implemented in order to reduce the risk to as low as reasonably practicable.

Table 16-8 Risk assessment

Consequence analysis		Risk assessment		
Hazard	**Consequence**	**Consequences**	**Likelihood**	**Unmitigated risk outcome (off site)**
Electrical exposure	Electrocution Fire	Insignificant	Unlikely	Low
Electrical fault at substation or transformer	Intense light and heat Fire Arc flash/electrocution	Insignificant	Unlikely	Low
Operational fire at the substation or BESS	Release of toxic products Fire escalation (spread) to other assets	Moderate	Unlikely	Medium
Bushfire	Fire escalation to adjoining sites	Moderate	Unlikely	Medium
BESS thermal runaway (risk related to lithium-ion batteries where the lithium-ion cell enters an uncontrollable, self-heating state that can result in release of extensive energy namely as heat but also violent cell venting which can release gas, fumes, shrapnel and/or particulates)	Fire and release of toxic products and intense heat Fire escalation for adjoint assets	Major	Rare	Medium
Localised chemical leak of hazardous substance such as fuel	Release of liquid or gas	Minor	Unlikely	Low
Pollution event at potential BESS site from containment failure	Environmental pollution	Moderate	Rare	Low
Natural hazards (bushfire, water/flooding, lightning)	Event causing a hazardous incident or a battery fire event	Major	Remote	Medium
Site security breach Intentional or accidental damage and/or failure of the BESS	Intentional or accidental damage and/or failure of the BESS	Moderate	Remote	Low

16.5.6 Telecommunications

Microwave links

The design and placement of transmission line towers has the potential to obstruct point to point microwave links which transmit microwave signals. This can impact the connectivity to mobile radio sites. It is recognised that emergency services use this radio network as part of their operations and during emergencies. Accordingly, impacts to the microwave links has the potential to impact upon the connectivity of the radio network.

EnergyCo met with the NSW Telco Authority in November 2022 to discuss the project and potential impacts to point to point microwave links and were provided spatial data of the current and proposed microwave links. As part of the transmission tower design development, the interface with microwave links was considered. Where practicable, the transmission towers have been placed 100 m outside the line between two microwave link points (referred to as the link path) to avoid potential impacts. However, in some locations due to local constraints some towers have been placed within 100 m of the link path. These will be reviewed during detailed design to determine the effect on the microwave link.

Radio frequency interference

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 radio frequency interference in public areas at ground level inside and outside the transmission line easement.

Radio frequency interference limits in the design of transmission lines are defined in *AS2344:2016 Limits of electromagnetic interference from overhead alternating current powerlines and high voltage equipment installations in the frequency range 0.15 Megahertz (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 radio frequency interference 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).

With respect to potential disruptions to radio communication services, it is expected that satisfactory level of radio reception would be achieved even outside of set limits for electric and magnetic interferences for all services as the devices and the transmission line would generally operate on different frequencies.

16.6 Management of impacts

16.6.1 Environmental management

During construction, hazards and risk would be managed through the CEMP. In addition, a comprehensive Bushfire Emergency Management and Evacuation Plan would be prepared as part of the construction emergency response plan for the project and for operation of the project.
The Bushfire Emergency Management and Evacuation Plan would be prepared in accordance with NSW RFS's Guide to Developing a Bushfire Emergency Management Plan and meet the requirements of Australian Standard *AS3745-2010 Planning for emergencies in facilities* and would include:

- protocols for the relocation of workers to nominated safe refuge zones during a bushfire emergency, either within or remote to the work zone
- protocols for the management of bushfire risk and fuel management during construction and operation. This would include the 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 workers of bushfire risks and preventative actions, including risks associated with the operation (and maintenance) of vehicles, plant and equipment.

An Emergency Management Plan would also be prepared for operation of the project. The plan would address the hazards associated with a Lithium-ion packed battery fire and fire-fighting requirements in operational areas. Emergency procedures will include provisions for the management of pollution incidents (water runoff and air), and personnel would be trained in emergency response in accordance with the requirements of *AS 3745:2010 Planning for emergencies in facilities*.

16.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential hazards and risks are listed in Table 16-9.

Mitigation measures in other chapters that are relevant to the management of hazards and risks include:

- Chapter 17 (Traffic and transport), specifically measures which address traffic and transport safety
- Chapter 18 (Waste management), specifically measures which handling waste
- Chapter 19.1 (Hydrology, flooding and water quality), specifically measures which address flood risks
- Chapter 19.2 (Soils and contamination) specifically measures which address management of contaminated land and materials.

Table 16-9 Proposed mitigation measures – Hazard and risk

Reference	impact	Mitigation measures	Timing	Applicable location(s)
BF1	Exposure of energy assets to radiant heat beyond the design tolerance of the asset	Asset Protection Zones (APZs) for switching stations and energy hubs (including the maintenance facility) will be established in accordance with the requirements of the NSW Rural Fire Service's documents Planning for Bushfire Protection 2019 (Appendix 4) and Standards for asset protection zones.	Pre-construction Construction	Key project assets in the operational area that require protection from the impact of radiant heat and direct flame contact associated with a bushfire
BF2	Exposure of energy assets to radiant heat beyond the design tolerance of the asset	Energy hubs, and switching stations, will be designed and constructed in accordance with bushfire attack level 29 in accordance with *AS3959-2018 Construction of Buildings in Bushfire Prone Areas.*	Pre-construction Construction	Operation area
BF3	Insufficient access to the construction and operation area for fire fighting	Access for firefighting appliances will be provided in accordance with Section 2 of the *NSW Rural Fire Service Fire Trails Standards.*	Pre-construction Construction Operation	All locations

Reference	impact	Mitigation measures	Timing	Applicable location(s)
BF4	Bushfire risk from construction	Hot work (activities involving high temperatures) and fire risk work (activities involving heat or with the potential to generate sparks) will be undertaken with appropriate safeguards to minimise the risk of ignition and spread of fire from construction activities, including suspension of hot work and fire risk work on days of elevated fire danger.	Construction	All locations
BF5	Bushfire risk from construction	Firefighting equipment will be maintained and made available for use during the construction phase in accordance with Planning for Bushfire Protection 2019 (NSW RFS 2019) including the following: • static water supply tanks with a minimum volume of 20,000 litres (each) will be provided at the construction compounds and workforce accommodation camps for firefighting purposes • 38 millimetre metal Storz outlets with a gate or ball valve will be provided as an outlet on each of the tanks • non-combustible water tanks and fittings will be used • firefighting equipment (inclusive of a slip on unit) will be maintained at and/or accessible to all active construction site personnel during the declared bushfire danger season and site personnel trained in its use.	Construction	All locations
HR1	Mine subsidence risk	Detailed design and construction planning will be undertaken in accordance with approvals issued by Subsidence Advisory NSW.	Detailed design Pre-construction	Mining areas
HR2	Impacts on underground utilities	The location of all services and utilities within the construction area will be confirmed prior to the commencement of construction (using Before-You-Dig searches, non-destructive digging and/or other appropriate methods). Any required protection or relocation will be designed in consultation with utility providers.	Detailed design Pre-construction	Construction area
AS1	Safety of aircraft movements	The final design of the project with transmission line and tower coordinates and elevations will be provided to the following stakeholders prior to construction: • Air Services Australia • Commonwealth Department of Defence • owners of Dalkeith, Tongy and Merotherie aircraft landing areas • NSW National Parks and Wildlife Service • property owners/occupiers within 5.5 km the transmission easement. Additional notification(s) will be undertaken if the final detailed design of the project alters the details previously supplied to these stakeholders, prior to the construction of the modified design elements.	Detailed design	Operation area

Reference	impact	Mitigation measures	Timing	Applicable location(s)
AS2	Aerial farming operations	At locations where the transmission lines will impact existing aerial farming operations, consultation will be undertaken with relevant landowners to identify appropriate mitigation arrangements such as the installation of aerial warning markers on the transmission lines (where feasible).	Detailed design	Operation area
AS3	Safety of aircraft movements	The following stakeholders will be notified of the scheduling of the use of cranes, drones and helicopters for the construction of the project, prior to the commencement of relevant works: • Air Services Australia • Commonwealth Department of Defence • property owners/occupiers within 5.5 km the transmission easement • owners at Dalkeith, Tongy and Merotherie aircraft landing areas • NSW Parks and Wildlife Service.	Pre-construction	Operation area
HA1	Storage and use of Dangerous Goods	Dangerous goods will be stored in accordance with suppliers' instructions and relevant legislation, Australian Standards, and applicable guidelines; and may include bulk storage tanks, chemical storage cabinets/ containers or impervious bunds. Any storage areas will be designed in accordance with Australian Standard AS1940: The storage and handling of flammable and combustible liquids where applicable. All personnel required to work with Dangerous Goods and other hazardous material will be trained in their safe use and handling.	Construction Operation	All locations
HA2	Management of hazardous materials (design)	Further assessment of hazardous materials and dangerous goods will be undertaken during detailed design, when detailed information on material quantities and types, transport movements and BESS design details are known, to ensure the thresholds in Applying SEPP 33 are not exceeded. Safety in design will be considered and implemented in operational design in accordance with a Safety Management System (SMS) based on applicable Australian Standard and guidelines for the Lithium-ion packed batteries and Class 9 Dangerous Goods.	Detailed design	Energy hubs and switching stations
HA3	BESS thermal runaway and resultant fire	Prior to construction of the BESS, a Fire Safety Study will be prepared based on the final design of the BESS. The Fire Safety Study will be prepared in accordance with the *Hazardous Industry Planning Advisory Paper No. 2 'Fire Safety Study' guideline* (DoP, 2011c).	Detailed design	Merotherie Energy Hub

Reference	impact	Mitigation measures	Timing	Applicable location(s)
HA4	BESS thermal runaway and resultant fire	The BESS will be installed in accordance with *AS/NZS 5139 Electrical installations – Safety of battery systems for use with power conversion equipment*. Optimal operation conditions of the BESS will be maintained in accordance with the operational design requirements, Australian Standard *AS 1670: Fire detection, warning, control and intercom systems* and Best Practice Guide: Battery Storage Equipment – Electrical Safety Requirements (2018) or equivalent.	Detailed design	Merotherie Energy Hub
HA5	Pollutant release	The design of the BESS (if applicable) will identify containment measures to be provided for the containment of cooling water and oils to ensure no offsite discharge occurs.	Detailed design	Merotherie Energy Hub
HA6	Pollutants and smoke moving offsite	Emergency procedures will include details for the establishment of a downwind exclusion zone(s) and evacuation protocols to be implemented in the event of a fire at the BESS (depending on the severity of the event).	Operation	Merotherie Energy Hub
BF6	Bushfire risk during operation	The project APZ will be established at construction and managed during operation in accordance with Appendix 4 of *Planning for Bushfire Protection 2019* and the NSW Rural Fire Service's document *Standards for asset protection zones*.	Operation	All locations

17 Traffic and transport

This chapter provides an assessment of the potential traffic and transport impacts of the project during construction and operation, and identifies mitigation measures to be adopted to avoid, minimise and manage these impacts. It summarises the assessment provided in Technical paper 13 – Traffic and transport (Technical paper 13). The SEARs as they relate to this assessment, and where in the EIS these have been addressed, are detailed in Appendix A.

17.1 Legislative and policy context

The traffic and transport assessment was undertaken in accordance with the SEARs and with reference to the requirements of relevant legislation, policies and/or assessment guidelines, including:

- *Roads Act 1993*
- NSW Heavy Vehicle Access Policy Framework (NSW Government, 2018)
- Guide to Traffic Management (Austroads, 2020)
- Guide to Road Design (Austroads, 2021)
- Guide to Traffic Generating Developments (Transport for NSW, 2002)
- Traffic Control at Work Sites – Technical Manual (NSW Government, 2022)
- 2026 Road Safety Action Plan (NSW Government, 2021)
- NSW Heavy Vehicle Access Policy Framework (Transport for NSW, 2008)
- New South Wales Class 1 Load Carrying Combination (Hunter Region) Mass and Dimension Exemption Notice Operator's Guide (NHVR, 2020).

17.2 Assessment approach

17.2.1 Study area

The traffic and transport study area comprises the transport networks that may be impacted by construction movements to and from the energy hubs, switching stations, access gates, construction compounds and workforce accommodation camps, or by the operation of the project (staff and maintenance movements). The study area is shown in Figure 17-1 (note that the study area does not include the Botobolar microwave repeater site, which would be subject to further assessment).

It includes the roads that provide access to the construction area back to the nearest highway. Beyond this point, the construction traffic is expected to diminish as it is distributed across the broader network to multiple origins and represents no measurable impact.

Construction routes and access gates are depicted in Figure B-3 in Appendix B of this EIS.

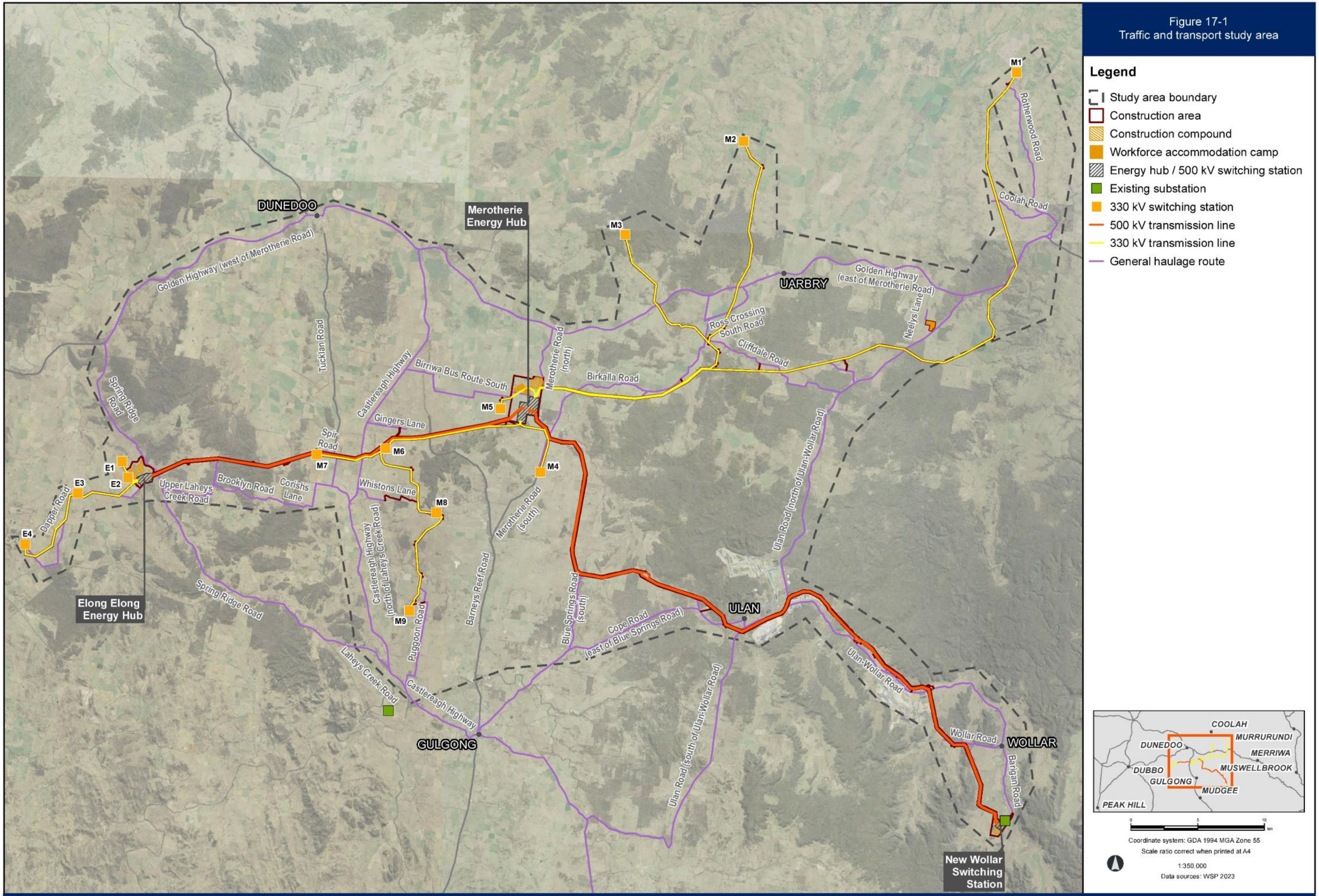

Figure 17-1
Traffic and transport study area

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17.2.2 Assessment approach

The general approach for undertaking the traffic and transport assessment included the following tasks:

- Determination of construction routes likely to be frequently used by heavy and light vehicles during construction within the study area.
- Desktop and mapping analysis to identify, describe and qualitatively assess the existing conditions of the construction routes.
- Completion of intersection and mid-block count surveys to understand current traffic demands, conditions and travel patterns. Surveys were completed on 19 October 2022 (intersections) and between 16 and 23 October 2022 (mid-blocks).
- Review of the proposed construction activities and methodology to derive the expected traffic generation and traffic distribution during construction of the project.
- Assessment of the potential traffic and transport impacts to key construction routes within the study area, associated with the expected construction traffic volumes. The assessment considered impacts to road efficiency, capacity, safety and condition, and potential impacts to property access, active transport, public transport and rail networks.

  For the assessment of road efficiency, capacity and safety impacts during construction on daily construction routes, this involved:

  - assessment of the level of service (with and without the project) in the AM and PM peak for roads that would be used daily during construction (mid-block assessment). This considered an upper limit of expected construction traffic volumes on designated construction routes during peak construction, as volumes along these roads would fluctuate according to the construction program. Existing traffic volumes on these roads were determined using survey data or estimated from intersection counts, and traffic lane capacity of the roads determined in accordance with Guide to Traffic Management (refer to sections 3.7 and 4.1.5 of Technical paper 13 for further information). Local roads that would be used for construction but have no available traffic data have been qualitatively assessed. Further information on the level of service is provided in Section 17.4.1
  - assessment of the layout of key intersections used by construction vehicles to determine if the intersections can safely accommodate construction vehicles during the AM and PM peak based on the design speed according to Guide to Traffic Management, or what turn treatments are required to ensure the safe operation of the intersections. The assessment has considered safety performance of the intersections and not the operational performance as almost all intersections impacted by the project are priority controlled, have low traffic demand and are operationally observed to have minimal traffic delay and queuing
  - identification of design requirements for access points to the transmission line to safely accommodate construction vehicle movements.
- Assessment of the potential traffic and transport impacts from operation of the project. The assessment considered impacts to road efficiency, capacity, safety and condition, as well as potential impacts to active transport, public transport and property access.
- Identification of mitigation measures to be implemented during construction and operation of the project to avoid, minimise and manage the potential traffic and transport impacts of the project as far as practicable.

Local road upgrades

The following road and intersection upgrades are required to ensure safe access to construction sites and the movement of Over Size and Over Mass (OSOM) equipment for the transmission project:

- Merotherie Road
- Spring Ridge Road
- Spring Ridge Road/Dapper Road intersection
- Neeleys Lane/Ulan Road intersection
- Golden Highway/Ulan Road intersection
- Merotherie Energy Hub Access Road/Merotherie Road intersection
- Merotherie Road/Golden Highway intersection.

The Critical State Significant Infrastructure (CSSI) declaration for the project identifies that the upgrading, relocating or widening of existing public roads within the Central-West Orana Renewable Energy Zone does not form part of the project when assessed and determined under Division 5.1 of the EP&A Act. Accordingly, EnergyCo intends to assess and determine the above road and intersection upgrades under Division 5.1 of the EP&A Act to allow these time critical works to be determined and commence construction prior to the determination of the CSSI application. However, the road and intersection upgrades are also included in the EIS so that in the event they are not determined under Division 5.1, they can be approved under the CSSI application. It is noted however that the need for additional road upgrades may also be identified as part of ongoing design development.

Construction routes

Construction routes for this assessment have been divided into two categories:

- Daily construction routes, being the routes used daily to facilitate construction activities and movements to and from construction areas within the study area.
- OSOM construction routes, being the routes that would be used for the transport of certain equipment and components of the project from ports (or other point of origin) to the energy hubs and switching stations. These OSOM movements are subject to restrictions to ensure that applicable loads utilise permitted routes based on a range of factors such as vehicle length and width, mass, and time of day or night.

Levels of service for mid-block road network performance

Level of service (LoS) is a measure of the performance of a road based on its capacity and the volume of traffic utilising the road. It is defined as the operational performance of traffic on a roadway, traffic lane, approach, intersection, route or network, based on measures such as delay and degree of saturation during a given time period. It provides a means of classifying a performance measure or measures that represent quality of service. LoS is measured on an A to F scale, with LoS A representing the best operational conditions from the road users perspective and LoS F the worst. Further information on the LoS criteria is provided in Table 17-1.

Table 17-1 Level of service criteria

Level of Service	Description
A	LoS A describes free-flow operations. Vehicles are almost completely unimpeded in their ability to manoeuvre within the traffic stream.
B	LoS B represents reasonable free-flow operations. The ability to manoeuvre within the traffic stream is only slightly restricted and the general level of physical and psychological comfort provided to drivers is still high.
C	Los C provides the flow conditions with speeds near the free-flow speed. Freedom to manoeuvre within the traffic stream is noticeably restricted, and lane changes require more care and vigilance on the part of the drivers.
D	LoS D is the level at which speeds begin to decline slightly with increasing flows, with density increasing more quickly. Freedom to manoeuvre is seriously limited and the drivers experience reduced physical and psychological comfort levels. Performance up to Level of Service D are considered typically acceptable by Transport for NSW.
E	LoS E describes operation at or near capacity. Operations at this level are highly volatile with virtually no usable gaps within the traffic stream, leaving little room to manoeuvre within the traffic stream. The physical and psychological comfort for drivers is poor.
F	LoS F describes unstable flow.

Source: Austroads Guide to Traffic Management

17.3 Existing environment

17.3.1 Existing road network

The road network within the study area comprises highways, main roads, regional roads and local roads that connect population centres, mining sites and residential properties with a network of sealed and unsealed roads. The roads that would be used by construction vehicles are described in this section and are shown in Figure 17-2. The existing conditions of the road network are presented based on the categories under this administrative framework, which is known as the *NSW Schedule of Classified Roads and Unclassified Regional Roads*.

Highways

There are two highways within the study area; the Golden highway and Castlereagh Highway, which are described in Table 17-2. These roads are typically constructed to a standard suitable to accommodate higher traffic demand, high-speed conditions and frequent and regular freight movements. Highways are classified roads and are operated and maintained by Transport for NSW.

Table 17-2 Highways in the study area

Road name	Description	Pavement	Configuration	Speed limit
Golden Highway (B84)	Golden Highway is a 313-kilometre highway which travels east-west between Dubbo and near Singleton. It passes through several towns in the Central-West Orana region, including Dunedoo, Elong Elong and Dubbo.	Sealed	Bidirectional two-lane road (one lane in each direction)	Predominantly 100 km/h posted speed limit. 50 km/h within regional towns
Castlereagh Highway (B55)	Castlereagh Highway is a 790-kilometre highway which travels north-south between the Great Western Highway near Lithgow in the south, to the Carnarvon Highway near St. George in Queensland. It passes though Mudgee, Gulgong and Dunedoo.	Sealed	Bidirectional two-lane road (one lane in each direction)	Predominantly 100 km/h posted speed limit. 50 km/h within regional towns

Main roads

The main roads within the study area are described in Table 17-3. Main roads are classified roads and connect smaller towns to the highway road network and with each other in rural areas.

Table 17-3 Main road network in the study area

Road name	Description	Pavement	Configuration	Speed limit
Ulan Road	Approximately 72 kilometres long road providing a north-south connection between Golden Highway in the north and Mudgee town centre.	Sealed	Bidirectional two-lane road (one lane in each direction)	100 km/h posted speed limit
Cope Road	Approximately 24 kilometres long road travelling east-west between Gulgong town centre and Cope Road–Ulan Road intersection.	Sealed	Bidirectional two-lane road (one lane in each direction)	100 km/h posted speed limit

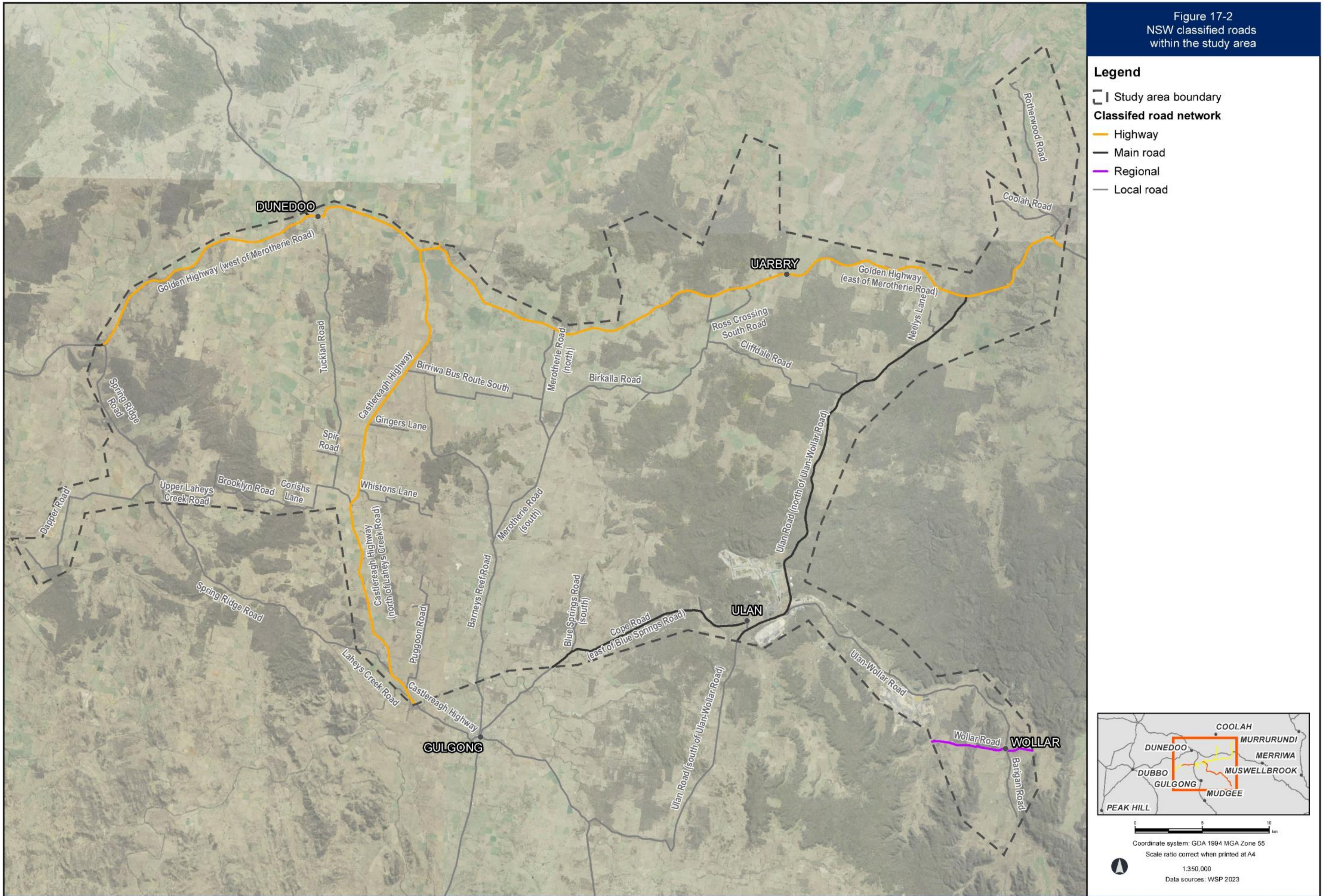
Regional roads

Wollar Road is the only regional road within the study area and is described in Table 17-4. Regional roads have a similar function to main roads, as they provide connections between highways and/or main roads and surrounding land uses.

Table 17-4 Regional road network in the study area

Road name	Description	Pavement	Configuration and	Speed limit
Wollar Road	Approximately 39 kilometres long road travelling north-east to south-west connecting the township of Wollar to Ulan Road–Wollar Road intersection, and towards Mudgee further south.	Sealed	Bidirectional two-lane road (one lane in each direction)	100 km/h posted speed limit

Figure 17-2
NSW classified roads within the study area



Local roads

Table 17-5 identifies the 29 local roads within the study area which would form part of the construction vehicle routes for the project. These roads would mostly be used during construction to access the transmission line sections of the construction area. All roads are bidirectional, with one lane in each direction.

Table 17-5 Local road network in the study area

Road name	Speed limit	Pavement
Ancrum Street, Cassilis	50 km/h	Sealed with unsealed shoulders and no line marking
Bald Hill Road, Dunedoo	100 km/h	Unsealed
Barigan Road, Wollar	100 km/h	Unsealed
Barigan Street, Wollar	50 km/h	Sealed with unsealed shoulders and no line marking
Birkalla Road, Merotherie and Bungaba	100 km/h	Unsealed
Birriwa Bus Route South, Birriwa and Merotherie	100 km/h	Unsealed
Blue Springs Road, Bungaba and Uarbry	100 km/h	Sealed with unsealed shoulders and no line marking in the southern section. Unsealed in the northern section
Brooklyn Road, Dunedoo	100 km/h	Unsealed
Cassilis Road, Cassilis	100 km/h near Golden Highway Reduces to 50 km/h near the town of Cassilis	Sealed with unsealed shoulders
Cliffdale Road, Turill and Uarbry	100 km/h	Unsealed
Coolah Road, Cassilis	100 km/h on rural segment Reduces to 50 km/h near the town of Cassilis	Unsealed/Partially Sealed
Corishs Lane, Tallawang	100 km/h	Unsealed
Dapper Road, Dunedoo	100 km/h	Unsealed
Gingers Lane, Tallawang	100 km/h	Unsealed
Highett Road, Ulan	100 km/h	Unsealed
Merotherie Road, Merotherie	100 km/h	Unsealed
Neeleys Lane, Turill	50 km/h	Unsealed
Phillip Street, Wollar	50 km/h	Sealed with unsealed shoulders and no line marking
Puggoon Road, Beryl and Tallawang	100 km/h	Unsealed
Ross Crossing Road, Uarbry	Unknown speed limit	Unsealed (access track)
Spir Road, Orana	100 km/h	Unsealed
Spring Ridge Road, Dunedoo and Tallawang	100 km/h	Sealed with unsealed shoulders and no line marking
Thompsons Road, Cassilis	100 km/h	Unsealed
Trgo Close, Wilpinjong	100 km/h	Unsealed

Road name	Speed limit	Pavement
Tucklan Road, Orana	100 km/h	Unsealed
Turill Bus Route, Turill	100 km/h	Unsealed
Ulan-Wollar Road, Ulan, Wilpinjong and Wollar	100 km/h	Sealed with unsealed shoulders and no line marking
Upper Laheys Creek Road, Dunedoo	100 km/h	Unsealed
Whistons Lane, Tallawang	100 km/h (Rural speed limit)	Unsealed

17.3.2 Mid-block volumes

Based on the survey results collected, the highest traffic volumes are observed on highways (State roads), which reflects the function of these roads. Roads that also experience higher traffic volumes include Cope Road (from 1,200–1,800 vehicles per day) and Ulan Road (approximately 9,000 vehicles per day) on weekdays.

All of the roads assessed in the study area perform at LoS A, with the exception of the following which operate at a LoS B:

- the south bound/east bound direction of Ulan-Wollar Road during the AM peak on Ulan-Wollar Road
- all directions on Ulan Road (north-east of Lue Road during the PM peak) perform at LoS B.

17.3.3 Key intersection layout and volumes

Ten intersections that would be used by construction traffic were assessed to determine if the layout of the intersections are suitable in their current arrangement to safely accommodate the existing AM and PM peak hour traffic volumes based on the design speed according to *Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management*. Details of the existing conditions of these intersections is provided in Table 17-6.

Further consideration and assessment of the potential need for upgrades to intersections as a result of the project construction traffic is provided in Section 17.4.2.

Table 17-6 Overview of key intersections (layout, speed and volumes)

Intersection	Type of intersection	Speed limit (km/h)	Surveyed volume AM / PM vehicles per hour (vph) (total)	Aggregate daily traffic AM / PM vehicles per day (vpd) (total)***	Current arrangement*
Merotherie Road/ Golden Highway	T-intersection	100	71 vph / 71 vph [a]	710 vpd / 710 vpd [a]	BAR / BAL
Spring Ridge Road/ Golden Highway	T-intersection	100	127 vph / 128 vph [a]	1270 vpd / 1280 vpd [a]	AUR / AUL
Ulan Road/ Ulan-Wollar Road	T-intersection	100	610 vph / 381 vph [c]	6100 vpd / 3810 vpd [c]	CHR / AUL
Castlereagh Highway/ Laheys Creek Road	T-intersection	100	11 vph / 1 vph [d]	110 vpd / 10 vpd [d]	BAR / BAL
Black Stump Way/ Golden Highway**	T-intersection	100	150 vph / 160 vph [a]	1500 vpd / 1600 vpd [a]	CHR / AUL

Intersection	Type of intersection	Speed limit (km/h)	Surveyed volume AM / PM vehicles per hour (vph) (total)	Aggregate daily traffic AM / PM vehicles per day (vpd) (total)***	Current arrangement*
Wollar Road/ Barigan Street/ Barigan Road/ Phillip Street	T-intersection	50	24 vph / 28 vph [a]	240 vpd / 280 vpd [a]	BAR / BAL
Golden Highway/ Ulan Road	T-intersection	100	188 vph / 180 vph [b]	1880 vpd / 1800 vpd [b]	BAR / AUL
Ulan Road/Cope Road (Main Street)	T-intersection	100, 50	615 vph / 420 vph [e]	6150 vpd / 4200 vpd [e]	CHR / BAL
Cope Road/ Blue Springs Road	T-intersection	100	118 vph / 127 vph [c]	1180 vpd / 1270 vpd [c]	BAR / BAL
Brooklyn Road/ Laheys Creek Road	T-intersection	100	4 vph / 3 vph [f]	40 vpd / 30 vpd [f]	BAL / BAR

Notes:

* BAL – basic left turn, BAR – basic right turn, CHL – channelised left turn, CHR – channelised right turn, AUL – auxiliary left turn and AUR – auxiliary right turn

** While within the study area, this intersection is unlikely to be used by construction traffic for turning movements. It has been included here as background information.

*** Through analysis of the total peak hour and daily traffic volume, it was found that peak hour demand makes up approximately 8–10 per cent of the daily traffic volume. Therefore, a conservative 10 per cent multiplier was applied to convert Surveyed peak hour volume to Aggregate Daily Traffic volume.

Volumes are reported for the following periods for the AM and PM periods:

a: 8:45 am – 9:45 am, 3 pm – 4 pm

b: 8:45 am – 9:45 am, 3:15 pm – 4:15 pm

c: 6 am – 7 am, 5:15 pm – 6:15 pm

d: 8:15 am -9:15 am, 3:00 pm – 4:00 pm

e: 6 am – 7 am, 5 pm – 6 pm

f: 7:30 am – 8:30 am, 5:45 pm – 6:45 pm

17.3.4 Heavy vehicle road network restrictions

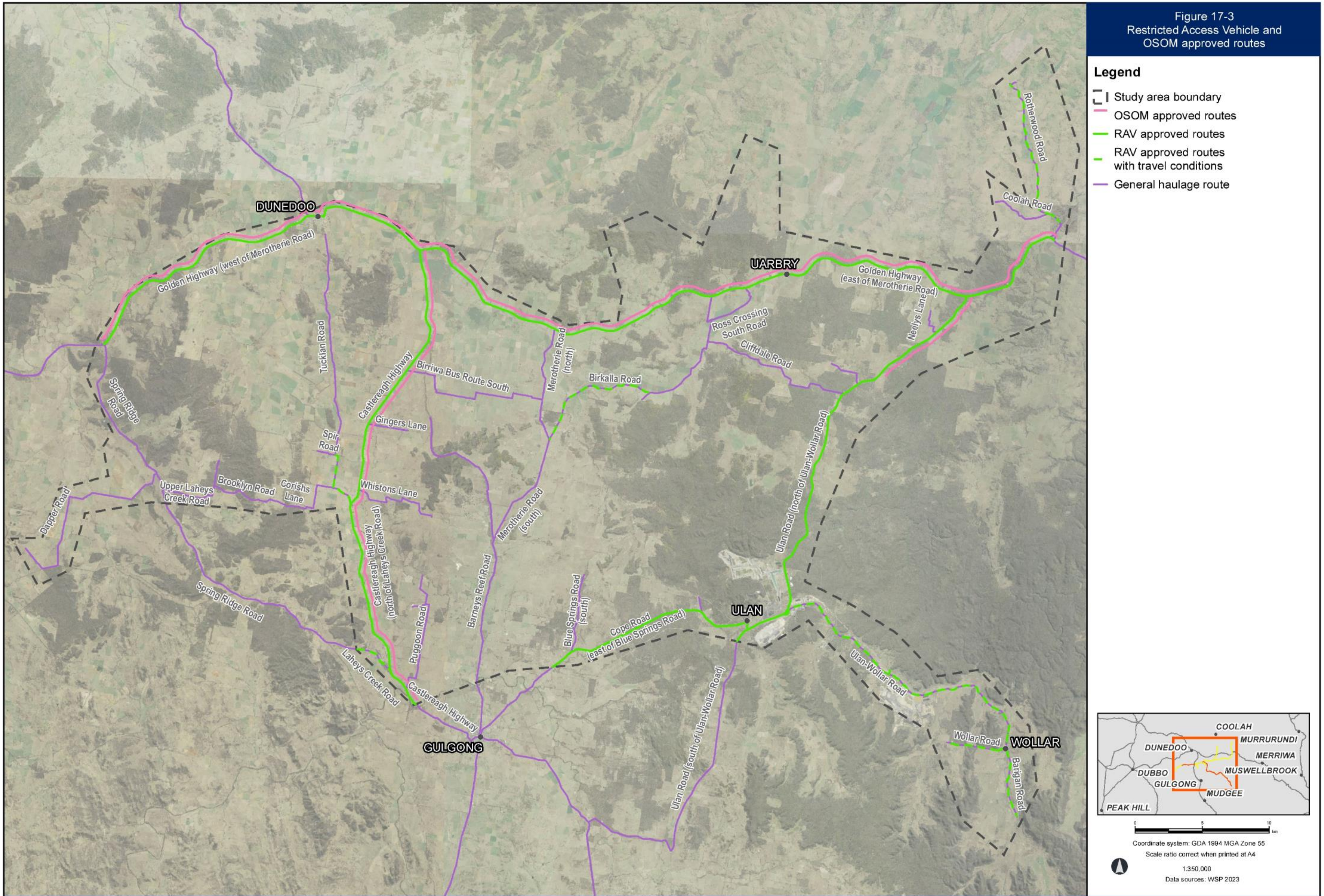
Construction routes in the study area that are approved for use by restricted heavy vehicles are shown in Figure 17-3. The following vehicle types may be used for the movement of plant, equipment and materials during construction of the project:

- restricted access vehicles (RAV) (i.e. 19 m, 23 m and 25/26 m B-doubles)
- OSOM vehicles, which are defined as a vehicle (or vehicle combination) that exceeds any general access mass or dimension limits.

The Golden Highway and Castlereagh Highway are part of the existing approved RAV and OSOM network. Approval for OSOM vehicles to travel on the road network is still required on these roads. It is to be noted that the last-mile road sections to the proposed Energy Hubs locations are currently not gazetted as approved OSOM routes at this stage.

Along the construction routes, highways, main roads and regional roads provide approved access for RAVs. Most local roads along construction routes are not part of the existing approved RAV and OSOM network.

Figure 17-3
Restricted Access Vehicle and OSOM approved routes



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:350,000
Data sources: WSP 2023

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17.3.5 Crash analysis

Table 17-7 provides a summary of the crash analysis for highway, main, regional and local roads between 2016–2021. There was a total of 63 crashes along the proposed project construction routes, with the majority of the crashes occurring in mid-block locations (90 per cent) and along highways (65 per cent). The least number of crashes occurred on Wollar Road whereas the majority of the crashes occurred on the Golden Highway. The most common degree of crash (or crash severity) was no casualty (32 per cent) and least common degree of crash contained a fatality (9.5 per cent). Further details are outlined in section 4.4 of Technical paper 13.

Table 17-7 Crash summary along construction route by degree of severity along the various construction routes between 2016 – 2021

	Highways		Main roads		Regional roads	Local roads	Total
Degree of crash	**Number of crashes on Golden Highway**	**Number of crashes on Castlereagh Highway**	**Number of crashes on Cope Road**	**Number of crashes on Ulan Road**	**Number of crashes on Wollar Road**	**Number of crashes**	
Fatal	4	0	1	0	0	1	6
Injury	9	2	1	0	0	3	13
Moderate injury	7	2	1	3	1	1	15
Minor injury/other injury	1	1	0	4	0	1	7
No casualty	11	3	1	4	0	1	20
Total	32	8	4	11	1	7	63
Location of crash							
Intersection	3	0	0	2	0	1	6
Mid-block	29	8	4	9	1	6	57

17.3.6 Public transport

Coaches provide the primary public transport service between the towns in the study area, with typically one to four services available a week, depending on the route. Coach services are available and travel through towns such as Gulgong, Dunedoo and Coolah. Local educational establishments are also well serviced by local school buses within study area.

Railway lines in the study area are not used for passenger services. Details about other transport infrastructure is provided in Section 17.3.8.

17.3.7 Active transport

In the study area, footpath networks are typically only provided in town centres.

Cycleway infrastructure is much less established within the study area. A search in Transport for NSW's Cycleway Finder identified only one location, being disconnected sections of the Golden Highway (road shoulder) that extends approximately 4.5 kilometres west of Cassilis Road. It is possible that cyclists utilise the road network beyond these sections.

Despite limited cycling infrastructure in the region, the Central West Cycle circuit has been developed by local cyclists, which uses around 400 km of backroads through Mudgee-Gulgong-Dunedoo-Mendooran-Ballimore-Dubbo-Geurie-Wellington-Goolma-Gulgong to Mudgee.

17.3.8 Other transport infrastructure

The project crosses two active freight railway lines within the study area, both of which are managed by the ARTC:

- Ulan – a single track rail line extending between Muswellbrook and Gulgong
- Wallerawang-Gwabegar – a single track rail line extending between Gulgong and Binnaway.

Both of these railway lines are only used as freight routes.

17.4 Potential impacts – construction

17.4.1 Road capacity and efficiency

Estimates of the maximum number of construction vehicle movements per hour associated with the workforce accommodation camps, energy hubs and switching stations are presented in Table 17-8 and depicted in Figure 17-4. A movement is defined as a vehicle on an inbound or outbound journey.

These estimated traffic movements are distributed across the construction routes and would vary according to the stage of construction and the location of construction activity along the transmission line. It is expected that construction of the project would take around four years, with an expected peak in activities from mid-2025 to mid-2026 when workforce accommodation camps are likely to be close to capacity.

As these numbers would fluctuate, the assessment has considered the maximum number of construction vehicles that would use the construction routes by applying the indicative movements summarised in Table 17-8 according to location (e.g. proximity to an energy hub) and rounded up to the nearest 25 vehicles per hour in Figure 17-4. These volumes represent the worst-case scenario as in reality, construction activities for the switching stations and transmission line would be completed progressively throughout the length of the project (i.e. not concurrently) and associated traffic movements would only be needed where the construction works take place.

Table 17-8 Construction vehicle movements per hour (indicative) during peak construction

Site	Movement per hour			Movement per day		
	Light vehicle	Heavy vehicle	Total	Light vehicle	Heavy vehicle	Total
New Wollar Switching Station*	4	20	24	44	198	242
Merotherie Energy Hub* and workforce accommodation camp	40	30	70	342	392	734
Neeleys Lane workforce accommodation camp	32	24	56	296	70	366
Elong Elong Energy Hub*	4	20	24	44	198	242
330 kV switching stations (typical)	12	1	13	34	38	72
Access gate (typical) (along the transmission line)	12	20	32	148	194	342

* denotes locations that would include main construction compounds

Figure 17-4
Maximum construction traffic volume by construction route

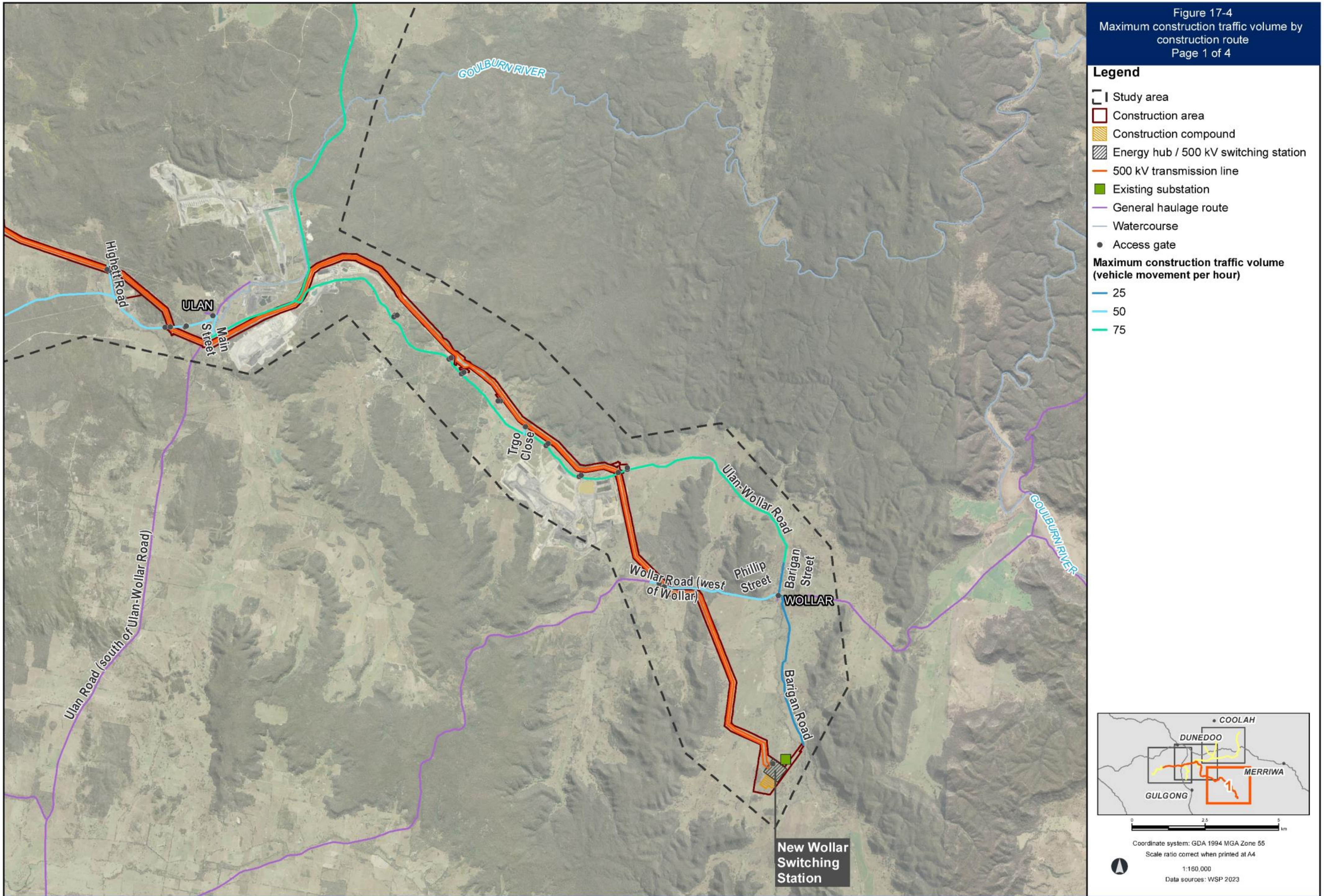

Figure 17-4
Maximum construction traffic volume by construction route
Page 2 of 4

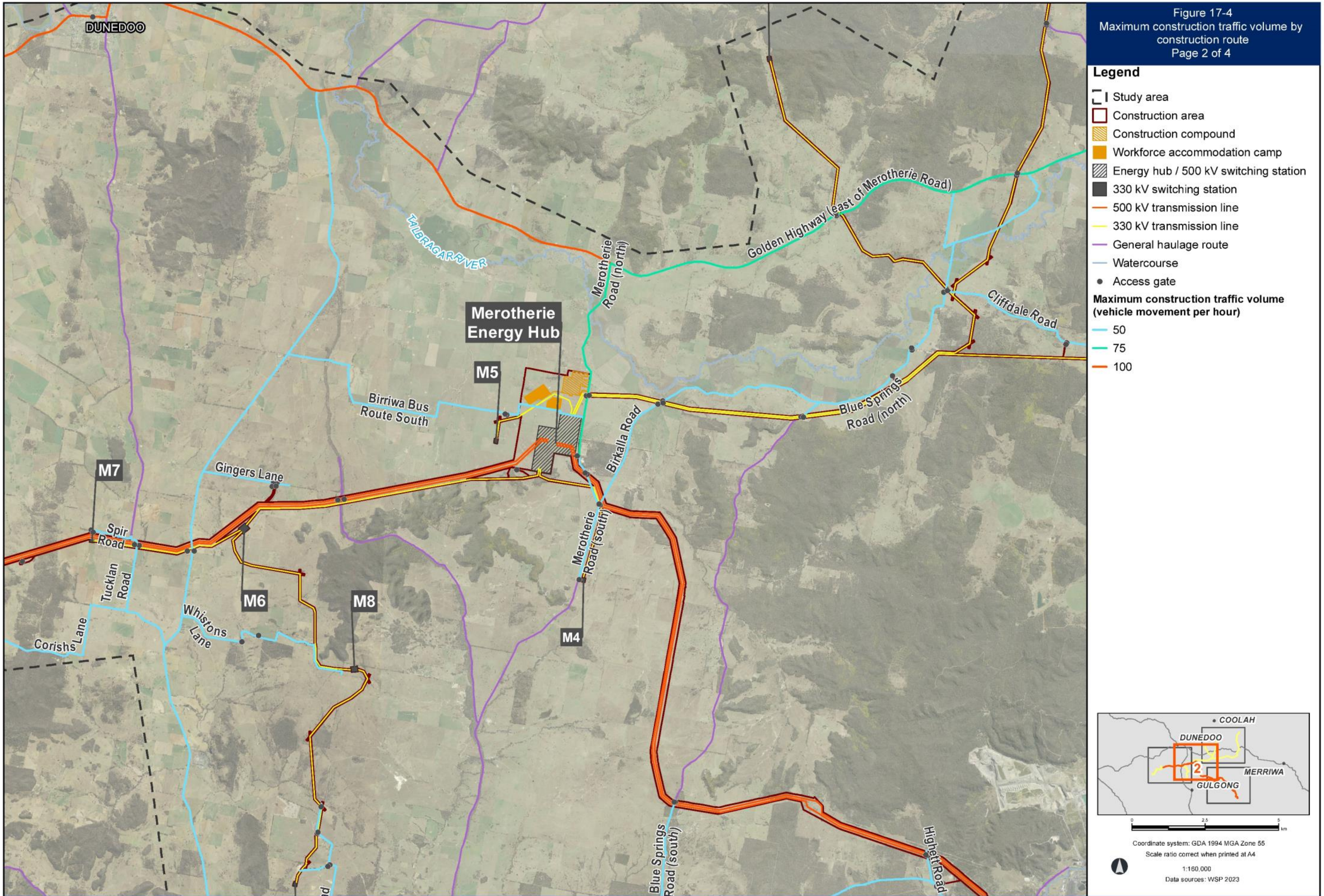

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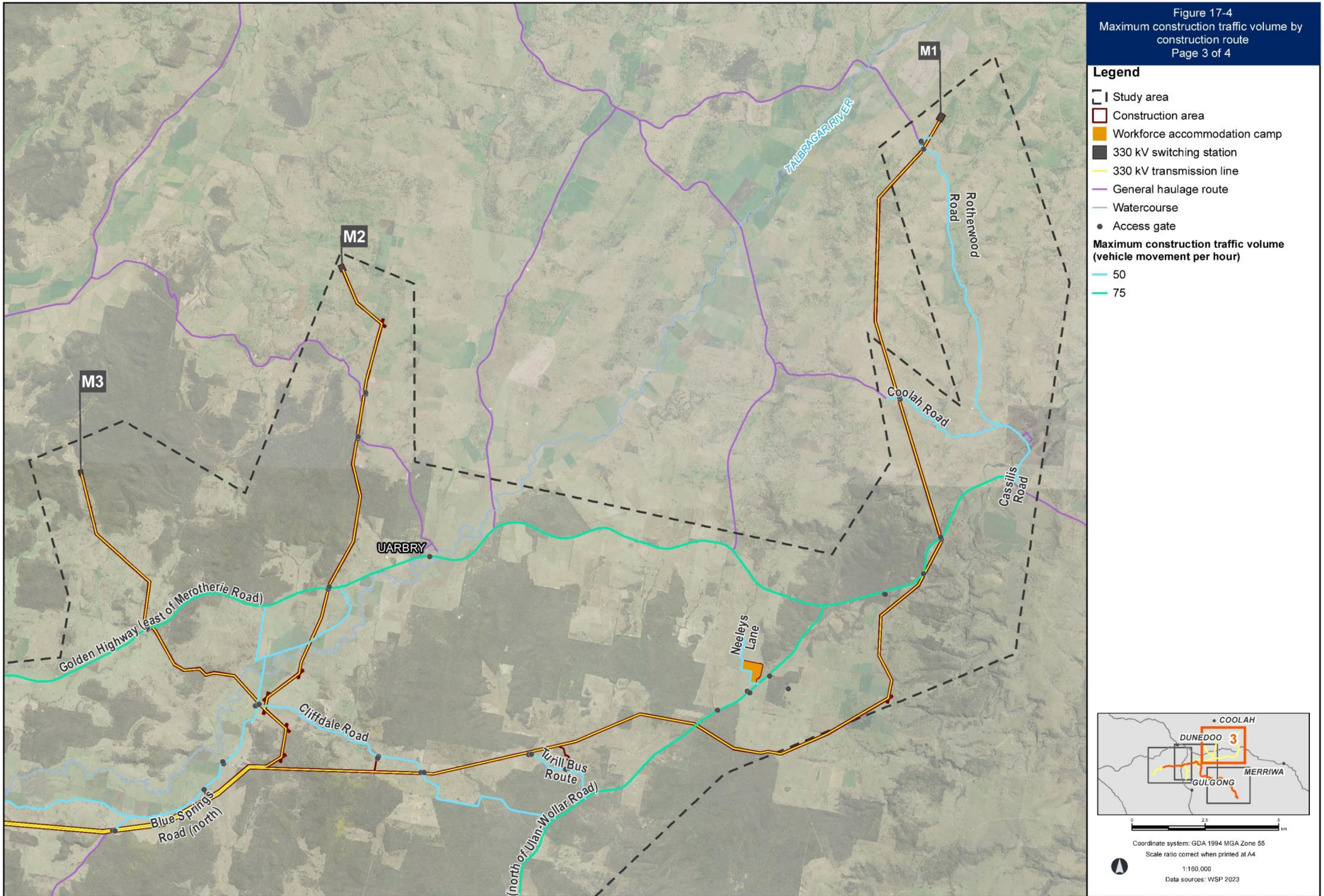
Figure 17-4
Maximum construction traffic volume by construction route
Page 3 of 4



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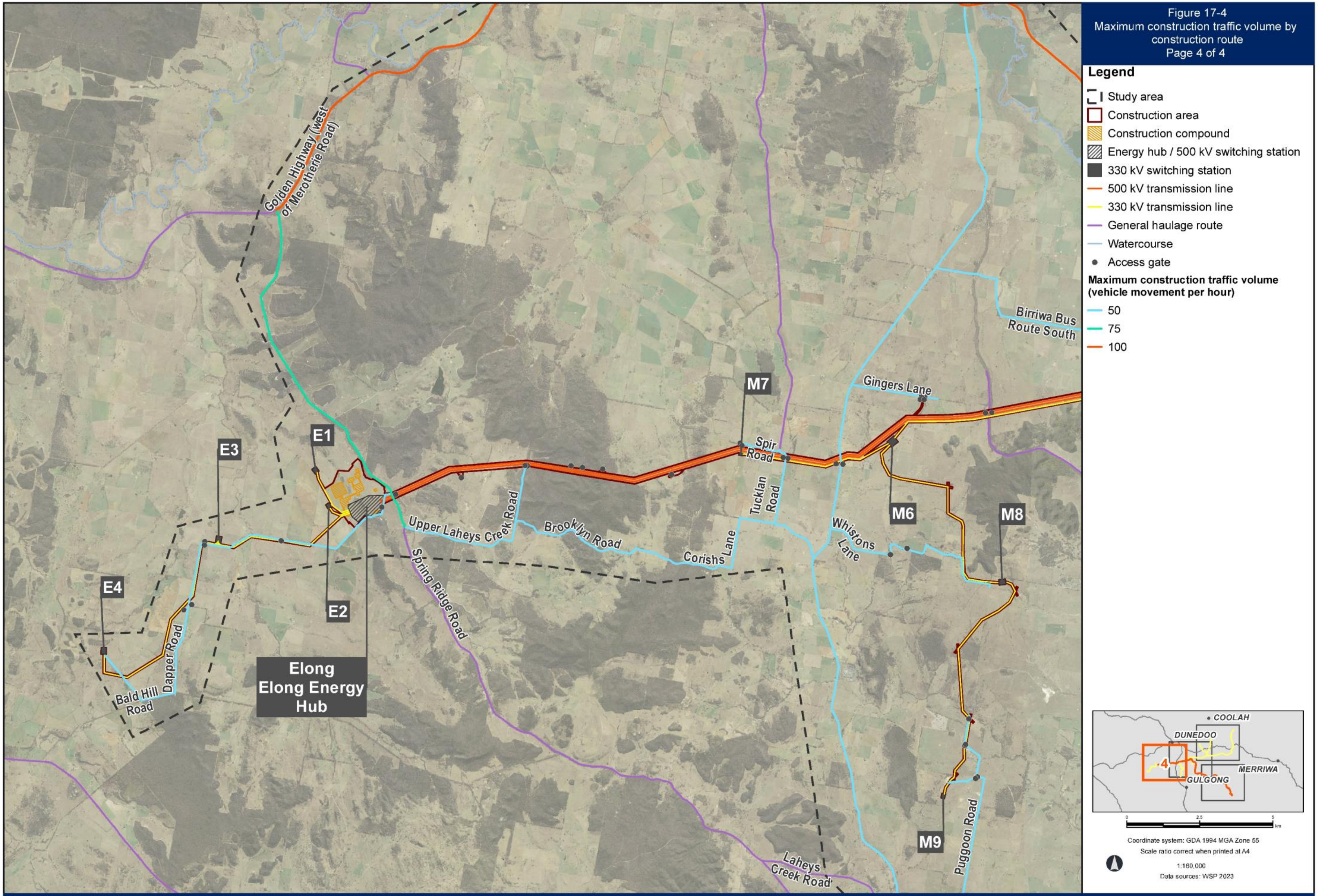

Figure 17-4
Maximum construction traffic volume by construction route
Page 4 of 4

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The additional traffic movements would bring a noticeable change to the local road environment; however all local roads would still operate within capacity. all local roads that form part of the project construction routes would maintain the same LoS A or LoS B as per existing conditions within the study area, except for Ulan-Wollar Road. At this location the AM peak in the southbound/eastbound direction would decrease from a LoS B to LoS C as a result of construction vehicle movements. Under existing conditions, Ulan-Wollar Road is highly utilised by workers travelling to the existing coal mine in the AM peak. Despite the reduced LoS, traffic would still operate at near free flowing conditions, although drivers would be required to exercise more care and vigilance when making lane changes.

A comparison of traffic performance along the project construction routes under existing conditions and with construction traffic is provided in Table 17-9. Bold text denotes where there has been a change in the LoS along an assessed road.

Several local roads that form part of the construction routes have not been quantitatively assessed (refer to Appendix A of Technical paper 13 for further details) and are not presented in Table 17-9. These are roads that would be used primarily to access transmission line access gates only. Construction vehicle movements would be limited to around 20 heavy vehicle movements and around 12 light vehicle movements per hour during the peak period. While the roads likely carry low volumes of existing traffic, the additional volumes of traffic during construction would be unlikely to adversely impact the performance and capacity of these roads.

Table 17-9 Road performance analysis during construction

Location	Road classification	Lane capacity (vph/ lane)	Level of Service (current)				Traffic volume with project movement during peak hour				Aggregate daily traffic volume with project movement (per day)*	Level of Service (predicted)			
			AM peak hour[1]		PM peak hour[2]		AM peak hour[1]		PM peak hour[2]		Daily	AM peak hour[1]		PM peak hour[2]	
			NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB		NB/WB	SB/EB	NB/WB	SB/EB
Golden Highway (near Spring Ridge Road, west of Dunedoo), Dunedoo	Highway	1,800	A	A	A	A	147	62	61	151	2540	A	A	A	A
Golden Highway (between Ulan Road and Merotherie Road), Uarbry)	Highway	1,800	A	A	A	A	122	42	46	110	1700	A	A	A	A
Castlereagh Highway (between Golden Highway and Tucklan Road), Birriwa	Highway	1,800	A	A	A	A	34	86	83	39	1330	A	A	A	A
Castlereagh Highway (north of Laheys Creek Road), Beryl	Highway	1,800	A	A	A	A	36	91	89	50	1640	A	A	A	A
Cope Road (between Blue Springs Road and Springwood Park Road), Cope	Main Road	1,400	A	A	A	A	61	111	51	96	1690	A	A	A	A
Ulan Road near Ulan township	Main Road	1,400	B	A	A	A	455	197	241	199	6520	B	A	A	A
Ulan Road (north of Ulan-Wollar Road)	Main Road	1,400	A	A	A	A	160	176	141	89	3360	A	A	A	A
Main Street – extension of Cope Road, Ulan	Main Road	1,000	A	A	A	A	54	132	13	134	1860	A	A	A	A
Wollar Road (west of Wollar)	Regional	1,000	A	A	A	A	56	11	13	52	670	A	A	A	A
Tucklan Road (south of Rhodes Street in Dunedoo), Dunedoo	Local	1,000	A	A	A	A	51	11	12	51	620	A	A	A	A

Location	Road classification	Lane capacity (vph/ lane)	Level of Service (current)				Traffic volume with project movement during peak hour				Aggregate daily traffic volume with project movement (per day)*	Level of Service (predicted)			
			AM peak hour[1]		PM peak hour[2]		AM peak hour[1]		PM peak hour[2]		Daily	AM peak hour[1]		PM peak hour[2]	
			NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB		NB/WB	SB/EB	NB/WB	SB/EB
Spring Ridge Road, south of Golden Highway	Local	1,000	A	A	A	A	15	72	70	13	870	A	A	A	A
Upper Laheys Creek Road	Local	1,000	A	A	A	A	5	49	46	7	540	A	A	A	A
Merotherie Road (south of Golden Highway)	Local	1,000	A	A	A	A	8	67	67	8	750	A	A	A	A
Barigan Street (north of Wollar)	Local	1,000	A	A	A	A	8	26	34	6	400	A	A	A	A
Barigan Road (to Wollar substation)	Local	1,000	A	A	A	A	8	27	27	8	350	A	A	A	A
Blue Springs Road (north)	Local	1,000	A	A	A	A	46	16	18	50	680	A	A	A	A
Blue Springs Road (south)	Local	1,000	A	A	A	A	46	16	18	50	680	A	A	A	A
Ulan-Wollar Road	Local	1,000	A	B	A	A	59	392	193	124	4510	A	C*	A	A
Maitland Street (east of Barigan Street)	Local	1,000	A	A	A	A	17	30	40	8	480	A	A	A	A

* Through analysis of the existing total peak hour and daily traffic volume, it was found that the existing peak hour demand makes up approximately 8 to 10 per cent of the daily traffic volume. Similarly, for construction peak hour movements, it was found that the peak hour demand makes up approximately 10 per cent of the daily traffic volume for significant traffic generating sites. Therefore, a 10 per cent multiplier was applied to convert indicative project peak hour movements to Indicative project daily movements. This is applicable to certain locations that did not collect continuous data over a 24 hour/7 day period.

17.4.2 Intersection operation and safety

Thirteen intersections were examined, as they would experience increases in traffic demand during construction. This comprised 12 existing intersections and one new intersection to be constructed for the project, which were assessed to determine if these intersections can accommodate the anticipated construction traffic movements efficiently and safely. The assessment for these intersections is presented in Table 17-10.

The assessment determined that the existing configurations of seven of the thirteen assessed intersections, would be appropriate to sufficiently accommodate the additional traffic volumes associated with the project.

Four of the thirteen assessed intersections have been assessed as likely to require upgrades, which include:

- Neeleys Lane/Ulan Road intersection
- Golden Highway/Ulan Road intersection
- Spring Ridge Road/Dapper Road intersection
- Merotherie Road/Golden Highway intersection.

In addition, a new access point would be required for the Merotherie Energy Hub from Merotherie Road. This access point has been assessed as requiring a basic left turn and a basic right turn.

The Neeleys Lane/Ulan Road intersection, would potentially require adjustments to provide a channelised right hand turn lane and an auxiliary left turn arrangement for the increased movements to and from the workforce accommodation camp. However, this would be confirmed during detailed design once final workforce numbers are confirmed. The Golden Highway/Ulan Road, and the Merotherie Road/Golden Highway intersections would be upgraded to provide channelised right hand turn arrangements, based on the intended use of these intersections. The Spring Ridge Road/Dapper Road intersection would also be upgraded to provide basic left turn and basic right turn arrangements.

The existing turn treatments of the Ulan Road/Cope Road intersection are under designed for the existing traffic demand under existing conditions and without the project, based on the intersection counts completed for the project. This intersection would cater for construction vehicles travelling to and from sections of the transmission line between New Wollar Switching Station and Merotherie Energy Hub. This is not a major trip generator for the project (with a maximum contribution of around 50 vehicles per hour) and the volumes would vary over the construction program according to the phase of activity within the transmission line, and the location of construction works at any given time. With construction traffic representing eight to 11 per cent of total movements, the project would seek to minimise construction vehicle movements through this intersection during the AM and PM peak hours to avoid the need to adjust the existing design and configuration of this intersection.

As noted in Section 17.2.2, EnergyCo are proposing to upgrade certain roads as part of a separate works package which would be assessed and determined under Division 5.1 of the EP&A Act. The same assessment process would also be followed for the proposed intersection works at the four locations identified above, with the works anticipated to be completed prior to the commencement of construction of the project. However, the road and intersection upgrades are also included in the EIS so that in the event they are not determined under Division 5.1, they can be approved under this CSSI application.

Table 17-10 Impacts to intersection operation from construction of the project

Intersection	Safe intersection sight distance	Minimum gap sight distance	Stopping sight distance		Current design	Preferred intersection requirement	Adjustments required?
			Light vehicles	Heavy vehicles			
Neeleys Lane/ Ulan Road intersection	248 m	111–139 m	165 m	191 m	BAR and BAL	CHR and AUL	Yes
New Wollar Switching Station access road/ Barigan Road	248 m	111–139 m	165 m	191 m	BAR and BAL	BAR and BAL	No
Ulan Road/ Ulan-Wollar Road	248 m	111–139 m	165 m	191 m	AUL and CHR	CHR and AUL	No
Golden Highway/ Ulan Road	248 m	111–139 m	165 m	191 m	BAR and AUL	CHR only. Requirement for BAL is satisfactory provided by the existing AUL.	Yes
Ulan Road/ Cope Road (Main Street)	248	111-139 m	165 m	191 m	CHR and AUL	CHR and AUR.	No
Merotherie Energy Hub Access Road/ Merotherie Road intersection	248	111-139 m	165 m	191 m	N/A	BAR and BAL	Yes
Merotherie Road/ Golden Highway intersection	248	111-139 m	165 m	191 m	BAR and BAL	CHR and BAL	Yes
Dapper Road/ Spring Ridge Road	248	111-139 m	165 m	191 m	N/A	BAR and BAL	Yes
Golden Highway/ Spring Ridge Road	248	111-139 m	165 m	191 m	AUR and AUL	BAR and BAL	No
Wollar Road/ Barigan Street/ Phillip Street	97	55-69 m	55 m	162 m	BAR and BAL	BAR and BAL	No
Brooklyn Road/ Laheys Creek Road	248	111-139 m	165 m	191 m	BAR and BAL	BAR and BAL	No
Castlereagh Highway/ Laheys Creek Road	248	111-139 m	165 m	191 m	BAR and BAL	BAR and BAL	No
Cope Road/Blue Springs Road	248 m	111–139 m	165 m	191 m	BAR and BAL	BAR and BAL	No

BAR – basic right turn

BAL – basic left turn

CHL – channelised left turn

AUL –auxiliary left turn

17.4.3 Access tracks to transmission lines

Access tracks to the construction area would be provided via access gates located along the transmission line corridor. Access to the gates would be via existing local roads or new access tracks to be constructed as part of the project where necessary. The traffic demand to these access points would generally be up to 32 vehicle movements per hour during peak construction periods, comprising approximately 20 heavy vehicle and 12 light vehicle movements.

The location of temporary access tracks was determined by EnergyCo based on the suitability for use based on topography, proximity to a public road and to minimise impacts to surrounding properties. Intersections of access tracks with public roads would be appropriately designed to ensure safe, adequate and all-weather access that can accommodate the different types of construction vehicles. Further detail on design considerations for access tracks and intersections is provided in section 5.2.2.3 of Technical paper 13.

17.4.4 OSOM movements

Construction of the project would require OSOM movements to the energy hubs and other locations across the construction area for the delivery of specialist electrical equipment and construction plant, materials and equipment. Appropriate travel permits for OSOM movements outside of pre-approved routes (i.e. 'last mile' sections) would be sought from the National Heavy Vehicle Regulator (NHVR). The OSOM movements would need to travel along some roads which are not gazetted for OSOM and RAV use, include:

- Spring Ridge Road between the Golden Highway and the Elong Elong Energy Hub access point
- Merotherie Road between the Golden Highway and the Merotherie Energy Hub access point
- Ulan Road, Ulan-Wollar Road, Barigan Street, Wollar Road and Barigan Road to access the New Wollar Switching Station. It is noted that this route has been approved for RAV use (up to 25/26 metres B-double) and has previously been used by other projects (e.g. Wollar Solar Farm) to access the site for construction.

As discussed in Section 17.2.2, EnergyCo is proposing to upgrade certain roads, including sections of Merotherie Road and Spring Ridge Road (including intersections) as part of a separate works package which would be assessed and determined under Division 5.1 of the EP&A Act to allow these time critical works to be determined and commence construction prior to the determination of the CSSI application.

17.4.5 Interaction with road and rail networks during the stringing of transmission lines

Traffic controls would be implemented to safely manage general traffic passing in proximity to the construction area. During transmission line stringing works, traffic controls would be implemented to safely manage traffic passing the work area. This may entail localised traffic controls (stop/go) being implemented, and/or a reduction in speed limits.

Any road closures that would result in a substantial impact would be assessed on a case-by-case basis, and approval sought from the relevant road authority in consultation with emergency services, landowners and other relevant stakeholders. Where feasible, temporary closures would be planned outside of the traffic peak periods to minimise impact to the road network. Where this not possible, temporary hurdles may be used (being vertical structures to support new conductors being strung across transport corridors), which would protect the existing infrastructure and allow continued use during the stringing operation.

Potential short term disruptions to rail operations (train movements) may occur during the stringing of transmission lines across the railway tracks at three locations along Sandy Hollow–Gulgong railway track and at two locations along the Wallerawang-Gwabegar railway track. These lines are used for non-passenger services (such as coal freight trains). Where required, the required access arrangements and approvals (including track possessions) would be sought and implemented for all temporary works that require access to and/or affect operations within the rail corridor. Any works traversing rail corridors would be assessed on a case-by-case basis, and prior approval sought from ARTC.

Full or partial track possessions would be sought for all temporary works that require access to the rail corridor. Any works traversing rail corridors would be assessed on a case-by-case basis, and prior approval sought from ARTC. These activities are unlikely to impact rail operations as these works would likely occur during rail maintenance periods or during rail possessions. Similar to works next to or above the road network, temporary hurdles may be used if a localised rail possession is required.

17.4.6 Impacts to road condition

The impact of project construction traffic on road pavement condition is expected to be minor. Heavy vehicles would likely have a larger impact on road pavement conditions; however the impact would depend on the existing road condition including remaining life of the pavement. Prior to construction, the Network Operator would be required to undertake pre-condition surveys of local roads along the construction route to record their condition along the construction routes on local council roads to confirm the existing condition of the road. Any rectification works that are required as a result of the project would be completed in consultation with the relevant council.

17.4.7 Road safety

Construction vehicle movements would occur across the road network as vehicles travel to/from construction compounds, workforce accommodation camps and the transmission line corridor. This increases interactions with the road network and also introduces risks associated with traffic movements into/out of multiple access points. Accordingly, appropriate traffic management, intersection treatments, signs and line marking are to be implemented at vehicle access points to minimise this impact. The impact to construction site locations and associated access points during construction is therefore considered to be low.

There is potential for driver fatigue due to the distances covered by required construction routes. As such, effective fatigue management would be implemented for drivers to minimise road safety issues associated with fatigue. The impact to driver fatigue during construction is therefore considered to be moderate.

17.4.8 Active transport

The project would not directly impact any formalised active transport facilities and construction activities would have limited interaction with active transport facilities given most works would occur beyond the road reserve.

Some construction routes use roads that form part of the Central West Cycle Trail. This part of the trail is known as the Gulgong to Dunedoo route and passes through sections of Barneys Reef Road, Merotherie Road and Birriwa Bus Route South. Merotherie Road and Birriwa Bus Route South in particular would be actively used by construction traffic with the Merotherie Energy Hub and main camp site located off these roads.

To minimise the impact of the project to this section of the Central West Cycle Trail, there would be active consultation with the cycling group, Mid-Western Regional Council and Warrumbungle Shire Council concerning the intended construction activities and/or construction movements that would be occurring on the affected routes. This may include provision of suitable road condition for cycling, separation of cycling route through the construction site wherever practicable, and consideration of traffic measures to manage safe movement for cyclists. Where absolutely necessary, temporary alternative access arrangements may need to be provided during a high-risk construction activity following consultation with affected stakeholders and relevant local councils.

17.4.9 Public transport

Interactions with public transport services would be limited to construction vehicles along construction routes or due to occasional road closures for stringing activities. However, any impacts on public transport services would be negligible as most roads would continue to operate with minimal impact on capacity or efficiency (as discussed in Section 17.4.1).

17.4.10 Property access and emergency services

Construction of the project would not significantly impact access to properties or disrupt emergency services. In the event of temporary, partial road closures or disruption to property access, the Network Operator would consult and/or notify the affected property owners of any changes to the road network. Where necessary, temporary alternative access to private property would be provided.

Similarly, any partial road closures would be coordinated with relevant road authority and emergency services would be notified of any required detours and duration of the task.

17.5 Potential impacts – operation

The routine inspection and/or maintenance of the project by staff and contractors would be variable, with a peak operational workforce of up to 60 personnel, comprising a combination of office and site-based roles. Site-based inspections and maintenance activities of the transmission infrastructure would occur infrequently, and would typically be carried out by three to five personnel and would generate minimal light vehicle traffic. As such, the impacts on the road network, in terms of capacity, efficiency and safety, and impacts on other road users (such as public and active transport) would be negligible.

17.6 Management of impacts

17.6.1 Environmental management

Traffic and transport impacts during construction would be managed in accordance with a traffic management sub-plan, which would form part of the Construction Environmental Management Plan (CEMP). The sub-plan would be prepared in consultation with local councils and Transport for NSW, and would include (but is not limited to):

- measures to manage impacts on the local road network and to maintain access to properties. This includes site specific traffic control measures to manage and regulate traffic movement
- a Vehicle Movement Plan and Driver Fatigue Management Plan to manage construction vehicles movements along construction routes
- notification and engagement procedures for property owners and/or local community where access could be disrupted by construction work
- incident response procedures.

Further details of the CEMF are provided in Chapter 21 (Environmental management) of the EIS.

17.6.2 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to traffic and transport are listed in Table 17-11.

Table 17-11 Proposed mitigation measures – Traffic and transport

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
T1	Intersection and access point upgrades	As part of the detailed design process, an evaluation of the potential need for upgrades to the following intersections will be undertaken as detailed below: • Intersection of Ulan Road /Neeleys Lane: Investigate and confirm if short channelised right and/or auxiliary left turn treatments (or suitable alternative) are required for safe access to the satellite workforce accommodation camp. • Intersection of Golden Highway/Ulan Road: Investigate and confirm if a new short channelised right turn treatment (or suitable alternative) is required to provide safer intersection operation and to accommodate additional increases in traffic demand during construction. Where the need for intersection upgrades are required, these will be designed and constructed in accordance with Austroads Guidelines, relevant applicable standards and consider the appropriate design vehicles.	Detailed design	Intersections and access points to construction sites

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
T2	Road and traffic management	Traffic control plans will be prepared in consultation with the relevant road authorities. The plans will be implemented by licenced traffic management contractors. Necessary road occupancy licences and road related work approvals will be obtained prior to the commencement of relevant works (including site access and access tracks).	Construction	Construction routes, access tracks, construction compound and workforce accommodation camp accesses
T3	Road safety – design related	All accesses will be designed to accommodate the required construction vehicle(s) requiring access, and in accordance with relevant Austroads guidelines (where applicable). Road safety audits and routine inspections will be completed on a regular basis.	Construction	Construction routes, access tracks, construction compound and workforce accommodation camp accesses
T4	Road safety – driver related	The following road safety measures will be implemented with regard to driver management during construction: • A Driver Code of Conduct will be developed and implemented. The code will 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. • In-vehicle monitoring systems (IVMS) will be installed in relevant vehicles to monitor load limits and fatigue management. • A Driver Fatigue Management Plan will be developed and implemented as part of the Construction Environmental Management Plan, and will incorporate appropriate measures to manage driver fatigue risks, including, but not limited to: — planning of regular breaks — mapping locations of driver rest areas along the proposed construction routes.	Construction	Construction routes, access tracks, construction compound and workforce accommodation camp accesses
T5	Rail safety	Early and ongoing consultation with the ARTC will be undertaken for works which will cross over existing rail lines. Relevant works will only proceed following receipt of applicable approvals/permits, including accreditations for workers requiring access within the rail corridor to undertake construction activities.	Construction	Where the transmission line requires access to rail corridor over railway tracks on select railway lines
T6	Access track condition	Access tracks used for construction sites, construction compounds and workforce accommodation camps will be maintained to safe standard.	Construction	All areas affected by construction including construction routes, access tracks, construction compounds and workforce accommodation camp accesses

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
T7	Road condition	Pre-construction road dilapidation surveys and routine inspections will be completed along all nominated construction routes on local roads. Where rectification works are required due to project impacts, consultation with the appropriate road authority will be undertaken to confirm the scope of the work required.	Pre-construction Construction	Local roads
T8	Temporary lane closures or temporary road closures	Road Occupancy Licence(s) will be sought for all temporary lane closures (as required). Where road closures are likely to result in a significant traffic impact (e.g. short-term full road closure and long-term temporary lane/ road closures), prior consultation will be undertaken with potentially affected stakeholders (e.g. landowners, emergency services, transport services) and relevant approval(s) obtained from the relevant roads authority. Where feasible, temporary road closures will be planned to occur outside of the traffic peak periods to minimise impacts to the road network.	Construction	All roads that intersect with the transmission line alignment (for stringing of transmission lines) or on construction routes
T9	Access to properties	Access to properties will be maintained throughout construction where feasible. Where this is not feasible, temporary alternative access arrangements will be provided following consultation with affected landowners and in accordance with the requirements of the pre-construction and construction Communication and Engagement Plan (as detailed in mitigation measure SI5). Disruptions to property access and traffic will be notified to landowners at least five days prior and in accordance with the relevant community consultation processes outlined in the Construction Environmental Management Plan.	Construction	All areas affected by construction
T10	Pedestrian and cyclist access	The project will actively consult with local bicycle groups, such as Central West Cycle (CWC) during construction, particularly regarding construction routes proposed on CWC's cycling route between Gulgong to Dunedoo. Safe pedestrian and cyclist access will be maintained where the project interacts with existing pedestrian or bicycle facilities. Where this is not feasible, temporary alternative access arrangements will be provided following consultation with affected stakeholders and the relevant roads authority.	Construction	All areas affected by construction
T11	Heavy vehicles using road network	A Vehicle Movement Plan will be prepared which identifies the construction vehicle route(s) (including OSOM routes) to be used during construction. The Vehicle Movement Plan will also include details of activities of adjoining land uses and awareness of public safety measures (e.g. entering urban areas from the highways) to provide guidance to drivers of construction vehicles travelling to and from project locations. Ongoing consultation will be undertaken with Transport for NSW regarding the use of State roads for OSOM vehicle routes.	Pre-construction Construction	Construction routes

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
T12	Access tracks maintenance and safety	The following maintenance and safety measures will be implemented at relevant locations along each of the access tracks, construction compounds and workforce accommodation camp access: • appropriate line marking and signage at access points • wheel cleaning facility as required at access points/intersections • signage to indicate trucks turning • potential use of road plates, propping (or similar) over culverts where required • improvements to existing roads at new access points which may include importing or stabilising material if required.	Construction	Access tracks, construction compound and workforce accommodation camp accesses

18 Waste management

This chapter provides an assessment of the potential impacts associated with waste generation during construction and operation of the project and identifies mitigation measures to be adopted for the project to avoid, minimise and manage these impacts. The Secretary's Environmental Assessment Requirements (SEARs) as they relate to waste management, and where in the Environmental Impact Statement (EIS) these have been addressed, are detailed in Appendix A (SEARs).

18.1 Legislative and policy context

Waste management and recycling is regulated in NSW through various legislative instruments, including the *Protection of the Environment Operations Act 1997* (POEO Act), Protection of the Environment Operations (Waste) Regulation 2014 (the Waste Regulation), Protection of the Environment Operations (General) Regulation 2022, and *Waste Avoidance and Resource Recovery Act 2001* (WARR Act), as described in Appendix C (Statutory compliance).

A key object of the WARR Act is to ensure that resource management options are considered against a waste management hierarchy in the following order:

1. avoidance and reduction of waste
2. reuse of waste
3. recycling, processing, or reprocessing waste
4. recovery of energy
5. disposal.

The assessment was also undertaken with reference to the following policy and strategies:

- *NSW Government Resource Efficiency Policy* (OEH, 2019b), which aims to reduce the NSW Government's operating costs and to drive resource efficiency by NSW Government agencies in four main areas – energy, water, waste and air emissions from government operations
- *NSW Waste and Sustainable Materials Strategy 2041 – Stage 1: 2021–2027* (NSW DPIE, 2021b), which outlines the actions the NSW Government will take from 2021 to 2027 to achieve long term targets for waste reduction and landfill diversion.

Although the *NSW Waste Avoidance and Resource Recovery Strategy 2014–21* (NSW Environment Protection Authority (EPA), 2014b) is no longer current, the general principles and vision of the strategy are still relevant, and have been considered, where possible throughout this assessment.

The POEO Act, Waste Regulation and supporting guidelines, including the *Waste Classification Guidelines* (NSW EPA, 2014a) (Waste Classification Guidelines), provide classifications and descriptions that apply to waste in NSW. In particular, the Waste Classification Guidelines provide direction on the classification of waste, specifying requirements for the handling, management, transportation and disposal of each waste category as defined in clause 49 of Schedule 1 of the POEO Act. If a waste is not pre-classified, it may need to be tested to determine its classification prior to off-site disposal.

The Waste Regulation also sets distance limitations on where certain waste must be managed based on the point of origin (referred to as the principle of proximity). For waste generated within NSW, this requires any waste to be managed at facilities that can lawfully accept the disposal of that waste and that are either located within 150 kilometres from the point of origin, or at the closest or second closest facility if none are located within 150 kilometres. Restricted solid waste must also be transported to the closest facility that can lawfully accept the disposal of waste. However, pursuant to clause 71(6) of the Waste Regulation, the NSW EPA may grant an exemption in relation to these requirements for the transportation of category 1 trackable waste or category 2 trackable waste. Further exemptions can be made by the NSW EPA under Clause 91 of the Waste Regulation.

18.2 Assessment approach

The assessment of potential impacts associated with waste generation during construction and operation of the project involved:

- reviewing the regulatory framework for waste management, as relevant to the project
- identifying, quantifying and classifying potential waste generating activities generated during construction and operation
- identifying opportunities to reduce waste generation through construction planning, continued development of the project design and beneficial reuse
- considering engagement outcomes relevant to the assessment, in particular feedback received from local government
- identifying potential impacts associated with waste and resource use as a result of the project
- identifying waste management measures for construction and operation.

The waste types and quantities of waste detailed in this assessment are indicative and have been identified for the purpose of determining potential waste impacts and waste management options. Typical management measures, in line with NSW regulatory frameworks, have been proposed to appropriately manage potential waste and resource use impacts.

The study area for this assessment consists of the four local government areas (LGAs) that the project is located within, being the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs.

18.3 Existing environment

Existing waste sources in the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs primarily includes waste from agricultural, mining and forestry operations and domestic waste.

A number of waste management and waste transfer facilities operated by local councils are located near the project and accept a wide range of wastes, including construction and demolition waste, domestic waste and recyclable materials. Table 18-1 identifies existing waste management facilities within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs, and the waste types able to be received by these facilities.

Engagement with the relevant councils has indicated the Mudgee Waste Facility is at capacity and would not be able to accept waste generated from the construction of the project, and commercial waste is not accepted at the Mid-Western Regional council-operated Gulgong Waste Facility. In addition, the Wellington Waste Transfer Station and Cassilis Waste Management Facility do not accept large volumes of waste.

Table 18-1 Waste management facilities within the study area

Facility name	Council	Wastes accepted according to waste classification	Approximate distance from project (by road)
Whylandra Waste and Recycling Centre (Cooba Road, Dubbo)	Dubbo Regional Council	• General solid waste (non-putrescible) • Hazardous waste	78 kilometres (km) west of western section of project
Wellington Waste Transfer Station (83 Nanima Village Road, Wellington)	Dubbo Regional Council	• General solid waste (non-putrescible) • Hazardous waste • Liquid waste	59 km south of western section of project
Mudgee Waste Facility (31 Blain Road, Caerleon)	Mid-Western Regional Council	• General solid waste (putrescible and non-putrescible) • Hazardous waste • Special waste • Restricted solid waste	42 km south of central section of project
Gulgong Waste Facility (62 Mineshaft Lane, Gulgong)	Mid-Western Regional Council	• General solid waste (putrescible and non-putrescible) • Hazardous waste	19 km southwest of central section of project
Kandos Waste Facility (110 Kandos Tip Road, Kandos)	Mid-Western Regional Council	• General solid waste (putrescible and non-putrescible) • Hazardous waste	90 km south of southeastern section of project
Baradine Waste Transfer Station (1630 Baradine Road, Baradine)	Warrumbungle Shire Council	• General solid waste (putrescible and non-putrescible) • Liquid waste	144 km north of northwestern section of project
Binnaway Waste Transfer Station (3856 Warrumbungle Way, Binnaway)	Warrumbungle Shire Council	• General solid waste (putrescible and non-putrescible) • Liquid waste	66 km north of northwestern section of project
Coolah Waste Transfer Station (101 Neilrex Road, Coolah)	Warrumbungle Shire Council	• General solid waste (putrescible and non-putrescible) • Liquid waste	31 km north of northwestern section of project
Coonabarabran Waste Transfer Station (4202 Baradine Road, Coonabarabran)	Warrumbungle Shire Council	• General solid waste (putrescible and non-putrescible) • Commercial waste (building and demolition) • Hazardous waste • Special waste • Liquid waste	108 km north of northwestern section of project
Dunedoo Waste Transfer Station (129 Avonside Road, Dunedoo)	Warrumbungle Shire Council	• General solid waste (putrescible and non-putrescible) • Liquid waste	25 km north of central section of project
Mendooran Waste Transfer Station (Tooraweenah Road, Mendooran)	Warrumbungle Shire Council	• General solid waste (putrescible and non-putrescible) • Liquid waste	55 km north of western section of project
Ulamambri Waste Transfer Station (3328 Box Ridge Road, Ulamambri)	Warrumbungle Shire Council	• General solid waste (putrescible and non-putrescible)	100 km north of northwestern section of project
Scone Waste Management Facility (129 Noblet Road, Scone)	Upper Hunter Shire Council	• General solid waste (non-putrescible) • Hazardous waste	128 km east of the northwestern section of project

Facility name	Council	Wastes accepted according to waste classification	Approximate distance from project (by road)
Cassilis Waste Management Facility (9756 Golden Highway, Cassilis)	Upper Hunter Shire Council	• General solid waste (putrescible and non-putrescible)	0.2 km northeast of the northeastern section of the project
Merriwa Waste Management Facility (96 Depot Road, Merriwa)	Upper Hunter Shire Council	• General solid waste (non-putrescible) • Hazardous waste	52 km east of northwestern section of project

18.4 Waste generation

18.4.1 Construction

The project has been designed, as far as practicable, to minimise the generation of waste through developing a project design which minimises excavation, an alignment which minimises demolition and a construction methodology which maximises the reuse of materials.

To facilitate waste avoidance and reduction planning and allow for considered and responsible management of unavoidable waste, the different types of waste and materials that may be generated by the project need to be identified early in the project development process.

The estimated potential construction waste streams and quantities generated by the project, based on the current design and indicative construction methodology, are outlined in Table 18-2. Most of the expected waste streams are likely to be classified as general solid waste (non-putrescible).

Estimated construction waste quantities, including indicative volumes of spoil generation, spoil reuse and spoil surplus quantities, would be confirmed during detailed design and incorporated into the Construction Environmental Management Plan (CEMP) for the project. Waste classifications and reuse/recycling/disposal locations would also be confirmed at that stage.

Table 18-2 Potential waste streams during construction

Construction activity	Waste stream	Likely classification of waste stream	Indicative volume
Clearing and grubbing	Green waste, including timber, shrubs, grasses, leaves and weeds	General solid waste (non-putrescible)	265,000 cubic metres
General earthworks and excavation activities	Spoil from excavations that is unsuitable for reuse	General solid waste (non-putrescible), subject to classification	1,000 tonnes (t)
Concrete batching plants	Concrete waste	General solid waste (non-putrescible)	12,500 t
Construction of project infrastructure and demobilisation of supporting infrastructure for workforce accommodation camps	Steel and other metals	General solid waste (non-putrescible)	2,100 t
	Timber used in forming of foundations or piles	General solid waste (non-putrescible)	3 t
	Conductor, earthing and tower waste materials, pipe and conduit, and electrical cabling	General solid waste (non-putrescible)	200 t
	Hazardous waste and/or contaminated waste	Hazardous waste and/or special waste (e.g. asbestos)	85 t
Construction of access roads	Asphalt, road base, concrete and gravel	General solid waste (non-putrescible)	Less than 150 t

Construction activity	Waste stream	Likely classification of waste stream	Indicative volume
Maintenance of construction plant, vehicles and equipment	Vehicle/plant maintenance: • empty oil and other containers/drums • lubricants, waste oils, fuels, coolant, radiator fluid, hydraulic fluid • drained oil filters • electrical waste, including batteries and cables • tyres	• General solid waste (non-putrescible) — drained oil filters (mechanically crushed), rags and oily rags (only if they contain non-volatile petroleum hydrocarbons and no free liquids) • Hazardous waste — containers holding oil, grease, and lubricants if residues have not been removed by washing • Liquid waste (oils) • Special waste (tyres)	33 t (empty oil and other containers) 130 t of liquid waste
Transportation of materials required for construction	Transportation and packaging waste, including plastic, paper, cardboard, pallets, fumigated timber cable drums	General solid waste (non-putrescible)	1,200 t
Activities at construction compounds and accommodation camps	General domestic waste, including food waste, paper, cardboard, plastic and glass	General solid waste (putrescible and non-putrescible)	2,500 t
Dewatering, dust suppression, washdown of plant and equipment and staff amenities	Wastewater, including concrete washouts and sewage	Liquid waste	300 megalitres

18.4.2 Operation

Waste generated during operation of the project is anticipated to be minimal and would mainly relate to the following operation and maintenance activities:

- periodic maintenance activities which would have the potential to generate some materials where elements of the project are required to be replaced or serviced
- general domestic waste generated by maintenance personnel
- vegetation management activities (which would typically be limited to maintenance of vegetation clearances limits within the operation area).

The anticipated waste streams during operation are shown in Table 18-3.

Table 18-3 Potential waste streams during operation

Frequency	Waste stream	Likely classification of waste
Less than yearly	Sewage and grey water	Liquid waste
Yearly	Domestic waste	General solid waste (non-putrescible)
	Rubbish and debris	General solid waste (non-putrescible)
5 per 20 years	Waste oil from energy hub transformers	• Hazardous waste — containers holding oils if residues have not been removed by washing • Liquid waste (oil)
	Green waste from vegetation maintenance	General solid waste (non-putrescible)
1 per 50 years	Waste conductors, earthing and tower materials, including aluminium, steel and copper	General solid waste (non-putrescible)
	Packaging waste, including plastic, paper and cardboard	General solid waste (non-putrescible)
	Transportation pallets	General solid waste (non-putrescible)
	Steel and fumigated timber cable drums (used for transportation/storage of transmission cables)	General solid waste (non-putrescible)
	Silica gel	Hazardous waste
	Lubricant oil	• Hazardous waste — containers holding lubricants if residues have not been removed by washing • Liquid waste (oil)
	Batteries	Hazardous waste

18.5 Potential impacts

18.5.1 Construction

If improperly managed, waste generated during construction of the project has the potential to contaminate soils, pollute water and generate leachate, odours and dust as well as result in associated environmental, health and safety risks.

Local waste management facilities closest to the project may have limited or no capacity to accept construction waste from the project (as discussed in Section 18.3) and may also have restrictions on throughput. If closer (but generally smaller) local facilities are unable to accept the waste quantities from the project, there may be a requirement to transport the waste generated by construction of the project (most likely via road transport using heavy vehicles) to larger regional facilities (where permitted by the Waste Regulation) located further away from the construction area. This may have the impact of longer and different waste haulage routes and additional traffic movements on the road network.

The potential impacts associated with waste generation and management during construction of the project are summarised in Table 18-4.

Table 18-4 Potential impacts associated with improper management of construction waste

Aspect of waste management	Potential impacts
Generation of waste, including excavation and handling	• environmental impacts associated with generation and handling of construction waste on-site, including: — dust from excavation, handling and movement of waste — erosion and sedimentation due to runoff from exposed surfaces during stockpiling and spoil handling — mobilisation of acid sulfate soil, where present — sediment laden/contaminated runoff and leachate generation, which if located close to receiving water bodies, could impact water quality and aquatic ecosystems — noise from plant and equipment movements associated with excavation and handling of waste on site — human health risks to construction workers and at off-site locations due to handling of contaminated soils and hazardous materials, such as asbestos and coal tar asphalt, lead paint, refrigerant and greenhouse gases • energy and water consumption associated with the manufacturing of packaging • environmental impacts associated with extraction of resources, including land degradation, biodiversity loss, noise, air and water pollution, waste generation, resource depletion.
Storage and segregation of waste	• odours and dust from stockpiling/storage of wastes • odours from septic tanks • cross contamination of wastes and soils due to improper segregation and storage • contamination of soils, groundwater and surface water from wastewater spills • human health and safety risks due to storage of contaminated soils and hazardous materials, such as asbestos, coal tar asphalt, lead paint, refrigerant, Sulfur Hexafluoride gas (SF_6) and batteries • sediment laden/contaminated runoff and leachate generation, which if located close to receiving waterbodies could impact water quality and aquatic ecosystems • waste build up from irregular or disrupted collections • attracting illegal dumping from third parties on stockpile sites or other waste storage areas • littering.
Waste transportation	• dust from loading waste onto vehicles and movement of waste on haul roads • road traffic noise from waste collection vehicles and movement of spoil • traffic generated by haulage of spoil to reuse/disposal facilities • odours from loading waste onto vehicles and movement of waste collection vehicles to disposal or recycling facilities • mud tracking on road from waste collection vehicles • unlawful transport of waste from the construction area.
Non-classified or incorrectly classified waste transport and disposal	• regulatory non-compliance • contamination of recycling facilities/landfills • contamination of soils, groundwater and/or surface water.
Unlicensed waste contractors transporting waste	• regulatory non-compliance • potential illegal dumping of waste • potential for disposal at unlawful unlicensed receival sites.
Waste recycling or disposal	• waste management facilities not able to accept waste due to limited capacity • traffic generated by haulage of waste to larger waste management facilities further away from the project.

The potential environmental impacts associated with the handling, on-site storage and transportation of waste are considered in the following chapters:

- Chapter 15 (Noise and vibration), for noise impacts associated with the use of construction equipment for excavation and stockpiling, and heavy vehicle movements
- Chapter 17 (Traffic and transport), for impacts associated with heavy vehicle movements, including transport of waste
- Section 19.1 (Hydrology, flooding and water quality) and Section 19.2 (Soils and contamination), for impacts associated with sediment, leachate generation and handling and storage of material on the project site
- Section 19.4 (Air quality), for air quality impacts including vehicle emissions and dust, associated with the excavation, handling and transport of material
- Section 19.5 (Climate change and greenhouse gas), for impacts associated with greenhouse gas emissions associated with the use of construction equipment for excavation, handling and transport of waste.

Construction waste management activities would not have a significant impact on the environment or human health provided:

- the mitigation measures provided in the chapters listed above are implemented
- construction wastes are managed as described in Section 18.6.1
- additional waste mitigation measures provided in Section 18.6.2 are implemented.

18.5.2 Operation

Potential impacts associated with operational waste generation and management would be consistent with the potential impacts identified during construction (refer to Table 18-4), however are expected to be minor due to the fewer waste streams and significantly smaller waste volumes generated during standard operational and maintenance activities. With the implementation of operational waste management procedures described in Section 18.6.1, and additional waste mitigation measures provided in Section 18.6.2, any residual impacts would be minimal.

18.6 Management of impacts

18.6.1 Approach to waste management

The approach to waste management would be guided by the waste management hierarchy, as set out in the WARR Act, with a focus on avoidance and reuse before consideration is given to recycling and disposal. Further optimisation of the project's design and construction methodology would continue, where practicable, to reduce material energy and fuel inputs, and incorporate sustainable procurement elements. All wastes generated from the project would be managed in accordance with the waste provisions contained within the POEO Act (including the conditions of any Environment Protection Licence (EPL) for scheduled activities under the POEO Act), and other relevant legislative and policy requirements, as defined by the instruments, strategies, policies and guidelines listed in Section 18.1.

Resource recovery orders and resource recovery exemptions issued by the NSW EPA allow some wastes to be beneficially and safely reused independent of the current legislative requirements for the disposal and reuse of waste at appropriately licensed facilities (such as holding an EPL and paying the waste levy for disposal). Waste generators and processors must meet all the conditions of an order to supply a resource recovery waste to a consumer. Those conditions may include material specification, record-keeping requirements and reporting. Resource recovery orders and exemptions may apply to the management of waste from construction of the project.

Waste management facilities that accept waste and recyclable materials within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs that the project is located within, are outlined in Section 18.3. The recycling and disposal facilities for each waste type would be determined based on availability/capacity, waste licensed to be accepted, and confirmed waste classifications. Arrangements would be made with waste management facilities, prior to the delivery of waste and recyclables to any facility, to ensure that the waste types and quantities can be accepted (refer to mitigation measure WM2 in Table 18-7).

The proposed approach to managing the different types of construction and operational waste, including measures to prevent cross contamination, are provided below. Additional mitigation measures, proposed to mitigate potential impacts if waste is not managed appropriately, are provided in Section 18.6.2.

Waste management – construction

Waste generated during construction of the project would be managed in accordance with the Construction Waste Management Plan, which would form part of the CEMP. The plan would define the processes, responsibilities and management measures that would be implemented during construction to manage waste. The plan would be prepared consistent with the *NSW Waste and Sustainable Materials Strategy 2041 – Stage 1: 2021–2027* (NSW DPIE, 2021b) and apply the circular economy principles to waste management.

The Construction Waste Management Plan would include (but not be limited to):

- how construction waste would be managed in accordance with the waste management hierarchy of the WARR Act (refer to Section 18.1)
- targets for the recovery, recycling and reuse of construction waste
- procedures for the handling, storage, classification, management and disposal of waste
- waste tracking and compliance management
- waste management facilities to be used by the project.

There is the potential for unexpected volumes of waste to be generated, including potentially contaminated material. During construction planning, suitable areas would be identified (within the construction area if practicable) to allow for contingency management of unexpected waste, including contaminated materials. Any previously unidentified contaminated material would be managed in accordance with the unexpected contaminated finds procedure described in Section 19.2 (Soils and contamination).

Throughout construction, waste would be segregated to minimise contamination and increase waste diversion from landfill. The approach to managing the different types of construction waste in accordance with the waste management hierarchy would be outlined in the Construction Waste Management Plan and is provided in Table 18-5.

Table 18-5 Management of construction waste

Waste type	Hierarchy	Management of waste
Green waste	Avoid	Clearing would be minimised as far as practicable by placing temporary infrastructure in cleared areas, as well as optimisation of the construction methodology to reduce the extent of vegetation clearing required.
	Reduce	Areas to be cleared would be demarcated, to reduce incidental clearing.
	Reuse	As far as practicable, weed-free green waste would be chipped, mulched and stockpiled for reuse within the construction area during finishing works, or for reuse as part of other projects in accordance with the requirements of any applicable resource recovery order and exemption. Materials with special habitat value, such as hollow-bearing logs or trees, would be selectively removed for reuse, or placed in nearby bushland where permitted.
	Dispose	If green waste cannot be reused, it would be collected by an authorised contractor and recycled off-site at an appropriately licensed facility. Weeds that present a biosecurity risk would be handled and disposed of in accordance with relevant guidelines or requirements.
Excavated materials	Reduce	Ongoing design development and construction planning would minimise the amount of excess excavated material generated as far as practicable. The project is designed to adhere to the natural ground profile, where practicable, in order to reduce the extent of earthworks required. Excavated material would be classified in accordance with the Waste Classification Guidelines. Material suitable for reuse would be segregated (where practicable) to enable reuse on-site or off-site. In situ testing of soils or excavated material in areas of potential contamination concern identified in Section 19.2 (Soils and contamination) would be undertaken to determine the appropriate waste classification of soils/materials. Any contaminated material disturbed during construction would be separated from uncontaminated material on-site to prevent cross contamination. Management of contamination and any resulting remediation would be carried out in accordance with the relevant legislation, standards and guidelines.
	Reuse	Material with suitable engineering properties that meets soil quality requirements (excluding prohibited or prescribed materials under the POEO Act and Protection of the Environment Operations (General) Regulation 2022) would be reused within the construction area where practicable, including for rehabilitation of borrow pits. Excess usable material would be transported off-site for reuse on other project sites, in accordance with the requirements of the relevant resource recovery order and exemption.
	Dispose	Excess material (including contaminated material) that is unable to be reused within the construction area or other project sites would be transported off-site by an authorised contractor, for treatment and/or disposal at an appropriately licensed facility based on its waste classification.

Waste type	Hierarchy	Management of waste
General construction and demolition waste (including waste from demobilisation of workforce accommodation camps), including concrete, asphalt, wood, bricks, gravel, scrap metals, conduits and pipes, conductor and earthing waste materials, electrical cabling and demountable accommodation and office buildings	Avoid	Procurement of surplus concrete materials, metal, wood, electrical equipment and cabling would be avoided as far as practicable by adhering to the *NSW Government Resource Efficiency Policy* (OEH, 2019b). Precast elements would be used where practicable (e.g. culverts).
	Reuse	Wood waste would be stored on-site for reuse and cured concrete would be crushed down to a recovered aggregate and utilised in general fill, pavement materials and for minor construction elements such as access tracks, where practicable. Recycling and reuse options of pipe and conduit would be investigated and implemented if practicable. Where practicable, waste would be segregated and stockpiled on-site and collected by an authorised contractor for off-site recycling at a construction and demolition waste recycling facility. Methods would be implemented to avoid mixing and avoid contamination for coal tar impacted asphalt from other layers in the road. This would include, where practicable, stripping off existing pavement in layers, and segregating different materials to avoid cross contamination. The respective pavement materials would be classified based on their potential for reuse, recycling or disposal in accordance with the waste hierarchy identified in the WARR Act. Opportunities for the reuse of demountable accommodation and office buildings would be investigated and pursued where practicable. Workforce accommodation camp buildings would be partially or completely disassembled onsite and transported to locations where it can be repurposed, where practicable.
	Dispose	Waste that cannot be recycled would be stored in designated storage areas and collected by an authorised contractor for off-site disposal at a suitably licenced facility.
Wastes from vehicle/plant maintenance, including adhesives, lubricants, waste fuels and oils, engine coolant	Avoid	Procurement of surplus oil, grease, and lubricants would be avoided as far as practicable by adhering to the *NSW Government Resource Efficiency Policy* (OEH, 2019b).
	Reuse	Recyclable waste oil and oil filters would be stored in recycling bins on-site and collected by an authorised contractor and recycled off-site, where practicable.
	Dispose	Waste from construction vehicle and plant maintenance activities that cannot be recycled would be collected and stored in designated waste storage areas for collection by an authorised contractor for off-site disposal. Where practicable, containers holding oil, grease and lubricants would be washed prior to disposal or stored separately for disposal as hazardous waste.
General domestic waste and packaging/ transportation waste and including paper, cardboard, plastics, glass, ferrous, and non-ferrous containers, pallets and food waste	Avoid	All personnel on-site would be mindful of consumption behaviours to avoid generating waste where practicable. Procurement of surplus materials would be avoided as far as practicable by adhering to the *NSW Government Resource Efficiency Policy* (OEH, 2019b).
	Reduce	Wastepaper from office/administration facilities would be minimised as far as practicable by enabling 'secure print' feature on all printers and by encouraging double-sided printing. Delivery of material on pallets would be limited as far as practicable. If materials have to be delivered to site on pallets, pallets would be returned to the supplier at time of delivery, where practicable, or otherwise recycled. Product stewardship arrangements would be sought, with a view to pallets being reused under the stewardship of the supplier.

Waste type	Hierarchy	Management of waste
	Reuse	Personnel would also be provided with waste training on how to use the waste bin system at each site compound and accommodation camp, and the level of source separation of waste required on-site prior to drop-off at site compounds or workforce accommodation camps. 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 practicable. Food organics would be stored in organics bins for collection by an authorised contractor, and composted off-site at an appropriately licensed facility, where practicable. Options to recover wood from pallets by chipping, for reuse as mulch, would be pursued where practicable (i.e. if untreated and uncontaminated).
	Dispose	Any rubbish or debris that is not recyclable would be placed in the general waste bin for collection by an authorised contractor and disposed of off-site at a licenced waste facility. Wood pallets not suitable for reuse or recycling would be stored in designated waste storage areas for collection by an authorised contractor for off-site drop-off.
Wastewater	Reuse	Opportunities for the reuse of wastewater, including concrete washout, would be investigated and pursued where practicable, and subject to meeting water reuse quality requirements. Options for wastewater reuse may include on-site reuse for construction purposes, such as concrete production, dust suppression and compaction of earthworks and pavement materials. Wastewater treatment facilities would be established at the workforce accommodation camps and potentially at the construction compounds, to produce effluent that meets the water quality requirements for dust suppression and use for other construction activities within the construction area.
	Dispose	Sewage and grey water from construction compounds (where wastewater treatment plants are not provided) and the initial establishment of the workforce accommodation camp sites would be disposed to sewer and transported via tanker trucks to an appropriately licenced liquid waste treatment facility. All wastewater treatments plants would produce sludge that requires disposal on regular intervals. Liquid waste sludge would be disposed to sewer and transported via tanker trucks to an appropriately licenced liquid waste treatment facility.

Waste management – operation

All operational waste would be managed by the Network Operator for the project. An Operational Environmental Management Plan (OEMP) (or equivalent system) would be prepared by the Network Operator, once appointed (refer to Chapter 20 (Environmental management)). This would include requirements for management of operational waste including the proposed approach to waste separation and sorting, storage, waste collection, handling, treatment and disposal processes to be adopted and monitoring and reporting requirements.

The approach to managing the different types of operational waste in accordance with the waste management hierarchy would be outlined in the OEMP and is provided in Table 18-6. The table also provides the contingency measures (disposal) for wastes that cannot be avoided, reused, recycled or treated.

Table 18-6 Management of operational waste

Frequency	Waste type	Waste classification	Hierarchy	Proposed waste management
Less than yearly	Sewage and grey water	Liquid waste	Dispose	Discharge to sewer or approved septic system.
Yearly	Domestic waste	General solid waste (non-putrescible)	Dispose	Removed from site and collected by regular waste collection service.
	Green waste from vegetation maintenance	General solid waste (non-putrescible)	Reuse	As far as practicable, green waste generated from maintenance activities would be chipped, mulched and reused for vegetation management or collected by an authorised contractor and recycled off-site.
			Dispose	Priority weeds would be disposed of in accordance with relevant guidelines/requirements.
	Rubbish and debris	General solid waste (non-putrescible)	Reuse	Rubbish and debris and any unexpected waste encountered during general maintenance activities may include electrical waste and other litter. Such wastes would be collected by an authorised contractor and recycled off-site, where recycling is considered practicable.
			Dispose	Where rubbish, debris and litter are not suitable to be reused, the waste would be collected by an authorised contractor and disposed off-site at a suitably licensed facility.
5 per 20 years	Waste oil from energy hub transformers	Hazardous waste — containers holding oils if residues have not been removed by washing Liquid waste (oil)	Reuse	Waste oil would be stored in recycling bins on-site and collected by an authorised contractor and recycled at a suitably licensed facility.
1 per 50 years	Waste conductor, earthing and tower materials, including aluminium, steel and copper	General solid waste (non-putrescible)	Reuse	Recyclable waste materials generated during the maintenance or replacement of operational equipment would be segregated and stored on-site and collected by an authorised contractor for recycling at a suitably licensed waste recycling facility.
			Dispose	Waste that cannot be recycled would be stored in designated storage areas and collected by an authorised contractor for off-site disposal at a suitably licenced facility.
	Packaging waste, including plastic, paper and cardboard	General solid waste (non-putrescible)	Reuse	Recyclable packaging materials such as paper, cardboard and plastics would be stored in recycling bins on-site for collection by an authorised contractor and recycled off-site.
	Transportation pallets	General solid waste (non-putrescible)	Reuse	Pallets would be returned to the supplier at time of delivery, where practicable.
	Steel and fumigated timber cable drums (used for transportation/storage of transmission cables)	General solid waste (non-putrescible)	Reuse	Fumigated timber cable drums would be returned to the supplier at time of delivery, where practicable. Steel waste would be collected by an authorised contractor for off-site recycling at a suitably licenced waste recycling facility.

Frequency	Waste type	Waste classification	Hierarchy	Proposed waste management
			Dispose	Waste that cannot be recycled would be stored in designated storage areas and collected by an authorised contractor for off-site disposal at a suitably licenced facility.
	Silica gel	Hazardous waste	Reuse	Silica gel would be stored in recycling bins on-site and collected by an authorised contractor for recycling at a suitably licensed facility.
	Lubricant oil	Hazardous waste — containers holding lubricants if residues have not been removed by washing Liquid waste (oil)	Reuse	Lubricant oil would be stored in recycling bins on-site and collected by an authorised contractor for recycling at a suitably licensed facility.
	Batteries	Hazardous waste	Reuse	Batteries would be collected by an authorised contractor and recycled at a suitably licensed facility.

18.6.2 Mitigation measures

The mitigation measures that would be implemented to address potential waste management issues are listed in Table 18-7. Through the implementation of these mitigation measures, residual impacts resulting from waste are anticipated to be appropriately managed.

Table 18-7 Proposed mitigation measures – Waste management

Reference	Mitigation measures	Timing	Applicable location(s)
WM1	Measures to minimise spoil generation, off-site disposal and reuse of material on-site will be investigated as part of the continued development of the project's design and construction methodology.	Pre-construction	All locations
WM2	EnergyCo will explore further opportunities with Mid-Western Regional, Dubbo Regional, Warrumbungle Shire and Upper Hunter Shire councils to reduce landfill demand placed on local waste management facilities as a result of the project	Pre-construction	All locations
WM3	Where practicable, opportunities to reuse or recycle waste and wastewater generated during construction and operation will be investigated during continued development of the project's design and construction methodology, as well as during operation, subject to meeting water reuse quality requirements.	Pre-construction	All locations
WM4	All waste generated by the project will be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014a) and the relevant requirements of the Protection of the Environment Operations (Waste) Regulation 2014.	Construction and operation	All locations
WM5	Waste streams will be segregated to avoid cross contamination of materials and maximise reuse and recycling opportunities.	Construction and operation	All locations
WM6	All waste generated and surplus spoil to be removed from the construction and operation of the project will be transported to appropriately licensed waste disposal or transfer facilities or other facilities lawfully able to accept materials.	Construction and operation	All locations

19 Other impacts

19.1 Hydrology, flooding and water quality

This section provides an assessment of the potential hydrology, flooding and water quality impacts of the construction and operation of the project and identifies mitigation measures to be adopted for the project to avoid, minimise and manage these impacts. The relevant assessments completed to support the Environmental Impact Statement (EIS) are provided in Technical paper 14 – Hydrology and water quality (Technical paper 14) and Technical paper 15 – Flooding (Technical paper 15). Potential groundwater impacts of the project, including impacts on groundwater levels, quality and recharge and flow, are assessed in Section 19.3 (Groundwater) and Technical paper 17 – Groundwater (Technical paper 17). The Secretary's Environmental Assessment Requirements (SEARs) as they relate to hydrology, flooding and water quality, and where in the EIS these have been addressed, are detailed in Appendix A (SEARs checklist).

19.1.1 Legislative and policy context

The hydrology, flooding and water quality assessment was undertaken in accordance with the SEARs and with consideration of the requirements of relevant legislation, plans, policies and assessment guidelines including:

- *Water Act 2007* (Water Act)
- *Murray–Darling Basin Plan 2012* (Murray–Darling Basin Authority, 2012) (Murray–Darling Basin Plan)
- Macquarie Castlereagh Surface Water Resource Plan, operating in accordance with Division 2 of Part 2 of the Water Act and the Murray–Darling Basin Plan
- *Water Act 1912* (Water Act), *Water Management Act 2000* (WM Act) and Water Management (General) Regulation 2018 (Water Management Regulation)
- relevant water sharing plans made under the WM Act, including:
  - Macquarie Bogan Unregulated Rivers Water Sources 2012
  - Hunter Unregulated and Alluvial Water Sources 2022
- *Protection of the Environment Operations (Hunter River Salinity Trading Scheme) Regulation 2002* (Hunter River Salinity Trading Scheme)
- Local Environmental Plans (LEPs), including the Warrumbungle LEP 2013, Mid-Western Regional LEP 2012, Dubbo Regional LEP 2022 and Upper Hunter LEP 2013
- *National Water Quality Management Strategy* (Department of Agriculture and Water Resources, 2018)
- *NSW Water Quality and River Flow Objectives* (NSW Department of Environment and Conservation, 2006) (NSW Water Quality and River Flow Objectives)
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council/ Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ), 2018) (ANZECC Guidelines for Fresh and Marine Water Quality)
- *Australian Rainfall and Runoff: A Guide to Flood Estimation* (Ball et al., 2019)

- *Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia, Handbook 7* (Australian Institute for Disaster Resilience, 2017)
- *NSW Floodplain Development Manual 2005* (NSW Government, 2005)
- *Planning Circular PS 21-006 – Considering flooding in land use planning: guidance and statutory requirements* (NSW Department of Planning, Industry and Environment (DPIE), 2021c)
- *Floodplain Risk Management Guideline: Practical Consideration of Climate Change* (NSW Department of Environment and Climate Change (DECC), 2007)
- *Controlled activities – Guidelines for riparian corridors on waterfront land* (NSW DPE, 2018c)
- Flood plans prepared by the NSW State Emergency Services (SES) for each of the local government areas (LGAs) within which the project is located, including the *Mid-Western Regional Local Flood Plan* (NSW SES, 2013b), *Dubbo City Local Flood Plan* (NSW SES, 2013a), *Warrumbungle Shire Local Flood Plan* (NSW SES, 2007) and *Upper Hunter Shire Local Flood Plan* (NSW SES, 2013c)
- *Developments adjacent to National Parks and Wildlife Service lands – Guidelines for consent and planning authorities* (NSW National Parks and Wildlife Service (NPWS), 2020)
- *Policy and guidelines for fish habitat conservation and management* (NSW DPI (Department of Primary Industries (DPI), 2013)
- *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull & Witheridge, 2003)
- *Guidelines and e-tools for controlled activity* (NSW DPE Department of Water, 2023)
- *Managing Urban Stormwater: Soils and construction – Volume 1* (Landcom, 2004) and *Managing Urban Stormwater: Soils and Construction – Volumes 2A and 2C* (NSW DECC, 2008a)
- NSW Environmental Water Register (WaterNSW, 2022a).

19.1.2 Assessment approach

Study area

The hydrology, flooding and water quality study area consists of the Macquarie River and Hunter River catchments, and sub-catchments. A catchment is the area that drains directly to a stream or body of water and includes areas upstream and downstream of the project.

Assessment approach

The assessment methodology involved:

- a desktop review of publicly available resources to gain an understanding of the existing environment, assessment criteria and water quality objectives relevant to the study area
- a review of surface water samples collected as part of the project's geotechnical and contamination investigations (refer to section 3.5.1 of Technical paper 14)
- a qualitative assessment of the potential hydrologic regime and geomorphic impacts from construction and operation of the project
- a qualitative assessment of the potential pollutants and impacts to water quality from construction and operation from the project, and the likely performance against the relevant water quality criteria and objectives set in the Murray-Darling Basin Plan

- an assessment of potential impacts to water supply and water resources, including:
  - review of indicative demand for water from construction and operation of the project
  - a qualitative assessment of potential impacts to water availability for the construction and operation of the project
- for the flood impact assessment, a qualitative and quantitative assessment was completed. This involved:
  - development of a set of hydraulic and hydrologic flood models of the catchments within the study area to model existing flood behaviour for the 10 per cent Annual Exceedance Probability (AEP), one per cent AEP, 0.5 per cent AEP, 0.2 per cent AEP and Probable Maximum Flood (PMF) events
  - for construction, a qualitative assessment of flood risks to the project and the potential impact on existing flood behaviour during the one per cent AEP event. This included impacts to mainstream flooding and localised overland flooding
  - for operation, a quantitative assessment of the impacts of the New Wollar Switching Station and energy hubs on flood behaviour for a range of flood events, with AEPs between 10 per cent and 0.2 per cent, and the PMF. For other components of the project, a qualitative assessment was completed. An assessment of climate change on flood behaviour and risks to the project was also completed for sites subject to quantitative assessment. The 0.5 per cent and 0.2 per cent AEP events were adopted as being representative of an increase in rainfall intensity of between 10 and 30 per cent in a one per cent AEP event in accordance with the NSW Government's *Floodplain Risk Management Guideline: Practical Considerations of Climate Change* (NSW DECC, 2007)
- identification of mitigation measures for the project to minimise and manage the potential impacts.

19.1.3 Existing environment

Catchments, topography and climate

The project is located across the Macquarie River and Hunter River catchments. Numerous natural watercourses intersect the study area, including perennial and ephemeral watercourses and unnamed drainage lines. A number of constructed dams are also located within the study area, including Burrendong Dam and Windamere Dam, to provide water supply for towns, industry, irrigators, stock and domestic users, as well as flood mitigation and recreation. Catchments and surface water features in the study area are shown in Figure 19-1.

The Hunter River catchment extends across an area of around 37,000 square kilometres, which discharges to the Tasman Sea at Newcastle. About a third of the project (around 33 per cent) is located within this catchment. The Goulburn River, a 6^{th} order stream (in the Strahler stream ordering system – refer to Table 19-1 footnote) (a medium sized stream) near Ulan, is a major tributary in the Hunter River catchment.

The Macquarie River catchment constitutes around nine per cent of the Murray-Darling Basin (around 91,960 square kilometres) and consists of the Macquarie-Bogan River and Castlereagh River catchments. The majority of the project (around 66 per cent) is located in the Macquarie-Bogan River catchment. This catchment is around 74,800 square kilometres and constitutes around seven per cent of the Murray-Darling Basin. Major rivers (9^{th} order streams, according to the Strahler stream ordering system) in the Macquarie-Bogan River catchment includes:

- the Macquarie River near Dubbo and Lake Burrendong
- the Talbragar River (a perennial watercourse) near Merotherie, Uarbry and Cassilis.

The Coolaburragundy River, a 5th order stream (a medium sized stream), flows in a southwesterly direction from the Liverpool Range northeast of Coolah, to join the Talbragar River near Leadville.

The 29 named watercourses intersected by the project are listed in Table 19-1, and include 1st order streams to 9th order streams (based on the Strahler stream ordering system). The majority of these watercourses are ephemeral and are dependent on rainfall events for flow.

Table 19-1 Watercourses intersected by the project by Strahler stream order

Stream order[1]	Watercourses
1	Salty Creek and Yellow Waterholes Gully
2	Browns Creek, Curryall Creek, Laheys Creek, Mona Creek, Planters Creek, Sportsmans Hollow Creek, Turill Creek, Wagrobil Creek and Wilpinjong Creek.
3	Back Creek, Cooyal Creek, Murrumbline Creek and White Creek
4	Four Mile Creek, Moreton Bay Creek, Stubbo Creek, Tallawang Creek and Tucklan Creek
5	Cainbil Creek, Cockabutta Creek, Copes Creek and Cumbo Creek
6	Moolarben Creek
7	Sandy Creek and Spring Flat Creek
8	Wialdra Creek
9	Talbragar River

1. The Strahler stream ordering system (Strahler, 1952; Strahler, 1957) is used to describe the hierarchy of streams from the top to the bottom of a catchment, with 1st order streams having no other streams flowing into it.

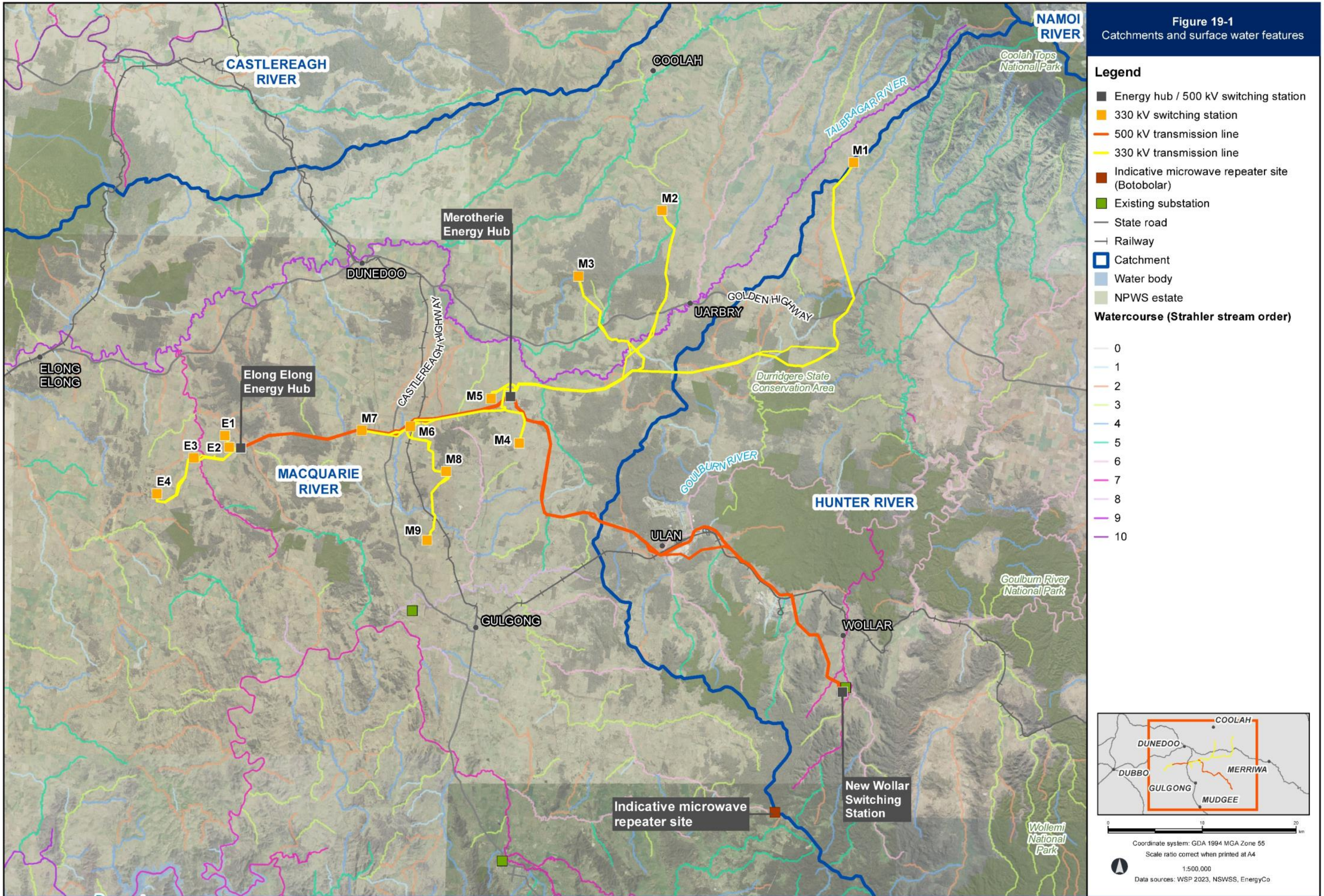
The Hunter River and Macquarie-Bogan River catchment divide occurs in the eastern portion of the study area and is generally orientated in a north-south direction to the east of Cassilis in the north and Ulan in the south (refer to Figure 19-1). From the catchment divide, the land slopes to the west towards the Talbragar River (a tributary of the Macquarie River), and east towards the Goulburn River (a tributary of the Hunter River).

The terrain is mainly characterised by flat to undulating plains, with areas of steeper topography located in the northeastern section of the project. Elevations across the study area vary between 350 metres Australian Height Datum (mAHD) and 700 mAHD. Land uses are predominately agricultural, consisting mostly of grazing and cropping activities. Other key land uses include nature conservation, mining and other land use such as infrastructure corridors (road, rail and energy), residential and farm infrastructure, and the production of native forests.

The Macquarie River catchment has a semi-arid climate with hot summers and cool winters in regional central-western NSW, whereas the Hunter River catchment experiences a highly variable climate with periods of severe drought and flood. Weather stations located near and around the project indicate an annual mean minimum temperature range of 8°C to 10°C in winter and an annual mean maximum temperature range of 22°C to 24°C in summer. Rainfall is distributed fairly evenly throughout the year, with weather stations recording mean annual rainfall between 613 to 667 millimetres per year. The spring, summer and autumn months of November to March are generally wetter with the rest of autumn and winter experiencing dryer conditions.

Climate change predictions forecast increases in temperatures, decreases in winter and spring rainfall, decreases/increases in summer and autumn rainfall throughout the region over the next 50 years (refer to Section 19.5 (Climate change and greenhouse gas)).

Figure 19-1
Catchments and surface water features



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Water quality

The existing water quality for the study area has been periodically monitored since 2005 and assessed at a number of locations as part of a range of management plans, assessments and other reports (refer to section 4.6 of Technical Paper 14). Parameters monitored to assess water quality include nutrients (nitrogen and phosphorus), pH, turbidity, salinity, dissolved oxygen, algal blooms and faecal contamination. These results have been compared to water quality criteria (ANZECC/ARMCANZ, 2018), to provide a rating based on the frequency and level of samples exceeding the criteria.

Available catchment water quality data in the study area suggests that water quality is varied, and is mainly influenced by agricultural land uses within the Macquarie River catchment and mining activities within the Hunter River catchment. Water quality within the Macquarie River catchment is generally rated as 'Fair' (50 to 75 per cent compliance with the ANZECC Guidelines for Fresh and Marine Water Quality), with exceedances generally recorded in relation to nutrients, particularly nitrogen and phosphorus, and salinity. Water quality at Elong Elong within the Macquarie River catchment is rated as 'Poor' (25 to 50 per cent compliance with the ANZECC Guidelines for Fresh and Marine Water Quality).

Water quality within the Hunter River catchment is generally rated as 'Poor', with exceedances generally recorded in relation to phosphorus. The Hunter River Salinity Trading Scheme operates in the Hunter River catchment by continuously monitoring real-time environmental conditions and discharges from industry into the river and scheduling saline industrial discharges at times of high river flows and low background salinity levels so that salinity targets are not exceeded.

Water quality monitoring results from the mining operations at Moolarben, Wilpinjong and Ulan indicate that water discharges from the mining operations into the environment were largely compliant, with exceedances generally recorded in relation to salinity, pH and suspended solids.

The NSW Water Quality and River Flow Objectives apply to the part of the study area located in the Hunter River catchment. The Murray–Darling Basin Plan supersedes the NSW Water Quality and River Flow Objectives for the remainder of the study area that is located within the Macquarie-Bogan catchment.

The water quality across the study area is not considered to meet the Murray–Darling Basin Plan water quality targets or the NSW Water Quality and River Flow Objectives, except for salinity levels in the Hunter River catchment which meet the targets for the middle section of the Hunter River Salinity Trading Scheme.

Water resources and water supply

The project is located within an area covered by two water sharing plans for surface water as outlined in Section 19.1.1. The water sharing plans, and their respective water sources, are as follows:

- *Water Sharing Plan for the Macquarie Bogan Unregulated Rivers Water Sources 2012:*
  - Upper Talbragar Water Source
  - Lower Talbragar Water Source
  - Cooyal Wialdra Creek Water Source
- *Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2022:*
  - Wollar Creek Water Source
  - Upper Goulburn River Water Source.

According to the NSW Environmental Water Register (WaterNSW, 2022a) all of these surface water sources are unregulated and there are no environmental water licences across these water sources. Unregulated rivers have natural flows that depend entirely upon the weather and climate and therefore do not have dams which are able to capture, store and regulate the flows.

Both the NSW Environmental Water Register and the Water Access Licence Register (NSW Land Registry Services, 2022) were reviewed to indicate water availability for the 2022/2023 water year. Within the Upper Talbragar Water Source, Lower Talbragar Water Source and Cooyal Wialdra Creek Water Source, water access licences (WALs) have been granted for domestic and stock and unregulated river water uses. The WALs for the Upper Talbragar Water Source and Lower Talbragar Water Source have been fully allocated for 2022/2023. The WALs for the Cooyal Wialdra Creek Water Source have no allocations in 2022/2023, which allow users to buy or transfer water allocations on an annual basis or share components from another licence holder.

Within the Wollar Creek Water Source and Upper Goulburn Water Source, WALs have been granted for aquifer, domestic and stock and unregulated river water uses. The domestic and stock WALs for the Wollar Creek Water Source and Upper Goulburn Water Source have been fully allocated for 2022/2023. Within the Wollar Creek Source, there are five unregulated river and three aquifer WALs with total share components of 78 megalitres per year and 782 megalitres per year respectively for 2022/2023, when the allocation is one megalitre per share. Within the Upper Goulburn Water Source, there are 16 unregulated river and three aquifer WALs with total share components of 1,780 megalitres per year and 102 megalitres per year respectively for 2022/2023, when the allocation is one megalitre per share.

Water extraction from the Upper Talbragar River, Lower Talbragar River and Upper Goulburn River is subject to conditions in relation to visible flow. Data from stream gauges located along the Talbragar River at Elong Elong and Dunedoo indicates that, on average, there is unlikely to be visible flow in the river to allow extraction for around two thirds of the year.

Potable water supplies are located in Dunedoo, Coolah and Gulgong, in addition to private companies in the region that supply potable and non-potable water. Outside urban areas, landowners rely on rainwater collected and stored on-site, the capture and storage of surface flows in dams and extraction from watercourses in accordance with surface water and groundwater WALs for stock and domestic use.

Flooding

The flood conditions within the sub-catchments of the Hunter River and Macquarie River catchments (as depicted in Figure 19-2) relevant to this assessment are detailed in Table 19-2. Existing flood conditions are described according to the key project features located within these catchments. The indicative extent and depth of flooding within these sub-catchments in the vicinity of the project are shown in Figure 4.2 to Figure 4.7 in Technical paper 15.

Table 19-2 Existing flooding conditions in sub-catchments in which project would be located

Feature	Description of flood conditions	Sub-catchment
Hunter River catchment		
New Wollar Switching Station	The area is not impacted by mainstream flooding from Wollar Creek. Drainage lines within the site convey overland flows, with flood depths of up to 0.2 metres (m) during flood events up to 1% AEP, except in the southern section of the site where flood depths of up to 0.6 m occur. During the PMF, flood depths would exceed one metre. The existing access road between Barrigan Road and the existing Wollar Substation experiences flood depths up to 1.7 m during the 10% AEP event, over 3 m during the 1% AEP event and over 10 m during the PMF event.	Wollar Creek

Feature	Description of flood conditions	Sub-catchment
Transmission line	Sections of the transmission line in the vicinity of watercourses experience flooding in the 10% AEP, 1% AEP and PMF events, which are summarised as follows: • depths of up to 2 to 3 m during the 1% AEP event in the vicinity of Spring Flat Creek, Cumbo Creek and Wilpinjong Creek (Wollar Creek sub-catchment) • depths of up to 1.9 m to 3 m during the 10% AEP event and depths of 2.3 m to 4 m during the 1% AEP event in the vicinity of Moolarben Creek and Sportsmans Hollow Creek (Goulburn River sub-catchment) • depths of up to 0.7 m to 2 m during the 10% AEP event and depths of up to 1.2 m to 3 m during the 1% AEP event in the vicinity of Murrumbline Creek, Wagrobil Creek, Curryall Creek and Yellow Waterholes Gully (Murrumbline Creek sub-catchment) • depths of 1 m during the 10% AEP event and depths of up to 1.5 m to 1.9 m for the 1% AEP event in the vicinity of the upper reaches of Turill Creek and Four Mile Creek (Four Mile Creek sub-catchment) • depths over 7 m in the 10% AEP event and depths of up to 8 m during the 1% AEP event in the vicinity of the lower reaches of Four Mile Creek (Four Mile Creek sub-catchment). The depths and extent of flooding increases during the PMF, with widespread flooding in the vicinity of watercourses particularly at the confluence of Moolarben Creek and Sportsmans Hollow Creek at Ulan.	Wollar Creek, Goulburn River, Murrumbline Creek and Four Mile Creek
Neeleys Lane workforce accommodation camp	The eastern portion of the Neeleys Lane workforce accommodation camp site is impacted by mainstream flooding from Ironbark Creek and one of its tributaries. During a 1% AEP event, flood depths across the eastern portion of the workforce accommodation camp would exceed 1.5 m in a number of locations. Sections of Ulan Road to the north and south of the site are also flooded.	Four Mile Creek
330 kV switching station	The switching station M1 site is located on a ridgeline and not impacted by overland flows.	Four Mile Creek
Macquarie River catchment		
Merotherie Energy Hub (including construction compound, workforce accommodation camp and maintenance facility)	The site is not impacted by mainstream flooding from the Talbragar River, but several major overland flow paths run through the site in a north-easterly direction. These flow paths experience flood depths up to 1.2 m , but are typically less than 0.5 m during flood events up to 1% AEP. During the PMF, flood depths would exceed one metre in a number of locations. Merotherie Road where it crosses Talbragar River and Cainbil Creek is frequently inundated by flow in the Talbragar River and Cainbil Creek, with flood depths up to 1 m (10% AEP) and 2 m (1% AEP). During a PMF event, flood depths would be up to 10 m.	Talbragar River
Elong Elong Energy Hub	The energy hub site is not impacted by mainstream flooding from Laheys Creek but several major overland flow paths run in a northerly direction through the middle and western portions of the site. These flow paths experience flood depths that exceed 0.5 m in a number of locations during the 1% AEP event. During the PMF, flood depths would exceed 1 m in a number of locations. The construction compound site is impacted by mainstream flooding from Laheys Creek with flood depths up to 1 m during a 10% AEP event, increasing to more than 2 m during a 1% AEP event. Spring Ridge Road at the crossing of Laheys Creek experiences flooding with depths up to 3.3 m in the 10% AEP event and up to 4 m during a 1% AEP event. During the PMF event, flood depths would be up to 9 m.	Sandy Creek

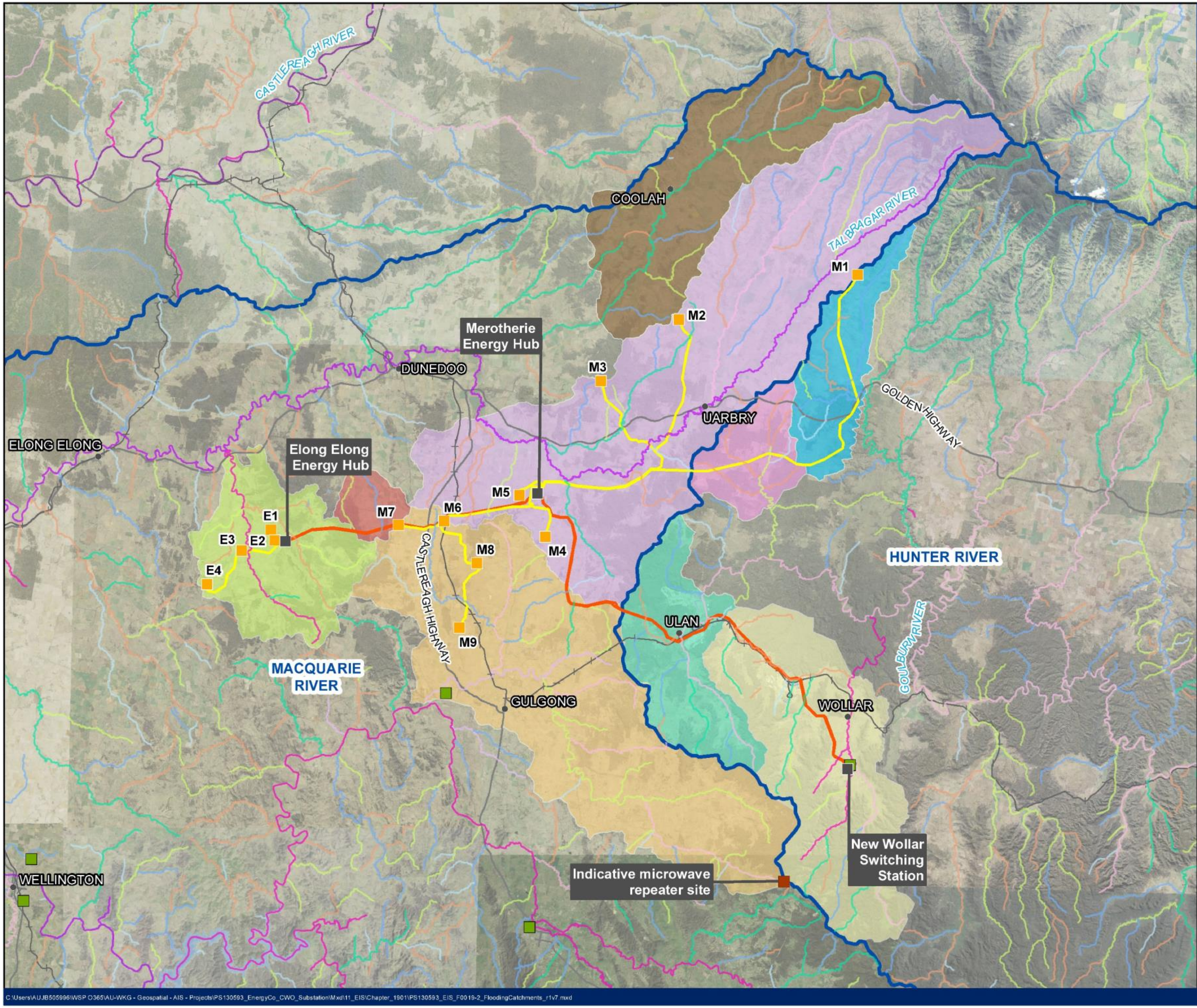
Feature	Description of flood conditions	Sub-catchment
Transmission line	Sections of the transmission line in the vicinity of watercourses experience flooding in the 10% AEP, 1% AEP and PMF events, which are summarised as follows: • depths of over 3 m during the 1% AEP event in the vicinity of Talbragar River and Cockabutta Creek (Talbragar River sub-catchment) • depths of up to 3 m in the vicinity of Tucklan Creek and depths of less than 0.3 m in the vicinity of Patricks Creek during the 1% AEP event (Tucklan Creek sub-catchment) • depths of up to 2.4 m during the 10% AEP event and depths of up to 3.3 m during the 1% AEP event in the vicinity of Sandy Creek (Sandy Creek sub-catchment) • depths of up to 5 m in the vicinity of the lower reaches of Tallawang Creek and depths of up to 2 m in the upper reaches of Tallawang Creek during the 1% AEP event (Wialdra Creek sub-catchment) • depths of less than 1 m during the 1% AEP event in the vicinity of the upper reaches of Copes Creek and Stubbo Creek (Wialdra Creek sub-catchment). The depths and extent of flooding increases during the PMF, with widespread flooding in the vicinity of watercourses particularly at Talbragar River, Tallawang Creek, Laheys Creek and Sandy Creek and Canbil Creek.	Talbragar River, Tucklan, Sandy Creek and Wialdra Creek
330 kV switching stations	Switching stations M2 to M9 are not impacted by mainstream flooding, however, all of these switching station sites are inundated by overland flow to varying degrees, due to local catchment runoff.	Talbragar River, Wialdra Creek and Tucklan Creek
	Switching stations E1 to E4 are not impacted by mainstream flooding, however overland flows of varying depths occur within these sites.	Sandy Creek

Sensitive receiving environments

A sensitive receiving environment is one that has a high conservation value or supports human uses of water that are particularly sensitive to hydrology, flooding and water quality impacts. In the context of this project, sensitive receiving environments are considered to be:

- watercourses intersected by the project
- surface water and groundwater sources utilised by the project (refer to discussion on water resources and water supply above and Section 19.3 (Groundwater))
- groundwater dependent ecosystems (GDE), which includes 17 unique high priority terrestrial GDEs and five high priority aquatic GDEs within 500 metres of the construction area (refer to Section 19.3 (Groundwater))
- Key Fish Habitat, including Wilpinjong Creek, Sportsmans Hollow Creek, Talbragar Creek, Wagrobil Creek and Laheys Creek (refer to Chapter 10 (Biodiversity)).

Figure 19-2
Flooding catchments



Legend

- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Indicative microwave repeater site (Botobolar)
- Existing substation
- State road
- Railway
- Catchment
- Water body

Strahler Stream Order

- 1
- 2
- 3
- 4
- 5
- 6
- 7
- 8
- 9
- 10

Subcatchment

- Coolaburragundy River
- Four Mile Creek
- Goulburn River
- Murrumbline Creek
- Sandy Creek
- Talbragar River
- Tucklan Creek
- Wialdra Creek
- Wollar Creek

0 10 20 km

Coordinate system: GDA 1994 MGA Zone 55

Scale ratio correct when printed at A4

1:590,000

Data sources: WSP 2023, NSWSS, EnergyCo

19.1.4 Potential impacts – construction

Geomorphology

The proposed transmission lines would require spanning of a series of watercourses, including the Talbragar River (a 9th order stream). Transmission line towers would be constructed at least 50 metres from the edge of watercourses with a stream order of three and above but could be located within the flood prone areas of some first and/or second order streams. In addition, temporary watercourse crossings in the form of culverts, causeway or fords may be required for access tracks where alternative vehicle access routes are impractical.

Potential impacts to the geomorphic conditions of watercourses as a result of these works would include:

- changes in the low flow channel shape of 1st and/or 2nd order streams due to construction works changing local runoff behaviour and overland flow paths
- increased sediment load from runoff from construction work areas.

These impacts would be minor and localised but could result in changes to erosion and channel shape due to the poor to moderate geomorphic conditions in the Talbragar River between Uarbry and Elong Elong and the Upper Goulburn River catchment. With the implementation of standard mitigation measures described in Section 19.1.6, impacts to the geomorphology of these watercourses would be minimal.

Water quality

The likelihood and magnitude of potential water quality impacts would vary depending on the stage of construction, area of disturbance and presence of high rainfall or wind weather events. With the implementation of standard mitigation measures described in Section 19.1.6, impacts to the existing water quality condition of sensitive receiving environments would be minimal. Additionally, the progressive nature of construction would limit the work areas and duration within which impacts could occur. Potential impacts to surface water quality could result from the following construction activities:

- Vegetation removal: The potential exposure of soils during the removal of vegetation could result in soil erosion and off-site movement of eroded sediments by wind and/or stormwater into receiving watercourses. If sediments enter watercourses, they could potentially directly and indirectly impact on the aquatic environment by increasing turbidity, reducing dissolved oxygen levels, and increasing the concentration of nutrients. The removal of vegetation could also increase runoff volumes over the short term and long term, which could impact water quality of downstream watercourses.
- Earthworks: The disturbance and exposure of soils during earthworks could impact the water quality of receiving watercourses through:
  - soil erosion and the off-site movement of eroded sediments by wind and/or stormwater into downstream watercourses, resulting in increased turbidity, lowered dissolved oxygen levels and increased nutrient levels
  - potential disturbance of saline or contaminated soils (e.g. contaminated with nutrients, heavy metals or other contaminants of concern) and mobilisation of these soils by stormwater runoff and subsequent transportation to downstream watercourses, potentially increasing contaminant concentrations in the receiving environment. Increased salinity levels in watercourses could also damage concrete and metal structures
  - increased surface water runoff due to soil stabilisation earthworks that impact the permeability of soils.

- Stockpiling and spoil handling: Stockpiling and spoil handling would pose a risk to the existing water quality in receiving environments through the increased likelihood of deposition and movement of sediment if not managed appropriately. Stockpiling of mulched vegetation would pose a risk of tannins leaching into watercourses and increased levels of organic substances in watercourses. The discharge of water that is high in tannins could increase the biological oxygen demand of the receiving environment, which could in turn result in a decrease in available dissolved oxygen. Once discharged to the environment, tannins could also reduce visibility and light penetration, and change the pH of receiving waters. These impacts could affect aquatic ecosystems in receiving environments.
- Watercourse crossings: Instream works to construct temporary bed-level fords, culverts or causeways would disturb bed and bank substrates, potentially leading to localised erosion and sediment transport downstream, resulting in increased turbidity, changes in pH, dissolved oxygen and nutrients and impacts on aquatic habitat. Poorly installed structures could increase the risk of sediment transport downstream and/or slow down the flow of water, resulting in increased turbidity, lowered dissolved oxygen levels and increased nutrients in watercourses.
- Concreting: Concreting activities could result in the discharge of cement dust, concrete slurries or washout water to downstream watercourses. This could potentially increase the alkalinity and pH of downstream watercourses which can be harmful to aquatic life. Concrete solids contained in the discharge also have the potential to clog stormwater pipes and cause flooding.
- Accidental spills: Contaminants from accidental chemical or fuel spills or leaks could potentially be transported downstream to receiving waters via overland flows.
- Construction compounds and workforce accommodation camps: The establishment of these sites would add additional impervious areas which could lead to increased runoff and soil erosion and sediment transport into receiving watercourses. Gross pollutants, such as paper and plastic packaging and materials and general litter, could be transported by stormwater runoff or wind into downstream watercourses.

Discharge of wastewater from the workforce accommodation camps and office areas would be avoided through onsite treatment and offsite disposal as per local council guidelines for wastewater systems (refer to Section 3.5.9). The wastewater treatment system would be designed, maintained and monitored in accordance with *Onsite domestic wastewater management, Designing and Installing On-Site Wastewater Systems* (WaterNSW, 2019), *AS/NZS 1547:2012 On-site domestic wastewater management* (Standards Australia, 2012) and the *Australian 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 water quality requirements for dust suppression and use for other construction activities within the construction area. Liquid waste generated by the wastewater treatment facilities and bathroom facilities in construction work areas would be removed and transported to a licensed facility.

Water supply and water resources

Water supply

It is estimated that around 700 megalitres of water would be required for construction per year, comprising:

- around 250 megalitres of non-potable water for:
  - dust suppression at construction work areas and on access tracks (around 125 megalitres)
  - earthworks and pavement compaction (around 115 megalitres)
  - landscaping (around 10 megalitres)

- around 450 megalitres of potable water for:
  - general worker facilities at the construction compounds and accommodation camps (around 420 megalitres)
  - concrete batching activities (around 30 megalitres).

The actual water usage during construction is expected to vary throughout the indicative construction period, depending on the intensity, nature and extent of construction activities taking place. A more detailed breakdown of the expected water demand per year over the construction period is provided in Table 19-3 (these figures have been rounded up above to provide a conservative estimate of the expected water demand).

Table 19-3 Expected annual water requirements for the project during construction

Construction activity	Water source type	Demand (megalitres (ML)) 2024*	Demand (ML) 2025	Demand (ML) 2026	Demand (ML) 2027
Compaction (general)	Non-potable	0	43	25	4
Compaction (pavements)	Non-potable	4	21	17	0
Dust suppression	Non-potable	6	88	31	0
Landscaping	Non-potable	0	1	6	2
Concrete	Potable	0	15	13	1
Drinking water	Potable	2	13	13	2
Construction compounds and accommodation camps	Potable	19	172	134	58
TOTAL		31	353	239	67

The use of non-potable water would be preferred over potable water for compaction, dust suppression and landscaping, however this would be dependent on the location and nature of the water use activity as well as the quantity and quality of available water at the time. Water for construction of the project would be sourced according to the following hierarchy, where practicable, and where water quality and volume requirements are met:

- rainwater harvesting (non-potable water)
- reuse of construction water (non-potable water)
- reuse of treated wastewater and/or groundwater inflows (non-potable water), where practicable
- reuse of treated mine water (non-potable water), if practicable. Reuse of treated mine water would be investigated in consultation with mine operators and the NSW Environment Protection Authority
- existing unregulated surface water sources (non-potable water), including the Upper Talbragar River Water Source, Lower Talbragar River Water Source and Upper Goulburn River Water Source, under WALs for the project. The available water in each water source is dependent on conditions in each water source which are dependent on the climate
- extraction from regulated groundwater sources via new groundwater bores (non-potable water), primarily for dust suppression (refer to Section 19.3 (Groundwater))
- existing regulated and unregulated surface water sources (potable water).

Potable water for human consumption would be supplied from council owned potable water supplies in Dunedoo and Coolah (in the Warrumbungle LGA) and Gulgong (in the Mid-Western Regional LGA).

The non-potable water demand for construction (around 250 megalitres) would be sourced from harvested rainwater, recycled construction water, treated wastewater or groundwater inflows, or existing surface water WALs. Where the surface water supply is limited or not available, the non-potable water demand would be sourced from regulated groundwater sources as described above. No new surface water extraction infrastructure to enable direct water take is proposed as part of the project.

Water would be transported from the appropriate source via tanker truck and stored in storage tanks located at the workforce accommodation camps, construction compounds and switching stations.

Surface water availability

Figure 19-3 compares the water demand for the project with water availability in the Upper Talbragar Water Source and Lower Talbragar Water Source during an average rainfall year and typical drought years (based on historical water usage data from the Cudgegong River Water Source). As data is not available for the Upper Talbragar and Lower Talbragar Water Sources, the Cudgegong River water source was used as a representative water source since the Cudgegong River catchment has similar land uses and climatic conditions as the study area and since data is available for this water source.

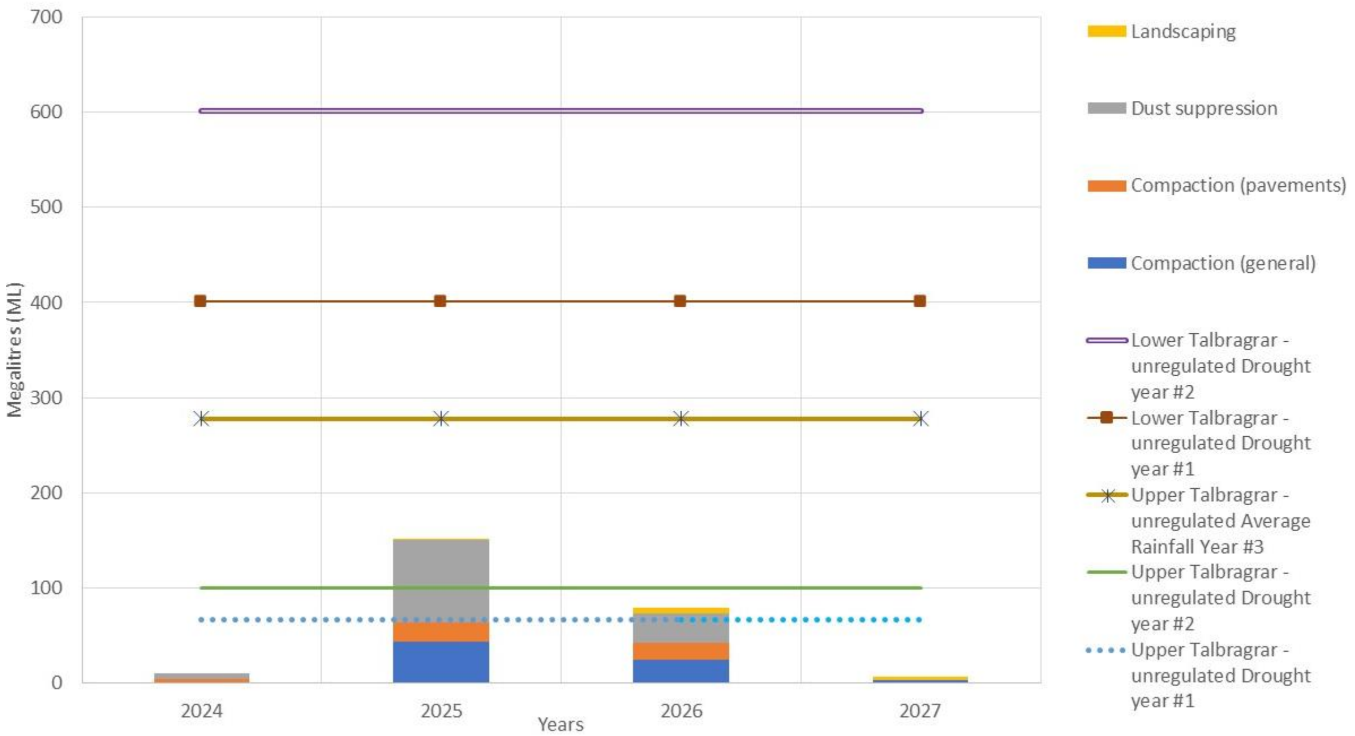
For all construction years, the available water for extraction would be limited by preceding rainfall and dependent on the extraction conditions of visible flow in the Upper Talbragar River and Lower Talbragar River (refer to Section 19.1.3). Historical data indicates that visible flow is only likely to occur around one third of the year.

In 2024 and 2027, the data indicates that there is a high chance of water being available from surface water sources for all construction activities, even during low rainfall or a drought period (subject to extraction conditions). During these years, the impact to available water in the Upper Talbragar River and Lower Talbragar River is considered to be low, as non-potable water demand volumes for the project during construction would be low.

The largest volume of non-potable water for construction would be required during 2025 and 2026. In an average year with a rainfall depth of 600 millimetres, 75 per cent of the total water usage would be potentially available (through general security licences) and likely to meet the non-potable water demand for the project, subject to the extraction conditions of visible flow in the Upper Talbragar River and Lower Talbragar River (refer to Section 19.1.3). By comparison, in a drought year the Upper Talbragar River would not meet the non-potable water demand for the project. However, as shown in Figure 19-3, the Lower Talbragar River has a large volume of potential water available, including during drought years, and could be the preferred source for non-potable water for the project during low rainfall periods.

EnergyCo has commenced discussions with a number of water suppliers in the region, to identify the sources and availability of the volume of water (potable and non-potable) required for the project from existing facilities. Further investigation of options for the provision and storage of construction water would be undertaken during continued development of the project design and detailed construction planning, in consultation with local councils, water utility companies, licence holders and mine operators. The preferred sources of construction water and the method of construction water storage would be confirmed prior to the start of construction.

Further opportunities to minimise water demand would be identified during continued development of the project design and detailed construction planning and implemented where practicable.



#1 Drought year – based on Cudgegong River Water Source water usage data for 2008–2009, 18% of total was available for regulated river (general security)

#2 Drought year – based on Cudgegong River Water Source water usage data for 2019–2020, 27% of total was available for regulated river (general security)

#3 Average rainfall year (600 millimetres) – 2012–2013, 75% of total water was available for regulated river (general security)

Figure 19-3 Water availability and water demand for the project

Flooding

Construction activities and associated construction sites on flood-prone land, including earthworks, material storage and stockpiling, workforce accommodation camps and construction compounds, have the potential to temporarily affect flooding behaviour. Without the implementation of appropriate management measures, flooding of the construction work areas has the potential to:

- detrimentally impact the downstream waterways through the transport of sediments and construction materials by floodwater
- obstruct the passage of floodwater and overland flow, which in turn could exacerbate flooding conditions in areas located outside the construction footprint
- cause damage to the proposed works resulting in project delays and safety risks to the construction workforce.

As outlined in Section 19.1.3, parts of the construction area are subject to flooding. Figure 5.1 of Technical paper 15 shows the extent to which the 10 per cent and one per cent AEP flood event would affect each construction work area across the extent of the project.

The depths of inundation during the 10 per cent AEP event are generally shallow and of short duration. The exception is the Elong Elong construction compound, where flood depths would exceed one metre during the 10 per cent AEP event, and increase to more than two metres during a one per cent AEP event, due to mainstream flooding from Laheys Creek.

During construction, the project has the potential to exacerbate flood conditions due to:

- construction activities within the Elong Elong construction compound, which has the potential to impact mainstream flooding in Laheys Creek
- construction activities within the energy hubs, switching station (except switching station M1), transmission line and Neeleys Lane workforce accommodation camp construction work areas have the potential to impact on local catchment flooding due to obstruction and changes to local drainage lines
- temporary creek crossings along access tracks have the potential to obstruct the conveyance of flows, which may in turn impact on the extent and depth of flooding and flow velocities within nearby watercourses and riparian areas.

All construction compounds and workforce accommodation camps would be located outside of high hazard areas, as defined in the *Floodplain Development Manual* (NSW Government, 2005). Detailed construction planning would identify how safe evacuation routes are provided for the workforce during a flood event.

Mitigation measures proposed to manage the risk of flooding to construction activities and facilities are outlined in Section 19.1.6. Further investigation would need to be undertaken during continued design development and detailed construction planning, as layouts and staging diagrams are further developed.

19.1.5 Potential impacts – operation

Geomorphology

Similar to construction related impacts, potential operational impacts to geomorphology would include:

- changes in low flow channel shape due to the placement of transmission line towers within the flood prone area of 1st and 2nd order streams that could result in changes to low flow runoff behaviour during flood events
- increased sediment load from runoff from access tracks.

These impacts would be minor and localised but could result in changes to channel shape due to the high fragility and lower recovery potential of minor watercourses. With the implementation of standard mitigation measures described in Section 19.1.6, impacts to the geomorphology of these watercourses would be minimal.

Localised changes within flow paths could be experienced during regular flood events but no significant impact is expected during large flood events, such as the one per cent AEP. Where transmission line towers are located outside of the flood prone areas of minor watercourses, there would not be any geomorphological impacts.

No transmission line towers would be located within the flood prone area of watercourses with a stream order of three and above and therefore no geomorphological changes within the watercourses are expected that would affect their long term health, including the movement of sediment (including nutrients) and the presence of ponds or ripples that support aquatic fauna and flora.

Water quality

There is potential for water quality impacts to occur during project operation and maintenance activities as a result of accidental spills or litter generated, however, these impacts would be minor and localised if the mitigation measures described in Section 19.1.6 are implemented.

New impervious areas at the energy hubs and switching stations have the potential to result in increased runoff volumes and speeds, with potential for increased localised scour and sediment loads in watercourses near these areas. Accidental spills and/or leaks of oils or other contaminating substances could also occur during the operation or maintenance of equipment at the energy hubs and switching stations, and/or from vehicles, plant and machinery completing maintenance activities along the transmission line easements. Contaminants and oils could potentially be transported downstream to receiving waters via overland flows. Oils form films on the surface of the water that reduces sunlight penetration into the water, resulting in an increase in the biological oxygen demand and chemical oxygen demand within the watercourse that may impact the aquatic ecosystem. Drainage infrastructure at the energy hubs and switching stations would be designed to minimise the potential for these impacts by:

- collecting runoff within the switchyard with a drainage system consisting of kerb and guttering, drains and stormwater pits and pipes and discharging it into onsite detention basins
- collecting runoff outside the switchyard and diverting it to natural watercourses or overland flow paths using appropriate dispersion structures or drainage infrastructure
- designing hardstand areas to drain to a bunded containment system to manage any spill or emergency events that could impact water quality. This containment system would be isolated from the stormwater drainage collection system to prevent cross-contamination.

Water supply and water resources

Water would be required during operation for on-site staff facilities and maintenance activities. Operational water demand would be minor and vary throughout operation.

The long term impacts of the expected operational water use on water resources would be minor. Water availability for operational water use would potentially be affected during dry periods when water availability and rainwater tanks could be low, and competition for water resources from existing irrigation suppliers in the region accessing the same water resources could be increased.

Flooding

Sections of the transmission line easement and access tracks would be inundated by mainstream flooding or overland flow paths during operation. Where transmission line towers occur within flood affected areas, the footings and legs of the structures would obstruct floodwater and potentially lead to an increase in the depth and velocity of floodwaters. Any change in the depth and velocity of flood flows would be confined to a relatively localised area around the footings and tower legs of each tower. Scour protection measures would be incorporated into the design of the transmission line towers where required, to manage localised increases in flow velocities and scour potential. Access tracks would also be designed with appropriate drainage control measures to manage runoff and scour potential.

During operation, the energy hubs and switching stations would not be impacted by mainstream flooding, but have the potential to impact overland flows due to:

- increases in the rate and volume of runoff due to the increase in impervious areas
- redistribution of flows as a result of diversion channels and culverts that would be installed at each site to control runoff and to manage the impact of flooding on electrical infrastructure during a 0.5 per cent (or greater) AEP event.

The changes to overland flows have the potential to result in an increase in peak flood levels, peak velocities and/or an increase in the duration or extent of flooding at the energy hubs and switching stations. Changes at these sites are discussed further in the following sections.

Overall, the project is expected to have only a minor and localised impact on peak flood levels and flow velocities during the one per cent and 10 per cent AEP flood events. As a result, the project:

- is not expected to have a significant impact on the extent of the flood planning area, as defined in the applicable LEPs
- would not increase the overall flood hazard for existing developments for events up to the one per cent AEP
- would not have an adverse impact on NSW State Emergency Services' emergency response arrangements as set out in the local flood plans for each LGA.

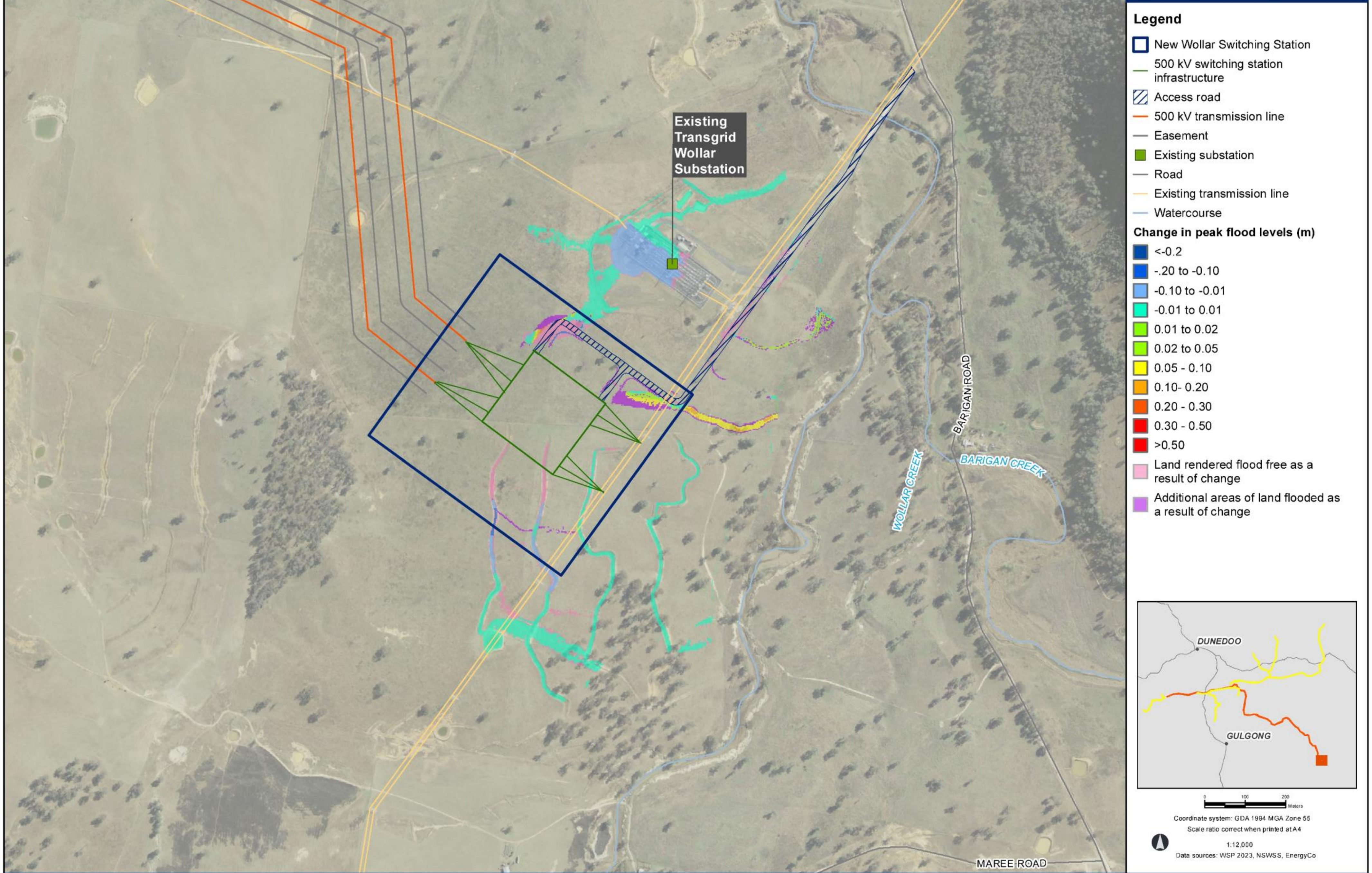
New Wollar Switching Station

Changes in flood levels at the New Wollar Switching station during the one per cent AEP and PMF events are summarised in Table 19-4. The change in peak flood levels during the one per cent AEP event is depicted in Figure 19-4.

Table 19-4 Changes in flood behaviour at New Wollar Switching Station

Flooding feature	Change in flood behaviour
Peak flood levels	The reduction in the catchment that drains through the existing Wollar Substation to the north of the New Wollar Switching Station (since the New Wollar Switching Station site would drain towards the west) would reduce flood depths within the drainage lines that run through the substation site. There would be a maximum increase of 0.11 m in peak flood levels during the 1% AEP event within the switching station site and along an eastern drainage line external to the site. The area external to the site currently experiences flood depths of less than 0.2 m and is cleared pastoral land that is zoned for primary production. The increase in the depth of inundation would not impact on any structures or lead to a significant increase in the extent of flooding. The electrical components within the switching station would be located a minimum of 0.5 m above the peak 1% AEP flood level. The switching station would be designed so that it would not be impeded by peak flood levels during a 0.5% AEP flood event. The proposed access road would result in a maximum increase of 0.05 m during the 1% AEP event along an existing drainage line that runs to the east of the existing Wollar Substation and the proposed access road. Existing flood depths during the 1% AEP event is typically less than 0.1 m. During a PMF event, peak flood levels along the drainage line that discharges from the eastern corner of the New Wollar Switching Station would increase by up to 0.25 m, on existing peak flood levels typically between 0.4 m and 0.7 m. Peak flood levels along the two drainage lines that run to the east of the existing Wollar Substation and the proposed access road would increase by up to 0.05 m, on existing peak flood levels between 0.1 m and 0.2 m. These increases in PMF peak flood levels are considered to be minor in terms of the nature of land impacted and the relative increase in flood hazard.
Peak flow velocities	For the drainage lines that run through the existing Wollar Substation to the north of the New Wollar Switching Station, increases in peak flow velocities would typically be less than 10% during the 1% AEP event, except at some localised areas where velocities would increase by up to 15%. This would result in a maximum velocity of less than 0.5 metres per second (m/s) and has low potential to cause scour. For the two eastern drainage lines, the peak velocity would increase by up to 50% during the 1% AEP event. This would result in peak flow velocities exceeding 1 m/s at a number of locations. This has the potential to increase scour and erosion in these drainage lines. Opportunities to reduce these changes would be considered during detailed design.
Duration and extent of inundation	Increases in the duration of flooding would typically be less than 1 hour, except at the two drainage lines that run to the east of the New Wollar Switching Station and the proposed access road. At these locations, the duration of flooding would increase by 1.1 hours during a 10% AEP flood event, and the extent of flooding would increase. Opportunities to minimise changes in the distribution of flow and increased runoff from impervious areas would be considered during detailed design.

Figure 19-4
Change in flood levels
(New Wollar Switching Station) – 1% AEP



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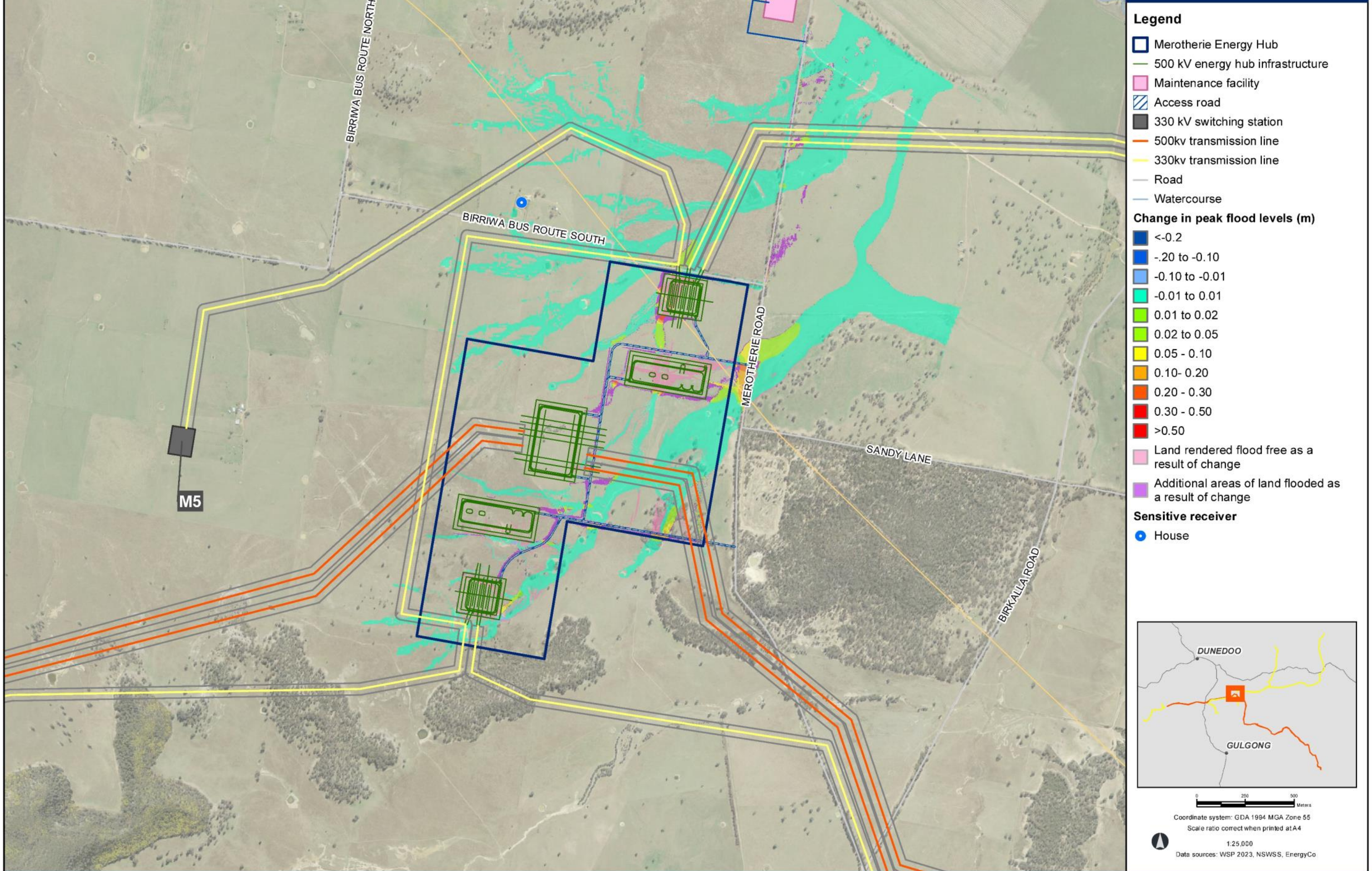
Merotherie Energy Hub

Changes at the Merotherie Energy Hub during the one per cent AEP and PMF events are summarised in Table 19-5. The change in peak flood levels during the one per cent AEP event is depicted in Figure 19-5.

Table 19-5 Changes in flood behaviour at Merotherie Energy Hub

Flooding feature	Change in flood behaviour
Peak flood levels	During the 1% AEP event, peak flood levels would increase along the four drainage lines that run through the site. The maximum increase would vary according to the drainage line but would be up to 0.23 m in the 1% AEP event. This would impact areas that include: • a local access road to the north of the site, with an increase of up to 0.06 m during the 1% AEP event. This road currently experiences peak flood levels up to 0.5 m under existing conditions • Merotherie Road, with an increase up to 0.23 m in the 1% AEP event • cleared land presently used and zoned for agricultural purposes, with an increase of up to 0.11 m during the 1% AEP event. This area presently experiences peak flood levels of up to 0.4 m during the 1% AEP event. The electrical components within the energy hub would be located a minimum of 0.5 m above the peak 1% AEP flood level. The energy hub would be designed so that it would not be impeded by peak flood levels during a 0.5% AEP flood event. During the PMF, peak flood levels would increase along an access road that is located to the north of the energy hub by up to 0.24 m, on an existing peak flood level of 0.8 m. Peak flood levels would also increase along the section of Merotherie Road where it runs to the east of the energy hub by up to 0.25 m, on an existing peak flood level of 0.9 m. There would also be localised increases in peak flood levels along the southern boundary of the energy hub by up to 0.6 m, on an existing depth of 1.3 m, with impacts confined to cleared land presently used and zoned for primary production.
Peak flow velocities	Increases in peak flow velocities in the receiving drainage lines downstream of the energy hub would typically be less than 10% during the 1% AEP event, with the exception of: • a maximum increase of 30% during a 1% AEP event at the northern drainage line, with peak velocities less than 0.7 m/s, except where this drainage line crosses a local access road to the north of the energy hub, where the peak flow velocities of up to 1.5 m/s would have the potential to increase scour of the road surface. • a maximum increase of 40% during the 1% AEP event at a drainage line that runs to the east of the energy hub, with a peak velocity of 1 m/s in a number of areas. These increases have the potential to increase scour and erosion in the drainage lines to the north and east of the energy hub, and increase the potential scour of the local access road surface. Opportunities to reduce these changes would be considered during detailed design.
Duration and extent of inundation	The two drainage lines to the north and east of the energy hub would experience an increase in the duration and extent of inundation. Opportunities to minimise changes in the distribution of flow and increased runoff from impervious areas would be considered during detailed design.

Figure 19-5
Change in flood levels
(Merotherie Energy Hub) – 1% AEP



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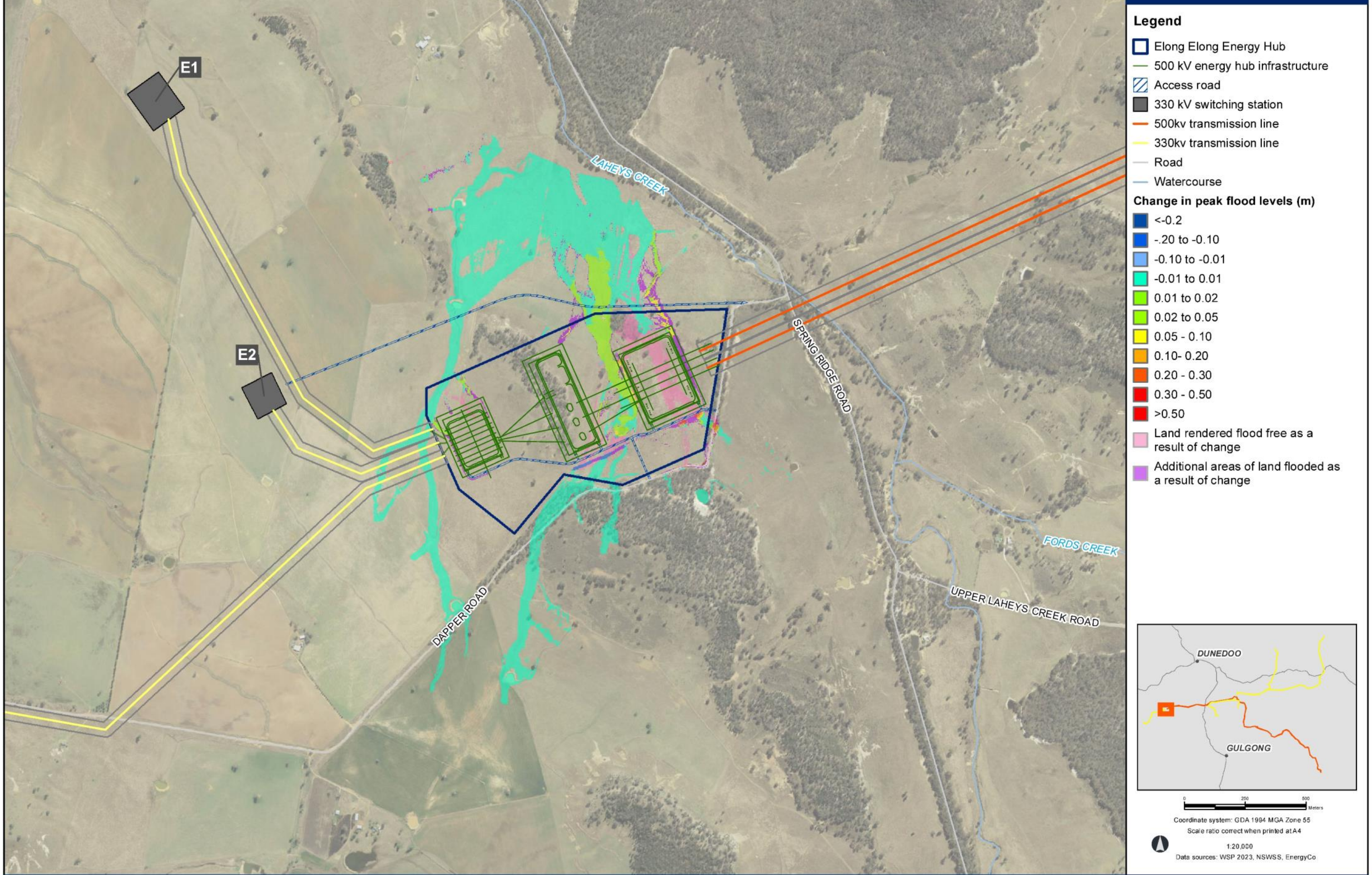
Elong Elong Energy Hub

Changes at the Elong Elong Energy Hub during the one per cent AEP and PMF events are summarised in Table 19-6. The change in peak flood levels during the one per cent AEP event is depicted in Figure 19-6.

Table 19-6 Changes in flood behaviour at Elong Elong Energy Hub

Flooding feature	Change in flood behaviour
Peak flood levels	Changes in peak 1% AEP flood levels downstream of the energy hub would typically be less than 0.01 m, except at a series of drainage lines that are located to its northeast, where peak flood levels would increase by up to 0.06 m. While the impacted area would extend around 300 m to the north of the energy hub, the increases in peak flood levels are considered minor relative to the existing peak flood levels of between 0.1 m and 0.5 m, and given the existing use of the land (i.e. cleared pastoral land zoned for primary production). The electrical components within the energy hub would be located a minimum of 0.5 m above the peak 1% AEP flood level. The energy hub would be designed so that it would not be impeded by peak flood levels during a 0.5% AEP flood event. During the PMF, peak flood levels along the series of drainage lines that are located to the northeast of the energy hub would be increased by up to 0.15 m on existing depths of between 0.4 m and 1 m. These increases in PMF peak flood levels are considered to be minor in terms of the nature of land impacted and the relative increase in flood hazard.
Peak flow velocities	Increases in peak flow velocities in downstream areas (north of the energy hub) would typically be less than 10% during the 10% AEP and 1% AEP flood events, except for a drainage line located to the northeast where peak flow velocities would increase by up to 60%. The peak flow velocity at this drainage line would be less than 0.5 m/s and would have a low potential for scour given the coverage of existing vegetation. If these areas are disturbed during construction they would need to be rehabilitated to ensure a suitable level of vegetation coverage so that the potential for scour is minimised.
Duration and extent of inundation	Increases in the duration of flooding would typically be less than 1 hour, except at two drainage lines to the northeast of the energy hub where the duration of flooding would be increased by 1.8 and 1.2 hours during the 10% and 1% AEP flood events, respectively. The extent of flooding would also increase. Opportunities to minimise changes in the distribution of flow and increased runoff from impervious areas would be considered during detailed design.

Figure 19-6
Change in flood levels
(Elong Elong Energy Hub) – 1% AEP



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330 kV switching stations

During operation, the switching station sites would not be impacted by mainstream flooding but would convey overland flows or local catchment runoff ranging from 0.15 metres to 0.5 metres during the one per cent AEP event, depending on the site. Overland flows would be redirected along the diversion channels and culverts that are proposed to control runoff around the switching stations, which in turn has the potential to result in a redistribution of flows in the receiving drainage lines. The electrical components within each switching station would be located a minimum of 0.5 metres above the peak 1% AEP flood level. Each switching station would be designed so that it would not be impeded by peak flood levels during a 0.5% AEP event.

The increase in impervious area associated with switchyard pads, buildings, access roads and other hardstand areas would increase the rate and volume of runoff, which in turn has the potential to increase the rate and volume of runoff being conveyed in the receiving drainage lines. Measures to manage impacts on flooding depth, velocity or duration of inundation external to the site would be identified during detailed design.

Impacts under future climate change conditions

Climate change is expected to lead to an increase in flood producing rainfall intensities, which would increase flood risks to the project due to:

- an increase in flooding risk to the switchyards, transformers, control buildings and associated infrastructure
- an increase in the frequency and extent to which the drainage systems that are proposed to control runoff from the switching stations and energy hubs would be surcharged
- an increase in the frequency and depth of flooding of access roads and access tracks that are used to access the switching stations, energy hubs and transmission line infrastructure.

Appendix C of Technical paper 15 contains a series of figures that show the indicative extent and depth of inundation in the vicinity of the energy hubs and New Wollar Switching Station for the 0.5 per cent and 0.2 per cent AEP flood events. These events have been selected to represent future climate change conditions (refer to Section 19.1.2).

The project would be designed to ensure that the function of the switching stations and energy hubs would not be impacted by flooding under future climate change conditions.

Under future climate change conditions, the project would result in either no change, or relatively minor increases in flood impacts at the energy hubs and the New Wollar Switching Station. Minor increases in peak flood levels of between 0.01 and 0.03 metres would occur at each of the energy hubs, while no change in flood impacts are expected at the New Wollar Switching Station during the one per cent AEP under future climate change conditions.

19.1.6 Management of impacts

Environmental management

Hydrology, flooding and water quality impacts during construction would be managed in accordance with the Construction Environmental Management Plan (CEMP). This would set out hydrology, flooding and water quality management objectives to minimise impacts on watercourses and other sensitive receiving environments, minimise water demand for the project and prioritise the use of non-potable water sources where practicable.

The CEMP requires the preparation and implementation of a soil and water management sub-plan. The plan would detail the processes, responsibilities and measures to manage potential soil and water quality impacts during construction. This would:

- be prepared in accordance with the principles and requirements in:
  - *Managing Urban Stormwater – Soils and Construction, Volume 1* (Landcom, 2004), and *Managing Urban Stormwater – Soils and Construction, Volumes 2A and 2C* (NSW DECC, 2008a), commonly referred to as the 'Blue Book'
  - *Best Practice Erosion and Sediment Control* (International Erosion Control Association, 2008)
  - *Controlled activities – Guidelines for riparian corridors on waterfront land* (NSW DPE, 2018c)
- include measures to manage potential water quality impacts during construction, including surface water and erosion control practices, minimising the duration of soil disturbance and the progressive rehabilitation and stabilisation of disturbed areas, management of water discharges from construction areas in accordance with applicable criteria, stockpile management controls, and spill response procedures
- include a surface water monitoring program
- include flood emergency management measures, including:
  - contingency planning for construction facilities that are located in areas that are inundated by mainstream flooding during a one per cent AEP event
  - the identification of how flood related risks to personal safety, damage to construction facilities and how equipment would be managed for construction facilities located within the floodplain
  - procedures to monitor accurate and timely weather data, and disseminate warnings to construction personnel of impending floods.

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 19-7.

Mitigation measures in other chapters that are relevant to the management of hydrology, flooding and water quality impacts include:

- Section 19.2 (Soils and contamination), specifically measures which minimise the extent of soil disturbance and address potential contamination impacts and spill management.

Through the implementation of these mitigation measures, residual hydrology, flooding and water quality impacts are anticipated to be appropriately managed.

Table 19-7 Proposed mitigation measures – hydrology, flooding and water quality

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
WA1	Construction water supply	Construction water supply arrangements will be confirmed during continued design development and detailed construction planning, based on further investigations that include ongoing consultation with water suppliers to access the local reticulated network, use of treated mine water, and use of water tanks within construction compounds.	Detailed design and pre-construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
WA2	Construction water supply	Opportunities to minimise water demand will be further explored during detailed design and construction planning, including: • capture and use rainwater at construction compounds and/or workforce accommodation camps • use of treated mine water, subject to any onsite reuse requirements • reuse/recycling of construction water (for example, water could be reused onsite for dust suppression, to assist with compaction) • treated wastewater and/or groundwater inflows • the use of additives in concrete mixtures to reduce the amount of water required • identification of alternative construction techniques which will reduce water use (where practicable).	Detailed design and pre-construction	All locations
WA3	Watercourse geomorphology	Where relevant, permanent erosion control measures will be designed and implemented at relevant energy hubs, switching stations and transmission line towers to minimise potential scour and erosion risks associated with surface water runoff during operation.	Detailed design and construction	Energy hubs, switching stations and transmission line towers
WA4	Dispersion of sediment into the environment	Areas disturbed as a result of construction activities will be managed in accordance with the requirements of *Managing Urban Stormwater Soils and Construction* (4th Edition) (Landcom, 2004). This will include the implementation of a range of erosion and sediment control measures which may include: • drainage control measures, e.g. flow diversion banks, straw bale berms and rock-lined chutes • sediment control measures, e.g. sediment fences, traps and basins and impervious covers • erosion control measures, e.g. covering of stockpiles, erosion control blankets, dust suppression measures (e.g. water trucks) and revegetation.	Construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
WA5	Water quality	A water quality monitoring program for construction will be prepared and implemented to monitor water quality conditions at perennial watercourses that the transmission lines will cross, and to facilitate monitoring of any changes in water quality that could be attributable to the project during construction. The program will detail: • water quality objectives and criteria for the project, in accordance with the *Murray–Darling Basin Plan 2012* (Murray–Darling Basin Authority, 2012) and *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000* (ANZECC/ARMCANZ, 2000) • frequency, location and duration of sampling, as minimum will include at least two monitoring locations located downstream and upstream of the project on the Talbragar River, Talbragar River at Elong Elong (412042), Cudgegong River at Yamble Bridge (421019) and Wollar Creek • monitoring for total dissolved solids, dissolved oxygen, electrical conductivity, total suspended solids, total nitrogen and total phosphorus. In the event of exceedances of the project water quality criteria, soil and water management measures adopted as part of the Construction Environmental Management Plan will be reviewed and revised accordingly.	Pre-construction and construction	Relevant locations
FL1	Flooding	Detailed construction planning will consider flood risk at construction sites and support facilities, including: • reviewing construction work area layouts and staging construction activities in order to avoid or minimise obstruction of overland flow paths and limiting the extent of flow diversion required • designing the layout of construction facilities and implementing stormwater management controls during their establishment in order to manage the impact of flooding on construction personnel, equipment and materials • identifying and applying measures to not worsen flood impacts on the community and on other property and infrastructure during construction up to and including the 1% AEP flood event where practicable. Where warranted by the scale and nature of the proposed works this will include flood modelling and assessment to assess the extent of potential impacts and therefore the scope of mitigation measures that may be required • measures to mitigate alterations to local runoff conditions due to construction activities.	Detailed design	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
FL2	Flood behaviour (construction)	Stockpiles will be located in areas which are not subject to frequent inundation by floodwater, ideally outside the 10% AEP flood extent. The exact level of flood risk accepted at stockpile sites will depend on the duration of stockpiling operations, the type of material stored, the nature of the receiving drainage lines and also the extent to which it will impact flooding conditions in adjacent development.	Construction	All locations
FL3	Flood safety	Construction compounds and workforce accommodation camps will be located outside high flood hazard areas based on a 1% AEP flood event.	Detailed design	Construction compounds and workforce accommodation camps
FL4	Emergency management	Flood emergency management measures for construction of the project will be prepared and incorporated into relevant environmental and/or safety management documentation. This will include: • contingency planning for construction facilities that are located in areas that are inundated by mainstream flooding during a 1% AEP event • for construction facilities located within the floodplain the identification of how flood related risks to personal safety and damage to construction facilities and equipment will be managed • procedures to monitor accurate and timely weather data, and disseminate warnings to construction personnel of impending flood producing rain.	Pre-construction	All locations
FL5	Climate change adaptation	The impact of the project on flood behaviour will be confirmed during detailed design. This will include consideration of future climate change.	Detailed design	All locations
FL6	Impacts to existing flooding regime	The project will be designed to minimise adverse flood related impacts on: • surrounding development for storms up to 1% AEP in intensity • critical infrastructure, vulnerable development or increases in risk to life due to a significant increase in flood hazard for floods up to the PMF.	Detailed design	All locations
FL7	Flood impacts	The energy hubs and switching stations will be designed to manage adverse impacts on the receiving drainage lines as a result of changes in the depth, velocity, extent and duration of flow during storms up to 1% AEP in intensity.	Detailed design	Energy hubs and switching stations
FL8	Flood impacts	The energy hubs and switching stations, including their access road connections to existing roads, will be designed to ensure that the existing level of flood immunity of the road network is maintained and increases in flood depths and hazards along the road network are minimised.	Detailed design	Energy hubs and switching stations
FL9	Waterway impacts	Localised increases in flow velocities at drainage outlets and waterway crossings will be mitigated through the provision of scour protection and energy dissipation measures.	Detailed design and construction	All locations

19.2 Soils and contamination

This section provides an overview of the existing environment of the project as it relates to soils and contamination, an assessment of the potential soil and contamination impacts of the project and identifies mitigation measures to be adopted to minimise and manage these impacts. It summarises the assessment provided in Technical paper 16 – Contamination (Technical paper 16). The SEARs as they relate to soil and contamination, and where in the EIS these have been addressed, are detailed in Appendix A.

19.2.1 Legislative context

The assessment of soils and contamination was undertaken in accordance with SEARs and with reference to the requirements of relevant legislation, policies and assessment guidelines including:

- *Protection of the Environment Operations Act 1997* (NSW) (POEO Act)
- *Contaminated Land Management Act 1997* (NSW) (CLM Act)
- State Environmental Planning Policy (Resilience and Hazards) 2021
- *Managing urban stormwater: Soils and construction volume 1* (Landcom, 2004)
- *Managing Urban Stormwater: Soils and Construction Volumes 2A and 2C* (NSW Department of Environment and Climate Change (DECC), 2008
- *NSW EES guidance on urban and regional salinity*
- *Landslide risk management guidelines* (Australian Geomechanics Society, 2007)
- *Soil and Landscape Issues in Environmental Impact Assessment* (Department of Land and Water Conservation, 2000)
- *Acid Sulfate Soil Manual* (Acid Sulfate Soil Management and Advisory Committee, 1998)
- *National Environment Protection (Assessment of Site Contamination) Measure* (NEPM) 1999 as amended in 2013
- Managing asbestos in or on soil guide (SafeWork NSW, 2014)
- *Guidelines for the Assessment, Remediation and Management of Asbestos – Contaminated Sites in Western Australia* (WA Department of Health, 2009)
- *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (NSW Environment Protection Authority (EPA), , 2015)
- *Guidelines for the NSW Site Auditor Scheme (3rd edition)* (EPA, 2017)
- *PFAS National Environmental Management Plan 2*.0 (Department of Agriculture, Water and the Environment, 2020)
- *National Water Quality Management Strategy* (NQWMS) (Australian Government, 2018)
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2018).

19.2.2 Assessment approach

Study area

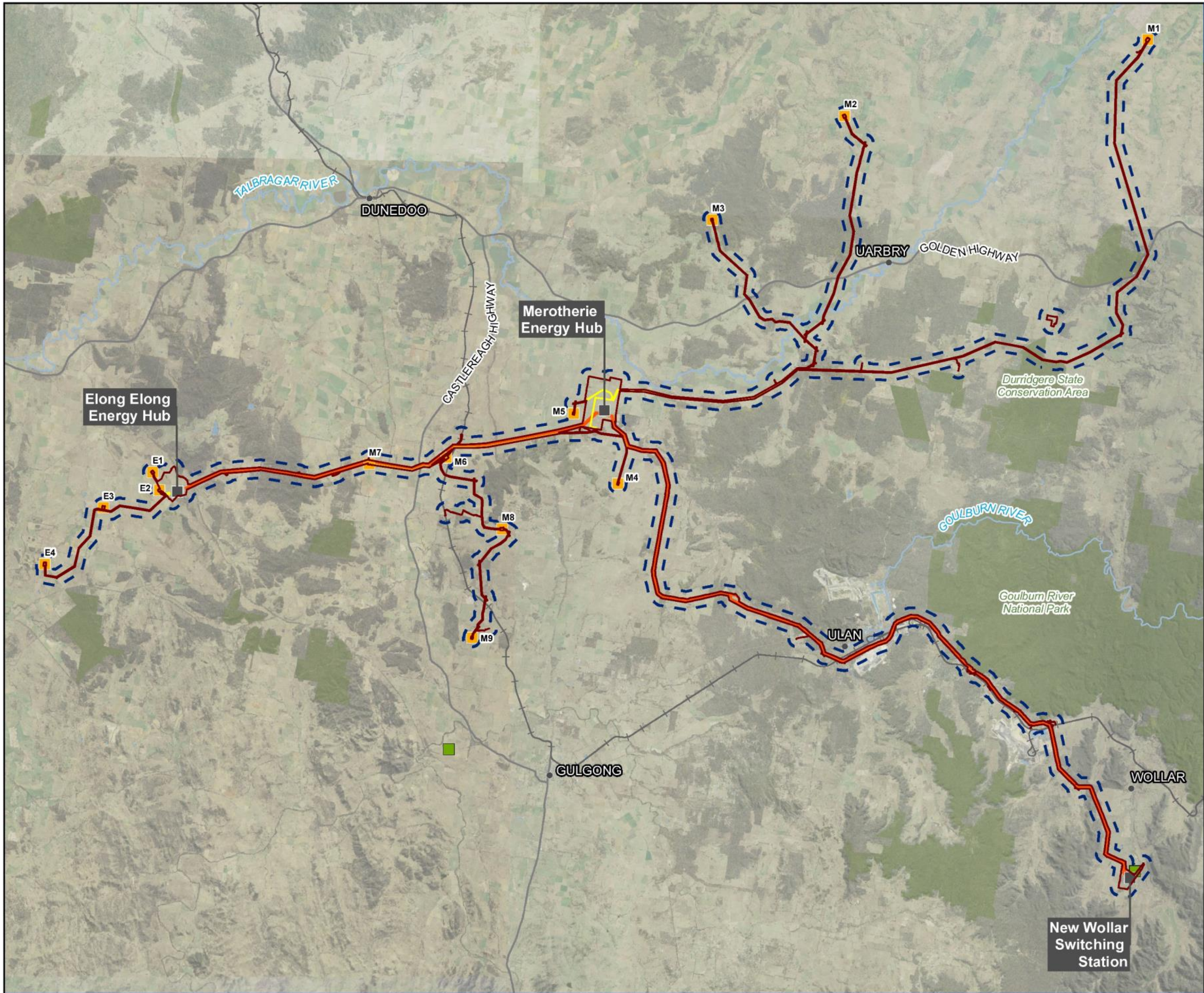
The study area for the soils and contamination assessment includes land within a 500 metre buffer of the construction area (refer to Figure 19-7).

Methodology

The assessment methodology involved:

- a desktop assessment of existing publicly available reports, mapping and databases relevant to soils, contamination and historical land uses. This included:
  - historical aerial photographs
  - geology, soils and land maps published by the Geological Survey of NSW, former Department of Conservation and Land Management, Heads of Asbestos Coordination Authorities and the Soil Conservation Service of NSW. This includes acid sulfate and naturally occurring asbestos maps
  - contaminated land registers and other relevant databases, including:
    - NSW EPA register of contaminated sites and list of notified sites, under sections 58 and 60 of the CLM Act, for sites located within two kilometres of the project study area
    - NSW EPA's environment protection licence records under section 308 of the POEO Act NSW
    - NSW EPA database of former gasworks sites
    - Department of Defence database for unexploded ordnance (UXO)
    - NSW Department of Primary Industries register of cattle dip sites
    - NSW EPA Per- and polyfluoroalkyl substances (PFAS) Investigation database
  - Australian Soil Resource Information System (maintained by the Commonwealth Scientific and Industrial Research Organisation (CSIRO))
  - NSW Soil and Land Information System (eSPADE) (NSW Department of Planning, Industry and Environment (DPIE), 2022)
  - EIS documents and monitoring data for the Wilpinjong, Moolarben and Ulan mine sites
- review of intrusive investigations undertaken by EnergyCo for the project
- identification of the potential for the project to disturb acid sulfate soils, saline soils, sodic soils, or naturally occurring asbestos during construction
- consideration of the potential impacts of the project due to erosion and sedimentation during construction and operation
- assessment of potential contamination risk in general accordance with the *Framework for the Assessment of Site Contamination* as outlined in NEPM (2013) during construction. This assessment included:
  - the identification of potential sources (or areas of contamination concern) based on historical and current land uses as well as the results of the desktop assessment and intrusive investigations
  - the level of unmitigated risk to sensitive receivers (both human and ecological) with consideration of the nature of contamination, the proximity of sensitive receivers and the presence of available pathways during construction that could expose or introduce contamination to sensitive receivers
- assessment of any long-term operational or maintenance activities that may have the potential to pose a contamination risk
- identifying mitigation measures for the project to address potential soil and contamination impacts.

Figure 19-7
Soils and contamination study area



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Contamination risk assessment

Potential contamination risks associated with construction and operation were identified and rated according to likelihood, consequence, and overall level of risk, in general accordance with *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines* (refer to Table 19-8 and Table 19-9).

Table 19-8 Likelihood for land contamination to be present

Likelihood	Description	Basis for ranking
High	Contamination potentially present at concentrations above the relevant guideline criteria and widespread	A high category would apply if the available information indicates the construction area or a portion of the construction area is identified: • as being contaminated on a public register of contaminated sites maintained by a regulator, or • has been the subject of an activity which is frequently associated with contamination.
Medium	Contamination potentially present at concentrations above the relevant guideline criteria and limited in extent	A medium category would apply if the available information indicates the construction area or a portion of the construction area: • is or has been the subject of an activity which in some circumstances is known to be associated with contamination • has been historically filled with imported material, the origin of which is unknown; and/or • has records indicating the potential for groundwater contamination.
Low	Contamination unlikely to be present above relevant guideline criteria and limited in extent	A low category would apply if the construction area has been partially cleared for agricultural and/or infrastructure (including roads) purposes, however no distinct contamination sources have been identified.
Insignificant	No contamination sources identified	The available information indicates that the construction area, or land within 500 m of the construction area is generally undisturbed bushland.

The consequence/pathway has been qualitatively classified as:

- Minor: minor localised levels of environmental impact or low levels of human exposure below the occupational exposure scenarios.
- Moderate: significant localised environmental impact or exposure to humans above occupational exposure scenarios.
- Significant: off-site environmental impact or an immediate and/or long-term harm to human health or the environment.

To provide the overall potential contamination risk for the project, a matrix was used which combines the potential likelihood of encountering contamination (as described in Table 19-8) and the consequence of this disturbance, should it occur(refer to Table 19-9). Overall risks are defined as:

- Low risk – impact can be managed by implementing standard construction management practices in accordance with relevant guidelines.
- Medium risk – contamination specific management plans and controls are required.
- High risk – engineered controls and/or environmental/health monitoring are required.

Table 19-9 Risk assessment matrix

Consequence	Likelihood			
	Insignificant	Low	Medium	High
Minor	Low	Low	Low	Medium
Moderate	Low	Low	Medium	High
Significant	Low	Medium	High	High

19.2.3 Existing environment

Regional geology

The NSW seamless geology dataset (Colquhoun, et al., 2021) indicates that the surface geology in the study area consists of a range of geological layers/provinces, which are described below in Table 19-10 and shown in Figure 19-8.

Table 19-10 Geological layers/provinces in the study area

Geological layer/ province	Description
Cenozoic Sedimentary Province	Cenozoic sedimentary alluvial surface sediments are associated with creeks and drainage lines. The discontinuous deposits along the valley floors and generally consists of fine to coarse grained sands and gravels in a silt/clay matrix, although some clean sand and gravel deposits are also present.
Cenozoic Igneous Province	The Cenozoic Igneous Province lies in the northeastern sections of the study area. This province contain basalt due to volcanic activity during the Cenozoic period. The fractured basalt of the Liverpool Ranges Basalt is highly dissected and overlies the Sydney Basin sandstone units in the northwestern region of the Hunter Valley.
Great Australian Basin	The Great Australian Basin is a sedimentary basin which, within the study area, primarily consists of sandstone, siltstone, mudstone and thin coal seams.
Permo-Triassic Basins	The Permo-Triassic basin sediments exist at surface in the eastern half of the study area near Wollar and also near the Elong Elong Energy Hub. The sediment includes pebbly to medium grained quartz sandstone, red-brown and green mudstone, and lenses of quartz conglomerate. Coal bearing rocks are located close to surface in the southeastern parts of the study area (near Wollar), near the Ulan, Moolarben and Wilpinjong coal mines.
Lachlan Orogen	The Lachlan Fold Belt, part of the Lachlan Orogen, is present at surface in the central part of the construction area. The surface geology consists of strongly sedimentary rocks, cherts, siltstones and mafic volcanic basalts and rhyolites, and plutonic granitic intrusions.

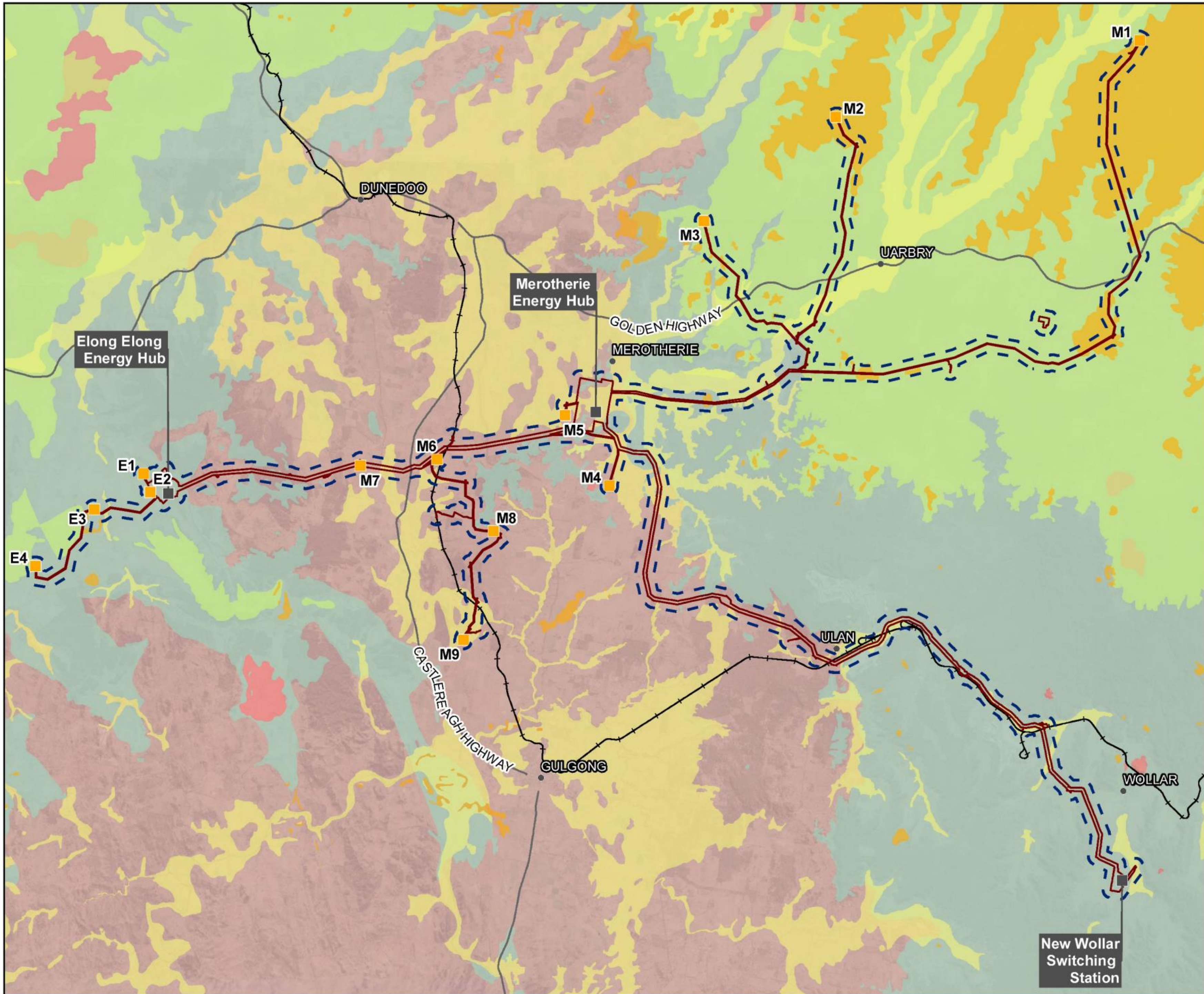

Figure 19-8
Surface geology

Legend

- Study area
- Construction area
- Energy hub / 500 kV switching station
- 330 kV switching station
- Road
- Railway

Geological layer/province

- Cenozoic Igenous Province
- Cenozoic Sedimentary Province
- Great Australian Basin
- Permian-Mesozoic Igenous Province
- Permo-Triassic Basin
- Lachlan Orogen

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Soil landscapes

Soils within the study area are generally mapped as chromosols, kurosols, and vertosols according to Australian Soil Classification (CSIRO, 2016) comprised of self-mulching black earth soils.

Nineteen soil landscapes are mapped within the study area (DPIE, 2020c and Murphy B.W. and Lawrie J.W, 1998) (refer to Figure 19-9 and Table 19-11). It is noted however that no available soil landscape mapping data exists for areas in the northeastern portion of the study area north of Uarbry. Published soil mapping indicates that the soils are expected to be predominantly in situ and colluvial materials derived from parent rock. The predominant soil types are typically loam and clay or a mixture of the two.

Soil salinity and soil sodicity

Dryland salinity is the accumulation of salts in the soil surface and in ground water in non-irrigated areas. Salinity is commonly caused by the mobilisation of salts in the soil profile by surface water or groundwater. The broad processes for groundwater mobilisation include groundwater recharge (or deep drainage), groundwater movement or groundwater discharge.

The study area is generally mapped as having a low salinity potential, however evidence of salting has been mapped near the Ulan, Moolarben and Wilpinjong coal mines. The Ulan, Turill and Barigan Creek soil landscapes are also associated with high levels of salinity, however occurrences in these landscapes are likely to be confined to drainage lines or depressions and/or footslopes and lower slopes.

Dryland salinity may also be caused by the exposure of naturally saline soils such as hypersaline clays. It can be associated with sodic soils (soils with an exchangeable sodium percentage) of more than six per cent. Soil landscapes commonly associated with sodic soils include Balladoran, Goonoo, Home Rule, Rouse, Turill and Ulan soil landscapes (refer to Table 19-11). Soil sodicity can lead to:

- reduced flow of water through soil — which limits leaching and can cause salt to accumulate over time and the development of saline subsoils
- dispersion in the soil surface, causing crusting and sealing, which then impedes water infiltration
- dispersion in the subsoil, accelerating erosion, which can cause the appearance of gullies and tunnels.

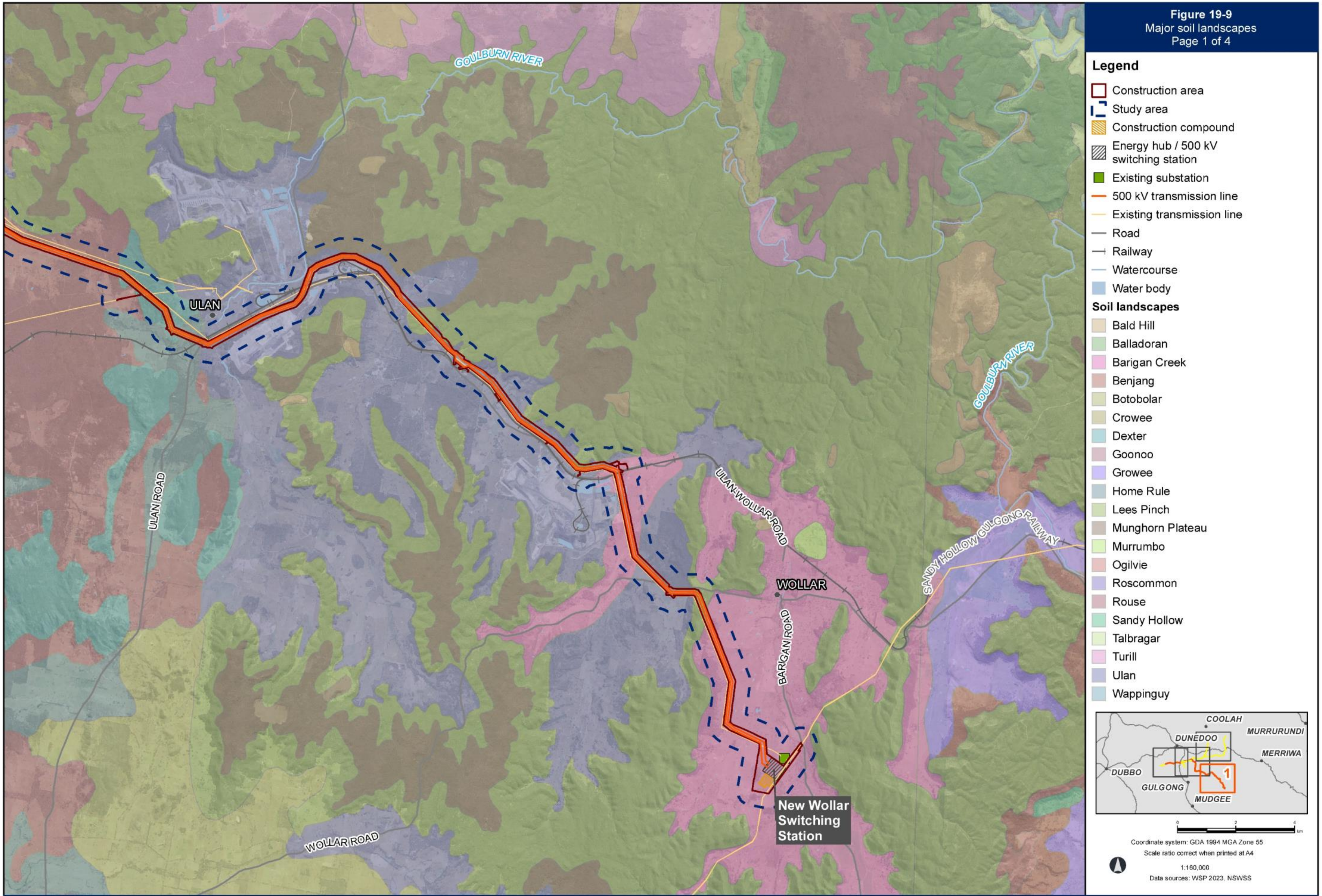

Figure 19-9
Major soil landscapes
Page 1 of 4

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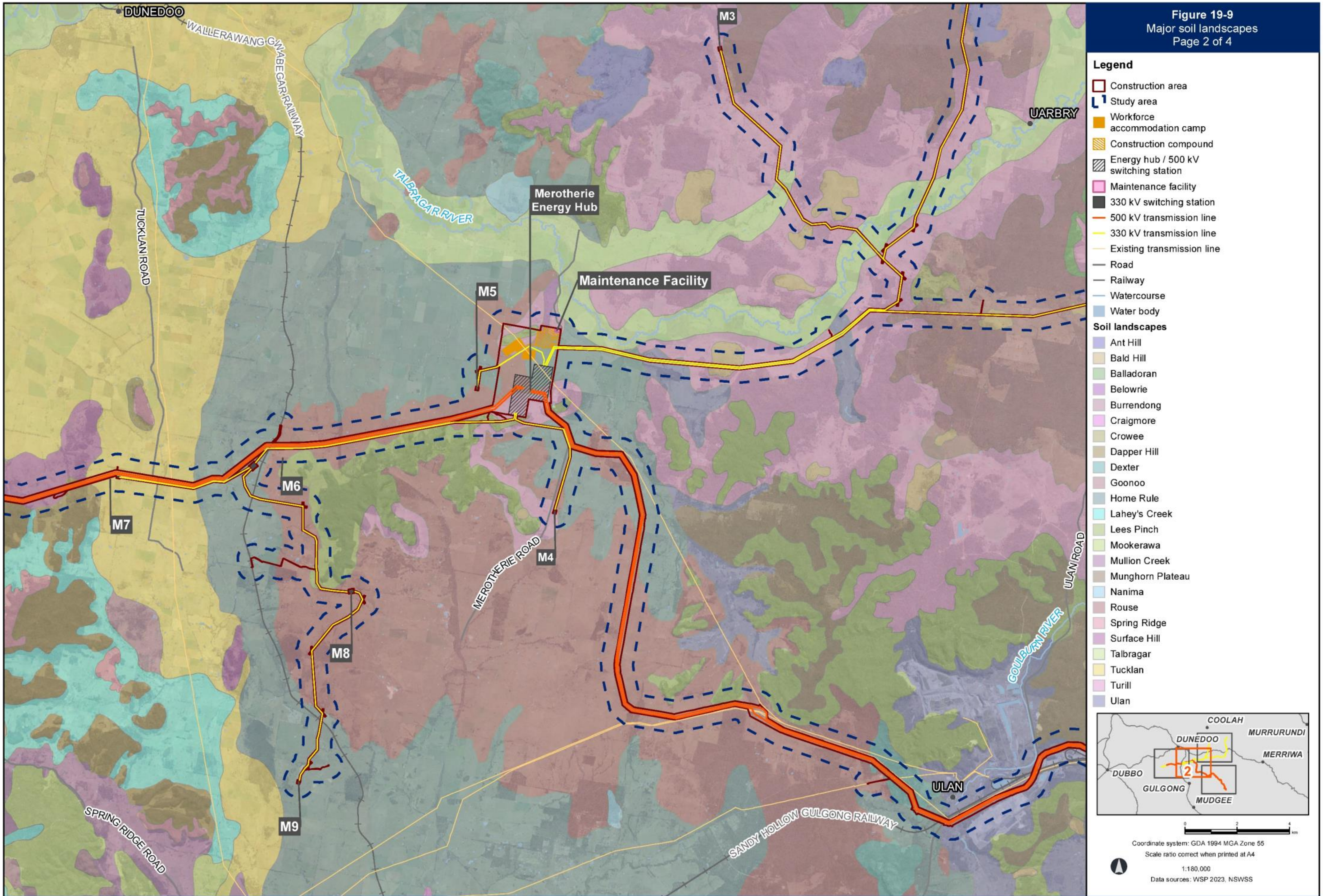

Figure 19-9
Major soil landscapes
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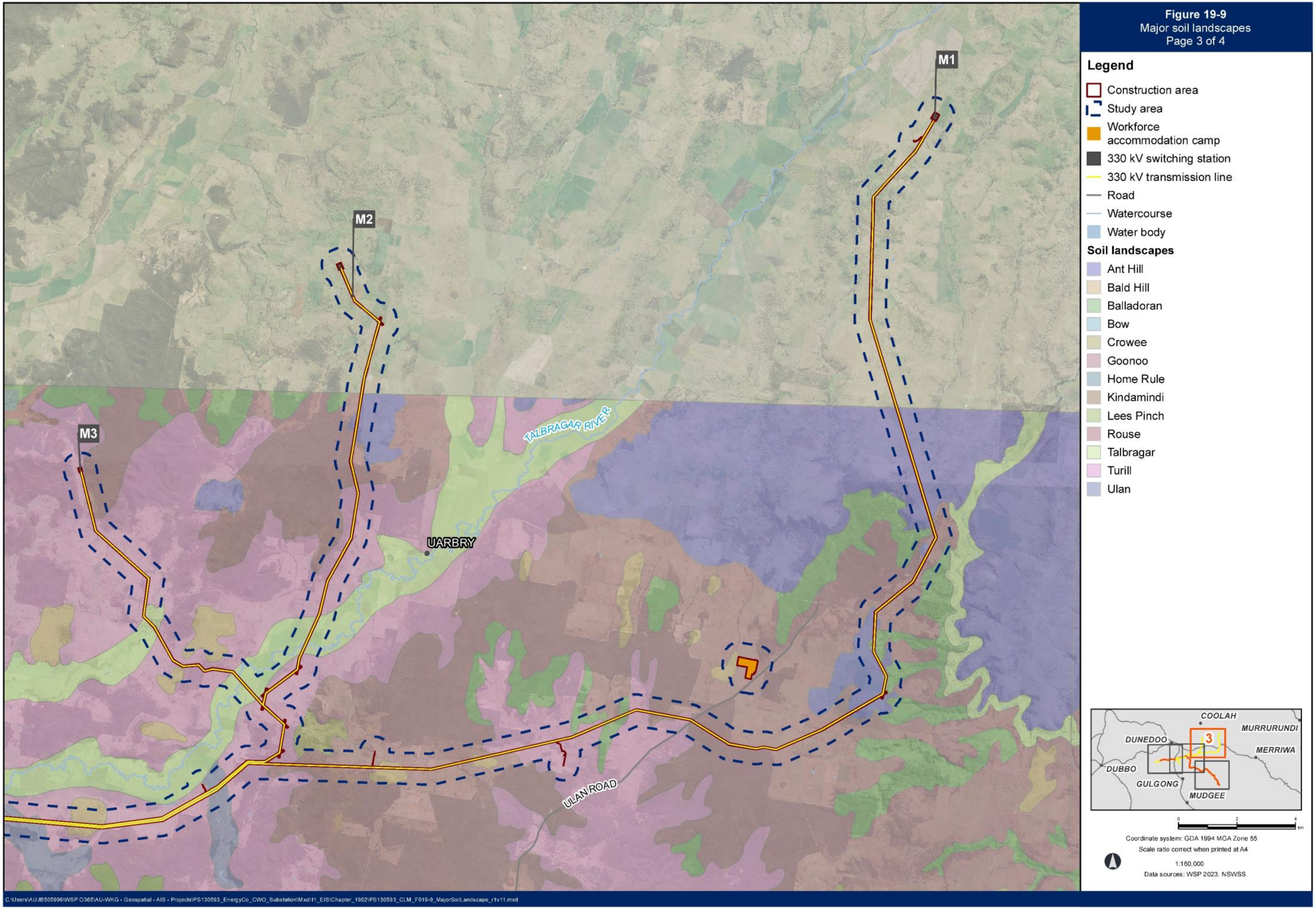

Figure 19-9
Major soil landscapes
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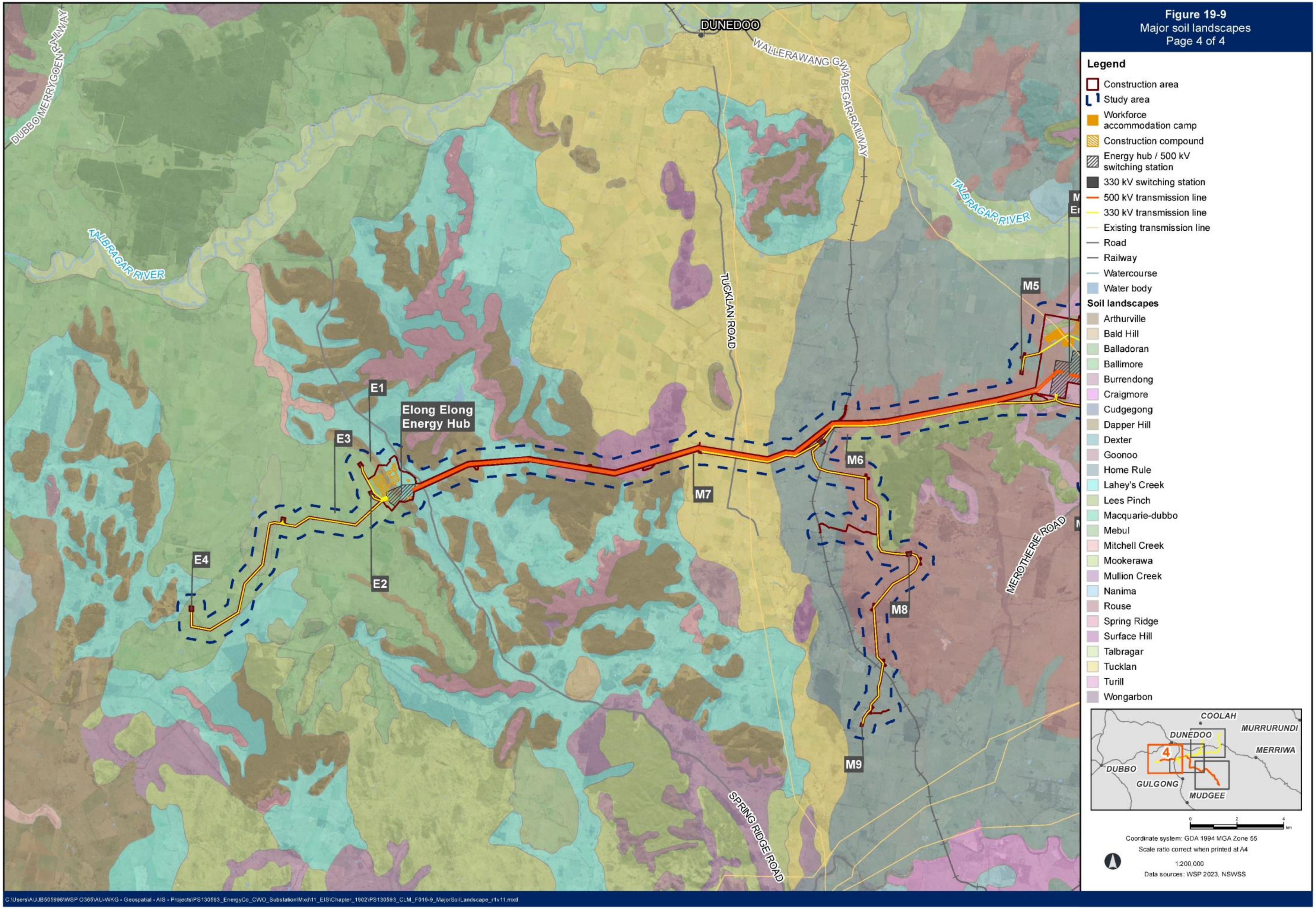
Figure 19-9
Major soil landscapes
Page 4 of 4
Legend
Construction area
Study area
Workforce accommodation camp
Construction compound
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing transmission line
Road
Railway
Watercourse
Water body
Soil landscapes
Arthurville
Bald Hill
Balladoran
Ballimore
Burrendong
Craigmore
Cudgegong
Dapper Hill
Dexter
Goonoo
Home Rule
Lahey's Creek
Lees Pinch
Macquarie-dubbo
Mebul
Mitchell Creek
Mookerawa
Mullion Creek
Nanima
Rouse
Spring Ridge
Surface Hill
Talbragar
Tucklan
Turill
Wongarbon
DUNEDOO
DUBBO MERRYGOEN RAILWAY
WALLERAWANG GWABEGAR RAILWAY
TALBRAGAR RIVER
TUCKLAN ROAD
MEROTHERIE ROAD
SPRING RIDGE ROAD
Elong Elong Energy Hub
E1
E2
E3
E4
M5
M6
M7
M8
M9
COOLAH
DUNEDOO
MURRURUNDI
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Table 19-11 Soil landscapes (Murphy B.W. and Lawrie J.W, 1998)

Soil landscape	Basic soil composition	Potential for erosion, sodic and salinity
Ant Hill	Shallow to deep and well to moderately drained black, red, and brown Chromosols and Dermosols on crests and side slopes.	• Low to high erosion hazard, increasing to high where this soil landscape occurs in sloped landscapes and areas under cultivation with low surface cover. • Low salinity potential.
Bald Hill	Soils derived from basic parent material and are clayey with high to moderate fertility.	• Low erosion hazard, increasing to moderate to high where this soil landscape occurs in sloped landscapes when surface cover is low. • Salinity is unlikely to occur.
Balladoran	Generally, very sandy soils formed on quartz sandstone; some clayey soil in depressions which usually have sodic subsoils.	• Low erosion hazard where this soil landscape occurs under forest, increasing to moderate to high in areas under grazing or cultivation. • Drainage depressions are susceptible to erosion due to sodic subsoils, and severe gully erosion can occur when these subsoils are exposed. • Low to moderate salinity potential.
Barigan Creek	Yellow Podzolic Soils comprised of dark reddish-brown fine sandy loam.	• Moderate erosion hazard, with high hazard potential where this soil landscape occurs in areas where surface cover is low or under cultivation. • Isolated high levels of salinity occur along some drainage lines and depressions.
Belowrie	Red earths comprised of dull reddish-brown loam.	• Low to moderate erosion hazard where surface cover is maintained, increasing to high hazard where this soil landscape occurs in areas where surface cover is low or under cultivation. • Low levels of salinity, noting salinity issues are absent.
Crowee	Yellow and brown earths comprising brownish-black sandy loam with weak structure.	• Moderate erosion hazard where surface cover is maintained, to very high where this soil landscape occurs in area under cultivation or where surface cover is low. • Potential for low levels of salinity. These areas are typically associated with drainage lines, depressions, footslope terraces and lower slopes and rarely associated with mid and upper slopes.
Dapper Hill	Yellow soloths comprising dark yellowish-brown sandy loam to loamy sand.	• Moderate to high erosion hazard, but very high erosion hazard where this soil landscape occurs in areas where surface cover is low or under cultivation, or in drainage lines. • Isolated low levels of salinity occur along some drainage lines and depressions.
Dexter	Siliceous Sands comprising dark brown to brown sandy loam to clayey sand.	• Low to high erosion hazard, with high hazards associated with this soil landscape where it is located in areas containing steep slopes. • Salinity issues are absent and unlikely to occur.
Goonoo	Generally, very sandy soils formed on quartz sandstone; some clayey soil in depressions which usually have sodic subsoils.	• Moderate to high erosion hazard, with higher erosion hazard occurring at locations where surface cover is low or flows are concentrated. Areas where this soil landscape occur in drainage depressions are susceptible to gully erosion without adequate protection from high runoff. • Drainage depressions contain dense sodic subsoils. • Low levels of salinity, with occurrences confined along drainage lines and depressions.

Soil landscape	Basic soil composition	Potential for erosion, sodic and salinity
Home Rule	Siliceous sands comprising Loose brown to dark brown loamy sand; small angular stones of quartz and felspar.	• Moderate to high erosion hazard, increasing to very high erosion hazard where this soil landscape is located on slopes, and where surface cover is low. Areas where this soil landscape occur in drainage depressions are susceptible to gully erosion without adequate protection from high runoff. • Subsoils in drainage depressions and lower slopes are sodic. • Potential for low levels of salinity. These areas are typically associated with drainage lines, depressions, footslopes and lower slopes and rarely associated with mid and upper slopes.
Lees Pinch	A mixture of shallow siliceous sands, shallow acid soils, and yellow earths.	• Moderate to high erosion hazard, with high erosion hazard where this soil landscape occurs on slopes and where surface cover is low. • Low levels of salinity.
Munghorn Plateau	A mixture of yellow earths comprising dark brown light sandy clay loam which shows organic influence; and siliceous sands comprising bright yellowish-brown to very dark brown, sandy loam to fine sandy loam.	• Moderate to very high erosion hazard, with higher hazards on slopes and where surface cover is low. Areas where this soil landscape occurs in gully depressions are susceptible to gully erosion without adequate protection from high runoff. • Salinity issues are absent and unlikely to occur.
Rouse	A mixture of yellow earths comprising dark brown light sandy clay loam which shows organic influence; and siliceous sands comprising bright yellowish-brown to very dark brown, sandy loam to fine sandy loam.	• Moderate to high erosion hazard, with higher hazard occurring where surface cover is low or flows are concentrated. Areas where this soil landscape occurs in drainage depressions are susceptible to gully erosion without adequate protection from high runoff. • Sodic subsoils are present, and severe gully erosion may occur when subsoils are exposed. • Low levels of salinity. These areas are typically associated with drainage lines, depressions, footslopes and lower slopes and rarely associated with mid and upper slopes.
Spring Ridge	A mixture of shallow siliceous sands, and yellow solodths comprising dark yellowish-brown sandy loam to loamy sand.	• Moderate to high erosion hazard. Areas where this soil landscape occurs in drainage depressions are highly susceptible to gully erosion without adequate protection from high runoff. • Salinity is absent and unlikely to occur.
Surface Hill	Non-calcic brown soils comprised dark reddish-brown fine sandy loam.	• Moderate to low erosion hazard, but erosion hazard increases to high at locations where this soil landscape occurs in sloped areas, and particularly where soil cover is poor. • Salinity is unlikely.
Talbragar	A mixture of black earths and non-calcic brown soils; both comprised of well-structured clays.	• Moderate potential for erosion, however erosion hazard is generally due to topography. High erosion hazards exist where this soil landscape occurs along some streambanks. • Isolated low levels of salinity occur along some drainage lines and depressions.
Tucklan	Andesite, basalt and associated shale, tuff, and siltstone. Comprised primarily of euchrozems with minor rises of red Podzolic soils and non-calcic brown soils (Dr2.22).	• Low to moderate erosion hazard, however can be high where this soil landscape occurs in sloped areas and where areas have low surface cover or are under cultivation. • Isolated low levels of salinity occur along some drainage lines and depressions.
Turill	A mixture of earthy sands and yellow soloths comprised of brown clayey sand, and dark brown sandy loams respectively.	• Low to high erosion hazard, but high to very high erosion hazard where surface cover is low or in areas under cultivation. Soils are susceptible to gully erosion due to sodic subsoils. • High levels of salinity in localised areas, with occurrences confined along drainage lines and depressions.

Soil landscape	Basic soil composition	Potential for erosion, sodic and salinity
Ulan	Yellow podzolic soils on lower slopes and drainage lines with patches of yellow solodic soils/solonetz in association with salt scalds.	• High to very erosion hazard on slopes in areas where surface cover is low and under cultivation. • Soils in drainage depressions are susceptible to gully erosion without adequate protection from high runoff as the subsoils are often sodic. • Potential for high levels of salinity. These areas are typically associated with drainage lines, depressions, footslopes and lower slopes and more rarely associated with mid and upper slopes.

Acid sulfate soils

Acid sulfate soils and potential acid sulfate soils are naturally occurring soils containing iron sulphides. On exposure to air, during excavations or other forms of soil disturbance, iron sulphides oxidise and create sulfuric acid. This increase in acidity can result in the mobilisation of aluminium, iron, and manganese from the soils. Published Acid Sulfate Soils mapping indicates there is generally a low or extremely low probability of acid sulfate soils within the study area. There is a potential for localised areas of acid sulfate soils in low lying waterlogged areas across the construction area, such as areas surrounding creeks or dams.

Naturally occurring asbestos

Naturally occurring asbestos refers to the mineral as a natural component of soils and rocks, which can be released from routine anthropogenic activities such as construction, or natural weathering processes. Naturally occurring asbestos is not known or expected to occur within the study area and as such, has not been considered further in this assessment.

Groundwater

A description of groundwater sources, groundwater levels and quality, groundwater users and groundwater dependent ecosystems is provided in Section 19.3 (Groundwater), and Technical paper 17 – Groundwater.

Contamination

Most of the study area is used for agricultural purposes, including livestock grazing and cropping. In general, these agricultural areas are infrequently intersected by infrastructure including roads, rail lines and electrical infrastructure. The exception is the southeastern portion of the study area, around the townships of Ulan and Wollar, where the Ulan, Wilpinjong, and Moolarben coal mining operations are located (refer to Figure 19-10 and Chapter 7 (Land use and property)).

A review of historical aerial photographs indicates that land use within study area has not changed significantly since the 1960's with a few minor exceptions. The main potential for historical contamination is associated with coal mining operations, which were first mined in the 1940's.

A review of a database search of potential current and former contaminant sources in the study area is presented in Table 19-12. There are no records within the study area for:

- sites with clean up and penalty notices, or with delicenced activities still regulated by the EPA
- former gasworks
- sites listed in the NSW EPA PFAS investigation program and UXO database (noting the search area for PFAS was extended to two kilometres from the construction area due to the characteristics of PFAS).

Table 19-12 Search of potential current and former contamination sources

Item	Details (if applicable)
List of NSW contaminated sites notified to EPA	There are no records of written notices issued under the CLM Act. One site, the Glencore Ulan Coal Mine has been notified to the EPA under section 60 of the CLM Act., The contamination is listed as not requiring regulation under the CLM Act.
Current NSW EPA licensed activities	There are three sites within the construction area which are currently subject to an Environment Protection Licence (EPL). At these, there are scheduled activities for coal works, and coal mining , and all have extensive dust, groundwater, and surface water monitoring programs as part of their licence conditions. Surface water monitoring programs are primarily focused on monitoring the discharge of dewatering flows from the mine. The sites include: • Ulan Coal Mines, 4505 Ulan Road, Ulan, NSW, 2850 (Licence No: 394) • Wilpinjong Coal Mine, 1434 Ulan-Wollar Road, Wilpinjong NSW 2850 (Licence No: 12425) • Moolarben Coal Operations Pty Ltd, 4250 Ulan Road, Mudgee NSW 2850 (Licence No: 12932). There are two sites within a 1 km buffer of the contamination study area that currently hold an EPL to undertake scheduled activities and/or scheduled development work under the POEO Act as detailed below: • Orica Explosives, Ulan Mine Site, Ulan Road, Ulan, NSW 2850 (Licence No: 4443) • Dronvisa Quarry, 12 Ulan-Wollar Road Ulan NSW 2850 (Licence No: 21765).
National waste management site database	There are two sites within a 0.5 km buffer of the contamination study area that are currently registered and are operational under the National Waste Management Site Database as detailed below: • Cassilis Transfer Station, 9756 Golden Highway, NSW 2329 (200 m north of the construction area) (Database ID NSW00281) • Ulan Transfer Station, 35 Bent Street Ulan NSW 2850 (400 m north of the construction area) (Database ID NSW01318).
Former licensed activities, now revoked or surrendered	None, however, mine sites have been subject to license variations during their operation.

As identified in Table 19-12, three current coal mining operations are located within the southeastern section of study area along the New Wollar Switching Station – Merotherie Energy Hub connection.

At the Wilpinjong Coal Mine (owned by Peabody), the construction area includes an area known as Pit 4. Pit 4 has been previously mined and backfilled with materials potentially containing high carbon material (HCM), and low-level coal. HCM is likely to be encountered at a depth of greater than one metre below the ground surface. Once excavated, HCM cannot be used as surface fill material and cannot be capped with topsoil and rehabilitated. It must be buried within the mine within specific areas in accordance with the Spontaneous Combustion Management Plan for the Wilpinjong Coal Mine. The location of HCM within remediated areas, such as Pit 4 is unknown as it was not surveyed by mine operators during placement. Based on rehabilitation plans prepared for the Wilpinjong Coal Mine, topsoil across remediated areas is likely to be very shallow and limited to a 0.15 to 0.3 metre layer.

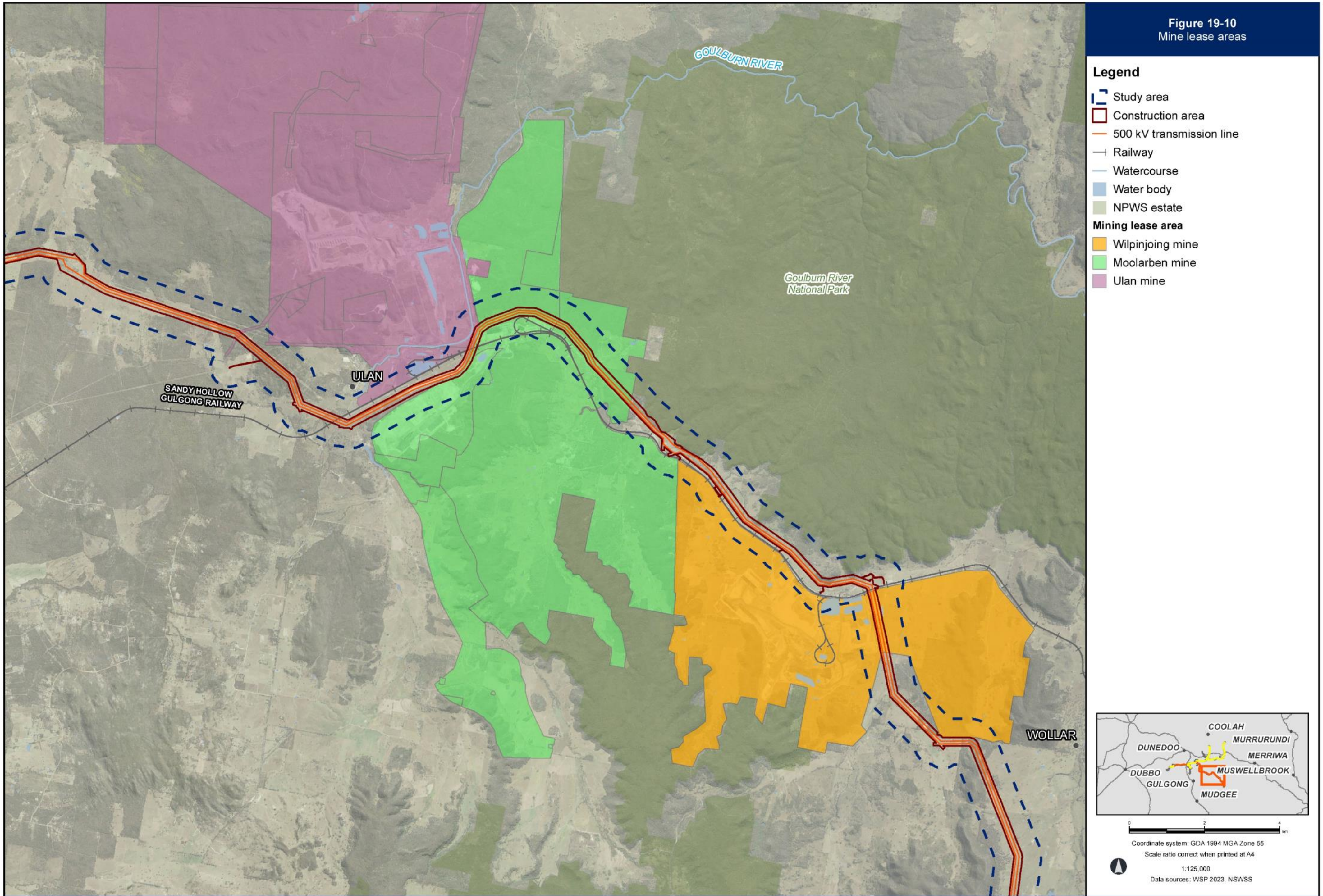
The construction area also passes to the east of a tailings dam. Anecdotal information indicates that around five to seven metres of coarse fill has been pushed over the dam, covered with topsoil and landscaped.

The construction area also intersects the periphery of the mining lease areas for the Ulan Coal Mine and the operational area of the Moolarben Coal Mine.

At the Moolarben Coal Mine, the construction area intersects the underground mine mains access (referred to as UG4) which runs in a southwesterly direction under Ulan Road (between UG1 and UG4).

At the Ulan Coal Mine, the construction area would be within the periphery of the mining lease area but is not within the current active mining area or any former rehabilitation areas.

Figure 19-10
Mine lease areas



Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:125,000
Data sources: WSP 2023, NSWSS

Areas of contamination concern

Table 19-13 provides an overview of the areas of contamination concern located within the study area, and the associated contaminants. The identification of an area of contamination concern does not represent actual contamination incidents or contamination conditions within the construction area. It is a statement of the potential for contamination to be present based on historical records and existing land uses and represents a worst-case scenario.

Table 19-13 Areas of contamination concern

Area of contamination concern	Reason for concern	Potential sensitive receivers	Potential contaminants	Risk ranking (refer to Table 19-8)
Existing Wollar substation site	Potential accidental spills from maintenance activities on-site and leaks from transformers. Potential leaks associated with fuel/transformer oil storage.	• construction/maintenance workers • aquatic ecosystems • terrestrial ecosystems near the substation • agricultural users on adjacent farming land	Poly chlorinated biphenyls (PCBs), Benzene, toluene, ethylbenzene, xylene, and naphthalene (collectively referred to as BTEXN) and Total Recoverable Hydrocarbons (TRH)	High
Mining leases areas	Uncontrolled earthworks, spills, illegal dumping of wastes, mine tailings.	• construction/maintenance workers • aquatic ecosystems • terrestrial ecosystems • agricultural users on adjacent farming land	Acid mine drainage, heavy metals, Polycyclic Aromatic Hydrocarbons (PAH), TRH, methane, HCM	High
Farm structures	Historical, uncontrolled earthworks/filling. Historical buildings and structures that have been demolished/degraded. Storage of agricultural chemicals on private properties and potential leaks associated with their use/application.	• construction/maintenance workers • aquatic ecosystems • terrestrial ecosystems • agricultural users	Heavy metals, asbestos, PAH, pesticides, TRH	Medium
Farm dams	Historical, uncontrolled earthworks/filling Accumulation of nutrients and pesticides from adjacent cropping activities.	• construction/maintenance workers • aquatic ecosystems terrestrial ecosystems • agricultural users	Heavy metals, BTEX, pesticides, TRH, nutrients, E. coli (and faecal bacteria)	Medium
Existing towers and transmission line infrastructure	Potential accidental spills from maintenance activities. Asbestos paints on tower infrastructure.	• construction/maintenance workers • terrestrial ecosystems • aquatic ecosystems • agricultural users on adjacent farming land	BTEXN, TRH, asbestos, pesticides	Low
Areas of active cropping/ cleared agriculture land	Historical, uncontrolled earthworks/filling. Potential leaks associated with agricultural activities. Nutrients and pesticides from cropping activities.	• construction/maintenance workers • terrestrial ecosystems • aquatic ecosystems • agricultural users	Heavy metals, pesticides, TRH, PAH, nutrients	Low

Area of contamination concern	Reason for concern	Potential sensitive receivers	Potential contaminants	Risk ranking (refer to Table 19-8)
Existing roadways and rail corridors	Spills from vehicles, and maintenance activities.	• construction/maintenance workers • terrestrial ecosystems • aquatic ecosystems • agricultural users on adjacent farming land	BTEXN, TRH, PAH, asbestos, pesticides	Low

19.2.4 Potential impacts – construction

This section presents an assessment of the potential impacts relating to soils and contamination that could not be avoided through development of the projects design and are anticipated to occur as part of construction. Impacts that have been avoided through design are described where relevant and detailed in Chapter 2 (Strategic context).

The key potential impacts relating to soils and contamination that may occur during construction include:

- impacts to and from the soil environment from construction activities
- encountering and disturbing potentially contaminated soil, groundwater, and surface water
- activities that may result in additional sources of contamination.

Impacts to and from the soil environment from construction activities

Erosion and transport of sediments

Construction of the project would temporarily expose the natural ground surface and sub-surface though the removal of vegetation, earthworks activities and excavation of surface soils. The exposure of soil to surface water runoff and wind can increase soil erosion potential, particularly where construction activities are undertaken in soil landscapes susceptible to erosion. The soil type expected within the construction area indicates that surface soils have a moderate to high potential for dispersion due to their sodic nature. If not properly managed, the exposure of the natural ground surface may result in potential sedimentation of surrounding land, drainage lines or downstream watercourses and dams.

The potential for erosion impacts would be minimised by implementing standard erosion management measures (refer to Section 19.2.6). Soil and sediment erosion control are critical especially within the vicinity of the mining leases. The three mines within the study area that the project intersects have extensive and existing surface water monitoring programs in place as part of their ongoing EPLs with strict compliance limits, and regular scheduled testing is undertaken.

Water and air quality impacts resulting from the exposure of the natural ground surface is discussed in Section 19.1 (Hydrology, flooding and water quality) and Section 19.4 (Air quality).

Acid sulfate soils

There is a low potential for localised areas of acid sulfate soils to be present in low lying waterlogged areas across the construction area, such as areas surrounding creeks or dams. Within the remainder of the construction area, there is a low to extremely low probability of encountering acid sulfate soils within the contamination study area (refer to Section 19.2.3).

Should disturbance of waterlogged areas be required, a preliminary assessment, in accordance with the Acid Sulfate Soil Manual, would be undertaken to determine whether acid sulfate soils are present and if the proposed works are likely to disturb these soils. If acid sulfate soils are present, then mitigation measures would be implemented in accordance with the Acid Sulfate Soil Manual.

Salinity

Development of rural land can change the movement of surface water and groundwater, resulting in a change in the way salts and other minerals interact. When the water table rises, dissolved salts that are typically locked in the soil and rock profile can potentially be carried to the surface causing increased soil salinity, and impact soil function and productivity. The current hydrogeological environment of the study area is not anticipated to be altered significantly by the project. As such, construction of the project is not expected to have a significant impact on soil salinity.

Mitigation measures in accordance with the NSW Department of Primary Industries (DPI) (2014) Salinity Training Handbook would be implemented where construction occurs in areas where evidence of salting has been previously mapped by DPIE (2014).

Disturbance of existing contamination

Table 19-14 provides an assessment of construction activities that could potentially disturb areas of contamination concern, and the risk this could pose. If inadequately managed, disturbance of existing contaminated areas has the potential to:

- mobilise contaminants, affecting nearby soils, surface water and groundwater
- increase the migration of contaminants into surrounding areas via leaching, overland flow and/or sub-surface flow (water and/or vapour) or dust, with the potential to impact on receiving environments
- increase the risk of exposure to contaminants (direct contact, ingestion and/or inhalation) by workers, visitors and the local community
- increase the risk of spontaneous combustion due to disturbance of HCM or result in the release of vapour.

Mining areas

There is a high risk of encountering contamination where construction would occur within past and active mining areas, mine surface water infrastructure or within 500 metres of mine water treatment infrastructure and/or rehabilitated areas. Detailed construction planning at these sites would consider interfaces with existing mine operations plans, the presence of existing environmental management controls, and proposed and existing rehabilitation programs for the mines. At Wilpinjong Coal Mine, the construction area would be excised from the mine operations plan.

Within the mine areas, the project would interact with:

- remediation areas at Wilpinjong mine (Pit 4) where excavation activities have the potential to encounter HCM
- underground mine UG4 mains access at Moolarben mine which runs underneath the construction area.

As outlined in Section 19.2.3, the construction area would not interface with current active mining operations or former rehabilitation areas of the Ulan Coal Mine.

At the mine sites, groundwater volumes encountered during construction are expected to be low but there remains a medium risk of encountering contamination, should dewatering be required during piling activities. Releases of groundwater off-site from mining areas into the surrounding environments would be suitably managed to protect the surrounding surface and groundwater receiving environments.

Further targeted investigations would be completed within the sections of the construction area that are located within the Wilpinjong coal mine area to confirm the potential to encounter contamination (soil and groundwater). This would be completed prior to construction and to inform the continued development of the project design in these areas.

Table 19-14 Preliminary risk ranking for areas of contamination concern disturbed by construction activities

Area of contamination concern	Construction activity	Potential contaminants	Pathway	Sensitive receiver, if not managed appropriately	Assessed risk
Existing Wollar Substation	Piling in the vicinity of the substation	PCBs and hydrocarbons in groundwater	• direct contact, ingestion or inhalation • migration from accidental discharges to receiving environments near the substation	• construction workers • aquatic ecosystems • terrestrial ecosystems • recreational users of watercourses • agricultural users on adjoining land	**Low** – as there is a: • low likelihood of contaminants to be present • moderate consequence in the absence of appropriate controls (refer to Section 19.2.6), despite negligible dewatering volumes being expected.
Existing towers and transmission line infrastructure	Excavation activities (earthworks), vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Pesticides, asbestos and hydrocarbons in soils	• direct contact, ingestion or inhalation • transport off-site via vehicle/plant movements • mobilisation via dust emissions • surface water runoff and discharges to receiving environments	• construction workers • terrestrial ecosystems • aquatic ecosystems	**Low** – as there is a: • low likelihood of contaminants to be present • minor consequence in the absence of appropriate controls (refer to Section 19.2.6).
	Piling adjacent to structures	Pesticides and hydrocarbons in groundwater	• direct contact, ingestion or inhalation • migration from accidental discharges to receiving environments	• construction workers • terrestrial ecosystems • aquatic ecosystems • agricultural users	**Low** – as there is a: • low likelihood of contaminants to be present • minor consequence in the absence of appropriate controls (refer to Section 19.2.6), noting dewatering volumes would be negligible.
Farm structures	Excavation activities (earthworks), vegetation clearing, vehicle movement, temporary stockpiling and utilities works	TRH, heavy metals, PAH, pesticides and asbestos in soils	• direct contact, ingestion or inhalation • transport off-site via vehicle/plant movements • mobilisation via dust emissions • surface water runoff and discharges to receiving environments	• construction workers • aquatic ecosystems • terrestrial ecosystems • agricultural users	**Low** – as there is a: • medium likelihood of contaminants to be present, however any contamination would be localised • minor consequence in the absence of appropriate controls (refer to Section 19.2.6).

Area of contamination concern	Construction activity	Potential contaminants	Pathway	Sensitive receiver, if not managed appropriately	Assessed risk
	Piling	TRH, heavy metals, PAH and pesticides in groundwater	• direct contact, ingestion or inhalation • migration from accidental discharges to receiving environments	• construction workers • aquatic ecosystems • terrestrial ecosystems • agricultural users	Low – as there is a: • low likelihood of contaminants to be present • minor consequence in the absence of appropriate controls (refer to Section 19.2.6), noting dewatering volumes would be negligible.
Farm dams	Excavation activities such as earthworks, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	TRH, heavy metals, PAH, pesticides, and asbestos in soils Heavy metals, E. coli (and faecal bacteria) and nutrients in surface waters	• direct contact, ingestion or inhalation • transport off-site via vehicle/plant movements • mobilisation via dust emissions • surface water runoff and discharges to receiving environments	• construction workers • aquatic ecosystems • terrestrial ecosystems • agricultural users	Medium – as there is a: • medium likelihood of contaminants to be present • moderate consequent if dam dewatering and filling is required and in the absence of appropriate controls (refer to Section 19.2.6).
Areas of active cropping/ cleared agricultural land	Excavation activities such as earthworks, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	TRH, heavy metals and PAH in soils	• direct contact, ingestion or inhalation • transport off-site via vehicle/plant movements • mobilisation via dust emissions • surface water runoff and discharges to receiving environments	• construction workers • terrestrial ecosystems • aquatic ecosystems • agricultural users	Low – as there is a: • low likelihood of contaminants to be present • minor consequence in the absence of appropriate controls (refer to Section 19.2.6).
	Piling	TRH, heavy metals and PAH in groundwater	• direct contact, ingestion or inhalation • migration from accidental discharges to receiving environments	• construction workers • terrestrial ecosystems • aquatic ecosystems • agricultural users	Low – as there is a: • low likelihood of contaminants to be present • minor consequence in the absence of appropriate controls (refer to Section 19.2.6), noting dewatering volumes would be negligible.

Area of contamination concern	Construction activity	Potential contaminants	Pathway	Sensitive receiver, if not managed appropriately	Assessed risk
Existing roadways and rail corridor	Excavation, vegetation clearing, vehicle movements, temporary stockpiling and utilities works	TRH, heavy metals, PAH, pesticides, and asbestos in uncontrolled fill or due to spills	• direct contact, ingestion or inhalation • transport off-site via vehicle/plant movements • mobilisation via dust emissions • surface water runoff and discharges to receiving environments	• construction workers • terrestrial ecosystems • aquatic ecosystems	Low – as there is a: • low likelihood of contaminants to be present • minor consequence in the absence of appropriate controls (refer to Section 19.2.6).
Mining lease areas – outside active mine footprints, including mining access roads	Excavation activities, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Acid mine drainage, methane, TRH, heavy metals and PAH in soils	• direct contact, ingestion or inhalation • transport off-site via vehicle/plant movements • mobilisation via dust emissions • surface water runoff and discharges to receiving environments • ingress/accumulation of methane gases within open excavations	• construction workers • recreational users of adjacent waterways • aquatic ecosystems • terrestrial ecosystems • agricultural users on adjoining land	Low – as there is a: • low likelihood of contaminants to be present, based on contamination investigations completed for the project • moderate consequence in the absence of appropriate controls (refer to Section 19.2.6).
	Pile construction	Acid mine drainage, methane, TRH, heavy metals and PAH in groundwater	• direct contact, ingestion or inhalation • migration from accidental discharges to receiving environments • emissions to air (spontaneous combustion)	• construction workers • recreational users of adjacent waterways • aquatic ecosystems • terrestrial ecosystems • agricultural users on adjoining land	Medium – as there is a: • moderate likelihood of contaminants to be present in groundwater • moderate consequence in the absence of appropriate controls (refer to Section 19.2.6), despite negligible dewatering volumes being expected.

Area of contamination concern	Construction activity	Potential contaminants	Pathway	Sensitive receiver, if not managed appropriately	Assessed risk
Mining lease areas – Active surface mining, mine surface water infrastructure, areas within 500 metres of water treatment plants, tailing dams associated with the Moolarben and Wilpinjong Coal Mines	Excavation activities such as earthworks, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	Acid mine drainage, methane, TRH, heavy metals and PAH in soils	• direct contact, ingestion or inhalation • transport off-site via vehicle/plant movements • mobilisation via dust emissions • surface water runoff and discharges to receiving environments	• construction workers • recreational users of adjacent watercourses • aquatic ecosystems • terrestrial ecosystems • agricultural users on adjoining land	**High** – as there is a: • high likelihood of contaminants to be present • significant consequence in the absence of appropriate controls (refer to Section 19.2.6).
	Piling	Acid mine drainage, methane, TRH, heavy metals and PAH in groundwater	• direct contact, ingestion or inhalation • migration from accidental discharges to receiving environments	• construction workers • recreational users of adjacent watercourses • aquatic ecosystems • terrestrial ecosystems • agricultural users on adjoining land	**Medium** – as there is a: • medium likelihood of contaminants to be present • moderate consequence in the absence of appropriate controls (refer to Section 19.2.6), noting dewatering volumes would be negligible.
Mining lease areas – Remediated mining landforms in the Wilpinjong coal mine	Excavation activities such as earthworks, vegetation clearing, vehicle movement, temporary stockpiling and utilities works	TRH, heavy metals and HCM in soils	• direct contact, ingestion or inhalation • transport off-site via vehicle/plant movements • mobilisation via dust emissions • surface water runoff and discharges to receiving environments • spontaneous combustion	• construction workers • recreational users of adjacent watercourses • aquatic ecosystems • terrestrial ecosystems • agricultural users on adjoining land	**High** – as there is a: • high likelihood of contaminants to be present • significant consequence in the absence of appropriate controls (refer to Section 19.2.6). However, it is unlikely contaminated soils would be exposed during shallow excavation (less than 1 metre depth).
	Piling	TRH and heavy metals in groundwater	• direct contact, ingestion or inhalation • migration from accidental discharges to receiving environments	• construction workers • recreational users of adjacent watercourses • aquatic ecosystems • terrestrial ecosystems • agricultural users on adjoining land	**Medium** – as there is a: • medium likelihood of contaminants to be present • moderate consequence in the absence of appropriate controls (refer to Section 19.2.6), noting dewatering volumes would be negligible.

Other areas

Outside the mining areas (refer to Table 19-14), there is a:

- low potential to encounter soil and groundwater contamination where construction would interact with existing substations, transmission line infrastructure, roadways, railways, and areas surrounding farm structures
- medium potential to encounter soil and surface water contamination where farm dams are present within the construction area.

Farm dams are located throughout the project construction area and present both erosional and contamination hazards to the surrounding environment. It is expected that impacts to farm dams would generally be avoided through continued design development where practicable. If not managed appropriately, the disturbance of contaminated soil and water commonly associated with farm dams (refer to Table 19-14) has potential to impact on human health and/or the environment. Additional investigations would be undertaken to confirm presence of contaminants prior to any works commencing within approximately 50 metres of a farm dam and the CEMP would contain appropriate measures to manage any required farm dam dewatering.

There also remains a general potential risk associated with encountering unexpected contamination, which would be managed through the implementation of an unexpected finds protocol.

Following the implementation of recommended management measures (refer to Section 19.2.6) it is anticipated that the identified risk to the project from encountering contaminated soil and groundwater would be effectively managed through the implementation of controls as part of the CEMP.

Potential contamination impacts from the project

During construction, there is also a potential general risk of spills of fuel, other hydrocarbons and waste material generated from storage of dangerous goods and hazardous materials and from construction vehicles, plant and equipment at storage and laydown areas that have the potential to contaminate soils and/or groundwater.

If not managed appropriately, the storage, use and disposal of dangerous goods and hazardous materials has the potential to expose surrounding soils to contamination. However, the risk associated with potential for the project to generate new sources of contamination is considered low and manageable through the implementation of standard environmental management measures as part of the CEMP and any relevant sub plans.

19.2.5 Potential impacts – operation

Soils

Operation of the project is unlikely to result in any significant impacts on soils.

The potential for erosion of soils may be present around infrastructure (particularly transmission line tower footings 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 project would be strategically designed to manage water flows and the effects of wind, including scour protection (where required). Any areas of erosion would be minor and capable of being rectified as part of regular maintenance activities during operation.

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 the implementation of an Operational Environmental Management Plan (OEMP) (or equivalent system) which would be prepared by the Network Operator, once appointed (refer to Chapter 20 (Environmental management).

Operation of the project is not expected to impact the salinity levels of soils within the operation area. Maintenance activities are unlikely to involve ground disturbance activities of sufficient magnitude to increase water infiltration resulting in erosion and off-site transport of saline sediments; particularly, with the implementation of standard erosion and sediment control measures.

Contamination

Operation of the project does not include maintenance activities that would disturb potentially contaminated soil or groundwater with all activities occurring above ground. As such, these activities would not expose the surrounding environment and other sensitive receivers to potentially contaminated soil or groundwater.

As some of the project's transmission infrastructure is located within the footprint of three coal mine leases, an easement would be required in these areas to facilitate worker access for maintenance activities without the potential of tracking contamination on/off-site. It is anticipated that the identified risk would be effectively managed through standard controls and through interface agreements with mining operators (refer to Section 7.6.1 in Chapter 7 (Land use and property)).

The operation of the project has the potential to impact the surrounding environment due to hydrocarbon (fuels, diesel, oils) leaks or spills within the operation area, which may result in the accidental contamination of soil, surface water and/or groundwater. Spill volumes from any incidents would be expected to be minor, however the potential for hydrocarbon fuel to migrate off-site cannot be disregarded. Spill containment facilities (such as bunded containers, designated fill points, and spill kits) would be used during maintenance activities within the operation area. Furthermore, it is expected that incident response procedures would be developed and implemented to manage the risk of contamination from these occurrences.

19.2.6 Management of impacts

Environmental management

Environmental management for the project would be managed in accordance with the CEMP. A Soil and Water Management Plan will be prepared as part of the CEMP, and will include, but not be limited to:

- measures to minimise impacts to soil and water, and to maintain water quality of nearby surface water bodies
- stockpile management procedures, including procedures for the segregation of waste and contaminated soils
- materials tracking and record keeping
- unexpected finds protocols for contaminated materials (including high carbon materials within the mine sites
- storage of chemicals and other hazardous materials
- spill management procedures
- measures to minimise water use during construction.

Operational controls will be managed within an Operational Environmental Management Plan (OEMP).

Mitigation measures

The mitigation measures that will be implemented to avoid, minimise and/or manage potential impacts to soils and contamination from construction and operation of the project are listed in Table 19-15.

Mitigation measures in other chapters that are relevant to the management of soils and contamination include:

- Chapter 16 (Hazard and risk), specifically measures which address the use and storage of dangerous goods and hazardous materials
- Chapter 18 (Waste management), specifically measures which address the storage, handling and disposal of waste materials (including potentially hazardous waste)
- Section 19.1 (Hydrology, flooding and water quality), specifically measures which address surface water quality impacts
- Section 19.3 (Groundwater), specifically measures which address interaction with groundwater.
- Section 19.4 (Air quality), specifically measures which address impacts of dust generation.

Table 19-15 Proposed mitigation measures – Soils and contamination

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
SC1	Mobilisation of saline soils	Prior to ground disturbance, a visual inspection will be undertaken in areas identified as potentially containing saline soils will be undertaken to look for the presence of saline soils. Areas where evidence of salting has been observed or recorded will be subject to further testing as required. If salinity is confirmed, excavated soils will be managed in accordance with *Book 4 Dryland Salinity: Productive use of Saline Land and Water* (NSW DECC 2008) to prevent impacts from salinity.	Construction	All locations
SC2	Impacts due to spontaneous combustion	Disturbance of areas of active (and previously active) surface mining, underground mine access and process routes will be avoided where practicable. Where this cannot be avoided, testing of the material(s) will be undertaken to confirm if High Carbon Material will be disturbed and/or exposed, and appropriate safeguards implemented to ensure the risk of spontaneous combustion is adequately controlled (in accordance with the *MDG Spontaneous Combustion Management Guideline* (Industry and Investment NSW, 2011)).	Detailed design, pre-construction and construction	Wilpinjong Coal Mine
SC3	Contamination exposure to human health and/or the environment	Disturbance to areas of medium to high risk of contamination will be avoided or minimised where practicable during construction. Management of contamination and any resulting remediation will be carried out in accordance with the relevant legislation, standards and guidelines, including but not limited to the National Environment Protection (Assessment of Contamination) Measure 1999, as amended 2013, and all relevant guidelines made or approved under the *Contaminated Land Management Act 1997* and the *Protection of the Environment Operations Act 1997*.	Detailed design and pre-construction	Areas of medium to high contamination risk
SC4	Contamination exposure to human health and/or the environment	Prior to construction activities within the Wilpinjong Coal Mine lease, areas subject to disturbance will be tested to confirm the presence/absence of contaminants of concern identified in Technical paper 16 – Contamination.	Detailed design and pre-construction	Wilpinjong Coal Mine site

Reference	Impact/issue	Mitigation measures	Timing	Applicable location(s)
SC5	Contamination exposure to human health and/or the environment	Additional intrusive investigations will be undertaken to confirm the presence/absence of the contaminants of concern prior to commencing ground disturbance within approximately 50 metres of farm structures or farm dams (if applicable).	Detailed design and pre-construction	All locations
SC6	Impacts due to spontaneous combustion	Remediation areas disturbed during construction of the project will be capped in accordance with the Peabody Energy Wilpinjong Capping of Tailings Storage Facilities TD5 Procedure (WI-MIN-PRO-0119).	Construction	Wilpinjong Coal Mine site
SC7	Contamination impact to human health and/or the environment	An unexpected finds protocol will be developed and implemented to manage the discovery of previously unidentified contaminated material (including the discovery of high carbon material within mining lease areas outside of areas indicated by mine operators where this occurs).	Construction	All locations
SC8	Soil and/or water pollution	Construction materials, spoil and waste will be stored/managed in accordance with applicable EPA requirements to minimise the potential for the project to result in the contamination of soil, groundwater, and/or surface water quality.	Construction	All locations
SC9	Soil and/or water pollution	All chemicals, fuels or other hazardous substances will 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 site plans.	Construction Operation	All locations
SC10	Soil and/or water pollution	Incident response procedures will be implemented to avoid and manage accidental spillages of fuels, chemicals or fluids during operation and maintenance activities. Environmental spill kits will be provided at strategic, accessible locations, and staff will be trained in spill response procedures (as a minimum spill kits will be located at the energy hubs and New Wollar Switching Station).	Operation	All

19.3 Groundwater

This section provides an assessment of the potential impacts of the project on groundwater aquifers and groundwater dependent ecosystems (GDEs), and identifies mitigation measures to minimise these impacts, as provided in Technical paper 17 – Groundwater (Technical paper 17). The SEARs as they relate to groundwater, and where in the EIS these have been addressed, are detailed in Appendix A (SEARs checklist).

19.3.1 Legislative context

The groundwater assessment was undertaken in accordance with SEARs and with reference to the requirements of relevant legislation, policies and assessment guidelines including:

- *Water Act 2007* (Cth)
- *Water Management Act 2000* (NSW) (WM Act)
- *Protection of the Environment Operations Act 1997* (POEO Act)
- *Murray–Darling Basin Plan 2012* (Murray–Darling Basin Authority, 2012)
- relevant water sharing plans made under the WM Act, including:
  - *NSW Murray-Darling Basin (MDB) Porous Rock Groundwater Sources 2020*
  - *MDB Fractured Rock Groundwater Sources 2020*
  - *North Coast Fractured and Porous Rock Groundwater Sources 2016*
  - *Macquarie-Castlereagh Groundwater Sources 2020*
- guidelines and policies relevant to the management of groundwater, including:
  - *NSW Aquifer Interference Policy* (AIP) (NSW Department of Primary Industries (DPI), 2012)
  - *NSW Groundwater Dependent Ecosystems Policy* (NSW Department of Land and Water Conservation, 2002)
  - *Guidelines for groundwater quality protection in Australia: National Water Quality Management Strategy* (Australian Government, 2013)
  - *Groundwater Assessment Toolbox for Major Projects in NSW* (NSW Department of Planning and Environment, 2022d)
  - *Assessing groundwater applications fact sheet* (DPI, 2018).

Further discussion on the legislation and policies relevant to the assessment of groundwater are provided in Technical paper 17.

19.3.2 Assessment approach

Study area

The groundwater study area for the purposes of this groundwater assessment is predominantly a 500 metre buffer around the construction area. This area was selected to characterise the existing hydrogeological environment in the context of the project and incorporate the potential extent of the project's influence on local groundwater sources and sensitive receivers such as GDE's and registered groundwater users.

Assessment methodology

The groundwater impact assessment for the project was undertaken using the methodology outlined in the NSW DPE Groundwater Assessment Toolbox (DPE, 2022b). The assessment methodology for the groundwater impact assessment involved:

- a desktop review of existing and available information to describe the existing environment, including:
  - publicly available databases relevant to climate, soils, geology and hydrogeology, including the WaterNSW real-time water data website (WaterNSW, 2022) and GDE Atlas (Bureau of Meteorology (BOM), 2022b) to identify registered groundwater bores and GDEs and characterise groundwater flows
  - geotechnical and hydrogeological data collected from site investigations (WSP, 2022)
  - previous studies further detailing the existing groundwater, soil, geological, topographical and hydrogeological environments
- development of a site conceptual model characterising the existing hydrogeological and groundwater conditions in the study area
- assessment of groundwater impacts in accordance with the AIP to determine if they meet the minimal impact thresholds from aquifer interference activities relating to water table and groundwater pressure drawdown, and changes to groundwater quality. If the potential impacts are less than the Level 1 minimal impact considerations defined by the AIP, then these impacts would be considered acceptable
- hydraulic assessment of the potential impacts from groundwater extraction for construction water supply in accordance with the criteria set out in the *Assessing groundwater applications fact sheet* (DPI, 2018)
- identifying mitigation measures to manage the potential impacts identified.

Further detail on the assessment of groundwater is provided in Technical paper 17.

19.3.3 Existing environment

Hydrogeology

The study area covers eight groundwater sources managed under four water sharing plans (see Table 19-16). Groundwater throughout the study area is both highly and less productive, and exists in alluvial, fractured, and porous rock aquifers. Highly productive groundwater is defined by the AIP based on the following criteria:

- has total dissolved solids of less than 1,500 milligrams per litre, and
- contains water supply works that can yield water at a rate greater than five litres per second.

Where an aquifer fails to meet these criteria, it is classified as less productive. Groundwater in shallow alluvial aquifers generally flows in a similar direction to the surface water through sediments consisting of gravel, sand, silt or clay. Flow of groundwater in porous rock aquifers is directed by voids within the rock and rock joints. Groundwater in fractured rock sources is stored and moves through fractures, joints, and faults within rock. There is potential for perched, non-permanent and localised aquifers to occur in the study area. Perched groundwater can occur at a variety of depths between the surface and the regional groundwater level. The topography and geology of the study area are described in Sections 19.1.3 and 19.2.3 respectively.

Recharge to these groundwater systems is primarily through infiltration from rainfall, runoff and surface water within the local area. The surface water catchments and climate and rainfall conditions relevant to the study area are described in Section 19.1.3.

The depth to groundwater throughout the study area is spatially variable and ranges from 0.2 to 53 metres below ground level. The depth to water depends on the underlying geology and the recharge and discharge in the local areas. Groundwater levels in the southeastern section of the study area are influenced by coal extraction from the Ulan, Wilpinjong and Moolarben coal mines.

Measured groundwater quality across the study area is fresh to brackish, with salinity (as total dissolved solids) ranging from 400 to 4,970 milligrams per litre. More saline groundwater was identified near the mining areas and east of the Merotherie Energy Hub. Groundwater quality depends on various factors, such as the geology the groundwater travels through and the water quality of surface water in the local areas that recharge the underlying aquifers.

Table 19-16 Water sharing plan and groundwater sources within the study area

Water Sharing Plan	Groundwater source	Aquifer type	Productivity
NSW MDB Porous Rock Groundwater Sources 2020	Sydney Basin MDB Groundwater Source	Porous rock	Highly
	Gunnedah-Oxley Basin MDB Groundwater Source	Porous rock	Less
NSW MDB Fractured Rock Groundwater Sources 2020	Liverpool Ranges Basalt MDB Groundwater Source	Fractured rock	Highly
	Lachlan Fold Belt MDB Groundwater Source	Fractured rock	Highly
North Coast Fractured and Porous Rock Groundwater Sources 2016	Sydney Basin-North Coast Groundwater Source	Porous rock	Less
	Oxley Basin Coast Groundwater Source	Porous rock	Less
	Liverpool Ranges Basalt Coast Groundwater Source	Fractured rock	Highly
Macquarie-Castlereagh Groundwater Sources 2020	Talbragar Alluvial Groundwater Source	Alluvial	Highly

Sensitive receivers

A groundwater sensitive receiver is defined as any identified receiver that utilises groundwater including registered bores and GDEs (refer to Figure 19-11).

The Bureau of Meteorology's Groundwater Dependent Ecosystems Atlas (BOM, 2022) identifies 17 unique high priority terrestrial GDEs and five high priority aquatic GDEs within the study area. The high priority GDEs are generally limited to small patches within remnant vegetation areas and along surface water drainages. Further detail on GDEs in the vicinity of the project is provided in the Chapter 10 (Biodiversity).

Registered bore users are considered as a sensitive receiver as they rely on groundwater to supply their water requirements across stock and domestic, irrigation, industrial and water supply uses. The number and type of registered groundwater bores within both the study area and the construction area are presented in Table 19-17.

Table 19-17 Registered bores identified within the study area and construction area

Type	Study area	Construction area
Stock and domestic	20	2
Unknown (use not listed)	1	0
General use	1	0

Conceptual site model

To help understand the groundwater environment during and after construction of the project, a conceptual groundwater model was developed as described in Table 19-18. A conceptual groundwater model incorporates the interpretation of the geological and hydrological conditions. Further detail is provided in Technical paper 17.

Table 19-18 Groundwater conceptual site model

Aspect	Description
Groundwater flow	Groundwater flow in shallow alluvial aquifers is generally a subdued reflection of topography and follows the surface water drainage systems. Flow of groundwater in porous rock aquifers is largely governed by primary porosity which is associated with water movement around the rock grains, as well as secondary porosity which is associated with water movement through fractures within the rock mass. The ability to transmit usable quantities of water in this type of groundwater source depends on the continuous interconnection of these higher permeability features. These aquifers can be unconfined where close to surface or confined where aquifers exist at depth and are beneath confining units. Groundwater in fractured rock groundwater sources is stored and moves through fractures, joints, bedding planes, faults and cavities within the rock mass. Fractured rock aquifers may be discontinuous at a scale of a few to tens of metres and not locally interconnected or may be continuous at a regional scale because some local fractures can be connected to a regional fracture network.
Recharge and discharge	Recharge to the groundwater systems in the study area is primarily through infiltration from rainfall, runoff and surface water within the outcropping (i.e. surface exposure) areas of the aquifer. Recharge can also occur from downward percolation of groundwater from overlying permeable layers that have sufficient permeability for groundwater exchange to occur. Discharge from groundwater systems in the study area is likely to primarily occur via evapotranspiration from shallow alluvial groundwater systems. Where there is high variation in relief and incised creeks, local groundwater flow may discharge to streams and creeks, potential groundwater springs and flow through the aquifer. Localised groundwater withdrawals would also occur from groundwater bores, although these are limited in number throughout the study area.
Aquifer interception	Aquifer interception throughout the construction area would be limited to where construction activities have the potential to intersect groundwater, and in locations where shallow groundwater levels or local perched aquifers exist. Water affecting activities, such as shallow excavations at the Elong Elong and Merotherie energy hubs, groundwater extraction for non-potable water supply, and piling for the transmission tower foundations, may intercept groundwater in some areas.

Figure 19-11
Groundwater sensitive receivers

Legend

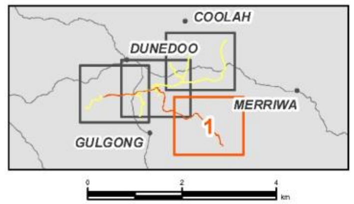
- Groundwater study area
- Construction area
- Construction compound
- Energy hub / 500 kV switching station
- 500 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse
- Water body

Registered groundwater bores

- Outside the construction area

High potential Groundwater Dependent Ecosystems

- Aquatic
- Terrestrial



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Scale ratio correct when printed at A4
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Data sources: WSP 2023

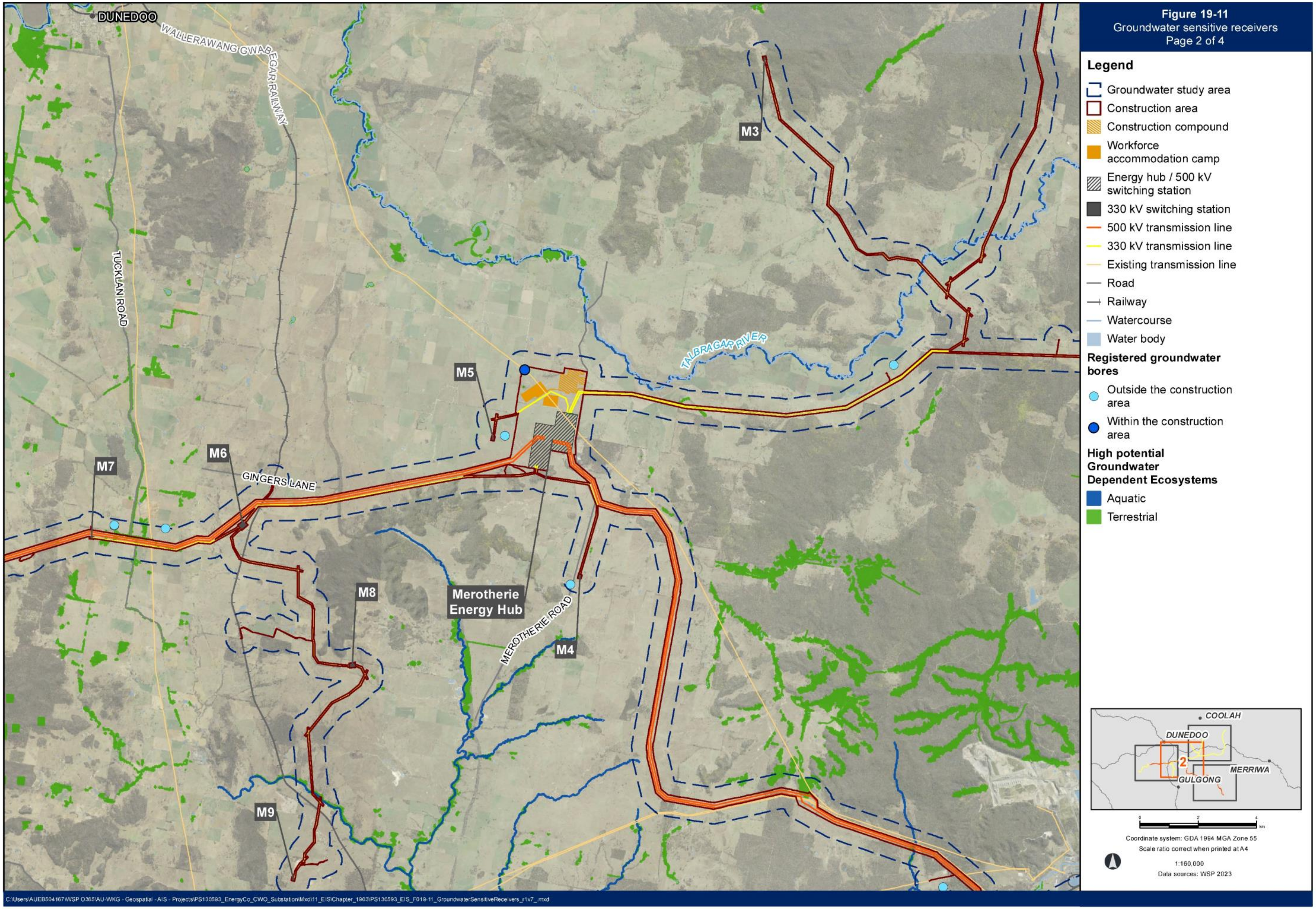

Figure 19-11
Groundwater sensitive receivers
Page 2 of 4
Legend
Groundwater study area
Construction area
Construction compound
Workforce accommodation camp
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing transmission line
Road
Railway
Watercourse
Water body
Registered groundwater bores
Outside the construction area
Within the construction area
High potential Groundwater Dependent Ecosystems
Aquatic
Terrestrial
DUNEDOO
WALLERAWANG GWABEGAR RAILWAY
TUCKLAN ROAD
GINGERS LANE
TALBRAGAR RIVER
MEROTHERIE ROAD
Merotherie Energy Hub
M3
M4
M5
M6
M7
M8
M9
COOLAH
DUNEDOO
MERRIWA
GULGONG
2
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Figure 19-11
Groundwater sensitive receivers
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Legend

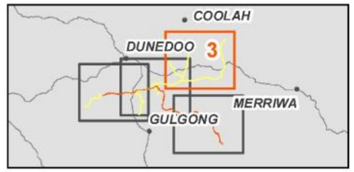
- Groundwater study area
- Construction area
- Workforce accommodation camp
- 330 kV switching station
- 330 kV transmission line
- Road
- Watercourse
- Water body

Registered groundwater bores

- Outside the construction area
- Within the construction area

High potential Groundwater Dependent Ecosystems

- Aquatic
- Terrestrial



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Scale ratio correct when printed at A4

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Data sources: WSP 2023

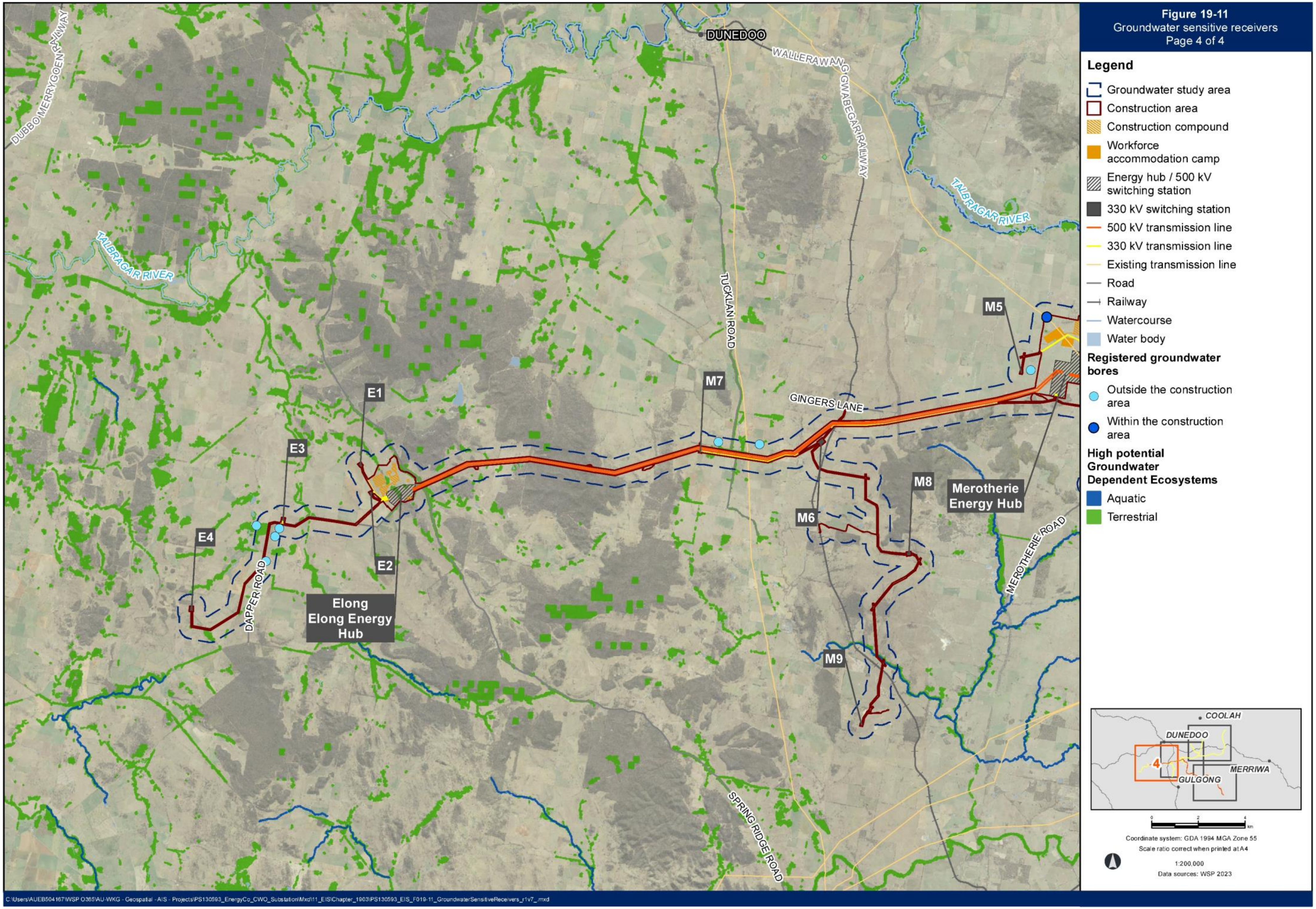

Figure 19-11
Groundwater sensitive receivers
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19.3.4 Potential impacts – construction

Potential risks to the groundwater environment as a result of the construction of the project are presented in Table 19-19. In addition to these risks to the groundwater environment, construction work could present a risk to groundwater bore infrastructure in the absence of mitigation.

These risks are considered further within this section.

Table 19-19 Potentials risks to the groundwater environment

Risk	Groundwater affecting activity	Consequence	Likelihood
Reduction of water quantity at sensitive receivers	Groundwater inflow during shallow excavations and blasting in areas of hard rock.	Groundwater level decline could cause less water to be available to other users or sensitive receivers such as GDEs.	**Unlikely.** Impacts would be limited to areas where the water table is close to surface and shallow excavations would occur. No or very limited and temporary groundwater take would occur via excavations.
	Groundwater extraction for water supply (construction only).	Groundwater level decline could cause less water to be available to other users or sensitive receivers such as GDEs.	**Likely.** Some drawdown would likely occur while groundwater extraction occurs. Extraction and drawdown would be temporary during the construction period only.
	Changes to surface infiltration due to temporary infrastructure (e.g. workforce accommodation camps) and removal of vegetation. Foundations or shallow excavations changing groundwater flow paths.	Recharge might increase in cleared areas and decrease where hardstand areas exist. Change in flow paths may occur on a small scale around tower foundation pilings.	**Unlikely.** Construction activities would be unlikely to change recharge across the regional groundwater sources due to construction works being temporary and confined to the construction area.
Change in water quality at sensitive receivers	Migration of contaminants into groundwater, due to the disturbance of contaminated groundwater or soils in identified areas of contamination concern or the disturbance of previously unidentified contaminated material. Potential infiltration of chemicals from incidental spills or leaks leading to the contamination of groundwater.	Contamination of groundwater sources could affect the quality of groundwater available for use and change the beneficial use of the resource.	**Unlikely.** Construction activities, procedures and requirements would manage risks associated with contaminated groundwater or soils, and chemical/fuel refuelling and containment.

Groundwater levels

Excavation

Potential impacts to groundwater levels due to construction may occur where the depth of excavations for transmission line towers, energy hubs and switching stations intersect the level of groundwater, and dewatering is required. Groundwater level decline from dewatering could cause less water to be available to other users or sensitive receivers.

The majority of excavations for the switching station foundations, including New Wollar Switching Station, would be up to about four metres below ground level. If shallow groundwater is encountered, it is likely to be perched, non-permanent and localised (that is, not regionally connected). Due to the existing groundwater levels being lower than the proposed excavation depths there would be no (or very limited) change in groundwater levels at any nearby receivers.

Excavations for the Elong Elong and Merotherie energy hub foundations would be up to around 10 to 15 metres below ground level. The excavation depths for the energy hubs are conservative estimates. The final design would be optimised to minimise excavation depths at the energy hubs. As groundwater at these locations is generally deeper, any groundwater interception as a result of excavation would be limited. A measurement of the groundwater level at a WaterNSW bore near the Elong Elong Energy Hub recorded groundwater at 15.2 metres below ground level (WaterNSW, 2022). This is beneath the maximum excavated depth of about 10 metres at Elong Elong Energy Hub. Therefore, groundwater inflow at the energy hub sites is not expected. The management of any groundwater, should it be encountered, would be in accordance with the mitigation measures provided in Section 19.3.7.

Piling

Piling would be undertaken at each transmission line tower location. Piling would typically consist of bored, cast in situ piles with reinforced concrete. Pile depth would generally range from five metres to 20 metres below ground level (mBGL). Piling designs through rehabilitated mining areas would be developed with the aim of minimising the effect of differential settlement on the tower structure. The final depth and diameter of piles would depend on ground conditions (e.g. greater piling depths would be required where soft soil types are present), and the type of transmission tower required.

Piling may intercept the local water table where it is close to surface. However, as concrete would be poured into the excavated pile, and water removed from the pile as it is displaced by the concrete, there would be no permanent take of water and no permanent change to groundwater levels and associated sensitive receivers during piling.

Blasting

Blasting may be required for the construction of some transmission line towers and the establishment of energy hubs and switching stations in areas of shallow hard rock. This would most likely include the transmission line from Merotherie Energy Hub towards switching stations M1, M2 and M3, and the transmission line between the Merotherie and Elong Elong energy hubs. The exact locations requiring blasting would be defined during detailed design following additional geotechnical investigations.

Blasting was identified as a water affecting activity during construction that could potentially impact groundwater levels. However, as the associated blasting halo is expected to be minor and not extend more than 10 metres from the origin of the blast(s), and not result in any take of groundwater, it is unlikely to result in an impact to the groundwater environment within the construction area or at adjacent sensitive receivers.

Water supply

In the event surface water availability does not meet the project's non-potable water requirements during construction, groundwater would be extracted at new bores established at the Merotherie and Elong Elong energy hubs. Extracted groundwater would be used for non-potable uses such as dust suppression, landscaping and surface compaction. Where water is proposed to be extracted (taken) from a groundwater source, a water access licence (WAL) under the WM Act would be obtained (unless a valid exemption otherwise exists).

The proposed groundwater bores would be around 100 metres deep, with the top 20 metres sealed with a cement/grout mixture to prevent inflow from any shallow water bearing zones. Water would be transported from groundwater extraction points via tanker truck and stored in storage tanks located at the workforce accommodation camps, construction compounds and switching stations. The proposed extraction volumes are provided in Table 19-20. Up to 124 megalitres (ML) of groundwater would be taken from each of the proposed bores over the construction period in accordance with WALs for the project.

The Merotherie Energy Hub is in the Lachlan Fold Belt MDB Groundwater Source managed by the Water Sharing Plan for the NSW MDB Fractured Rock Groundwater Sources 2020. The plan specifies a long-term average annual extraction limit of 253,788 ML/year for the Lachlan Fold Belt MDB Groundwater Source.

The Elong Elong Energy Hub is in the Gunnedah-Oxley Basin MDB Groundwater Source managed by the Water Sharing Plan for the NSW MDB Porous Rock Groundwater Sources 2020. The plan specifies a long-term average annual extraction limit of 127,500 ML/year for the Gunnedah-Oxley Basin MDB Groundwater Source.

Table 19-20 Construction non-potable water demand

Proposed extraction point	Annual water demand (ML/year)				Total (ML)
	Year 1	Year 2	Year 3	Year 4	
Merotherie Energy Hub	5	76	40	3	124
Elong Elong Energy Hub	5	76	40	3	124

Drawdown

The hydraulic assessment for the proposed extraction involves the analysis of expected drawdown impacts compared to the acceptable levels of impact specified for each groundwater source as set out in the *Assessing groundwater applications fact sheet* (DPI, 2018). The assessment criteria for an acceptable level of impact are:

- the cumulative drawdown would not exceed more than 40 per cent of the total available drawdown (TAD) (prior to the project) at a distance of 200 metres from any of the proposed extraction bores, including at the proposed groundwater bores
- the extraction would not result in an additional drawdown of more than three metres at any nearby water supply works (excluding those on the same property).

As there are no water supply bores subject to a WAL within 200 metres of the proposed extraction bores, only the two proposed extraction bores have been included in the assessment of cumulative drawdown.

The predicted cumulative drawdown at the proposed extraction bores is provided in Table 19-21 and the predicted additional drawdown at bores within five kilometres of the proposed extraction bores is provided in Table 19-22.

The assessment identified that the proposed extraction over the four-year construction period would result in 'no more than minimal harm' to the groundwater resource and surrounding sensitive receivers, such as other groundwater users or GDEs, as both proposed bores would meet the assessment criteria for an acceptable level of impact.

Table 19-21 Predicted cumulative drawdown at proposed groundwater bores

Extraction point	40 per cent TAD (mBGL)	Cumulative drawdown at 200 m from water supply bore during construction (mBGL)			
		Year 1	Year 2	Year 3	Year 4
Merotherie Energy Hub	34.1	15.3	18.0	16.6	15.1
Elong Elong Energy Hub	46.3	10.5	13.4	11.9	10.4

Table 19-22 Predicted additional drawdown at surrounding groundwater bores

Proposed extraction point	Bore GW number	Bore type	Distance (m)	Additional drawdown during construction period (m)			
				Year 1	Year 2	Year 3	Year 4
Elong Elong Energy Hub	GW058583 (80WA711302)	Stock	3,000	0.1	1.5	1.1	0.4
	GW805034	Stock, domestic	3,963	0.1	1.3	0.9	0.4
	GW001142	Stock	4,414	0.1	1.2	0.9	0.4
Merotherie Energy Hub	GW800590	Stock, domestic	1,278	0.1	2.1	1.4	0.4
	GW006099	Stock	2,547	0.1	1.6	1.1	0.4
	GW054481	Stock, domestic	4,386	0.1	1.2	0.9	0.3
	GW052517	Stock, domestic	4,730	0.1	1.1	0.8	0.3

Groundwater quality

During construction, changes to groundwater quality can occur from:

- migration of contaminants into groundwater, due to the disturbance of contaminated groundwater or soils during excavations or piling in identified areas of contamination concern (refer to Section 19.2.4) or the disturbance of previously unidentified contaminated material
- accidental release of chemicals used in construction, such as fuel and oils, that migrate into groundwater.

Areas of potential contamination concern within a 500 metre radius of the construction area are outlined in Section 19.2.4. Contaminated groundwater from identified areas of contamination concern poses a low risk to the environment, as the volumes of groundwater expected to interact with project infrastructure during construction would be negligible or are not expected to require management.

The potential impact would depend on the extent and type of contamination and the volume of chemical and hazardous material spilled. Contamination of groundwater sources could reduce the quality of groundwater available for use and change the beneficial use of the resource.

Potential adverse impacts on groundwater quality are unlikely to occur due to the nature of the project construction activities. Any impacts would be managed through the implementation of standard procedures near areas of known soil contamination, and chemicals and hazardous material stored on site, and staff training.

Groundwater recharge and flow

Recharge from infiltration may be impacted through changes in land use and vegetation clearing or changes to the permeability of the underlying soils through compaction in the area beneath the work pads or access roads and tracks used for construction activities. However, building work pads and access tracks would only have a minimal impact on groundwater recharge, according to section 3.3 of the AIP. Other construction activities are unlikely to change recharge across the groundwater sources due to construction works being temporary and confined to the construction area.

Where concrete pilings for transmission tower construction intercept the local water table, localised small scale changes in groundwater flow paths would occur. However, the concrete pilings beneath the water table would not obstruct groundwater flow or reduce the available water at sensitive receivers. None of the structures or construction activities within the construction area would result in any permanent groundwater take that would alter the groundwater flow in the study area.

Bore infrastructure

Two registered bores were identified within the construction area (refer to Table 19-17). During construction, there is an increased risk of groundwater bore infrastructure being damaged as a result of project construction activities such as vehicle and plant movement and earthworks. Mitigation measures to manage this potential impact are described in Table 19-23.

19.3.5 Potential impacts – operation

The risk assessment identified one potential impact to groundwater with a low likelihood of occurring during operation of the project. The risk identified was changes to groundwater quality (contamination) through accidental release of chemicals used during operation and maintenance.

Groundwater levels

No permanent groundwater take is proposed for this project. Therefore no impacts to groundwater levels and groundwater sensitive receivers are predicted during operation as no groundwater would be extracted.

Groundwater recharge and flow

The project would have permanent infrastructure that results in changes to surface infiltration, such as new energy hubs, switching stations and transmission tower footings. The increase in impervious areas due to the permanent infrastructure would result in a negligible decrease in surface infiltration. Infiltration may also increase in areas with reduced vegetation due to management within transmission line easements.

Where concrete piles for transmission line towers intercept groundwater, localised small scale changes in flow paths may occur. The concrete piles beneath the water table would not obstruct groundwater flow and reduce the available water at sensitive receivers, as the piling diameter would be negligible compared to the overall extent of regional groundwater flow. None of the structures along the operational area would result in any permanent groundwater take that would alter the groundwater flow in the study area.

Groundwater quality

Changes to groundwater quality can occur from the accidental release of chemicals used during maintenance activities, such as cleaning solvents, fuel and oils. However, due to the small volumes stored and used in the operation area, the potential impact to groundwater from hazardous chemicals would be low.

19.3.6 Aquifer interference policy – minimum impact considerations

The AIP sets out the Aquifer Interference Assessment Framework for assessing projects in NSW. The *Water Management Act 2000* includes the concept of ensuring 'no more than minimal harm' for both the granting of WALs and the granting of approvals. The AIP defines minimal impact considerations in assessing whether more than minimal impacts might occur to a key water-dependent asset. The AIP is used to guide proponents and DPE in assessing aquifer interference activities and includes minimal impact considerations for assessing the impacts of all aquifer interference activities. An assessment of the potential impacts of the project during construction and operation has been completed having regard to the minimal impact considerations for less and highly productive groundwater sources and is provided in chapter 8 of Technical paper 17.

There is no permanent take of groundwater from the groundwater sources within the study area from any project activity, resulting in no change to existing water table fluctuations. Changes to groundwater quality due to contamination could occur from accidental leaks and spills of chemicals, or the migration of contaminants into groundwater, due to the disturbance of contaminated groundwater or soils in identified areas of contamination concern or the disturbance of previously unidentified contaminated material.

The assessment complies with Level 1 minimal impact considerations indicating that the project is predicted to have minimal impact to the underlying groundwater environment.

19.3.7 Management of impacts

Environmental management

Environmental management for the project would be carried out in accordance with the approach as detailed in Chapter 21 (Environmental management).

A Soil and Water Management sub-plan will be prepared as part of the Construction Environmental Management Plan (CEMP) for the project and contain appropriate measures in the event that groundwater is encountered during construction. The sub-plan will include, but not be limited to, the following management measures:

- appropriate design of fuel and oil storage areas
- use of nominated and bunded fuel and chemical storage areas
- provision of spill kits for cleaning up chemical, oil and fuel spillages
- training for personnel
- procedures for managing any intercepted shallow groundwater
- procedures for soil storage (including any potential contaminated soil) and erosion control.

Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to groundwater are listed in Table 19-23.

Mitigation measures in other chapters that are relevant to the management of groundwater include:

- Section 19.1 (Hydrology, flooding and water quality), specifically measures which address surface water quality impacts
- Section 19.2 (Soils and contamination), specifically measures which address interaction with contaminated soils and water.

Table 19-23 Proposed mitigation measures – Groundwater

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
GW1	Lowering of groundwater levels due to interception and take of water	In the event that groundwater is encountered during excavations, any dewatering volumes will be recorded and managed in accordance with the *Water Management Act 2000*.	Construction	Areas of intercepted groundwater
GW2	Lowering of groundwater levels due to water extraction	Monitoring and recording of extraction volumes from water supply bores will be undertaken and regular analysis of extracted volumes will be completed against predicted volumes in Technical paper 17 (refer to Table 6-5), applicable water access licence and approval requirements.	Construction	Water supply bores at energy hubs

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
GW3	Impacts due to blasting	Control measures will be identified prior to blasting activities in relevant areas to avoid adverse impacts to sensitive groundwater receivers.	Construction	Finalised blasting locations if within 50 metres of high potential groundwater dependent ecosystems or existing bores
GW4	Damage to bore infrastructure	Direct impacts to registered bores will be avoided, where practicable. If the bores are not required to be removed during construction, then they will be clearly demarcated to protect the infrastructure. Where impact is unavoidable and a bore will require decommissioning, it will be replaced in a similar nearby location in consultation with landowner.	Construction	All locations

19.4 Air quality

This chapter provides an overview of the existing environment as it relates to air quality, an assessment of the potential air quality impacts of the project and identifies mitigation measures to be adopted to minimise these impacts. It summarises the assessment provided in Technical paper 18 – Air quality (Technical paper 18). The Secretary's Environmental Assessment Requirements (SEARs) as they relate to the assessment of air quality, and where in the Environmental Impact Statement (EIS) these have been addressed, are detailed in Appendix A (SEARs checklist).

19.4.1 Legislative context

The air quality impact assessment was undertaken in accordance with the SEARs and with reference to the requirements of relevant legislation, policies and/or assessment guidelines, including:

- *National Environment Protection Council Act 1994* (Cth)
- National Environment Protection (Air Toxics) Measure 2021 (Cth)
- National Environment Protection (Ambient Air Quality) Measure 2021 (Cth)
- *Protection of the Environment Operations Act 1997* (NSW)
- *Approved Methods for Modelling and Assessment of Air Quality in New South Wales* (NSW Environment Protection Authority (EPA), 2016) (the Approved Methods)
- *Guidance on the assessment of dust from demolition and construction* (Institute of Air Quality Management (IAQM), 2014) (IAQM Guidance).

19.4.2 Assessment approach

Study area

The study area for the air quality impact assessment comprises:

- the construction area (inclusive of the construction compounds and workforce accommodation camps and construction routes) and areas within 350 metres (consistent with the IAQM Guidance)
- construction routes where these are situated along public roads, generally extending up to 500 metres from each access point along the public road network and encompassing adjoining land by up to 50 metres from the road.

Operational air quality impacts are predicted to be within 100 metres of the operation area due to the lower level of activity during operation. Therefore operational impacts fall within the study area. The study area is shown on Figure 19-12.

Assessment methodology

The assessment methodology for the air quality impact assessment involved:

- a desktop review of existing environment conditions relevant to air quality, including local topography, climate and existing ambient air quality. This included a review of:
  - local meteorological and climate data collected by Bureau of Meteorology (BOM) at six Automatic Weather Stations (AWS) located at Mudgee Airport, Merriwa (Roscommon), Gulgong Post Office, Dunedoo Post Office, Cassilis (Dalkeith) and Dubbo Airport
  - ambient air quality data collected between 2017–2021 by the NSW Government at Merriwa (Roscommon) and Dubbo Airport
  - air quality monitoring data collected generally between 2017–2021 at the Moolarben, Wilpinjong and Ulan coal mines
  - the National Pollutant Inventory (NPI) for the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter local government areas (LGAs) within which the study area is located to understand emissions from industrial sources for the financial year of 2020–2021
- a risk-based assessment of potential dust impacts during construction in accordance with IQAM for amenity-based risks (such as dust soiling) and human health risks. It considers the magnitude of dust emissions for each key activity type (grouped as earthworks, general construction and track out) and the sensitivity of the surrounding area (with consideration of existing air quality as well as the proximity and density of sensitive receivers to the activity). This approach results in a risk rating for each key activity for both air quality and human health impacts without mitigation (rated as negligible to high) and is used to determine what mitigation and management measures are required to effectively manage these risks
- a qualitative assessment of amenity impacts on sensitive receivers located adjacent to local roads that form part of the construction routes. Sensitive receivers are those located within 100 metres from paved public roads and within 200 metres on unpaved public roads
- a qualitative assessment of other potential sources of air emissions and odour during construction and operation
- identifying mitigation measures to manage the potential impacts identified.

Further detail on the assessment methodology is provided in chapter 3 of Technical paper 18.

Figure 19-12
Air quality study area

Legend
- Study area
- Construction area
- 330 kV switching station
- Existing substation
- State road
- Railway
- Watercourse
- Water body
- Local government area
- NPWS estate

0 5 10 km

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:350,000
Data sources: WSP 2023

C:\Users\AUJB505996\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\11_EIS\Chapter_1904\PS130593_EIS_AQ_F019-12_AirQualityStudyArea_r1v6.mxd

19.4.3 Existing environment

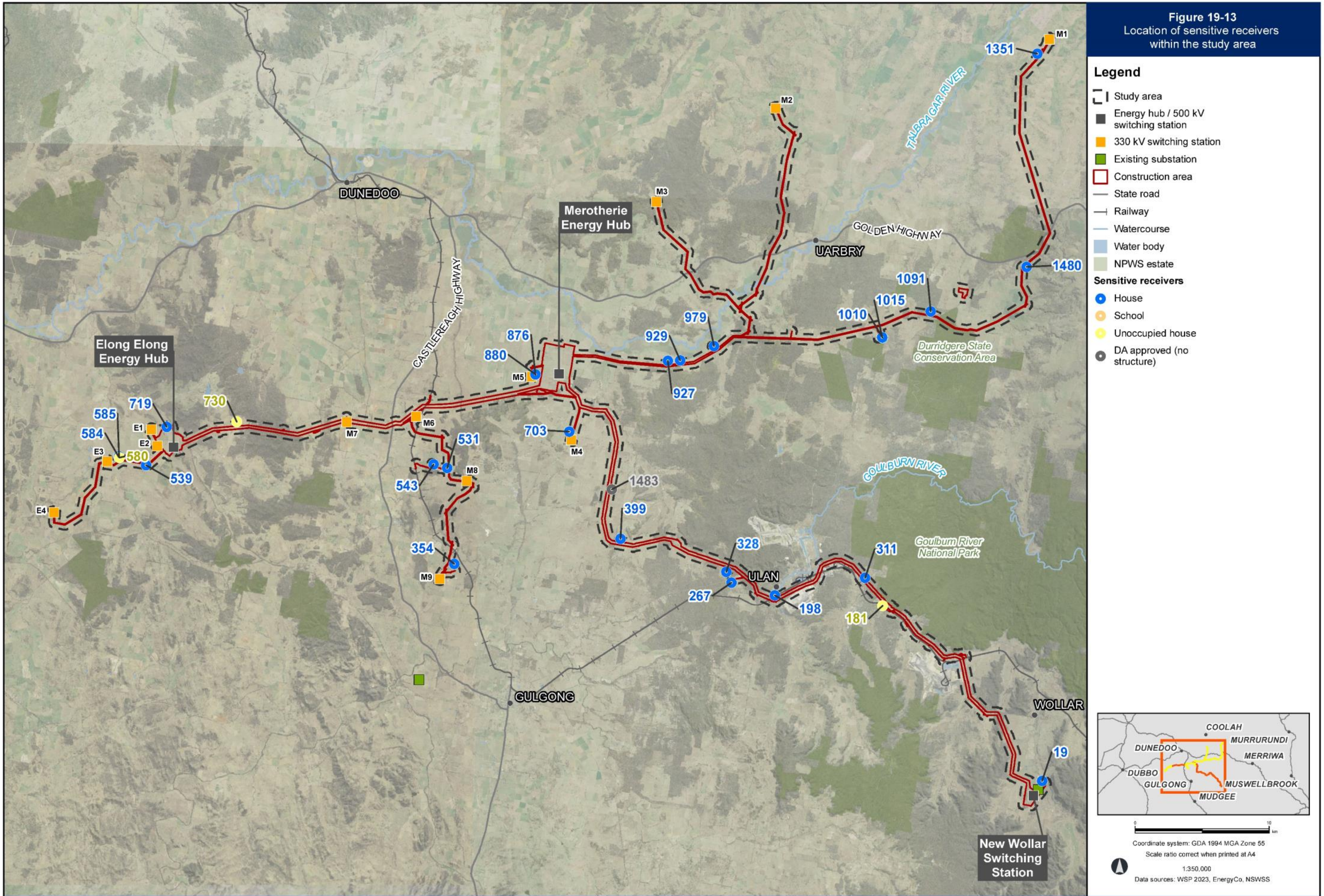
Sensitive receivers

There are 28 sensitive receivers within 350 metres of the construction area (refer to Figure 19-13). These receivers include 24 occupied residential dwellings, three unoccupied residential dwellings and one property with development application (DA) approval to build a house. These receivers are located within the study area near the New Wollar Switching Station (ID 19), the Elong Elong Energy Hub (ID 719), the M5 Switching Station (ID 876 and ID 880) and along the future transmission lines. There are no sensitive receivers within 350 metres of the Merotherie Energy Hub construction area, the other 330 kV switching stations or the Neeleys Lane workforce accommodation camp.

It is noted that at the time of finalising the air quality assessment, it became known there was a newly constructed dwelling at 121 Cliffdale Road, Uarbry in proximity to the construction area. As this was identified in the final stages of the preparation of Technical paper 18, it has not been included. To address this issue a revised impact assessment will be carried out and the results presented in the submissions report. This will include conducting a search to confirm if any there are any newly approved DA's for dwellings in the study area that need to be included in the assessment.

The majority of the sensitive receivers are scattered across the study area and are typically located greater than 100 metres from the construction area. As such, most sensitive receivers are assessed as having a low sensitivity to dust impacts (including dust soiling and/or human health impacts). Two sensitive receivers were assessed as having medium sensitivity to human health impacts as these receivers are located around 50 metres or less from the construction area.

Figure 19-13
Location of sensitive receivers within the study area



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Climate and meteorology

Meteorological conditions are important for determining the direction and rate at which emissions from a source would disperse. Concentrations of pollutants within an airshed may build up during calm conditions (wind speeds of less than 0.5 metres per second (m/s)) and dispersion is poor whereas pollutants tend to disperse quickly during periods of strong winds, resulting in lower pollutant concentrations.

Data collected from the six AWSs show some variability in meteorological conditions, which is likely attributed to the extent of the study area, and not all AWS record the same measurements (refer to Table 19-24). Key observations are that the study area experiences:

- average maximum temperatures range from 31 degrees Celsius (°C) to 33°C (January)
- average minimum temperatures range from 1.1°C to 3°C (July)
- the annual average rainfall ranges from around 570 millimetres at Dubbo Airport AWS to 676 millimetres at the Gulgong Post Office AWS
- months through autumn to spring are the driest, with April typically having the lowest average monthly rainfall ranging from around 29 millimetres at Merriwa AWS to around 36 millimetres at Dubbo Airport AWS. During summer, the highest average monthly rainfall occurs in December ranging from around 62 millimetres at Dubbo Airport AWS to around 89 millimetres at Cassilis
- the average wind speed ranges from 3.1 m/s at Mudgee Airport AWS to 4.3 m/s at Dubbo Airport AWS, noting:
  - at Mudgee Airport AWS, the most frequent wind direction in summer was from the southeast with an average wind speed is 3.5 m/s. During winter, the most frequent wind speed was from the northeast and west with an average wind speed of 2.8 m/s
  - at Dubbo Airport AWS, the most frequent wind direction in summer was from the east with an average wind speed of 4.9 m/s. During winter, the most frequent wind direction was also from the east with an average wind speed of 3.8 m/s.

Table 19-24 Summary of the average climatic data from the six meteorological stations near the project (BOM 2022c)

Station name and location	Average max temp (°C) in January	Average min temp (°C) in July	Average rainfall (mm)	Average max 9:00 pm relative humidity (%)	Average max 3:00 pm relative humidity (%)	Average max 9:00 am wind speed (km/h)	Average max 3:00 pm wind speed (km/h)
Mudgee Airport	31.1	1.1	642.9	87	37	17.3	19.3
Merriwa	31.9	2.2	590	No data	No data	No data	No data
Gulgong Post Office	31.9	2.7	676	85	37	9.1	12.5
Dunedoo Post Office	33.1	2.5	627.1	86	38	18[4]	20.8
Cassilis (Dalkeith)	No data	No data	634.1	No data	No data	No data	No data
Dubbo Airport	33.6	3.0	569.1	86	30	21.5	20.2

Ambient air quality

Air quality within the study area is predominately influenced by rural activities, including dust from exposed land, agricultural activities and from vehicles on the road network. During unfavourable meteorological conditions, local air quality in the eastern section of the study area can be potentially influenced by mining activities at Wollar and Ulan given the nature of these operations. Other sources contributing to the local airshed includes industrial and extractive industries, railway operations, fuel and waste burning and residential activities.

These activities give rise to a range of emissions including total suspended solids (TSS), deposited dust, particulate matter (PM_{10} and $PM_{2.5}$), oxides of nitrogen (NO_x), carbon monoxide (CO) and sulphur (SO_2), volatile organic compounds (VOC) and semi-volatile organic compounds (SVOC).

Emissions from all industrial and diffuse sources located within the Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs (as reported to the NPI) are summarised in Table 19-25. No data was used from:

- the Warrumbungle LGA, as there were no facilities that reported emissions to the NPI for the FY 2020/2021
- the Dubbo Regional LGA, as emissions were underestimated as diffuse (fugitive) emissions were not reported in the 2020/2021 financial year.

Table 19-25 NPI reported total emission sources (2020/2021)

Pollutant	Emissions to air (kilograms)		
	Mid-Western Regional	Dubbo Regional[1]	Upper Hunter
PM_{10}	6,508,291	107,863	6,276
$PM_{2.5}$	202,266	14,201	646
NO_x	3,531,035	195,493	12,521
CO	4,317,874	85,397	27,736
SO_2	21,334	152	731
Total VOCs	511,277	32,124	8,868
PAHs [B(a)P TEQ][2]	317	7	9

1. Fugitive emissions were not included for the financial year 2020/2021 reporting year
2. Polycyclic aromatic hydrocarbons [Benzo[a]pyrene toxic equivalency quotient]

Ambient air quality data collected from the Merriwa and Dubbo ambient air quality monitoring stations (AAQMS) are summarised in Table 19-26. The Dubbo AAQMS does not conform to Australian Standards and is not a National Environment Protection Measure (NEPM) performance monitoring station. As such, comparisons against air quality impact criteria set in the Approved Methods has only been made against the Merriwa AAQMS results.

Table 19-26 Ambient air quality from Merriwa and Dubbo AAQMS

Station	Pollutant	Averaging period	Air quality impact assessment criteria (μg/m³)	Year				
				2017	2018	2019	2020	2021
Merriwa	PM_{10}	Maximum 24-hour	50	14.2	**197.1**	**302.1**	**620.7**	35.4
		Annual	25	14.2	19.2	**27.9**	18	11.3
	$PM_{2.5}$[1]	Maximum 24-hour	25	–	–	–	**43.1**	**14.7**
		Annual	8	–	–	–	**14.9**	4.2

Station	Pollutant	Averaging period	Air quality impact assessment criteria (µg/m³)	Year				
				2017	2018	2019	2020	2021
Dubbo	Total dust	Annual	–	8.7[2] 7.9[3]	12.1[3]	11[3] 51[2]	13[2]	5.4[2]
	PM_{10}	Maximum 24-hour	–	43.5[3]	115[3]	30[3] 419[2]	399[2]	18[2]
		Annual	–	7.8[3]	12[3]	11[3] 44[2]	12[2]	4.6[2]
	$PM_{2.5}$	Maximum 24-hour	–	27.2[3]	69[3]	27[3] 215[2]	58[2]	12[2]
		Annual	–	6.7[3]	9.6[3]	9[3] 14[2]	3.8[2]	1.9[2]

1. Continuous $PM_{2.5}$ monitoring at Merriwa commenced on 31 July 2020.
2. Monitoring conducted by DRX DustTraks, which is not a National Environment Protection Measure (NEPM) performance monitoring station and does not conform to Australian Standard. Levels are to be viewed as indicative only. Further, a full year was not captured in 2017 or 2019.
3. Monitoring conducted by an Environmental Dust Monitor, which is not a National Environment Protection Measure (NEPM) performance monitoring station and does not conform to Australian Standard. Levels are to be viewed as indicative only. Further, a full year was not captured in 2017 or 2019.

Bold indicates an exceedances of the Approved Methods criterion.

The data shows that:

- for particulate matter measured at the Merriwa AAQMS, the annual average criterion for PM_{10} and $PM_{2.5}$ was exceeded for multiple years. For PM_{10}, the 24-hour average criterion was exceeded multiple times during 2018 and 2020. Exceedances in 2018 and 2020 were due to bushfire smoke and regional dust events
- for dust and particulate matter measured at the Dubbo AAQMS, elevated concentrations of PM_{10} over 25 µg/m³ were observed on 48 days over 2017 to 2021. This is attributed to a range of events, including dust storms, bushfire smoke and fog events. Elevated levels of PM_{10} and $PM_{2.5}$ were due to widespread bushfire smoke.

Ambient air quality monitoring data from the three mine sites indicates compliance for monitored pollutants with relevant criteria in most instances, with some exceedances of criteria for particulate matter. The majority of these exceedances was attributed to regional bushfires or dust events. Further information is provided in section 4.4.2.3 of Technical paper 18.

19.4.4 Potential impacts – construction

Dust impacts

Dust impacts depend on the quantity and drift potential of the particles in the atmosphere. Larger particles (the larger particle fractions of total suspended particles (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 suspended in the air for longer and are 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.

The following activities have the potential to generate dust during construction:

- vegetation clearing and grubbing
- installation and use of temporary infrastructure, such as construction compounds and workforce accommodation camps
- earthworks within the construction area, including at energy hubs, switching stations and along the transmission line (transmission tower foundations and access tracks)
- civil construction works at energy hubs and switching stations, and at transmission line tower sites
- erosion of unsealed surfaces
- materials handling and loading at laydown areas and construction compounds, vehicle movements on unsealed roads/surfaces and
- crushing, grinding and screening activities and operation of concrete batching plants at the construction compounds at the energy hubs and New Wollar Switching Station
- dirt, mud, or other materials tracked onto a paved public roadway by a vehicle leaving the construction area (generally referred to as track out), or dust generated by a vehicle leaving the construction area via unsealed public roads.

The volume of dust potentially generated during a typical workday would vary depending on the types of activities occurring at each location, the prevailing weather conditions (e.g. dry windy conditions increase the potential for wind erosion) and the controls that are implemented to reduce these emissions. Dust generated by helicopter landing and take-off at construction compounds is expected to be minimal and short term.

As there are no sensitive receivers within 350 metres of the Merotherie Energy Hub construction area and the 330 kV switching stations (except M5 Switching Station), these sites are not considered further in accordance with the IQAM. Dust emissions from construction work or activities that are screened out by the IAQM methodology are not expected to generate dust emissions of significance, or impact sensitive receivers located beyond the study area.

Earthworks and civil construction activities at the New Wollar Switching Station and Elong Elong Energy Hub have the greatest potential for generating dust emissions given the nature and extent of works for construction of permanent project infrastructure at these locations, as well as these areas being the sites for main construction compounds (including concrete batching plants and crushing and screening).

Construction activities at the 330 kV switching station (M5) and along the transmission line have lower potential for dust emissions given the smaller scale of ground disturbance. Construction vehicle movements at all assessed project locations have the potential for medium to large magnitude of emissions (unmitigated) due to the number of predicted daily heavy construction vehicle movements.

While earthworks, civil construction and construction vehicle movements are considered to have medium to high emission magnitude potential, the distance between most of the sensitive receivers in the study area and the construction area means that construction activities are anticipated as having an overall negligible to low risk rating (unmitigated) (refer to Table 19-27). Two receivers (ID 876 and ID 880) in proximity to switching station M5 have the potential to be affected by concurrent dust generating activities at the nearby transmission line alignment and Merotherie Energy Hub. However, as they are located over 200 metres from each of these components, the potential air quality impact at these locations are predicted to remain low.

Potential dust impacts would be temporary in nature and would be substantially reduced with the implementation of standard mitigation measures, as identified in Section 19.4.6.

Table 19-27 Summary of dust risk

Project location	Earthworks		Construction		Track out	
	DS[1]	HH[2]	DS[1]	HH[2]	DS[1]	HH[2]
New Wollar Switching Station						
ID 19	Low	Low	Low	Low	Low	Low
Elong Elong Energy Hub						
ID 719	Low	Low	Low	Low	Low	Low
M5 Switching Station						
ID 876	Low	Low	Low	Low	Low	Low
ID 880	Low	Low	Low	Low	Low	Low
Transmission line						
ID 539	Negligible	Low	Negligible	Low	Low	Low
ID 543	Negligible	Low	Negligible	Low	Low	Low
All other receiver locations	Negligible	Negligible	Negligible	Negligible	Low	Low

1. DS: Dust soiling
2. HH: Human health

Amenity impacts along local roads used by construction vehicles

As outlined in the assessment approach (Section 19.4.2), additional consideration has been given to amenity impacts (dust) for residents located within 200 metres of a construction route. Of the 30 local roads that would be used by construction vehicles, 22 roads are unsealed.

On sealed roads, dust may be generated in the wake of construction vehicles during dry conditions. During dry and high wind conditions, there is a greater potential for dust to be generated by vehicular movements on unsealed roads. The generation and dispersion of dust as a result of construction vehicle movements would depend on the meteorological conditions (wind speed and direction) and surface conditions of the road. Potential amenity impacts to 33 sensitive receivers located within 200 metres of these roads may occur during these conditions; however, they would be intermittent and of short duration.

Gaseous emissions

Gaseous emissions such as CO, NO_x, SO_2, VOCs and SVOCs would be generated from vehicles, plant and machinery as well as fugitive sources during the construction phase. Gaseous emissions from vehicles, plant and machinery as well as from fugitive emission sources during construction of the project would be manageable with the implementation of the mitigation and management measures identified in Table 19-28. With the implementation of these mitigation measures, the potential impacts are expected to be negligible at nearby sensitive receivers.

Daily construction vehicle movements and plant and equipment usage would be required throughout the construction area, and would include daily construction vehicle movements along the length of the alignment. Construction vehicles, plant and equipment involved in construction of the project would include (but not be limited to); excavators, cranes, rigid tippers, semi-trailers, rollers, dozers, concrete batching plants, concrete agitators, watercarts, crusher/screener, graders, stringing winches, backhoes, dumper trucks, trenchers, transport trucks, generators, and air compressors. Fuel combustion emissions from construction vehicles, plant and equipment operating in the construction area would be intermittent and transient as not all the plant and machinery would be operating simultaneously and at all locations during construction.

Fuels and chemicals stored within construction compounds, storage and laydown areas and at workforce accommodation camp sites have the potential to generate fugitive emissions. Fuels and chemicals would be stored in purpose built bunded areas and any fugitive emissions from their use are expected to be minor and readily dispersed within the construction area without impacts to nearby sensitive receivers.

Odour

Wastewater treatment plants are proposed to be installed and operated at the workforce accommodation camps at Merotherie and Neeleys Lane, Turrill. The wastewater treatment plants are expected to consist of a generally contained system that would include biological and chemical treatment, filtration, and disinfection.

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. Sensitive receivers in the study area are not expected to be impacted by odour emissions from the wastewater treatment plants, given the approximate distance between the wastewater treatment plants and the sensitive receivers.

19.4.5 Potential impacts – operation

During operation of the project, windblown dust may be generated from vehicle movements along unsealed areas within the operational area. The potential for dust generation during operation is expected to be low and of minimal impact at sensitive receivers in the study area due to infrequent use and low number of vehicle movements.

Sulphur hexafluoride (SF_6) would be used as an insulating gas in high voltage infrastructure at energy hubs and switching stations, and would be emitted at trace levels. Impacts on the receiving environment as a result of these emissions are expected to be negligible.

Routine inspections, maintenance/emergency works would require the use of light vehicles and/or light aircraft to transport personnel and conduct required maintenance and emergency activities, as well as vegetation removal to maintain appropriate clearances to the transmission lines. These vehicle movements and activities would generate emissions as a result of fuel combustion and dust emissions; however, resultant air quality impacts are expected to be low, and not of significance.

19.4.6 Management of impacts

Environmental management

Air quality impacts during construction would be managed in accordance with the Construction Environmental Management Plan (CEMP). This would set out air quality management objectives and measures to minimise dust during construction, and to maximise workers' awareness of air quality management requirements.

Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential impacts to air quality are listed in Table 19-28.

Mitigation measures in other chapters that are relevant to the management of air quality include:

- Chapter 16 (Hazard and risk), specifically measures to manage fuels and chemical storage during construction
- Section 19.2 (Soils and contamination), specifically measures which address soil disturbance and erosion which could lead to dust generation.

Table 19-28 Proposed mitigation measures – Air quality

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
AQ1	Dust generation – general	Management measures to prevent or minimise dust generation and impacts to the local community and environment will include (but not be limited to): • use of water sprays or dust suppression surfactants as required for dust suppression where required and appropriate • adjusting the intensity of activities based on observed dust levels and weather forecasts • minimising the amount of material stockpiled and position stockpiles away from surrounding receivers • project construction vehicle movements are to adhere to designated entry/exit routes and parking areas • implementation of measures to minimise the tracking of material onto sealed roads (e.g., wheel wash) • covering of loads • stabilising disturbed areas as soon as practicable, including new access routes • minimising the extent of disturbance as far as practicable • regularly conducting visual inspections of dust emissions and applying additional controls as required • where practicable minimise concurrent construction activities near sensitive receivers that have a greater potential of the risk of dust impact.	Construction	All locations
AQ2	Vehicle and plant emissions	Where feasible, construction vehicles and machinery will be fitted with appropriate emission control equipment and maintained in a proper and efficient manner.	Construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
AQ3	Dust emissions from concrete batching plants	Measures will be implemented at concrete batching plants to minimise emissions to air as far as practicable. The measures will be regularly inspected with additional controls implemented as required. Measures to minimise emissions to air from concrete batching plants may include: • all aggregate and sand will be stored appropriately in storage bins or bays to minimise dust generation, and material will not exceed the height of the bay • cement silos and hoppers will be fitted with dust filters • all inspection points and hatches will be fully sealed • all dry raw materials to be transferred into the bowl of an agitator via front end loaders by maintaining adequate moisture levels and/or an enclosed conveyor • cement silos will be fitted with fitted with an emergency pressure alert and automatic cut off protection to prevent overfill • transfer of cement from storage to batching will occur via sealed steel augers.	Construction	Concrete batching plant(s)
AQ4	Dust emissions from crushing and screening plant	To minimise dust emissions associated with the proposed crushing and screening activities, the following measures will be implemented: • ensure screen covers are fitted to the screening operations • control dust emissions from screening operations using water sprinklers, where required and appropriate • inspect the water sprinklers on a regular basis 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.	Construction	Crushing and screening
AQ5	Vehicle emissions along construction routes	During high wind conditions (wind speeds greater than 5 metres per second), reduced speed limits for project heavy vehicles on unsealed roads will be implemented.	Construction	Construction routes

19.5 Climate change and greenhouse gas

This section provides a preliminary assessment of the potential climate change and greenhouse gas (GHG) impacts of the construction and operation of the project and identifies mitigation measures to be adopted for the project to avoid, minimise and manage these impacts. There are no SEARs for the project to address climate change risks and greenhouse gas emissions.

19.5.1 Legislative context

The assessment of greenhouse gas emission and climate change risk was undertaken with reference to the requirements of relevant legislation, policies and assessment guidelines including:

- *Climate Change Act 2022 (Cth)*
- *The National Greenhouse and Energy Reporting Act 2007 (Cth)*
- *Rural Fires Act 1997 (NSW)*
- *State Infrastructure Strategy 2022* (Infrastructure NSW, 2018)
- *NSW Critical Infrastructure Resilience Strategy 2018* (Resilience NSW, 2018)
- *NSW Climate Change Policy Framework* (Office of Environment and Heritage (OEH), 2016)
- *NSW Government Resource Efficiency Policy* (OEH, 2019b)
- *The Net Zero Plan Stage 1: 2020-2030* (NSW DPIE, 2020a)
- *Climate Change in Australia Technical Report 2015* (CSIRO, 2015)
- *Climate Change Impact and Risk Management – A Guide for Business and Government* (Australian Greenhouse Office, 2006)
- *Climate Risk Ready NSW Guide* (DPIE, 2021e)
- *Carbon Estimate and Reporting Tool* (Carbon Estimate and Reporting Tool) (Transport for NSW, 2018b)
- Greenhouse Gas Protocol (Greenhouse Gas Protocol) (World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI), 2012)
- *Climate change adaptation for settlements and infrastructure – a risk based approach* (Standards Australia, 2013)
- *ISO 31000-2018 Risk Management – Guidelines (ISO, 2018b)*.

19.5.2 Assessment approach

Climate change pre-screening

The pre-screening involved:

- review of climate change projection data relevant to the project location based on the Central Slopes Cluster Report, Climate Change in Australia Projections for Australia's Natural Resource Management Regions (Ekström, M et al, 2015)
- review of the project infrastructure design parameters including design life for key assets (such as electrical equipment, foundations and buildings, roads and drainage) and operational temperature thresholds
- identification of the climate change-related hazards to key assets of the project for a Representative Concentration Pathway (RCP) 8.5 and/or as informed by the Climate Change in Australia Thresholds Calculator (Climate Change in Australia, 2021), NSW Rural Fire Service's (RFS) bushfire prone mapping, flood prone land mapping provided in Technical paper 15 – Flooding and other literature
- identification of mitigation measures in response to the potential risks identified for key components.

The Intergovernmental Panel on Climate Change (IPCC) publishes GHG concentration trajectories known as Representative Concentration Pathways (RCPs). Each RCP reflects different possible future scenarios considering the rate at which efforts to reduce anthropogenic GHG emissions will proceed over the coming decades. There are four RCPs: RCP2.6, RCP4.5, RCP6.0 and RCP8.5, with the numerical value referring to the concentration of GHG in the atmosphere in the year 2100. RCP2.6 is considered a very low emission scenario, and RCP8.5 is considered a very high future emissions scenario. Until mid-century, the differences in outcomes between the RCPs is often very small due to the climate system being relatively slow to respond to changes in GHG concentrations. The assessment has adopted RCP8.5, which offers a conservative approach for climate change risk assessment and most closely represents the current trajectory of observed anthropogenic emissions.

This pre-screening is not a climate change risk assessment. The risks identified are not exhaustive and would inform a more detailed climate change risk assessment during detailed design.

Greenhouse gas assessment

The GHG assessment was prepared using:

- International Standard *ISO 14064-1:2018: Greenhouse gases — Part 1: Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removal* (ISO, 2018a)
- International Standard *ISO 14064-2:2019: Greenhouse gases — Part 2: Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements* (ISO, 2019)
- *National Greenhouse Gas Accounts Factors* (DCCEEW, 2021)
- *Greenhouse Gas Assessment Workbook for Road Projects* (Transport Authorities Greenhouse Group (TAGG), 2013).

The assessment involved:

- preliminary quantification of Scope 1, Scope 2 and Scope 3 GHG assessment during construction (see discussion below)
- qualitative assessment of the potential GHG emissions during operation through the review of relevant literature and similar project indicators, as the detailed information required to quantify emissions is presently not available
- identification of mitigation measures to reduce GHG emissions.

Under the Greenhouse Gas Protocol (WRI and WBCSD, 2021), the direct and indirect GHG emission sources of a development can be classified into three 'scopes' for GHG accounting and reporting purposes:

- Scope 1 emissions are direct GHG emissions generated by the project. These are emissions produced by sources that are owned or controlled by the proponent.
- Scope 2 emissions are GHG emissions released into the atmosphere from consumption of energy generated off-site.
- Scope 3 are other indirect GHG emissions. These emissions are produced by sources that are not owned or controlled by the proponent but are the result of the proponent's activities. This includes emissions associated with the extraction, production and transport of purchased construction materials.

A summary of the identified construction GHG emissions sources that were included as part of this assessment are provided in Table 19-29.

Table 19-29 GHG emission resources

Scope	Emission sources
Scope 1	Fuel combusted on-site from mobile construction plant and equipment.
	Fuel combusted and operational impacts of earthworks.
	Removal of vegetation (including the release of carbon existing within this vegetation when it is cleared and the loss of its potential to act as a carbon sink in the future).
Scope 2	Electricity generated offsite to power construction plant, equipment, site offices and accommodation camps.
Scope 3	Emissions associated with the extraction and production of materials used during the construction of the project.
	Upstream emissions from fuel extraction, transmission and distribution associated with the generation of electricity.
	Upstream fuel extraction and processing for fuel supplied to site.
	Transport emissions associated with the delivery of plant, equipment and construction materials.
	Transport emissions associated with the removal of construction and demolition waste from site.
	Decomposition of construction and demolition waste taken to landfill.

In line with the ISO14064-1 exclusion requirements, the following construction related GHG emission sources have been excluded from this assessment since detailed information was not available at this stage of the project to enable calculation:

- emissions associated with production of capital plant and equipment
- emissions associated with the transport of employees to and from site
- emissions associated with the design and planning phase of the project.

Greenhouse gas emissions are reported in terms of tonnes of carbon dioxide equivalent (tCO_2-e). Some of the most commonly assessed GHG are carbon dioxide (CO_2), sulphur hexafluoride (SF_6), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs).

19.5.3 Climate change risk assessment

Climate change projections

CSIRO and Bureau of Meteorology Climate Futures presents climate data through the Climate Futures tool in the form of Cluster Reports, which are regional downscaled climate projections across eight regions in Australia. Based on the location of the project, the Central Slopes Natural Resource Management Cluster has been used to inform the assessment. The projections for the Central Slopes Cluster based on RCP 8.5 is provided in Table 19-30.

Table 19-30 Summary of key climate change projections relevant to the project (CSIRO, 2015)

Climate variable	Climate projection
Temperature	Increase in minimum, average and maximum temperatures, with progressively hotter conditions towards the northwest. Increase in frequency and duration of hottest days. Very hot days (days over 40°C) are projected to at least double by 2050 and triple by 2070, and extended periods of warm weather (days over 35°C) are projected to occur for about 50 days per year by 2050 and 65 days per year by 2070 across the study area.
Rainfall	Decrease in winter and spring rainfall, and decreases/increases in summer and autumn rainfall. Increased intensity of extreme rainfall events, resulting in more frequent and severe floods.
Bushfire	An increase in the number of days with severe fire weather in conjunction with a lengthening of the fire season.
Storms and extreme winds	Little change in average wind speeds in the near future in all seasons. Projections for extreme wind speeds later in the century uncertain due to modelling and monitoring limitations. Fewer but more intense east coast lows in future, resulting in damaging winds. Conditions conducive to the formation of severe convective winds (which could lead to transmission tower failure) are likely to occur between 36 and 48 days a year on average.
Soil moisture	An increase in evaporation in conjunction with a decline in soil moisture.
Coastal erosion and sea level rise	The project is located in an inland area not subject to the influences of coastal erosion or sea level rise.

Asset life and vulnerability to climate hazards

The project has a varied expected design life depending on the asset. For the purposes of this assessment, the following design lives apply:

- electrical equipment – 40 years
- civil works (foundations and buildings) – 50 years
- roads and drainage – 40 years
- transmission lines (including footings, towers and lines) – 50 years.

For temperature thresholds, the maximum operating temperature for operations are:

- 90°C for energy hubs and switching stations
- 70°C for fibre cables
- 120°C for conductors.

With consideration of the maximum design life, projections up to 2090 are considered relevant to this assessment.

Table 19-31 outlines the key asset categories associated with the project and their potential to be impacted by climate variables outlined in Table 19-30.

Table 19-31 Vulnerability of project asset to climate hazards

Climate hazards	Asset						
	Transmission lines	Underground fibre optic communication cables	Switching stations	Energy hubs	Maintenance facility	Microwave repeater stations	Access roads
Extreme heat	V	×	V	V	V	V	×
Flooding	V	×	V	V	×	×	V
Bushfire	V	×	V	V	V	V	V
Storms/wind	V	×	×	×	×	V	×
Drought	×	×	×	×	×	×	V
Coastal inundation/ erosion	×	×	×	×	×	×	×

* Underground fibreoptic infrastructure is generally more resilient to bushfires when compared with aerial infrastructure which is exposed to the heat and flames of a bushfire. However, in certain circumstances, bushfires can enter underground pit and pipe networks causing damage (ACMA 2020)

Based on a review of available mapping and the Climate Change in Australia Thresholds Calculator (Climate Change in Australia, 2021), a preliminary pre-screening of the exposure of the project was undertaken. The preliminary pre-screening is provided in Table 19-32.

Table 19-32 Assessment of the exposure of the project to climate hazards

Climate hazards	Preliminary assessment of exposure
Extreme heat – infrastructure	Based on the geographical location, the majority of the project is projected to be exposed to one to five days above 40°C by 2050 , except the sections of the transmission line to the east and west of the Elong Elong Energy Hub, as well as the Elong Elong Energy Hub and switching stations E1 and E2. At these locations, assets would be subject to approximately six to fourteen days over 40°C. 40°C is the ambient operating temperature of the transmission conductors.
Extreme heat – worker safety	Based on the geographical location, the majority of the project is projected to be exposed to 30 to 45 days over 35°C, including energy hubs and switching stations (except switching stations M1 to M3). Elsewhere, the project is exposed to 15 to 30 days over 35°C, by 2050.
Flooding	The majority of the project is outside flood prone land or is in areas of a lower exposure to a flooding hazard. The exception is along the New Wollar to Merotherie transmission line (with areas of medium and high exposure), short sections of the transmission line near Elong Elong Energy Hub and the Tallawang extension (medium exposure), the Elong Elong Energy Hub (medium exposure) and Switching Station E1 (medium exposure). However, the risk posed by climate change requires further assessment to determine the degree of exposure.
Bushfire	In areas that have been mapped for bushfire risk, the transmission line is subject to lower to high exposure. Areas of high and/or medium exposure occur in short sections along the New Wollar to Merotherie transmission line, the majority of the 330 kV transmission lines in the northeast, and short sections to the west of Elong Elong Energy Hub. Elong Elong Energy Hub itself is subject to high exposure and switching stations are subject to lower to medium exposure (where mapping is available). Central areas of the project have not been mapped by local councils, including Merotherie Energy Hub and switching stations M4 – M6. However these areas may also be prone to bushfires.
Storms/strong wind and drought	The entirety of the project would be exposed to storms/strong winds or severe drought conditions. All transmission lines and microwave repeater sites are considered to be exposed to storms/strong winds.

Climate change risks during operation

Table 19-33 provides a list of potential impacts on project assets if exposed to the climate hazards identified in Table 19-32. Recommended adaptation measures are also provided for further consideration as the project design progresses in accordance with mitigation measure CC2 (refer Table 19-35).

In addition to the adaptation measures listed in Table 19-33, the following proposed project controls in place:

- For bushfire:
  - asset protection zones around energy hubs, switching stations and accommodation camps have been incorporated into the project as detailed in Chapter 3 (Project description) and Chapter 16 (Hazard and risk)
- For flooding:
  - flood modelling has been undertaken to assess potential climate change impacts by using the current 0.5 per cent AEP as a proxy for a one per cent AEP event under climate change. The bench levels for the energy hubs and switching stations were identified to be outside the 0.5 per cent AEP during reference design.

Table 19-33 Climate risks

Climate hazard	Risk statement	Affected assets	Recommended adaptation measures
Extreme weather (general)	An increase in the magnitude of extreme weather events, leading to damage to equipment, and resulting failure. Potential impacts on customers.	Transmission lines Switching stations Energy hubs Communication assets	• Regular and ad hoc inspection and maintenance of project infrastructure would be undertaken during operation. • Underground and overhead fibre optic communications cables would be provided to monitor and control the network infrastructure within the transmission easement.
Extreme heat	An increase in the magnitude of extreme heat events that exceed the ambient operational temperature thresholds for critical equipment, leading to failure and/or a requirement to reduce the line rating, and potential impacts on customers (which will likely correlate with periods of peak demand).	Transmission lines Switching stations Energy hubs Communication assets	• Review ambient operating temperature thresholds for critical assets during the detailed design stage to ensure they are adequate to account for future ambient temperature increases associated with climate change. Consider conducting heat load assessments for the proposed buildings considering increase in ambient temperature to ensure air-conditioning units are appropriately sized and rated. Incorporate passive cooling design elements where appropriate to reduce the cooling load. • Ensure that the duration of back-up power supply units is adequate.
Bushfire	An increase in the frequency and intensity of challenging bushfire conditions that increases the likelihood of bushfires damaging critical equipment (transmission lines, switching stations, energy hubs and communication equipment), leading to impacts to customer service and higher maintenance costs (particularly as these conditions may negate the effectiveness of hazard reduction burns and/or increase the number of incidents where a fire cannot be controlled).	Transmission lines Switching stations Energy hubs Communication assets	• Consider undertaking further studies during the detailed design stage to better understand the risk to conductors from bushfire events. • Consider conducting detailed bushfire risk modelling and adopt technical and operational risk reduction measures if appropriate. • Review asset protection zones around energy hubs and switching stations during detailed design to ensure they are adequate.
Bushfire	An increase in the likelihood of the transmission lines starting a bushfire, due to the increase in the frequency and intensity of challenging bushfire conditions. This could result in potential threats to safety and property of nearby landholders.	Transmission lines	• Review recent research and disaster reports relating to bushfires and electricity networks to inform design and operational procedures. • Consider conducting detailed bushfire risk modelling and adopt technical and operational risk reduction measures if appropriate.
Bushfire and drought	Potential for the build-up of pollution on insulators (which can lead to arcing or flashover events), due to extended periods without rainfall in combination with particulate matter from bushfire events.	Switching stations Energy hubs	• Consider particulate matter build-up in operational and maintenance plans.

Climate hazard	Risk statement	Affected assets	Recommended adaptation measures
Bushfire (and/or drought conditions)	Potential risks to worker safety and sensitive electronic equipment that could arise from an increase in the length and severity of bushfires, and the number of days where bushfires or dust storms leads to an increase in poor on-site air quality.	Communication assets Maintenance facilities	• Ensure occupational health and safety (OH&S) guidelines incorporate clauses relating to poor air-quality for outdoor workers. • Consider use of air-conditioning systems that are fitted with filters effective at removing bushfire smoke and/or dust. • Ensure maintenance schedules include regular cleaning and/or onsite availability of replacement filters for air-conditioning units.
Bushfire and extreme heat	Potential reduction in suitable weather periods to undertake maintenance activities, including hazard reduction activities, due to an increase in the length of the bushfire season and the number of high temperature days (which correlate to times of peak power demand).	All assets	• Consider employing a surge workforce (or cross training staff) to ensure staffing constraints are not a limiting factor in maintenance activities.
Bushfire	Impacts to worker safety and asset performance and operation following bushfire events (fallen trees, damaged roads), due to an increase in the frequency of severe bushfire weather that limits the ability of staff to access the network and equipment.	All assets	• Identify and implement remote operation technologies, if feasible, to allow the assets to be monitored and controlled remotely. • Develop a Bushfire Emergency and Evacuation Plan and implement staff safety training.
Bushfire	Potential increase in concurrent failures of primary and secondary telecommunication assets through direct flame impacts, loss of power, and/or overheating due to potential failures of air-conditioning systems as a result of an increase in the intensity, severity and widespread nature of bushfires.	Communication Assets	• Consider optimising the resilience of the microwave and fibre-optic links by providing back-up power supplies which can run both the air-conditioning and telecommunication equipment.
Increased rainfall intensity	Potential inundation of project components due to an increase in the frequency of severe flooding events, magnitude of flooding events, depth of overland flows, peak flow velocities or duration of flooding that exceeds the design of the project, leading to failure of the network.	All assets (in/near flood prone locations)	• Where transmission line towers are located within the one per cent AEP envelope, ensure towers are adequately designed to withstand flooding impacts. • Consider siting flood sensitive electrical equipment and ventilation openings above the Probable Maximum Flood height if practical and feasible. • Flood modelling during detailed design to consider future climate change in accordance with Australian Rainfall and Runoff 2019.
Increased rainfall intensity	Increased incidence of water ingress through the roof or vertical elements of the built elements, due to an increase in rainfall, leading to equipment and network failure.	Energy hubs Switching stations Communication assets Maintenance facility	• Design to avoid elements prone to failure/water ingress (e.g. flat/near-flat roofs, boxed gutters, eave-less design, roof penetrations). • Ensure downpipes are adequately sized to minimise the risk of blockages.

Climate hazard	Risk statement	Affected assets	Recommended adaptation measures
Increased rainfall intensity	Potential for increased occurrence of flooding events that may impact supply chains or access for maintenance staff during operation, due to an increase in the frequency and intensity of rainfall events.	All assets	• Ensure the operations management plan/manual considers the effects of flooding on operation of the project. This should also consider the increased risk due to climate change.

19.5.4 Greenhouse gas emissions

Construction

The estimated GHG emissions from the Scope 1, Scope 2 and Scope 3 emissions during construction of the project are estimated to be a total of 611,607 tCO_2-e, as shown in Table 19-34. Scope 3 emissions are estimated to be the largest contributor (approximately 94 per cent) to GHG emissions during construction, primarily due to the embodied emissions within materials that would be produced for the project. Scope 1 emissions would account for approximately 5.7 per cent and Scope 2 emissions would account for approximately 0.03 per cent of the total GHG emissions during construction.

Table 19-34 Estimated GHG emissions during construction

Source		Greenhouse gas emissions (tCO_2-e)
Scope 1		
Fuel combustion onsite		13,698
Earthworks		4,091
Removal of vegetation		19,578
	Subtotal	37,578
Scope 2		
Electricity use		212
	Subtotal	212
Scope 3		
Embodied emissions from production of materials		516,554
Upstream emissions associated with fuel combusted onsite		874
Upstream emissions associated with electricity production and transmission		19
Construction waste disposal		600
Transport of materials to site		55,406
Transport of waste		363
	Subtotal	573,817
	Total	**611,607**

A breakdown of GHG emissions associated with material required for the construction of project components is shown in Figure 19-14.

Transmission lines are the most significant contributor to the GHG emissions associated with the construction of the project, accounting for 72 per cent of total GHG emissions during construction. This is due to the significant quantity of steelworks, concrete foundation and aluminium conductors required for the transmission lines.

During construction, the consumption of resources with embodied emissions is unavoidable and must be considered in the context of the design life of the major components of the project (being around 30 to 50 years), its role in the transmission of renewable energy and the contribution to a net-zero emissions future.

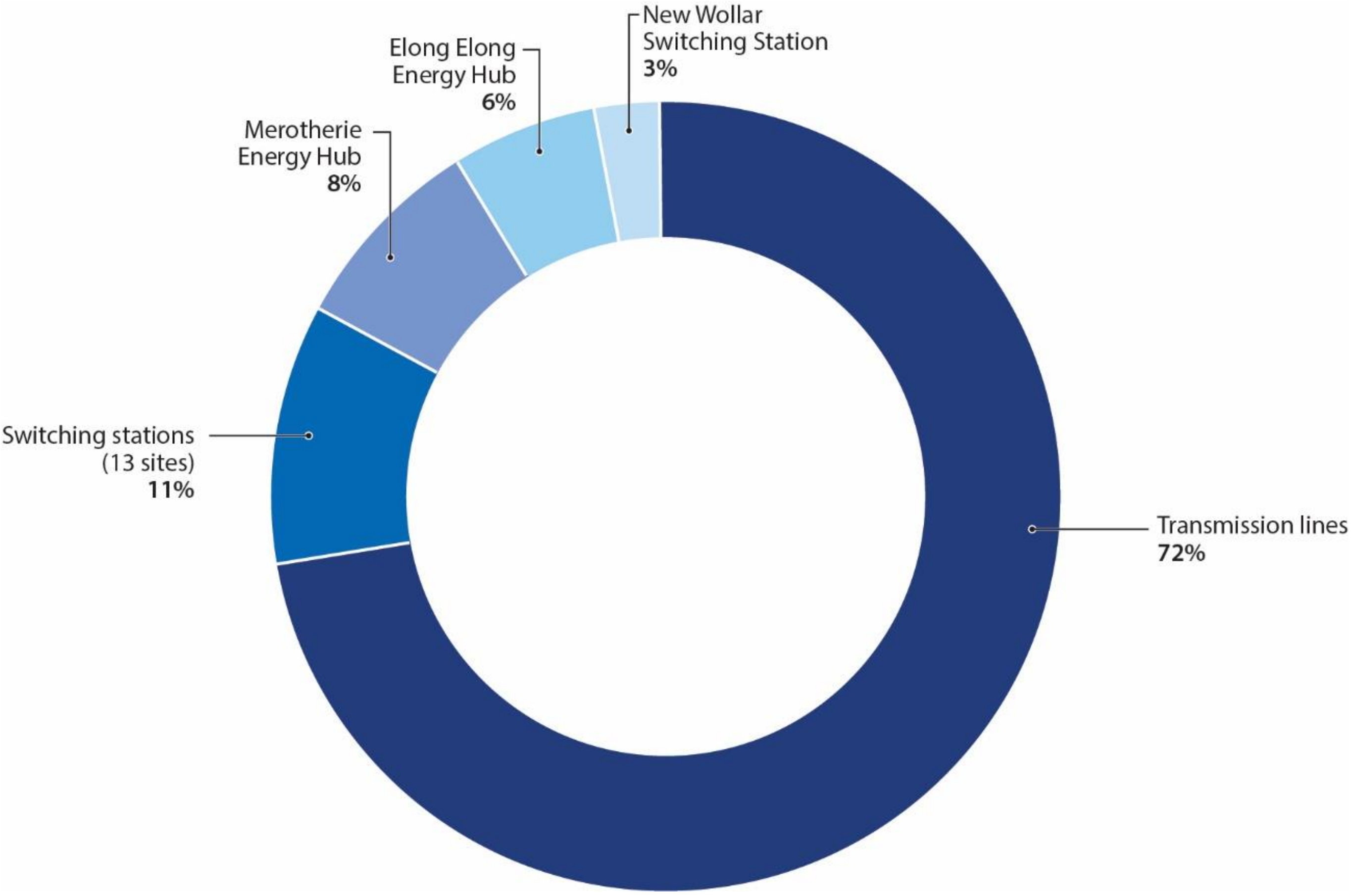


Figure 19-14 Greenhouse gas emissions during construction

Operation

The project would have an overall benefit in reducing greenhouse gas emissions in the wider economy by enabling an increase in the generation of renewable energy in the grid, to replace carbon intensive fossil fuel generation.

There would be greenhouse gas emissions during the operation of the project, due to electricity consumption to power the energy hubs and switching stations, energy losses during transmission, the operation of switchgear and the maintenance of project infrastructure.

Transmission losses in the network would require more electricity to be generated, which contributes to higher operational and embodied emissions across the NSW transmission network. Efficiency measures to reduce losses, can therefore contribute to a reduction in emissions across the network.

Approaches to minimise the energy loss include:

- optimising transmission line design to minimise resistance, and/or using conductors with low resistivity and advanced technologies to regulate voltage and optimise energy transfer
- using high quality transformer materials, optimising transformer design, and implementing efficient cooling mechanisms.

Emissions of sulphur hexafluoride (SF6) from switchgear could significantly contribute to the project's greenhouse gas emissions during operation, as it has a global warming potential about 23,500 times the global warming potential of carbon dioxide over a 100 year period (Clean Energy Regulator, 2022; Zhou, Teng, & Tong, 2018).

Greenhouse gas emissions associated with the maintenance of project infrastructure would include:

- operational emissions associated with vehicle emissions from the operation and maintenance fleet, released during activities such as equipment replacement and repairs
- embodied emissions that arise from the manufacturing, transportation, and installation of new equipment and materials needed for replacement or repairs.

19.5.5 Mitigation measures

The mitigation measures that would be implemented to avoid or minimise potential climate change risks to the project and reduce GHG emissions of the project are listed in Table 19-35.

Mitigation measures in other chapters that are relevant to the management of hazards and risks include:

- Chapter 16 (Hazard and risk) specifically measures which address bushfire risk
- Section 19.1 (Hydrology, flooding and water quality) specifically measures which address flood behaviour with consideration of future climate change.

Table 19-35 Proposed mitigation measures – Climate change and GHG

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
GHG1	Greenhouse gas emissions	A greenhouse gas (GHG) assessment and design refinement will be carried out during detailed design to identify opportunities to minimise GHG emissions during construction. Opportunities for consideration will include: • using low carbon concrete and steel in transmission line towers and civil infrastructure • giving preference to environmentally labelled products and materials, such as those with Environmental Product Declarations • implementing product stewardship schemes to take back, reuse or recycle materials/ products used during construction to minimise waste and associated emissions • minimising vegetation clearing during construction to preserve carbon sinks • implementing efficient construction practices, such as modular construction and off-site fabrication to minimise construction time and associated emissions.	Detailed design	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
GHG2	Greenhouse gas emissions	A GHG assessment and design refinement will be carried out during detailed design to identify opportunities to minimise GHG emissions during operation. Opportunities for consideration will include: • designing and implementing energy-efficient transmission infrastructure to minimise energy losses during operation and lower GHG emissions • investigating the use of non-SF6 technologies for transformers and switchgear. If SF6 is required, leak detection systems will be considered, and regular inspections and maintenance undertaken to reduce the risk of SF6 leaks • incorporating solar energy technologies, such as installing solar panels, at energy hubs and switching stations to reduce energy consumption within the National Electricity Market which still includes fossil fuel generated electricity • transitioning to zero-emission vehicles for operation and maintenance equipment, such as battery electric vehicles or hydrogen fuel cell vehicles • implementing advanced monitoring and control systems for transmission infrastructure to optimise energy efficiency and reduce energy losses • implementing demand-side management strategies to actively manage electricity consumption, reduce energy demand and associated GHG emissions.	Detailed design, operation	All locations
CC1	Climate change	A detailed climate change risk assessment will be carried out during detailed design in accordance with AS5334-2013.	Detailed design	All locations
CC2	Climate change	Following the detailed climate change risk assessment under mitigation measure CC1, adaptation measures will be developed to address climate change risks associated with bushfire, extreme heat, drought and increased rainfall intensity.	Detailed design	All locations

20 Cumulative impacts

This chapter provides an assessment of the potential cumulative impacts associated with the construction and operation of the project, when considered together with other relevant future projects in the Central-West Orana region. The cumulative impact assessment completed to support the Environmental Impact Statement (EIS) is provided in Appendix E (Cumulative impact assessment). The Secretary's Environmental Assessment Requirements (SEARs) relevant to cumulative impacts, and where they are addressed in the EIS, are provided in Appendix A (SEARs checklist).

20.1 Assessment approach

The *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE, 2022a) (the Guidelines) recognises that cumulative impact assessment can be undertaken at a strategic level and a project level.

The Guidelines note that strategic-level cumulative impact assessment includes a range of government legislation, strategies, plans, policies and guidelines that have been developed over time to anticipate and respond to environmental, social and economic changes.

Project-level cumulative impact assessment builds on the findings of project assessments to consider impacts from a proposed project in combination with other relevant future projects that are anticipated or reasonably foreseeable. Project-level cumulative impact assessment is therefore the assessment of environmental, social, economic and other impacts which result from a project when added to other relevant future projects.

The assessment presented in this chapter is a project-level cumulative impact assessment based on the approach described in the Guidelines. The Guidelines define cumulative impacts as those arising as a result of incremental, sustained and combined effects of human action and natural variations over time that can be both positive and negative. These impacts can be caused by the compounding effects of a single project or multiple projects in an area, and by the accumulation of effects from past, current and future activities as they arise.

The Guidelines identify important principles that should be considered in the approach to cumulative assessment, including:

- proportionate: the assessment is to focus on the key matters that could be materially affected by the cumulative impacts of the project and other relevant future projects – not on every conceivable cumulative impact on every matter
- collaboration: managing cumulative impacts is a shared responsibility and requires collaboration between government, industry and the community.

The approach to the assessment has been informed by these principles by:

- focussing on assessment matters that could be materially affected as described in Section 20.2
- recognising that not all Renewable Energy Zone (REZ) related cumulative impacts can be addressed through a project-level approach alone, requiring a more strategic and collaborative approach between EnergyCo, renewable energy developers, councils and government agencies (refer to Section 20.3 for further details).

The selection of relevant future projects considered in the assessment was based on the following criteria outlined in section 3.4 of the Guidelines:

- project size: projects considered in the assessment are typically large-scale major development or infrastructure projects, including changes to existing projects, projects under assessment, approved projects and development that is required for the project but subject to a separate assessment (related development)
- project timeframe and planning approval: projects likely to be constructed and/or operated concurrently or sequentially with the project (referred to as 'this project' in this chapter), 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 an application and scoping document or EIS have been lodged with the New South Wales (NSW) Department of Planning and Environment (DPE))
- project location: projects with potential impacts that would spatially overlap with the potential impacts of this project on a local or regional scale, such as shared use of roads for construction access.

Projects with the following planning status were considered in the assessment:

- proposed projects: projects currently under statutory environmental impact assessment where an application has been lodged
- approved projects: approved projects that have not started construction or that are currently under construction where construction periods overlap with this project
- changes to existing projects, including projects where:
  - an approval is due to run out and operations are likely to cease
  - an announcement has been made that operations will cease
  - the intensity of the project's operations may change over time (e.g. the project is currently operating below its approved capacity, the project is currently under construction and will only start operating in two years)
  - approval is being sought for a major expansion of the project.

As part of the relevant future projects that were selected based on the above criteria, a specific category of 'related development' has been identified, these being defined as development that responds to the opportunities created by the project or which is required as a result of the project.

Projects were identified from publicly available information (including scoping reports, environmental impact statements and relevant environmental information) of the following (searched in February 2023):

- NSW major projects portal
- NSW Western Regional Planning Panel project register, focusing on other State Significant Infrastructure (SSI) or State Significant Development (SSD) and Division 5.1 of the *Environmental Planning and Assessment Act 1979* projects that are likely to significantly affect the environment and require an EIS
- Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Public notices list
- local council websites/development application tracking databases, focusing on any major greenfield and urban renewal developments that are scheduled for the area
- Transport for NSW website.

The relevant future projects and key issues that were considered as having the potential to result in cumulative impacts with the project are listed in Table 20-1. The location of major (SSI or SSD) relevant future projects are shown in Figure 20-1 (where they are within the extent of the figure). Further detail on the projects identified for consideration are provided in Appendix E (Cumulative impact assessment).

The proposed Narragamba solar farm that would connect to this project (subject to the outcomes of the Consumer Trustees competitive tender process for rights to access the new transmission infrastructure and obtaining planning approval) has been announced and a Scoping Report was published for the project in July 2023 (ACEN Australia, 2023). Due to the late availability of that document, the project has not been included in this assessment, but would be considered further as part of the Submissions Report.

Potential impacts of the relevant future projects were considered to identify issues that would potentially be materially affected by the cumulative impacts of this project in combination with the relevant future projects, and issues that do not require further cumulative impact assessment.

Issues that would potentially be materially affected by the cumulative impacts of this project in combination with the relevant future projects include land use, property and agriculture, landscape character and visual amenity, biodiversity, Aboriginal heritage, social, economic, traffic and transport, noise and vibration, bushfire risk and other general hazards, surface water and groundwater supply, air quality and waste management.

Issues were not considered further in the assessment where there would be no potential overlap in the impacts of this project and the relevant future projects' impacts, or potential cumulative impacts are expected to be relatively minor. These issues include aviation, soils and contamination, groundwater levels, flow, recharge and quality, non-Aboriginal heritage, geomorphology, flooding and water quality and greenhouse gas, and are discussed further in Section E2.3.1 of Appendix E (Cumulative impact assessment).

The level of assessment (standard or detailed) and type of assessment (quantitative or qualitative) required for each key issue assessed was based on the scale and nature of the potential cumulative impacts, available information in publicly available planning documents and uncertainties associated with each relevant future project, as outlined in section E2.2 of Appendix E (Cumulative impact assessment).

A detailed assessment was undertaken where the cumulative impacts of the project and relevant future projects are likely to be significant. A standard assessment was undertaken where the cumulative impacts of the project and relevant future projects are not likely to be significant. Quantitative methods were used to assess the relevant cumulative impacts where the relevant data was available in publicly available planning documents. Qualitative assessment or suitably sensitivity testing was carried out where the cumulative impacts of relevant future projects were in the scoping phase at the time of EIS preparation and detailed technical studies have not yet been undertaken to assess potential impacts.

The assessment is limited by the available information in publicly available planning documents. Uncertainties, including challenges obtaining information and data about the relevant future projects, and assumptions made in the assessments have been documented in Appendix E (Cumulative impact assessment) where relevant.

Table 20-1 Relevant future projects with the potential for cumulative impacts

Project			Potential cumulative impacts											
ID and name	Planning status and environmental assessment documentation reviewed	Distance from project	Land use, property and agriculture	Landscape and visual	Biodiversity	Aboriginal	Social	Economic	Noise and vibration	Bushfire and general hazards	Air quality	Traffic and transport	Waste management	Surface water and groundwater supply
Related development														
1 – Public road works	Pre-REF (Review of Environmental Factors) EnergyCo information (not in public domain)	Direct overlap in some instances, extending to around 4 kilometres (km) from the project				✓	✓	✓	✓	✓	✓	✓	✓	✓
2 – Liverpool Range wind farm	Approved, modification under assessment EIS, Response to Submissions Report, Modification Report and Assessment Report	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3 – Valley of the Winds wind farm	Under assessment EIS and associated technical studies	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4 – Barneys Reef wind farm	Scoping/pre-EIS Scoping Report	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
5 – Birriwa solar farm	Under assessment EIS and associated technical studies	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6 – Tallawang solar farm	Under assessment EIS and associated technical studies	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

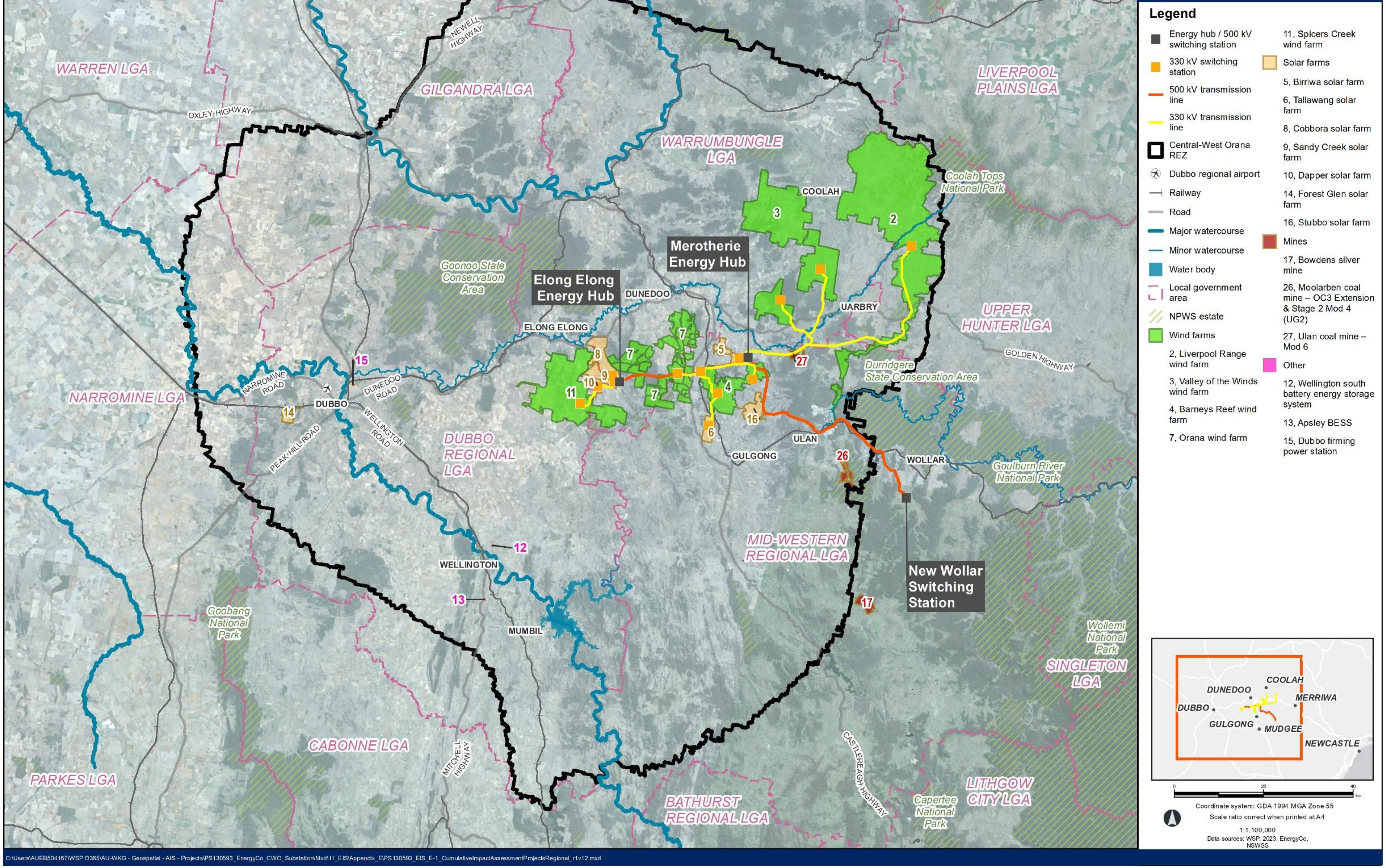
Project			Potential cumulative impacts											
ID and name	Planning status and environmental assessment documentation reviewed	Distance from project	Land use, property and agriculture	Landscape and visual	Biodiversity	Aboriginal	Social	Economic	Noise and vibration	Bushfire and general hazards	Air quality	Traffic and transport	Waste management	Surface water and groundwater supply
7 – Orana wind farm	Scoping/pre-EIS Scoping Report	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
8 – Cobbora solar farm	Scoping/pre-EIS Scoping Report	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9 – Sandy Creek solar farm	Scoping/pre-EIS Scoping Report	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10 – Dapper solar farm	Scoping/pre-EIS Scoping Report	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
11 – Spicers Creek wind farm	Scoping/pre-EIS Scoping Report	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Proposed projects														
12 – Wellington south battery energy storage system (BESS)	Under assessment EIS and associated technical studies	36 km southwest of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
13 – Apsley BESS	Under assessment EIS and associated technical studies, Submissions Report, Amendment Report and Assessment Report	47 km southwest of western section of project	✓		✓	✓	✓	✓		✓			✓	✓

Project			Potential cumulative impacts											
ID and name	Planning status and environmental assessment documentation reviewed	Distance from project	Land use, property and agriculture	Landscape and visual	Biodiversity	Aboriginal	Social	Economic	Noise and vibration	Bushfire and general hazards	Air quality	Traffic and transport	Waste management	Surface water and groundwater supply
14 – Forest Glen solar farm	Under assessment EIS and associated technical studies, Submissions Report, Amendment Report and Assessment Report	61 km west of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
15 – Dubbo firming power station	Scoping/pre-EIS Scoping Report	50 km west of western section of project			✓		✓	✓		✓			✓	✓
Approved projects														
16 – Stubbo solar farm	Approved EIS and associated technical studies, Submissions Report, Amendment Report and Assessment Report	Adjacent to project along New Wollar Switching Station — Merotherie Energy Hub connection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
17 – Bowdens silver mine	Approved EIS and associated technical studies, Submissions Report, Amendment Reports and Assessment Report	23 km southwest of New Wollar Switching Station	✓		✓	✓	✓	✓		✓			✓	✓

Project			Potential cumulative impacts											
ID and name	**Planning status and environmental assessment documentation reviewed**	**Distance from project**	**Land use, property and agriculture**	**Landscape and visual**	**Biodiversity**	**Aboriginal**	**Social**	**Economic**	**Noise and vibration**	**Bushfire and general hazards**	**Air quality**	**Traffic and transport**	**Waste management**	**Surface water and groundwater supply**
18 – Inland Rail (Narromine to Narrabri)	Approved EIS and associated technical studies, Submissions Report, Amendment Report and Assessment Report	81 km west of western section of project			✓	✓	✓	✓		✓			✓	✓
19 – Dunedoo solar farm	Approved EIS and associated technical studies, Submissions Report, Amendment Reports and Assessment Report	20 km north of central section of project	✓		✓	✓	✓	✓		✓			✓	✓
20 – Uungula wind farm	Approved EIS and associated technical studies, Submissions Report, Amendment Report and Assessment Report	25 km south of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
21 – Maryvale solar farm	Approved EIS and associated technical studies, Submissions Report and Assessment Report	30 km southwest of western section of project	✓		✓	✓	✓	✓		✓			✓	✓

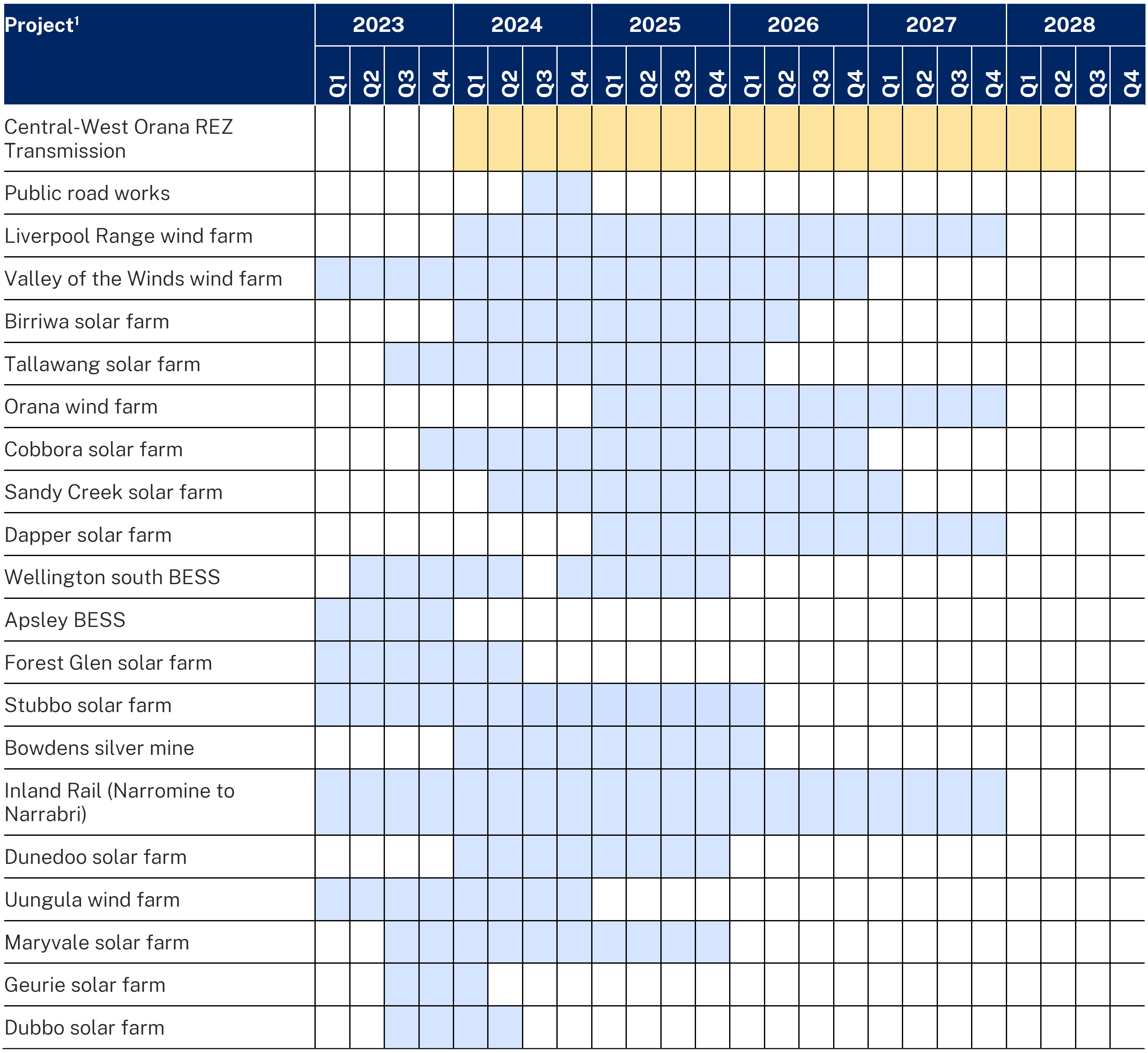
Project			Potential cumulative impacts											
ID and name	Planning status and environmental assessment documentation reviewed	Distance from project	Land use, property and agriculture	Landscape and visual	Biodiversity	Aboriginal	Social	Economic	Noise and vibration	Bushfire and general hazards	Air quality	Traffic and transport	Waste management	Surface water and groundwater supply
22 – Geurie solar farm	Approved Council assessment reports	35 km southwest of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
23 – Dubbo solar farm		48 km west of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
24 – Gilgandra solar farm		77 km northwest of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
25 – Wahroonga solar farm		81 km west of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
Changes to existing projects														
26 – Moolarben coal mine OC3 Extension & Moolarben Stage 2 – Modification 4 – UG2	Under assessment OC3 Extension: EIS and associated technical studies Stage 2 – Modification 4 – UG2: Modification Report and Submissions Report	Direct overlap	✓		✓	✓	✓	✓	✓	✓	✓			✓
27 – Ulan coal mine Modification 6	Under assessment Modification Report	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓

Figure 20-1
Cumulative impact assessment projects (regional)



The potential overlap in construction schedules of the project with the relevant future projects is based on publicly available information and is shown in Table 20-2. The overlap would be dependent on the project approval timeframes of the relevant future projects. Projects that have not indicated the expected start or completion date of construction in publicly available environmental assessment documentation have not been included in Table 20-2.

Table 20-2 Anticipated schedule overlap with relevant future projects during construction



1. Includes only projects that have provided indicative construction periods in publicly available environmental assessment documentation.

20.2 Potential cumulative impacts

This section provides an overview of the cumulative impacts that may occur as a result of this project and the identified relevant future projects during construction and operation. The assessment methodologies for each assessment topic are provided in Appendix E (Cumulative impact assessment).

20.2.1 Land use, property and agriculture

The project would require the use of land, both temporarily for construction and permanently for operation. The majority of this land is currently used for agricultural purposes. This requirement for land, and the subsequent impacts to agricultural land use and productivity, is generally consistent with the majority of the relevant future projects, as it involves:

- temporary removal of agricultural land and agricultural productivity during construction, for construction compounds, temporary access roads/tracks and construction work areas outside areas where project infrastructure is installed
- permanent removal of agricultural land and agricultural productivity at locations where project infrastructure (energy hubs, switching stations, transmission line towers, solar panels etc) is proposed
- establishment of 'dual use' areas, where the presence of project infrastructure allows for the continuation of some agricultural activities, such as within transmission line easements, or continued grazing of sheep beneath solar or wind energy generation infrastructure.

Construction

For the purpose of calculating the loss of agricultural value (production) from the use of land for construction, a conservative ('worst case') scenario was used that assumed the entire construction area for this project would be unavailable for agricultural use during the construction period, the estimated loss of agricultural production would be around $1.35 million per year. This is equivalent to around 0.21 per cent of the total gross value of annual agricultural production across the four impacted local government areas (LGAs). This is considered a 'worst case' impact as it is expected that agricultural land uses (such as grazing) would continue within parts of the construction area, subject to the timing and location of construction activities, and the ability to implement safe access arrangements.

The majority of the relevant future projects have the potential to contribute to cumulative land use, property and agriculture impacts. A summary of the potential cumulative land use, property and agriculture impacts of each of these projects is provided in Table E-7 in Appendix E (Cumulative impact assessment).

The temporary removal of agricultural land during construction of wind farm projects would generally be limited to small areas of each impacted landholding (typically less than five percent of each landholding), with existing agricultural activities continuing on the largest part of the landholding. For solar farm projects the removal of agricultural activities during construction would extend across the construction area of each project. Disturbed areas not required for operation would be rehabilitated to ensure minimal impacts on agricultural operations. Agricultural operations may also be temporarily impacted due to increased construction traffic, vegetation removal, the generation of noise, vibration and dust, damages/changes to farm infrastructure and increased biosecurity risks. These impacts would be minimised with the implementation of mitigation measures for each project, and would be managed via property management plans and in consultation with landowners.

With the implementation of the mitigation measures outlined in Chapter 7 (Land use and property) and Chapter 8 (Agriculture) and the management approach outlined in Section 20.3, cumulative impacts on agriculture, as a result of the overlap in construction activities for the project and the relevant future projects, are not expected to be significant.

Operation

Operation of this project would result in a permanent change in land use from the existing agricultural land use to electrical infrastructure where permanent infrastructure would be established (e.g. transmission line towers, energy hubs, maintenance facility, switching stations, access tracks and access roads). The permanent loss of agricultural land is equivalent to around 0.13 per cent of the total area of agricultural land use in the four impacted LGAs. This represents an estimated loss in agricultural productivity of around $317,550 per year, which represents around 0.05 per cent of the total annual gross value of agricultural production across the four impacted LGAs. Land within the transmission line easements for this project, and immediately next to the easements, would remain available for agricultural activities such as grazing and cropping, however, would be subject to certain restrictions for safety and operational reasons.

Most of the relevant future projects would have a relatively minor cumulative impact on agricultural production, as some agricultural activities would be allowed to continue across the respective project areas during operation, depending on the type of project and the type of agriculture. For example, wind farms would allow cropping to continue within the project footprint, whereas solar farms would remove existing arable land within their project footprints from future crop production. However, grazing could most likely continue within the project footprint of both solar and wind farms.

Mining projects, such as Bowdens silver mine and Moolarben coal mine (OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2), would collectively remove around 2,500 hectares of land currently used for agricultural production throughout the life of the projects and rehabilitation periods. This is likely to impact local agricultural productivity, however is unlikely to result in a significant impact on regional agricultural production. Considering the impacts of this project on regional agricultural productivity, this project in combination with these mining projects are unlikely to result in significant cumulative impacts on regional agricultural productivity.

The remainder of the relevant future projects would have limited cumulative impacts on agriculture due to their small footprint (such as the BESS projects and small solar farms), or distance from this project (such as Inland Rail and some solar farms).

This project, in combination with wind farms located near this project may have a cumulative impact on aerial agriculture operations (e.g. aerial spraying), as these projects would introduce new obstacles (and turbulence, in the case of wind turbines) into the airspace and reduce the area available for aerial application, as aircraft would not be able to operate under the transmission lines or wind turbines. Cumulative impacts on aerial agriculture operations in the vicinity of the wind farms are expected to be minor when the recommended risk management process is carried out by the pilot and landowner.

Cumulative biosecurity risks are expected to be low once standard mitigation measures are implemented by each project.

20.2.2 Landscape and visual

If approved, there would likely be cumulative landscape and visual impacts associated with this project and the relevant future projects, due to the proximity and associated potential for the projects to be seen together and change the character of the surrounding landscape.

The cumulative impacts have been assessed for five geographical areas, due to the close proximity of relevant future projects to this project in these areas, the cumulative impact of these projects on landscape character and the potential overlap in visibility between the projects during construction and operation:

- southeast (Ulan and Bungaba)
- northeast (Cassilis and Turill)
- north (Leadville, Coolah and Uarbry)
- central (Merotherie, Birriwa, Barneys Reef, Stubbo and Tallawang)
- west (Elong Elong, Cobbora, Gollan, Goolma and Dunedoo).

Table 20-3 provides a summary of the potential cumulative landscape character and visual impacts during construction and operation.

Construction periods of relevant future projects near the north eastern, central and western sections of this project are likely to overlap with this project over several years (refer to Table 20-2). Construction activities for the relevant future projects and this project would extend across large areas of the landscape, and would contrast with the rural amenity and scenic quality of the existing rural landscape. These activities would be seen from several dwellings and local roads, including at night where construction lighting is required.

The most substantial cumulative landscape character and visual impacts would be experienced

- in the landscapes between Gulgong and Dunedoo
- between Tallawang and Spicers Creek (the central and western sections of the project), where multiple renewable energy projects are proposed in combination with this project
- in the landscapes between Cassilis and Leadville (the northeastern section of the project), where two large wind farm projects are proposed in combination with this project.

Views of these projects would be prominent and contrast with the undulating rural and forested hills of the surrounding landscape, including at night, when some private dwellings would have views of operational lighting at switching stations, energy hubs and operations and maintenance buildings.

Table 20-3 Potential cumulative landscape character and visual impacts during construction and operation

Location and relevant future projects	Cumulative landscape character impacts	Cumulative visual impacts
Southeast – Ulan and Bungaba • Ulan coal mine Modification 6	Construction: Where construction periods overlap, this project in combination with the Ulan coal mine Modification 6, would result in cumulative landscape character impacts to the south of Blue Springs Road, Bungaba in the Talbragar River rural valley landscape character zone (LCZ) (RV-3), due to the removal of bushland vegetation, the use of large-scale machinery and vehicles, landform changes and the construction of surface infrastructure. The majority of construction lighting for the Ulan coal mine Modification 6 at night would be located underground within mine exploration areas, however some external lighting may be required. At night, there is the potential for cumulative landscape character impacts in the Talbragar River rural valley LCZ, due to the construction lighting required for this project and the Ulan coal mine Modification 6 project. Nearby private dwellings, including a couple of dwellings to the north of the Ulan coal mine are likely to have views of this construction lighting. Operation: Operational activities for the Ulan coal mine would be underground and is not expected to result in any cumulative landscape character impacts. At night, external lighting would be provided at surface infrastructure of the Ulan coal mine. Operational lighting for this project and the Ulan coal mine Modification 6 project would increase lighting levels with the surrounding low district brightness landscape of the Talbragar River rural valley LCZ. There is the potential for views to this operational lighting from a couple of private dwellings to the north of the Ulan coal mine.	Construction: If approved, construction of the Ulan coal mine Modification 6 may be seen sequentially and together with this project in the area south of Blue Springs Road, Bungaba. Construction activities for these projects, including vegetation removal, earthworks, construction of project infrastructure and vehicles and machinery travelling along access tracks and construction routes, may be seen from sections of local roads such Blue Springs Road, and from nearby rural properties. These construction activities would contrast with the rural amenity and scenic quality of the existing rural landscape, resulting in potential cumulative visual impacts. Operation: Although most of the Ulan coal mine Modification 6 project infrastructure would be located underground, some surface infrastructure such as haulage roads would be seen in addition to transmission infrastructure of this project from sections of local roads such Blue Springs Road, and from nearby rural properties. This infrastructure would contrast with the existing rural amenity and scenic quality of this area, resulting in potential cumulative visual impacts. There is the potential for cumulative visual impacts as the Ulan coal mine Modification 6 project would be seen together with this project from about two private dwellings.

Location and relevant future projects	Cumulative landscape character impacts	Cumulative visual impacts
Northeast – Cassilis and Turill • Liverpool Range wind farm	Construction: The construction program for the Liverpool Range wind farm is likely to overlap with construction of this project for several years. There is the potential for cumulative impacts on landscape character where construction activities would take place near the Cassilis connection and switching station M1, in the Cassilis to Coolah undulating rural hills LCZ (URH-5). This change in landscape character would be mostly due to the construction of the wind farm, as the wind farm would require construction activity of a larger scale and over a broader area, with a relatively small contribution by the Central-West Orana REZ Transmission project. Changes to landscape character would be associated with the use of large-scale machinery and vehicles, landform changes, the removal of vegetation, the installation of project infrastructure and widespread road and access track upgrades. At night, there is the potential for cumulative landscape character impacts in the Cassilis to Coolah undulating rural hills LCZ, due to the construction lighting required for this project and the Liverpool Range wind farm. One private dwelling, which is associated with the Liverpool Range wind farm project and would host transmission line infrastructure for the Central-West Orana REZ Transmission project, is likely to have views of this construction lighting. Operation: This project and the Liverpool Range wind farm would introduce energy and electricity infrastructure, access tracks and upgraded roads into a landscape where there is currently limited built development and a prevailing undulating rural landscape character. This infrastructure would change the landscape character to one where the presence of energy and electricity infrastructure is more frequently encountered and prominent, resulting in a cumulative landscape character impact. The contribution of the Central-West Orana REZ Transmission project to this change in landscape character would be greater in the vicinity of the Cassilis connection and switching station M1 where these projects would be seen together. The Liverpool Range wind farm is unlikely to require aviation obstacle lighting on the wind turbines, however, there would be low intensity night lighting at the substations, control and auxiliary buildings of the wind farm. Low-level lighting is required for the Central-West Orana REZ Transmission project at the Cassilis connection and switching station M1, where these projects would be seen together. Together these projects would slightly increase the lighting levels within parts of the Cassilis to Coolah undulating rural hills LCZ at night, and result in a potential cumulative landscape character impact. One private dwelling, which is associated with the Liverpool Range wind farm project, and would also host transmission line infrastructure for the Central-West Orana REZ Transmission project, is likely to have views of this operational lighting.	Construction: The construction of the approved Liverpool Range wind farm would be seen sequentially and together with this project in undulating rural hills north of Cassilis, for several years. Construction activities for these projects, including vegetation removal, earthworks, construction of project infrastructure and vehicles and machinery travelling along access tracks and construction routes, may be seen from sections of local roads such Rotherwood Road and Coolah Road, and from nearby rural properties between Cassilis and Coolah. These construction activities would contrast with the rural amenity and scenic quality of the existing rural landscape, resulting in potential cumulative visual impacts. Operation: This project and the operational Liverpool Range wind farm would be seen sequentially and together from sections of local roads such Rotherwood Road and Coolah Road, and from nearby rural properties between Cassilis and Coolah. The Liverpool Range wind farm proposes multiple wind turbines around four times the height of this project's transmission line towers. Views of these projects would be prominent and contrast with the rural amenity and scenic quality of the existing rural landscape, resulting in potential cumulative visual impacts. One private dwelling, which is associated with the Liverpool Range wind farm project, and would also host transmission line infrastructure for the Central-West Orana REZ Transmission project, is likely to have views of this project and the wind farm.

Location and relevant future projects	Cumulative landscape character impacts	Cumulative visual impacts
Northeast – Leadville, Coolah and Uarbry • Valley of the Winds wind farm	Construction: The construction program for the Valley of the Winds wind farm is likely to overlap with construction of this project for several years. There is the potential for cumulative impacts on landscape character where construction activities would take place near the Coolah and Leadville connections and switching stations M2 and M3, in the Uarbry and Tongy undulating rural hills LCZs (URH-3 and URH-4). This character change would be mostly due to the construction of the wind farm, as the wind farm would require construction activity over a much larger scale and broader area than the Central-West Orana REZ Transmission project. Changes to landscape character would be associated with the use of large-scale machinery and vehicles, landform changes, the removal of vegetation, the installation of project infrastructure and widespread road and access track upgrades as a result of this project and the wind farm project. At night, there is the potential for cumulative landscape character impacts in the Uarbry and Tongy undulating rural hills LCZs, due to construction lighting required for this project and the Valley of the Winds wind farm. Nearby private dwellings, including one dwelling which is associated with the Valley of the Winds wind farm project and would host transmission line infrastructure for the Central-West Orana REZ Transmission project, are likely to have views of this construction lighting. Operation: This project and the Valley of the Winds wind farm would introduce energy and electricity infrastructure, access tracks and upgraded roads into a landscape where there is currently limited built development and a prevailing undulating rural landscape character. This infrastructure would change the landscape character to one where the presence of energy and electricity infrastructure is more frequently encountered and prominent, resulting in cumulative landscape character impact. The contribution of the Central-West Orana REZ Transmission project to this change in landscape character would be greater in the vicinity of the Coolah connection and switching station M2, where these projects would be seen together. The Valley of the Winds wind farm may require aviation obstacle lighting on the wind turbines, as well as low intensity night lighting at the switching stations, substations, control and operations and maintenance buildings of the wind farm. Low-level lighting is required for the Central-West Orana REZ Transmission project at the Cassilis connection and switching stations M2 and M3, where these projects would be seen together. Together these projects would increase the lighting levels within parts of the Uarbry and Tongy undulating rural hills LCZs at night, and result in a potential cumulative landscape character impact. Nearby private dwellings, including one dwelling which is associated with the Valley of the Winds wind farm project and would host transmission line infrastructure for the Central-West Orana REZ Transmission project, are likely to have views of this operational lighting.	Construction: If approved, construction of the Valley of the Winds wind farm would be seen sequentially and together with this project in this area north of Uarbry, for several years. Construction activities for these projects, including vegetation removal, earthworks, construction of project infrastructure and vehicles and machinery travelling along access tracks and construction routes, may be seen from sections of local roads such Moorefield Road, and from nearby rural properties. These construction activities would contrast with the rural amenity and scenic quality of the existing rural landscape, resulting in potential cumulative visual impacts. Operation: The operational Valley of the Winds wind farm would be seen sequentially and together with this project in undulating rural and forested hills north of Uarbry. The Valley of the Winds wind farm proposes multiple wind turbines around four times the height of this project's transmission line towers. The projects would be seen from sections of Moorefield Road and from nearby rural properties south of Coolah and around Leadville. View of these projects would be prominent and contrast with the rural amenity and scenic quality of the surrounding landscape, resulting in potential cumulative visual impacts. One private dwelling, which would host both wind farm project infrastructure and transmission line infrastructure for the Central-West Orana REZ Transmission project, is likely to have views of this project and the wind farm.

Location and relevant future projects	Cumulative landscape character impacts	Cumulative visual impacts
Central – Merotherie, Birriwa, Barneys Reef, Stubbo and Tallawang • Birriwa solar farm • Barneys Reef wind farm • Stubbo solar farm • Tallawang solar farm	Construction: In the landscapes between Gulgong and Dunedoo, multiple renewable energy projects are proposed/approved near this project, and the construction periods of these projects are likely to overlap with this project over several years. This project, in combination with the relevant future projects, would gradually transform the predominantly rural landscape character of the Narragamba to Blue Springs LCZ (URH-1) and Birriwa to Tallawang undulating rural hills LCZ (URH-2) to a landscape where the construction and installation of energy and electricity infrastructure characterises large areas of the landscape. Cumulative impacts on landscape character would be associated with earthworks, vegetation removal, construction of the project infrastructure and the movement of machinery and vehicles. Cumulative landscape character impacts could also occur in the Barneys Reef forested hills LCZ (FH-4), where construction activities for this project and the Barneys Reef wind farm may overlap. However, this character change would be mostly due to the construction of the wind farm, as it would require construction activity over a much larger scale and broader area than this project. At night, there is the potential for cumulative landscape character impacts on the Narragamba to Blue Springs, Birriwa to Tallawang undulating rural hills and Barneys Reef forested hills LCZs, due to construction lighting required for the Central-West Orana REZ Transmission project and the relevant future projects. Several private dwellings near the Merotherie Energy Hub would have views of construction lighting from this project and the Birriwa solar farm. Several private dwellings near the Castlereagh Highway would have views of construction lighting from this project and the Barneys Reef wind farm. Operation: This project, in combination with the relevant future projects, would transform the Narragamba to Blue Springs and Birriwa to Tallawang undulating rural hills LCZs from predominantly rural to having a prevailing character of renewable energy infrastructure, due to the introduction of solar panel arrays, switching and substations, BESS facilities, workshops maintenance and operations buildings, maintenance access tracks and upgraded roads into the landscape. The contribution of this project to this change in character would be greater in the vicinity of the Merotherie Energy Hub and in areas to the west of the energy hub. Cumulative landscape character impacts are also expected in a small area of the Barneys Reef forested hills LCZ, due to the introduction of energy and electricity infrastructure for the Barneys Reef wind farm and this project.	Construction: The construction of the approved Stubbo solar farm could potentially overlap with this project for several years in the area northeast of Gulgong, in the vicinity of Blue Springs Road. Construction of the remaining relevant future projects could potentially be seen sequentially and together with construction of the project in areas between Gulgong and Dunedoo. Cumulative visual impacts may occur as construction activities would be spread across a large area and viewed against the hills at Barneys Reef, which would impact the existing rural amenity and scenic quality of views in this area. In particular this would affect views from the Castlereagh Highway, where large scale construction would be seen for an extended duration on both sides of the highway. Operation: In this area north and northeast of Gulgong, the relevant future projects would extend across a large area of undulating rural landscape and would be viewed against a backdrop of hills at Barneys Reef. The projects would be viewed sequentially and together, from nearby roads, such as the Castlereagh Highway, and rural properties, including private dwellings. Cumulative visual impacts may occur as the scale, proximity and extent of this project and the relevant future projects would contrast with the rural amenity and scenic quality of existing views, which do not currently contain large-scale built features or infrastructure. Two private dwellings near the Merotherie Energy Hub may have views of this project together with the Birriwa solar farm. Around six private dwellings near the Castlereagh Highway, some of which are not associated with either of these projects, may have views of this project and the Barneys Reef wind farm.

Location and relevant future projects	Cumulative landscape character impacts	Cumulative visual impacts
	At night, there is the potential for cumulative landscape character impacts on the Narragamba to Blue Springs and Birriwa to Tallawang undulating rural hills LCZs, due to construction lighting required for this project and the proposed solar farm and BESS projects. This is likely to include low-level lighting for safety and security at switching stations, battery storages and permanent operations and maintenance buildings. Cumulative landscape character impacts are also expected on the Barneys Reef forested hills LCZ near the Merotherie Energy Hub and switching stations M6 and M8, due to night lighting required for this project and the Barneys Reef wind farm (including lighting at operation and maintenance buildings, battery storage facilities, substations and aviation obstacle lighting on the wind turbines). Several private dwellings near the Merotherie Energy Hub may have views of operational night lighting from this project and the Birriwa solar farm. Some of these dwellings would be associated with the solar farm project or host transmission line infrastructure for this project (Central-West Orana REZ Transmission project). Around six to eight private dwellings near the Castlereagh Highway may have views of operational lighting from this project and the Barneys Reef wind farm.	

Location and relevant future projects	Cumulative landscape character impacts	Cumulative visual impacts
West – Elong Elong, Cobbora, Gollan, Goolma and Dunedoo • Orana wind farm • Sandy Creek solar farm • Cobbora solar farm • Dapper solar farm • Spicers Creek wind farm	Construction: In the landscapes between Tallawang and Spicers Creek, multiple renewable energy projects are proposed near this project, and the construction periods of these projects are likely to overlap with this project over several years. This project, in combination with the relevant future projects, would gradually transform the predominantly rural landscape character of the Dapper and Elong undulating rural hills LCZ (URH-6) and Spring Ridge and Tuckland forested hills LCZ (URH-2) to a landscape where the construction and installation of energy and electricity infrastructure characterises large areas of the landscape. Cumulative impacts on landscape character would be associated with earthworks, vegetation removal, construction of the project infrastructure and the movement of machinery and vehicles. Operation: This project, in combination with the relevant future projects, would transform the Narragamba to Blue Springs and Birriwa to Tallawang undulating rural hills LCZs from predominantly rural to having a prevailing character of renewable energy infrastructure, due to the introduction of solar panel arrays, switching and substations, BESS facilities, workshops, maintenance and operations buildings, maintenance access tracks and upgraded roads into the landscape.	Construction: Multiple renewable energy projects are proposed in the rural area west of the Castlereagh Highway, between Tallawang and Spicers Creek. If approved, construction of these projects would be seen sequentially and together with the project in this area, for around two to three years. The works at multiple construction sites would be visible, including leveling works, foundation construction and presence of vehicles and machinery travelling along access tracks and construction routes. As this area is fairly remote, the projects would be seen from sections of local roads such Spring Ridge Road and Dapper Road, and from nearby rural properties. The construction activities would extend across a large part of this rural area and contrast with the rural amenity and scenic quality of the existing rural landscape, resulting in potential cumulative visual impacts. Operation: In this area between Tallawang and Spicers Creek, the relevant future projects and this project would extend across a large area of undulating rural landscape. These projects would be viewed sequentially and together, from nearby roads such as the Spring Ridge Road and Dapper Road and from rural properties, including private dwellings. There is the potential for cumulative visual impacts due to the scale, proximity and extent of this project and the relevant future projects, and their contrast with the rural amenity and scenic quality of the existing rural landscape, that do not currently contain large scale built features or infrastructure. About five dwellings would have views of this project and the Orana wind farm, of which several would host infrastructure for this project and/or the wind farm project. About 10 dwellings in the vicinity of the Elong Elong Energy Hub would have views of this project, the Spicers Creek wind farm and Sandy Creek, Cobbora and Dapper solar farms, most of which would also host one of these projects.

20.2.3 Biodiversity

Relevant future projects that were considered relevant future projects for the cumulative biodiversity impact assessment are identified in Table E-11 of Appendix E (Cumulative impact assessment).

Cumulative impacts on native vegetation, threatened and migratory species and threatened ecological communities

Table 20-4 provides a summary of the total impact on native vegetation, Threatened Ecological Communities (TECs) and threatened species for each relevant future project (based on publicly available information). Six of the relevant future projects are in the early planning stages and the likely impacts of these projects are currently unknown, however biodiversity impacts from all of these projects can be expected. The total ecosystem credit and species credit requirements for each project are also provided to provide an overview of cumulative offset requirements.

Due to the variance in impacts between projects, the total native vegetation impact is considered to represent impact to threatened species habitats, and the species credit requirement is considered to represent the level of impact to threatened species.

The direct cumulative impact on native vegetation as a result of this project, in combination with the relevant future projects, is estimated to be 9,859.21 hectares. The cumulative ecosystem credit requirement is 147,215.25 credits and the cumulative species credit requirement is 305,854 credits.

Table 20-4 Potential cumulative impacts of relevant future projects on native vegetation, TECs and threatened species

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Related development						
Liverpool Range wind farm	1,790	• White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• White Box - Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland.	• Ausfeld's wattle • *Silky swainson-pea* • Glossy black-cockatoo • Large-eared pied-bat • Square-tailed kite • Squirrel glider • Eastern cave bat	30,101	20,405
Valley of the Winds wind farm	1,340.78	• Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	• Large-eared Pied Bat • Large Bent-winged Bat • Barking Owl • Squirrel Glider • *Acacia ausfeldii* • Bush Stone-curlew • Gang-gang Cockatoo • Glossy Black-Cockatoo • Eastern Pygmy-possum • *Commersonia procumbens* • *Cynanchum elegans* • Pale-headed Snake • Stephens' Banded Snake • Square-tailed Kite • *Monotaxis macrophylla* • Greater Glider	8,966	19,688

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
				• Brush-tailed Rock-wallaby • Koala • *Prasophyllum petilum* • *Prasophyllum sp. Wybong* • Grey-headed Flying-fox • *Tylophora linearis* • Masked Owl • Eastern Cave Bat		
Barneys Reef wind farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	Not identified in Scoping Report	Not identified in Scoping Report	Unknown	Unknown	Unknown
Birriwa solar farm	368.71	• Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	• Large-eared Pied Bat • Barking Owl • Powerful Owl • Koala • Masked Owl • *Acacia ausfeldii* • Bush-stone Curlew • Glossy Black Cockatoo • Eastern Pygmy Possum • *Dichanthium setosum* • *Diuris tricolor* • *Euphrasia arguta* • White-bellied Sea Eagle • Little Eagle • Major Mitchells Cockatoo • Square-tailed Kite	281	350

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
				• Squirrel Glider • Brush-tailed Phascogale • Superb Parrot • *Prasophyllum petilum* • *Prasophyllum sp. Wybong* • *Swainsona sericea*		
Tallawang solar farm	41.89	• White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions • Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions.	• White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands • Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia.	No Species Credit Species recorded	1,124	0

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Cobbora solar farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	• Possible: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • Possible: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions • Possible: Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	• Possible: Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • Possible: White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	Unknown	Unknown	Unknown

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Sandy Creek solar farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	• Possible: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • Possible: Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions • Possible: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Possible: Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • Possible: White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	Unknown	Unknown	Unknown

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Dapper solar farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	• Possible-likely: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions • Likely: Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions.	• Possible-likely: White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	Unknown	Unknown	Unknown
Spicers Creek wind farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	• Possible: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • Possible: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Possible: Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • Possible: White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	Unknown	Unknown	Unknown

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Orana wind farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	• White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions • Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions.	• White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands • Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia.	Unknown	Unknown	Unknown
Proposed projects						
Wellington South BESS	9.47	• White Box Grassy Woodland in the Upper Slopes Sub-region of the NSW South Western Slopes Bioregion.	N/A	• Pink-tailed Legless Lizard • Bush-stone Curlew • Gang-gang Cockatoo • *Euphrasia arguta* • Key's Matchstick Grasshopper • Squirrel Glider • Brush-tailed Phascogale • Koala • Superb Parrot	27	108

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Apsley BESS	212	• White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	N/A	No Species Credit Species Recorded	0	0
Forest Glen solar farm	1,650	• Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions.	N/A	• Bush Stone-curlew • *Commersonia procumbens* • *Dichanthium setosum* • *Diuris tricolor* • White-bellied Sea-Eagle • Little Eagle • *Homoranthus darwinioides* • *Indigofera efoliata* • Major Mitchell's Cockatoo • Square-tailed Kite • *Monotaxis macrophylla* • Barking Owl • Squirrel Glider • Koala • Superb Parrot • *Prasophyllum sp.* Wybong • *Pterostylis cobarensis* • *Swainsona sericea* • *Tylophora linearis*	95	0

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Dubbo firming power station	Unknown Project is in the 'Prepare EIS' stage; Limited information available	Unknown	Unknown	Unknown	Unknown	Unknown
Approved projects						
Stubbo solar farm	5.53	• White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	Barking Owl	87	66
Bowdens silver mine	381.71	• White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	• Koala • Squirrel Glider • Regent Honeyeater • *Acacia ausfeldii*	23,019	45,946

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Inland Rail (Narromine to Narrabri)	1,732	• Myall Woodland in the Darling Riverine Plains, Brigalow Bet South, Cobar Peneplain, Murray-Darling Depression, Riverina and NSW South Western Slopes bioregions	• Hunter Valley Weeping Myall (*Acacia pendula*) Woodland	• *Pterostylis cobarensis* • *Commersonia procumbens* • *Bertya opponens* • *Polygala linariifolia* • *Diuris tricolor* • *Swainsona murrayana* • *Lepidium aschersonii* • *Tylophora linearis* • *Lepidium monoplocoides* • Barking owl • Bush stone-curlew • Eastern pygmy-possum • Glossy black-cockatoo • Koala • Little eagle • Masked owl • Pale-headed snake • Rufous bettong • Square-tailed kite • Squirrel glider	34,820	160,421

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Dunedoo solar farm	8.4	• White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	No Species Credit Species recorded	19	0
Uungula wind farm	639	• White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	• Koala • Squirrel Glider • *Acacia ausfeldii* • *Dichanthium setosum* • *Swainsona sericea* • *Swainsona recta* • *Zieria obcordate* • Brush-tailed Rock-wallaby • Eastern Pygmy-possum • Regent Honeyeater	26,988	6,705
Maryvale solar farm	1.2	• White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	N/A	• Little Eagle • Swift Parrot • Regent Honeyeater • Little Lorikeet • Scarlet Robin • Flame Robin	124.25	0

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Geurie solar farm	<1	N/A	N/A	N/A	0	0
Dubbo solar farm	Unknown Project is in the very early stages of planning, but no expected impacts to TECs or native species predicted.	Unknown	Unknown	Unknown	Unknown	Unknown
Gilgandra solar farm	None.	N/A	N/A	• Black-breasted Buzzard • Eastern Pygmy-possum • Koala • *Goodenia macbarronii*	0	0
Wahroonga solar farm	Unlikely to Impact. Project is in early stages of planning, but no expected impact to TECs or native species is predicted.	Unknown	Unknown	Unknown	Unknown	Unknown
Changes to existing projects						
Moolarben coal mine OC3 Extension and Moolarben Stage 2 - Modification 4 - UG2	624.18	• White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions • Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion Vulnerable Ecological Community.	• White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands • Central Hunter Valley eucalypt forest and woodland.	None	0	0

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Ulan coal mine Modification 6	Unknown Environmental Impact Assessment yet to be completed	• Possibly: White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Possibly: White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	None	0	0
Sub-totals						
Related development, proposed and approved projects	8,805.87	N/A	N/A	N/A	125,651.25	253,689

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Central-West Orana Renewable Energy Zone Transmission project (this project)						
This project	1,053.34	• Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion • Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions • White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Central Hunter Valley eucalypt forest and woodland • Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.	• *Acacia ausfeldii* • *Eucalyptus camaldulensis* - endangered population • *Eucalyptus cannonii* • *Dichanthium setosum* • *Leucochrysum albicans* subsp. *Tricolor* • *Swainsona sericea* (potentially) • Glossy Black-Cockatoo • Little Eagle • Masked Owl • Barking Owl • Squirrel Glider • Large-eared Pied Bat • Large Bent-winged Bat • Eastern Cave Bat.	21,564	52,165
Cumulative biodiversity impacts						
Cumulative totals	9,859.21	N/A	N/A	N/A	147,215.25	305,854

Cumulative impacts on groundwater dependent ecosystems

Many potential groundwater dependent ecosystems (GDEs) are located in and around the relevant future projects. Relevant future projects that may have potential impacts on GDEs include the Moolarben coal mine OC3 Extension and Stage 2 – Modification 4 – UG2, and Ulan coal mine Modification 6, Dubbo firming power station, Inland Rail (Narromine to Narrabri), Dunedoo solar farm and Uungula wind farm. The remaining projects, including this project, are not anticipated to impact groundwater during construction, operation or decommissioning, and therefore cumulative impacts are not expected on GDEs for these projects.

Cumulative impacts on wildlife connectivity and habitat corridors

Many of the relevant future projects occur on land where the connectivity of native vegetation and habitat corridors has been previously compromised by clearing for agricultural land uses. This is particularly evident for the solar farms which are built, or proposed to be built, in paddocks.

The relevant future projects are likely to reduce the integrity of current corridors and connectivity. The projects are likely to result in short term impacts due to species relocating outside of the development footprints during vegetation removal and other construction activities. Once construction is completed, species are expected to move back into habitats adjacent to the relevant project. Long term impacts could include permanent breaks in connectivity due to vegetation removal and the installation of fence lines and access roads across relatively large intact blocks of habitat. The wind farm projects would also result in some interruption of aerial habitat through the introduction of potential turbine strike and barotrauma (rapid or excessive air-pressure change near moving turbine blades that result in haemorrhaging of the lungs).

This project would contribute to cumulative impacts to wildlife connectivity and habitat corridors and would potentially have one of the largest impacts to connectivity. This is due to the linear nature of the project bisecting large areas of native vegetation associated with the Durridgere State Conservation Area (SCA) east of Ulan Road and vegetation to the north of Tuckland State Forest. It should however be noted that this project traverses a relatively disturbed landscape that contains cleared paddocks, three working coal mines and existing power lines that cut through areas of vegetation. Functional connectivity for bird and bat species has remained despite these developments and it is likely that a similar level of functional habitat connectivity would remain after this project is constructed. As this project would allow wildlife movement through the transmission line easements, wildlife connectivity may remain largely unaffected for all species. Potential impacts on wildlife connectivity and habitat corridors are also expected to reduce over time as species and ecosystems acclimatises to the presence of the energy hubs, switching stations and transmission lines and towers.

Further details about the potential impacts of this project and the relevant future projects on wildlife connectivity and habitat corridors are provided in Table E-14 of Appendix E (Cumulative impact assessment).

Cumulative impacts on protected lands

Protected areas are set aside for conservation and managed by the NSW National Parks and Wildlife Service, and include areas such as national parks, nature reserves, regional parks and SCAs. The majority of the relevant future projects do not occur within or next to protected lands. Relevant future projects that are located directly next to or within protected lands include Liverpool Range wind farm (located next to and within the Durridgere SCA), Spicers Creek wind farm (located next to the Dapper Nature Reserve), Orana wind farm (located next to Goodiman State Conservation Area and Tuckland State Forest) and Moolarben coal mine OC3 Extension and Stage 2 – Modification 4 – UG2 (located next to Munghorn Gap Nature Reserve).

This project would directly impact the Durridgere SCA, and would contribute to cumulative impacts to protected lands (however, the transmission alignment through the SCA, if Tilt Renewables, as proponent of the Liverpool Range wind farm, is successful in the Consumer Trustee's access right tender process, would negate the need for a longer section of alignment through the SCA associated with the approved Liverpool Range wind farm, with an overall net reduction in impacts to biodiversity values and area of disturbance in the SCA).

20.2.4 Aboriginal heritage

The potential impacts of the relevant future projects on Aboriginal heritage sites, places and/or deposits are summarised in Table 20-5. Mining projects would have the most substantial impacts on Aboriginal heritage and include impacts on all recorded site types. These include rock shelters, ochre quarries, and high-density stone artefact scatters, all of which are typically of moderate or high significance based on criteria identified in relevant assessment guidance. Renewable energy projects would have lesser impacts, and generally avoid areas of greatest sensitivity to generally impact on sites of lower significance such as isolated finds or low/moderate density stone artefact scatters. In many instances, relevant future projects are still in the pre-EIS planning phase, and as such potential cumulative impacts from these projects is limited to date.

This project would result in direct impacts on 37 Aboriginal sites, places and/or deposits within the construction area, resulting in their complete loss. These are dominated by subsurface moderate and high density artefact sites in close proximity to some creek corridors (including Laheys Creek, Sandy Creek, Tallawang Creek and Wilpinjong Creek), rockshelters, grinding grooves and culturally modified trees (many only tentatively classified). In addition, this project would directly impact about 100 hectares of creek banks identified as having subsurface potential. A low density stone artefact background scatter is considered present across the entire construction area and would also be adversely affected where ground disturbance occurs. Nine Aboriginal sites, including several high value grinding groove sites at the Merotherie Energy Hub, and a significant artefact site with associated grinding groves at the Neeleys Lane workforce accommodation camp, can be avoided (although these sites may be indirectly impacted by visual impacts, potentially resulting in partial loss of value). In addition, EnergyCo is continuing to explore the potential avoidance of other sites of high and moderate significance within the construction area, especially within the energy hub and switching station sites, construction compounds and workforce accommodation camps. It is expected that all eight rockshelters, the remaining two grinding groove sites, a culturally modified tree and two high density artefact scatters of the directly impacted sites would be either avoided or minimally affected by this project during continued development of the project design.

This project, in combination with the relevant future projects, would result in a potential cumulative loss of between five to 16 per cent of the Aboriginal site types identified within the construction area of this project, which include rockshelters, grinding grooves, culturally modified trees and moderate or high significant stone artefact deposits. EnergyCo is continuing to explore the potential avoidance of sites of high and moderate significance within the construction area. This project, in combination with the relevant future projects, would also result in the protection of numerous cultural heritage sites avoided through design and construction refinement.

No cumulative impacts are expected on Aboriginal heritage as a result of the operation of this project in combination with the relevant future projects.

While the project and the relevant future projects would result in some loss of cultural materials, it is acknowledged that increasingly, engagement on cultural heritage is seeking to move beyond the material to a more holistic consideration of heritage. The investigations for this project and relevant future projects have significantly improved our archaeological and scientific understanding of a previously poorly understood areas. The information obtained through each project's ACHA will be provided to proponents of other renewable energy generation projects and thereby assist in identifying key sites of local and regional value for a more holistic approach to the conservation of cultural materials across the REZ. Further potential cumulative Aboriginal heritage benefits include opportunities for Aboriginal heritage interpretation and engagement with Aboriginal communities during project assessment and development.

Table 20-5 Potential cumulative Aboriginal heritage impacts of relevant future projects during construction

Project	Distance from project	Aboriginal heritage identified	Significance	Aboriginal heritage to be impacted and/or protected
Liverpool Range wind farm	Direct overlap	19 Aboriginal sites comprising isolated or low density stone artefacts (<3 artefacts), moderate density stone artefact scatters (10 — 30 artefacts), a small rock shelter with PAD, grinding grooves, and PADs.	2 sites of moderate significance (grinding grooves and stone artefacts adjacent to creek) all other sites are of low significance.	Potential impact to 16 sites (isolated artefacts to moderate density artefact scatters). Protection of grinding groove sites and rock shelter.
Valley of the Winds wind farm	Direct overlap	7 Aboriginal sites comprising: isolated artefacts, stone artefact scatters, stone artefact scatters with PAD, stone quarry, grinding grooves/ waterhole/stone arrangement.	Low significance was allocated to stone artefact scatters and isolated finds. Low-moderate significance was allocated to stone stone artefact scatters with PAD. High significance was allocated to rare sites in good to very good condition.	2 sites were identified as being subject to direct partial or total harm (AHIMS #36-3-3806 Cainbil Creek OS-1 and The Rock IF-1) this sites were low-moderate and low significance.
Barneys Reef solar farm	Direct overlap	Desktop information indicates 68 sites within the project boundary, dominated by stone artefacts of varying densities.	Yet to be assessed as this project is still in the scoping phase.	Yet to be assessed as this project is still in the scoping phase.
Birriwa solar farm	Direct overlap	8 Aboriginal sites comprising: 1 stone artefact scatter with PAD, 4 stone artefact scatters, 2 isolated finds and a scarred tree.	All sites assessed as having low significance except the 1 stone artefact scatter with PAD which was low-moderate.	1 site identified as being subject to impact (AHIMS #36-2-0518 – Mangarlowe IF-2). This site is an isolated find of low significance.
Tallawang solar farm	Direct overlap	31 Aboriginal sites were identified. These comprised: nine PADs (PAD 1 AS to PAD 3 AS; PAD 4 to PAD 6; PAD 7 IF; PAD 8 AS to PAD 9 AS), 12 stone artefact scatters (AS1-12), and 10 isolated stone artefacts or isolated finds (IF1-10).	Isolated finds and low density scatters were assessed as having low significance. Artefact scatters with moderate to high densities were assessed as having low-moderate significance.	The proposed development changed design to avoid areas of PAD, riparian corridors and minimising (where possible) impacts to surface sites. This allowed areas of moderate to high significance to be avoided. Areas of development to occur in areas of low significance.

Project	Distance from project	Aboriginal heritage identified	Significance	Aboriginal heritage to be impacted and/or protected
Orana wind farm	Direct overlap	Desktop information indicates 39 sites within the project boundary, dominated by stone artefacts of varying densities.	Yet to be assessed as this project is still in the scoping phase.	Yet to be assessed as project is still in the scoping phase.
Cobbora solar farm	Direct overlap	Desktop information indicates 103 sites within the project boundary, dominated by stone artefacts of varying densities.	Yet to be assessed as this project is still in the scoping phase.	Yet to be assessed as this project is still in the scoping phase.
Sandy Creek solar farm	Direct overlap	7 previously recorded sites comprising a hearth, surface stone artefact concentrations with associated PADs, and isolated surface stone artefacts. A further 33 sites was found during survey and comprised: stone artefact scatters, isolated finds and 1 culturally scarred tree.	Yet to be assessed as this project is still in the scoping phase.	Yet to be assessed as this project is still in the scoping phase.
Dapper solar farm	Adjacent to project along Goolma connection	Desktop information indicates no sites within the project boundary.	Yet to be assessed as this project is still in the scoping phase.	Yet to be assessed as this project is still in the scoping phase.
Spicers Creek wind farm	Overlaps project along Goolma connection	Desktop information indicates 3 sites within the project boundary, dominated by stone artefacts of varying densities.	Yet to be assessed as this project is still in the scoping phase.	Yet to be assessed as this project is still in the scoping phase.
Wellington south BESS	38 km southwest of this project	No Aboriginal sites identified and not expected to occur within the area.	N/A	No impacts to Aboriginal heritage.
Apsley BESS	48 km southwest of this project	2 isolated finds identified within project area but outside of impact area.	Low significance.	No impacts to Aboriginal heritage.
Dubbo firming power station	50 km west of the western section of the project	No information provided.	Yet to be assessed as this project is still in the scoping phase.	Yet to be assessed as this project is still in the scoping phase.
Forest Glen solar farm	The project area is 61 km west of this project	No Aboriginal sites identified.	N/A	No impacts to Aboriginal heritage.

Project	Distance from project	Aboriginal heritage identified	Significance	Aboriginal heritage to be impacted and/or protected
Stubbo solar farm	Adjacent to project along New Wollar Switching Station — Merotherie Energy Hub connection	25 Aboriginal sites comprising less than 9 isolated or low density stone artefacts, 8 moderate and high density stone artefact scatters (10–100 artefacts), various PADs associated with these sites, and a culturally modified tree.	Low-moderate significance was allocated to the isolated and low density stone artefact scatters. Moderate-high significance to moderate and high density stone artefact scatters and PADs.	Potential impact to 1 low significant isolated stone artefact. Remaining identified sites should be avoided.
Bowdens silver mine	60 km south of this project	45 previously recorded sites comprising: rock shelter with art, stone artefact scatters and isolated finds. Additional 31 sites found during survey and comprise: 19 stone artefact scatters, 9 isolated finds, 2 scarred trees and a rock shelter with PAD.	Majority of sites allocated low significance. 4 sites are of low-moderate significance (stone artefact scatters) and 1 site is of moderate significance (rock shelter).	26 sites situated within disturbance area, includes direct impact to site of moderate significance (rock shelter).
Inland Rail (Narromine to Narrabri)	81 km west of the western section of the project	152 sites and 13 areas of PADs identified. Sites comprised: 93 culturally modified trees, 13 PADS, 8 stone artefact scatters/ PAD, 24 stone artefact scatters, 17 isolated artefacts, 3 ceremony and dreaming sites, 2 grinding grooves, a reburial site, a shelter tree, an ochre quarry, a historic burial site and a cultural crossing.	All sites assessed as having high social significance.	48 sites to potentially impacted – including: 29 culturally modified trees, 8 stone artefact scatters, 4 stone artefact scatters/ PAD, 2 grinding groove sites, 2 PADs, 1 archaeological deposit, 2 isolated finds.
Dunedoo solar farm	18 km north of this project	26 sites comprising – 1 previously recorded site, 9 isolated finds and 16 stone artefact scatters.	Low, low-moderate and moderate significance.	Impacts to a total of 6 isolated finds, 10 artefact scatters and 1 previously recorded site. Harm avoided to 8 sites. No impacts to sites with low-moderate or moderate significance.
Uungula wind farm	25 km south of the western section of the project	76 sites comprising isolated finds or stone artefact scatters.	Majority of sites assessed as being of low significance. 1 site is of moderate significance.	45 sites subject to harm, no harm to site of moderate significance.
Maryvale solar farm	30 km southwest of the western section of the project	7 sites within study area comprising: 4 stone artefact scatters, 2 isolated artefacts and one culturally modified tree.	4 sites were assessed as being of low significance and 3 sites were of moderate significance.	No impacts to Aboriginal heritage.

Project	Distance from project	Aboriginal heritage identified	Significance	Aboriginal heritage to be impacted and/or protected
Geurie solar farm	35 km southwest of the western section of the project	No cultural materials identified, site considered disturbed.	N/A	N/A
Dubbo solar farm	48 km west of western section of project	2 sites consisting of varying densities of stone artefacts identified.	Both sites assigned low significance classification.	Not provided.
Gilgandra solar farm	77 km northwest of western section of project	Site inspection identified an isolated find (Oakvale IF1) and an extension to AHIMS #28-4-0056.	N/A	No impacts to Aboriginal heritage.
Wahroonga solar farm	81 km west of western section of project	No cultural materials identified, site considered disturbed.	N/A	N/A
Moolarben coal mine OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2	Overlaps New Wollar Switching Station — Merotherie Energy Hub connection	At least 871 sites have been identified within the mine area. These comprise: PADs, stone artefact scatters, grinding grooves, isolated finds, rock shelters with art. A further 9 sites were identified for extension and comprised: stone artefact scatter, isolated finds and a rock shelter with PAD.	Newly identified sites assessed as being of low significance except for a stone artefact scatter which was moderate.	Around 40% of the 871 Aboriginal sites have been impacted by the mining activities over the years. 2 sites to be impacted by extension.
Ulan coal mine	Overlaps New Wollar Switching Station — Merotherie Energy Hub connection	22 new sites identified during survey for modification comprising: 13 stone artefact scatters, 7 isolated finds, 2 rock shelters, 5 rock shelters/PAD. The site database for the entire project area includes 1,274 known sites within the mine area.	Varied (low to high significance).	315 Aboriginal sites/PADs occur within the area or zones of potential subsidence impact. Increased impacts were also noted for the following sites assessed as being of high significance: an Ochre Quarry (ID#807), rock shelter with artefacts (ID#284), rock shelter with art and artefacts (ID#161, ID#162).

20.2.5 Social

Construction

A summary of this project's contribution to potential cumulative social impacts during construction is provided Table 20-6. This project's contribution to these impacts would range from minimal to moderate.

Table 20-6 Potential cumulative social impacts of the Central-West Orana Transmission project during construction

Potential impact	Social locality	Central-West Orana REZ Transmission project's contribution to cumulative impact
Detrimental effects to community cohesion	Local	Moderate
Diminished short term accommodation and housing affordability and availability	Local	Minimal
Impacts to sense of safety due to an influx of non-resident workforce	Local	Moderate
Diminished sense of place due to cumulative amenity impacts	Local and regional	Minor
Changes to the way people move and work due to perceived road delays and reduced sense of safety	Local	Minimal
Local business opportunities and economic stimulus due to project procurement opportunities	Local and regional	Moderate
Improved livelihoods due to increased local employment opportunities	Local and regional	Moderate
Diminished workforce availability due to increased competition with the project for local employees	Local	Moderate
Impacts on Aboriginal cultural values	Local	Moderate
Impacted capacity of health, food, and social services	Local and regional	Moderate
Changes to the way people enjoy and connect with the environment	Local and regional	Moderate
People's capacity to influence decisions regarding changes that may affect their lives	Local and regional	Moderate

Operation

A summary of this project's contribution to potential cumulative social impacts during operation is provided in Table 20-7. This project's contribution to these impacts would range from minimal to major.

Table 20-7 Potential cumulative social impacts of the Central-West Orana Transmission project during operation

Potential impact	Social locality	Central-West Orana REZ Transmission project's contribution to cumulative impact
Potential disruption to telecommunications in the vicinity of transmission infrastructure, including radio, internet, and television	Local	Minimal
Increased renewable energy sources and choices	Regional	Major
Stress due to perceived bushfire risk	Local	Moderate
Diminished sense of belonging due to loss of aesthetic values and perceived loss of biodiversity	Local	Moderate
Diminished sense of safety due to flooding and drainage changes	Local	Minimal
Impact to agricultural land and food production for future generations	Local	Minimal

20.2.6 Economic

Construction

This project, in combination with the relevant future projects, would generate a large demand for a suitably qualified construction workforce in regional areas. It is estimated that over 4,000 workers would be required for Central-West Orana REZ renewable energy generation and transmission projects between mid-2025 and mid-2026 (EnergyCo, 2023b). This labour demand would be met by:

- the unemployed workforce, increased labour force participation and/or workers from other industries within the Central-West Orana region
- workers moving into the region from the rest of NSW and Australia during their employment period, or commuting from outside the region (fly-in-fly-out and drive-in-drive-out).

Workers (and their families) relocating to regional areas, even temporarily, or workers from the region not emigrating from the region in search of work, may contribute to population growth, or reduce or prevent population decline. Population growth is an important driver of the health of regional economies, and creates an increased demand for goods, services and jobs.

Regional population growth would increase the demand for short term and long term accommodation, which may result in an increase in housing prices and rents, and shortages in short term accommodation. The extent of housing price impacts would depend on a number of variable factors, including the number of workers requiring accommodation and the supply of workforce accommodation (e.g. workforce accommodation camps, adaptive reuse or extension of existing buildings, use of existing granny flats and spare bedrooms, use of vacant housing) and other housing. Early provision of additional workforce accommodation may reduce any price impacts on housing.

The cumulative demand for labour in the region may help address the current jobs growth imbalance between Australia's biggest cities and the regions. Regional jobs growth would provide opportunities for the regional workforce, attract middle-and highly-skilled workers and families to regional areas, reduce outmigration of the regional workforce to cities, and increase labour force participation in regional areas. EnergyCo (2023) has identified potential skills shortages in the region for a range of key occupations, including construction managers, electrical engineers, civils engineers, transmission line workers, and electricians.

This project, in combination with the relevant future projects, would substantially increase direct economic activity in the region as well as flow-on economic activity to businesses that are able to supply the goods and services required for project construction and operation, and demanded by workers.

The sectors of regional economies that are most likely to be directly impacted as a result of cumulative project construction include the heavy and civil engineering construction, construction services and non-residential building construction sectors. Sectors that are most likely to be impacted by production induced flow-on economic activity (companies buying goods and services from each other) include:

- professional, scientific and technical services
- wholesale and retail trade
- structural metal product manufacturing
- road transport
- employment, travel agency and other administrative services
- cement lime and ready-mixed concrete manufacturing.

Consumption induced flow-on economic activity (expenditure of construction worker wages) would be mainly experienced in the following sectors:

- retail and wholesale trade
- food and beverage services
- health care services
- primary and secondary education
- residential care and social assistance services
- road transport
- professional, scientific and technical services.

Any business that can provide the goods and services demanded for project construction and operation, and by workers, would benefit from the cumulative economic activity.

A temporary increased demand for construction workers in the region may lead to increased construction sector (and other sector) wages and attraction of workers from other relevant sectors of the economy over the short term, which may result in temporary labour shortages and associated shortages of goods and services and rising inflation. A temporary increased demand for construction materials, such as quarry materials and concrete, may also result in increased prices for these materials and potential shortages for other uses.

The extent of these short term impacts would depend on the balance of labour supply from within the region and outside the region, as well as adjustment of the overall labour market, and other markets, in response to increased demand. Over the medium term, markets would adjust to some extent (e.g. increased labour force participation, new quarry proposals to supply demand for aggregate etc), which would enable wages and prices to return to previous levels. Any price increases and suppression of other economic activities in the region represents the operation of the market system where scarce resources are reallocated to where they are most highly valued and where society would benefit the most from them.

Operation

No cumulative economic impacts are expected as a result of the operation of this project, in combination with the relevant future projects.

20.2.7 Noise and vibration

Relevant future projects located within two kilometres of this project have the potential to generate cumulative noise impacts during construction and operation. Cumulative vibration impacts are considered highly unlikely to arise from adjoining projects (due to the large separation distances) and have not been considered in the assessment.

Construction

A summary of the potential cumulative noise impacts of this project in combination with the relevant future projects during construction is provided in Table 20-8. There is a medium to high risk of cumulative noise impacts during construction of this project, mainly during the transmission line works for this project. The most substantial cumulative noise impacts would occur near Ulan coal mine Modification 6, Orana wind farm and Barneys Reef solar farm. The extent and magnitude of cumulative noise impacts are highly dependent on the timing and overlap of individual construction activities.

Table 20-8 Potential cumulative noise impacts during construction

Project	Potential cumulative noise impacts with this project	Risk of noise impacts
Liverpool Range wind farm	Cumulative noise impacts have been predicted during construction activities at up to 5 receivers, mainly during the transmission line works for this project. The most substantial noise impacts would occur as a result of the Liverpool Range wind farm construction. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level from either project.	Medium
Valley of the Winds wind farm	Cumulative noise impacts have been predicted during construction activities at up to 3 receivers, mainly during the transmission line works for this project. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level from either project. Exceedances are expected across multiple stages of the wind farm construction, with higher noise levels predicted in the earlier stages.	Medium
Barneys Reef solar farm	Cumulative noise impacts have been predicted during construction activities at up to 18 receivers, mainly during the transmission line works for this project. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level from either project.	High
Birriwa solar farm	Cumulative noise impacts have been predicted during construction activities at up to 4 receivers, mainly during the transmission line works for this project. Noise impacts from the Birriwa solar farm are predicted to be minimal. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project.	Medium
Tallawang solar farm	It is predicted that Tallawang solar farm is likely to meet construction noise criteria, and thus cumulative noise impacts with this project are unlikely.	Nil
Orana wind farm	Cumulative noise impacts have been predicted during construction activities at up to 15 receivers, mainly during the transmission line works for this project. Noise impacts from the Orana wind farm are predicted to be minimal. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level from either project.	High
Cobbora solar farm	Cumulative noise impacts have been predicted during construction activities at up to 4 receivers, mainly during the transmission line works for this project. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level from either project.	Medium
Sandy Creek solar farm	Cumulative noise impacts have been predicted during construction activities at up to 4 receivers, mainly during the transmission line works for this project. The most substantial noise impacts would occur as a result of the Sandy Creek solar farm construction. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level from either project.	Medium
Dapper solar farm	Cumulative noise impacts have been predicted during construction activities at up to 5 receivers, mainly during the transmission line works for this project. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project.	Medium
Spicers Creek wind farm	Cumulative noise impacts have been predicted during construction activities at up to 5 receivers, mainly during the transmission line works for this project. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level from either project.	Medium
Stubbo solar farm	Cumulative noise impacts have been predicted during construction activities at up to 5 receivers, mainly during the transmission line works for this project. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level from either project.	Medium
Moolarben coal mine OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2	No cumulative noise impacts are expected due to the distance from these projects from this project.	Nil

Project	Potential cumulative noise impacts with this project	Risk of noise impacts
Ulan coal mine Modification 6	Cumulative construction noise impacts may be noted at up to 22 receivers, mainly during the transmission line works for this project. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level from either project. Out of hours works at Ulan coal mine may impact two (potentially different) receivers under noise-enhancing meteorological conditions, however noise mitigation measures will aim to avoid any work outside of standard hours.	High

Operation

A summary of the potential cumulative noise impacts of this project in combination with the relevant future projects during operation is provided in Table 20-9. There is a low to high risk of cumulative noise impacts during operation. Cumulative noise impacts would mostly be associated with transmission line infrastructure generating corona noise during mild wet and misty weather conditions, which is expected to be unpredictable and temporary. The most substantial cumulative noise impacts would occur near Ulan coal mine Modification 6, Liverpool Range wind farm, Barneys Reef solar farm, Sandy Creek solar farm, Dapper solar farm and Orana wind farm.

Table 20-9 Potential cumulative noise impacts during operation

Project	Potential cumulative impacts with this project	Risk of impacts
Liverpool Range wind farm	Cumulative operational noise impacts may be noted at up to 5 receivers, primarily during adverse weather conditions generating corona noise. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level for each project.	Medium
Valley of the Winds wind farm	Cumulative operational noise impacts may be noted at up to 2 receivers, primarily during adverse weather conditions generating corona noise. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level for each project.	Low
Barneys Reef solar farm	Cumulative operational noise impacts may be noted at up to 4 receivers, primarily during adverse weather conditions generating corona noise. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level for each project.	Medium
Tallawang solar farm	No receivers are predicted to be impacted by cumulative operational noise impacts.	Nil
Orana wind farm	Cumulative operational noise impacts may be noted at 2 receivers, primarily during adverse weather conditions generating corona noise. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level for each project.	Medium
Cobbora solar farm	Cumulative operational noise impacts may be noted at 1 receiver, primarily during adverse weather conditions generating corona noise. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level for each project.	Low
Sandy Creek solar farm	Cumulative operational noise impacts may be noted at up to 2 receivers, primarily during adverse weather conditions generating corona noise. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level for each project.	Medium
Dapper solar farm	Cumulative operational noise impacts may be noted at up to 2 receivers, primarily during adverse weather conditions generating corona noise. Under worse case conditions, noise levels may be up to 3 dB louder than the maximum predicted noise level for each project.	Medium
Spicers Creek wind farm	No receivers are predicted to be impacted by cumulative operational noise impacts.	Nil

Project	Potential cumulative impacts with this project	Risk of impacts
Stubbo solar farm	Cumulative operational noise impacts may be noted at 1 receiver, primarily during adverse weather conditions generating corona noise. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level for each project.	Low
Moolarben coal mine OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2	No cumulative noise impacts are expected as both projects would comply with noise criteria.	Nil
Ulan coal mine Modification 6	Cumulative operational noise impacts may be noted at up to 8 receivers. Noise impacts from the operation of the Ulan coal mine Modification 6 project are not yet known. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted noise level for each project.	High

20.2.8 Bushfire risk and general hazards

Construction

There would be an increased risk of bushfire ignition where construction activities and operation of this project would overlap with the relevant future projects on bushfire prone land. Potential sources of ignition are outlined in Sections 16.5.1 and 16.6.1 and include hot works (welding and grinding), electrical faults, the generation of sparks during the use of vehicles and equipment and lightning strikes. Fuel leaks and spills from plant and machinery, and the storage of flammable goods during construction, could also provide a fuel source for bushfires if ignited.

Construction and operation of this project and the relevant future projects would also involve the use, storage and transport of dangerous goods and hazardous materials, which would increase health and safety risks to people, property and the environment where project timeframes overlap.

Standard mitigation measures would be implemented for each project to minimise potential hazards and risks and provide emergency protocols, in accordance with a safety management system, policies and guidelines. Minor road upgrades and access track works are proposed for most projects, which would provide adequate emergency egress and evacuation routes.

Operation

The relevant future projects and this project would increase the risk of bushfire in the four impacted LGAs through the introduction of potential sources of ignition and fuel sources in bushfire prone land.

The bushfire risk posed by each relevant future project and this project would be managed with the establishment of asset protection zones around switching stations and energy hubs, vegetation clearing within the transmission line easements and regular inspection and maintenance of project infrastructure.

20.2.9 Traffic and transport

Construction

Where construction routes of this project would overlap with the relevant future projects, the number of construction vehicles may increase on the road network. Of the relevant future projects identified in Table 20-1, only the following related development projects would utilise construction routes proposed by this project (and were therefore considered in the assessment):

- Liverpool Range wind farm
- Valley of the Winds wind farm
- Stubbo solar farm
- Barneys Reef solar farm
- Birriwa solar farm
- Tallawang solar farm
- Cobbora solar farm
- Sandy Creek solar farm
- Dapper solar farm
- Orana wind farm.

Other projects are considered to have negligible cumulative traffic and transport impacts in combination with this project as they would utilise construction routes not utilised by this project, or are already operational.

Construction of the public road works (related development project 1 in Table 20-1) have not been included in the assessment as a potential cumulative impact, as environmental assessment for these works has not yet commenced and there is insufficient information in the public domain (however, once completed they will potentially mitigate cumulative traffic impacts as discussed below). The Moolarben coal mine OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2, and Ulan coal mine Modification 6 projects are currently in operation and their impacts have been included as part of the baseline conditions in the traffic assessment for this project (Technical paper 13). These projects are therefore also not included in this assessment.

A summary of the potential traffic and transport impacts of each of the ten relevant future projects during the construction and operation of this project is provided in Table 20-10. The table additionally identifies the roads that would be the subject of cumulative impacts (in relation to the project and the relevant future project).

A quantitative sensitivity assessment of the predicted mid-block road network performance of the impacted construction routes (i.e. routes impacted by the project and one or more of the relevant future projects) is provided in Table 20-11.

The assessment indicates that the additional traffic volumes generated by the 10 related development projects (in combination with this project) would have only a minor impact on the capacity and efficiency of the impacted roads, with the existing level of service (LoS) (LoS A for all routes) maintained on most roads. A moderate impact on capacity (a reduction of LoS from A to B) is expected on Cope Road and Ulan Road due to the high traffic volumes that would be generated by the Stubbo solar farm. At LoS B however, traffic would still be considered as free-flowing. The predicted low level of impacts are mainly due to the current low traffic demand on these roads.

EnergyCo is proposing to upgrade certain roads that would be used to access the construction area as part of a separate works package to ensure they can support OSOM movements. These upgrades would potentially assist in mitigating some of the potential cumulative impacts.

EnergyCo has also recently finalised an agreement with Transport for NSW to facilitate the upgrade of the State's road network to support OSOM movements between the Port of Newcastle and the Central-West Orana REZ. The upgrades delivered by these works would provide REZ-wide traffic and transport benefits.

Table 20-10 Potential traffic impacts of the relevant future projects during construction and operation

Project	Access roads used by project and Central-West Orana Transmission project	Potential traffic impacts	
		Construction	Operation
Liverpool Range wind farm Located between Coolah and Cassilis; overlaps project along Cassilis connection. Wind turbine components would be transported to the site from Port of Newcastle, travelling on the Hunter Express and Golden Highway. Upgrades to local roads includes Coolah Road, Ulan Road and other access roads are proposed. Upgrades to key intersections such as along Coolah Road, Ulan Road and others are proposed.	Coolah Road, Ulan Road and Golden Highway	The project would generate 401 vehicles per day, which would result in an increase of 40 vehicle movements per hour (inbound to the project area in the morning (AM) peak and outbound in the afternoon (PM) peak).	All scheduled and unscheduled maintenance will generate up to 30 vehicle movements per day, largely comprising light vehicles such as utility vehicles and/or vans. These movements can be readily accommodated on the existing road network and potential cumulative impacts are expected to be minor.
Valley of the Winds wind farm Located between Coolah and the Golden Highway; overlaps project along Coolah and Leadville connections. Upgrades to local roads are proposed. Intersection upgrades on the state road network are proposed along the Golden Highway.	Golden Highway	The project would generate 253 light vehicle and 8 heavy vehicle movements per hour during the peak construction period if the workforce is to be distributed across nearby towns. This would result in an increase of around 135 vehicles/hour (inbound to the project site in the AM peak and outbound in the PM peak) on both Golden Highway. If the project provides a centralised workforce accommodation camp, it would generate 64 light vehicle and 8 heavy vehicle hourly movements. This would result in an increase of around 8 vehicles/hour (inbound to the project site in the AM peak and outbound in the PM peak) on the Golden Highway.	Around 100 light vehicle movements (50 inbound and 50 outbound) would be generated per day. Heavy vehicles would only be required for infrequent repairs and maintenance and are not expected to occur on a regular basis. These movements can be readily accommodated on the existing road network and potential cumulative impacts are expected to be minor.

Project	Access roads used by project and Central-West Orana Transmission project	Potential traffic impacts	
		Construction	Operation
Stubbo solar farm Located north of Gulgong; adjacent to project along New Wollar Switching Station — Merotherie Energy Hub connection. No upgrades to the road network would be required.	Golden Highway, Ulan Road, Cope Road and Blue Springs Road	The project is expected to generate 580 daily vehicle movements, or 242 vehicle movements during the peak hour (230 light vehicles and 12 heavy vehicles). This increase would reduce the mid-block level of service from LoS A to LoS B. This is considered a medium impact as under LoS B, traffic would still be free-flowing.	Around 20 light vehicle movements (10 in the morning peak and 10 in the afternoon peak) would be generated per day. These movements can be readily accommodated on the existing road network and potential cumulative impacts are expected to be minor.
Barneys Reef solar farm Located north of Gulgong; overlaps project along Merotherie Energy Hub — Elong Elong Energy Hub connection and Tallawang south connection. Upgrades to local roads and intersections would be required.	Merotherie Road and Gingers Lane	The project would result light, heavy and OSOM vehicle movements. The Scoping Report has not detailed the increase in traffic demand on the road network as part of the project.	Operational traffic would be minimal and generally only involve the movements of light vehicles. These movements can be readily accommodated on the existing road network and potential cumulative impacts are expected to be minor.
Birriwa solar farm Located on Barneys Reef Road, southwest of Dunedoo; overlaps project along Merotherie west connection. Upgrades to the Castlereagh Highway/Barneys Reef Road intersection, as well as upgrades to Birriwa Bus Route South are proposed.	Castlereagh Highway	During the peak construction period, the project would generate 360 light vehicle, 13 shuttle bus and 120 heavy vehicle movements per day. During the peak hour, the project would generate 360 light vehicle, 13 shuttle bus and 28 heavy vehicle movements. 35% of movements would occur along the north (Dunedoo and Dubbo) and 65% of movements would occur in the south (Mudgee and Gulgong) on the Castlereagh Highway where it intersects with Barneys Reef Road. Merotherie Road would experience an increase of 4 vehicles per hour (360 light vehicles and 13 heavy vehicles) and Castlereagh Highway north of Barneys Reef Road would experience an increase of 10 vehicles per hour (360 light vehicles and 13 heavy vehicles) during the peak period.	Up to 20 light vehicle movements per day would be required. Heavy vehicles would only be required for larger components of the project. These movements can be readily accommodated on the existing road network and potential cumulative impacts are expected to be minor.

Project	Access roads used by project and Central-West Orana Transmission project	Potential traffic impacts	
		Construction	Operation
Tallawang solar farm Located near Laheys Creek Road/Castlereagh Highway intersection; overlaps project along Tallawang south connection.	Laheys Creek Road and Castlereagh Highway	The project would generate 300 light vehicle movements (150 hourly movements) and 270 heavy vehicles and 2 OSOM movements per day during the peak construction period (30 heavy vehicle and 1 OSOM vehicle movements during the peak hour). The project would generate 150 vehicle movements per hour (inbound to the project site in the AM peak and outbound in the PM peak), split between north (Dunedoo) and south (Gulgong).	Operational traffic would be minimal and generally only involve the movements of light vehicles. These movements can be readily accommodated on the existing road network and potential cumulative impacts are expected to be minor.
Cobbora solar farm Located in Cobbora, southwest of Dunedoo; overlaps project along Cobbora north connection.	Golden Highway and Spring Ridge Road The project currently considers two site access points at the northern access (5 km from the Golden Highway) and southern access (10 km from the Golden Highway).	A number of projects would require access to/from Spring Ridge Road, including Cobbora solar farm, Sandy Creek solar farm, Dapper solar farm and Orana wind farm. The Scoping Report has not detailed the increase in traffic demand on the road network as part of the project.	Operational traffic would be minor and generally only involve the movements of light vehicles. These movements can be readily accommodated on the existing road network and potential cumulative impacts are expected to be minor.
Sandy Creek solar farm Located off Sandy Creek Road southwest of Dunedoo; overlaps project along Cobbora west connection	Golden Highway and Spring Ridge Road A number of access options are currently being investigated for the site, including Option 2 (eastern entry via Spring Ridge Road and Dapper Road).	The Sandy Creek solar farm would be accessible from the Golden Highway via Spring Ridge Road. A number of access options are currently being investigated for the site, including Option 2 (eastern entry via Spring Ridge Road and Dapper Road). Light vehicles would access the site via Spring Ridge Road. The Scoping Report has not detailed the increase in traffic demand on the road network as part of the project	Operational traffic would be minimal and generally only involve the movements of light vehicles. These movements can be readily accommodated on the existing road network and potential cumulative impacts are expected to be minor.

Project	Access roads used by project and Central-West Orana Transmission project	Potential traffic impacts	
		Construction	Operation
Dapper solar farm Located along Sandy Creek Road southwest of Dunedoo; adjacent to project along Goolma connection.	Golden Highway, Spring Ridge Road, Sandy Creek Road and Dapper Road	The project area would be accessed via the Golden Highway via Spring Ridge Road or Dapper Road. The Scoping Report has not detailed the increase in traffic demand on the road network as part of the project.	Operational traffic would be minimal and generally only involve the movements of light vehicles. These movements can be readily accommodated on the existing road network and potential cumulative impacts are expected to be minor.
Orana wind farm Located south of Dunedoo; overlaps project along Merotherie Energy Hub — Elong Elong Energy Hub connection, Tallawang west connection and Tallawang south connection. The Tucklan Road/Castlereagh Highway intersection would be upgraded to accommodate OSOM vehicle movements. A third access point would be via Spring Ridge Road in the west.	Tucklan Road, Spring Ridge Road, Golden Highway, Castlereagh Highway, Corishs Lane, Brooklyn Road, Upper Laheys Creek Road and Spir Road.	The wind farm would be accessed via Tucklan Road off the Golden Highway at the north of the wind farm site and via Tucklan Road off the Castlereagh Highway at the east of the wind farm site. The Scoping Report has not detailed the increase in traffic demand on the road network as part of the project.	Operational traffic would be minor and generally only involve the movements of light vehicles. These movements can be readily accommodated on the existing road network and potential cumulative impacts are expected to be minor.

Table 20-11 Potential cumulative impacts on road performance during construction

Route	Road classification	Relevant future projects utilising route in combination with the Central-West Orana Transmission project	Traffic volumes (vehicles per hour) of this project during construction (Level of Service)				Additional peak hour vehicle movements generated by relevant future projects				Cumulative traffic volumes (vehicles per hour) with Central-West Orana REZ Transmission project (Level of Service)			
			AM peak hour		PM peak hour		AM peak hour		PM peak hour		AM peak hour		PM peak hour	
			NB/WB[1]	SB/EB[1]	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB
Golden Highway (near Spring Ridge Road, west of Dunedoo), Dunedoo	Highway	• Birriwa solar farm	147 vehicles per hour (vph) (LOS A)	62 vph (LOS A)	61 vph (LOS A)	151 vph (LOS A)	13	1	1	13	160 vph (LOS A)	63 vph (LOS A)	62 vph (LOS A)	164 vph (LOS A)
Golden Highway (between Ulan Road and Merotherie Road), Uarbry	Highway	• Valley of the Winds wind farm • Liverpool Range wind farm.	122 vph (LOS A)	42 vph (LOS A)	46 vph (LOS A)	110 vph (LOS A)	5	43	43	5	127 vph (LOS A)	85 vph (LOS A)	89 vph (LOS A)	115 vph (LOS A)
Castlereagh Highway (between Golden Highway and Tucklan Road), Birriwa	Highway	• Birriwa solar farm	34 vph (LoS A)	86 vph (LoS A)	83 vph (LoS A)	39 vph (LoS A)	9	80	80	9	43 vph (LOS A)	166 vph (LOS A)	163 vph (LOS A)	48 vph (LOS A)
Castlereagh Highway (north of Laheys Creek Road), Beryl	Highway	• Tallawang solar farm	36 vph (LOS A)	91 vph (LOS A)	89 vph (LOS A)	50 vph (LOS A)	68	7	7	68	104 vph (LOS A)	98 vph (LOS A)	96 vph (LOS A)	118 vph (LOS A)
Merotherie Road (south of Golden Highway)	Local road	• Birriwa solar farm • Barneys Reef solar farm.	8 vph (LOS A)	67 vph (LOS A)	67 vph (LOS A)	8 vph (LOS A)	3	26	26	3	11 vph (LOS A)	93 vph (LOS A)	93 vph (LOS A)	11 vph (LOS A)
Cope Road (between Blue Springs Road and Springwood Park Road)	Main road	• Stubbo solar farm	61 vph (LOS A)	111 vph (LOS A)	51 vph (LOS A)	96 vph (LOS A)	218	24	24	218	279 vph (LOS A)	135 vph (LOS A)	75 vph (LOS A)	314 vph (LOS A)
Ulan Road near Ulan	Main road	• Stubbo solar farm	455 vph (LOS B)	197 vph (LOS A)	241 vph (LOS A)	199 vph (LOS A)	25	217	217	25	480 vph (LOS B)	414 vph (LOS B)	458 vph (LOS B)	224 vph (LOS A)

(1) NB = Northbound; WB = Westbound; SB = Southbound; EB = Eastbound

Operation

Operation and maintenance activities of the relevant future projects have the potential to increase the number of vehicle movements on the road network in combination with this project.

A summary of the potential cumulative traffic and transport impacts during operation of this project is provided in Table 20-10. Only the related development projects would utilise roads used by this project during operation. Each of these projects would generate up to between 20 and 100 light vehicle movements per day. This is expected to result in an overall minor cumulative impact on traffic and transport, as additional traffic movements would be readily accommodated on the existing road network. Heavy vehicles would only be required for infrequent repairs and maintenance and are expected to have a negligible cumulative impact.

20.2.10 Waste management

Construction

A number of waste management and waste transfer facilities operated by local councils are located near this project, and would also potentially service the relevant future projects considered in this assessment. These facilities accept a wide range of wastes, including construction and demolition waste, domestic waste and recyclable materials. Table 18-1 of Chapter 18 (Waste management) identifies existing waste management facilities within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs, and the waste types able to be received by these facilities.

Engagement with the relevant councils have indicated the Mudgee Waste Facility is at capacity and would not be able to accept waste generated from the construction of the project, and commercial waste is not accepted at the Mid-Western Regional council-operated Gulgong Waste Facility. In addition, the Wellington Waste Transfer Station and Cassilis Waste Management Facility do not accept large volumes of waste.

While there is only very limited information available about the quantities and types of waste generated by the relevant future projects, or their intended waste management strategies, waste generation by these projects would potentially impact on waste management facilities considered for this project. Potential waste management impacts of this project may therefore be significantly exacerbated by the potential cumulative waste management impacts of the relevant future projects.

As detailed in Chapter 5 (Community and Stakeholder Engagement), EnergyCo has been engaging with local councils (including Mid-Western Regional Council, Dubbo Regional Council, Warrumbungle Shire Council and Upper Hunter Shire Council) to discuss this project and the development of the Central-West Orana REZ. The capacity of waste infrastructure to accept the anticipated waste volumes of this project has been raised as a key issue in discussions to date. In response, EnergyCo has undertaken a series of studies to guide how cumulative impacts in the Central-West Orana REZ will be managed, including a dedicated study on waste management. EnergyCo will continue to engage with local councils about the management of potential cumulative waste management impacts as the project progresses.

Operation

Cumulative waste management impacts are expected to be minor due to the significantly smaller waste volumes generated during standard operational and maintenance activities for this project and the relevant future projects.

20.2.11 Surface water and groundwater supply

Construction

Surface water supply

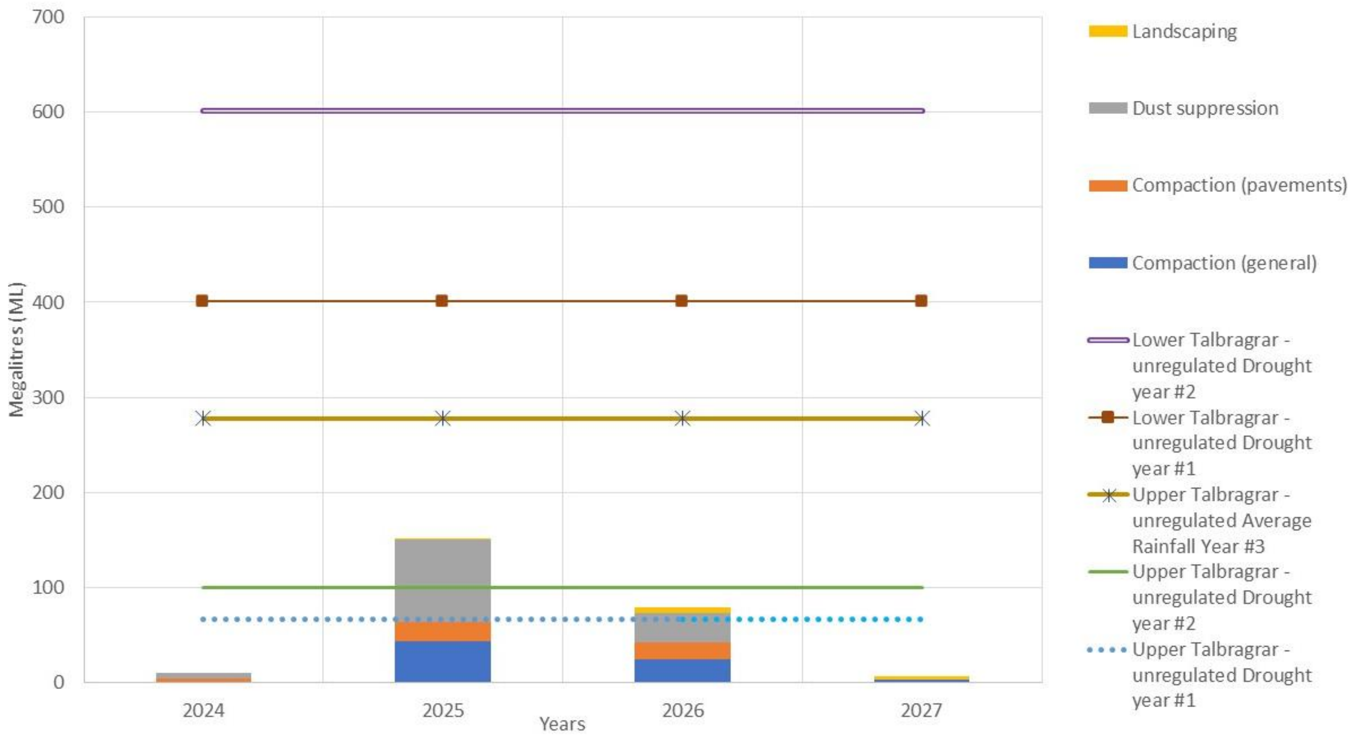
Around 250 megalitres of non-potable water is required for construction of this project, and would be sourced according to a hierarchy that prefers the use of harvested rainwater, recycled construction water, treated wastewater or groundwater inflows and treated mine water (where practicable) over sourcing water from existing unregulated surface water sources (refer to Section 19.14 (Hydrology, flooding and water quality)). Surface water sources considered for the supply of non-potable water for this project include the Upper Talbragar River Water Source, Lower Talbragar River Water Source and Upper Goulburn River Water.

Only two of the relevant future projects are likely to have a substantial water demand overlap with this project during construction, based on publicly available information:

- Liverpool Range wind farm, which overlaps the project along the Cassilis connection
- Tallawang solar farm, which overlaps the project along the Tallawang south connection.

Since neither of these projects have confirmed their proposed source of water supply, the assessment has assumed that the projects would extract water from the same surface water sources as this project. All other relevant future projects would use either bore water or transport water from other water sources, or do not provide detail of the project water demands of the project or source of surface water supply.

Between 2024 to 2026, Liverpool Range wind farm and Tallawang solar farm would require 95 megalitres from the Upper Talbragar River Water Source and Lower Talbragar River Water Source, in addition to this project's water demand. There is currently sufficient water available in these surface water sources in an average rainfall year, to accommodate this additional demand, as shown in Figure 20-2. However, during low rainfall or a drought period, there is likely to be an impact on the available water in the Upper Talbragar River Water Source and Lower Talbragar River Water Source. The trading of water access licences (WALs) for these water sources is subject to the open market and there is a limited volume and number of WALs available for each water source. WALs are granted subject to conditions which set out the licence holder's responsibilities and any restrictions. The volume of water licensed users can extract (known as an allocation or available water determination), is dependent on a range of factors including dam storage levels, river flows and catchment and climatic conditions, and is governed by the water sharing plan for the water source to ensure sustainable use of water sources. The allocation of available water through WALs thereby minimises cumulative impacts to water availability within the catchment.



#1 Drought year – based on Cudgegong River water source usage 2008–2009, 18% of total was available for regulated river (general security)

#2 Drought year – based on Cudgegong River water source usage 2019–2020, 27% of total was available for regulated river (general security)

#3 Average rainfall year – 600 millimetres – 2012–2013, 75% of total water was available for regulated fiver (general security)

Figure 20-2 Cumulative construction water demand and water availability

Groundwater supply

No groundwater take has been identified for relevant future projects within five kilometres of the proposed groundwater bores at the energy hubs, and therefore no cumulative groundwater impacts are likely to occur. Furthermore, groundwater extraction requires a water supply work approval, that takes into account existing extraction from any surrounding approvals, and therefore cumulative demand is considered for each new approval application.

Operation

Surface water supply

Surface water demand would reduce significantly for this project and the relevant future projects during operation, as water would be required for maintenance activities only.

The majority of the relevant future projects, and this project, would primarily source non-potable water from rainwater harvesting. Any additional water demand would be supplied from groundwater bores (excluding this project) and existing unregulated surface water sources. Surface water demand would be minimal for each project (less than an estimated five megalitres per year), which is well within the capacity of the Upper Talbragar River Water Source, Lower Talbragar River Water Source and Upper Goulburn River Water Source. Therefore, any potential cumulative impacts on available water in surface water sources during operation would be minor.

Groundwater supply

There is no permanent groundwater take proposed as part of the operation of this project, and therefore no cumulative impacts are expected on groundwater sources.

20.2.12 Air quality

Construction

Cumulative air quality impacts are likely to occur where relevant future projects within five kilometres of this project would undertake dust generating construction activities concurrently with this project.

A summary of the potential cumulative air quality impacts during construction is provided in Table 20-12. The highest potential for cumulative air quality impacts is in the western section of this project, where construction activities for several related development projects may overlap with this project.

With the implementation of standard mitigation measures for each project, any potential cumulative air quality impacts are expected to be minor.

Table 20-12 Potential cumulative air quality impacts during construction

Relevant future projects	Cumulative air quality impacts
Liverpool Range wind farm	Potential for cumulative impacts at one receiver given the potential for direct overlap of construction activities at switching station M1 and associated transmission line.
Orana wind farm	Potential for cumulative impacts at several sensitive receivers given the potential for direct overlap of construction activities along the transmission line between Elong Elong Energy Hub and Merotherie Energy Hub.
Barneys Reef wind farm	Potential for cumulative impacts at several sensitive receivers given the potential for direct overlap of construction activities at switching stations M4, M5, M6 and M8 and the Merotherie Energy Hub.
Stubbo solar farm	Potential for cumulative impacts at 2 sensitive receivers given the potential for direct overlap of construction activities along the transmission line from the Merotherie Energy Hub to New Wollar Switching Station. One of these receivers may also experience cumulative impacts as a result of construction activities at the Barneys Reef wind farm (located around 3.5 km to the northwest boundary of Stubbo wind farm).
Birriwa solar farm	Potential for cumulative impacts at 3 sensitive receivers given the potential for direct overlap of construction activities at switching station M5. One receiver may also experience cumulative impacts as a result of construction activities at the Barneys Reef wind farm (located around 4.2 km to the northwest boundary of Birriwa solar farm).
Tallawang solar farm	Potential for cumulative impacts at one sensitive receiver given the potential for direct overlap of construction activities at switching station M9 and associated transmission line. There is also the potential for cumulative impacts from construction activities at the Barneys Reef wind farm if construction periods overlap.
Cobbora solar farm	Potential for cumulative impacts at 3 sensitive receivers given the potential for direct overlap of construction activities at the Elong Elong Energy Hub, switching stations E1 and E2 and associated transmission line. If construction periods overlap, there is also the potential for cumulative impacts from construction activities at the Sandy Creek solar farm, Dapper solar farm and Spicers Creek wind farm.
Sandy Creek solar farm	Potential for cumulative impacts at 3 sensitive receivers given the potential for direct overlap of construction activities at the Elong Elong Energy Hub, switching station E3 and associated transmission line. If construction periods overlap, there is also the potential for cumulative impacts from construction activities at the Cobbora solar farm, Dapper solar farm and Spicers Creek wind farm.
Dapper solar farm	Potential for cumulative impacts at 3 sensitive receivers given the potential for direct overlap of construction activities at switching station E2 and associated transmission line, the Elong Elong Energy Hub and switching station E1. If construction periods overlap, there is also the potential for cumulative impacts from construction activities at the Cobbora solar farm, Sandy Creek solar farm and Spicers Creek wind farm.

Relevant future projects	Cumulative air quality impacts
Spicers Creek wind farm	Potential for cumulative impacts at 2 sensitive receivers given the potential for direct overlap of construction activities at switching station E4 and associated transmission line. If construction periods overlap, there is also the potential for cumulative impacts from construction activities at the Cobbora solar farm, Dapper solar farm and Sandy Creek solar farm.
Ulan coal mine Modification 6	Potential for cumulative impacts at 9 sensitive receivers within 5 km of the proposed Ulan coal mine Modification 6 works.

Operation

Air quality impacts from this project during operation would be minimal and are unlikely to contribute to cumulative air quality impacts with the relevant future projects.

20.3 Management of impacts

The approach taken to the assessment of cumulative impacts acknowledges that each project will be required to mitigate its own impacts to acceptable levels, minimising the overall contribution to cumulative impacts. However, it is also recognised that not all REZ related cumulative impacts can be addressed through a project-level approach alone, requiring a more strategic and collaborative approach between EnergyCo, renewable energy developers, councils and government agencies.

Over the last 12 months, EnergyCo has consulted with the community, councils and other government agencies on studies to inform how cumulative impacts in the Central-West Orana REZ will be managed. The studies cover a range of issues that have been identified as priorities through this consultation, including:

- workforce accommodation
- road upgrades and traffic management
- training and skills
- waste management
- mobile connectivity
- social infrastructure.

Given the scale and complexity of the task, work undertaken to date has focussed on data gathering to:

- establish baseline information across a range of matters, for example, existing levels of service provision (e.g. medical services and waste infrastructure)
- identify key project parameters for this project and related development projects that could impact service provision (e.g. temporary workforce numbers and waste volumes).

Data gathering has been supplemented by engagement with government agencies with expertise or regulatory responsibility in an area relevant to the studies, to verify baselines and understand plans for future investment or expansion of service provision. This has provided an important evidence base to identify potential measures to manage cumulative impacts and to ensure they are targeted, coordinated and complement existing commitments and policy directions.

The next stage involves the establishment of working groups involving representatives from councils, agencies and EnergyCo to assess and prioritise recommendations, including the identification of funding sources and lead agency responsibilities and implementation timeframes. The outcomes of this next stage will be documented in an Implementation Plan by the end of 2023.

21 Environmental management

This chapter provides the approach to environmental management of the project, a compiled list of all identified mitigation measures to address project impacts and a summary of project uncertainties and the approach to design refinements.

21.1 Approach to environmental management

EnergyCo will appoint a Network Operator to design, build, finance, operate and maintain the project. The proposed Network Operator would be required to have an environmental management system that is ISO 14000 accredited.

Should the project be approved, the environmental performance of the project would be managed in accordance with:

- the Network Operator's environmental management system, including processes and procedures
- the project as described in this EIS
- the mitigation measures that have been identified to minimise environmental impacts (as summarised in Section 21.4)
- the conditions of approval and other licences, permits and consents granted for the project
- the Construction Environmental Management Plan (CEMP)
- an Operational Environmental Management Plan (OEMP) (or equivalent).

The approach to construction environmental management is outlined further in Section 21.2.

21.2 Construction environmental management

A range of processes, procedures and actions would be implemented to ensure that construction activities are undertaken in accordance with the environmental, stakeholder and community management requirements identified in the EIS throughout the construction period. Specifically, this would include, but not be limited to the following:

- preparation and implementation of Environmental Work Method Statements for enabling works
- preparation and implementation of the CEMP, sub-plans and other supporting documentation for each specific environmental impact
- identification of roles and responsibilities including the relationship between EnergyCo, the Network Operator and the Environmental Representative
- implementing environmental management training and awareness for construction staff
- continuation of stakeholder and community engagement activities during construction.

These requirements are summarised in the following sections.

21.2.1 Enabling works

Enabling works are activities that occur early in the overall construction program and prior to the Planning Secretary's approval of the CEMP to:

- facilitate the commencement of substantial construction works
- to manage specific feature or issues
- collect additional information required to finalise aspects of the design and construction methodology.

To be considered enabling works, these works must be considered to have minor or low impacts, and typically must not impact features of high environmental or heritage conservation significance, or excess amenity impacts to nearby receivers. Enabling works are further described in Chapter 3 (Project description).

Enabling works would be managed under site-specific Environmental Work Method Statements or similar environmental management documents. All enabling works would be subject to the relevant mitigation measures, any relevant conditions of approval and the CEMF.

21.2.2 Construction environmental management plan

The management of environmental impacts during the main construction works would be documented in the CEMP and would be prepared by the Network Operator in collaboration with EnergyCo. The CEMP would provide the overall environmental management framework and procedures to ensure that environmental impacts are minimised and that legislative and approval requirements are fulfilled.

The CEMP would be prepared in accordance with *Environmental Management Plan Guidelines for Infrastructure Projects* (DPIE, 2020d) and *Independent Audit Post Approval Requirements* (DPIE, 2020e). It would include:

- the environmental policy, objectives and performance targets for construction
- reference to relevant statutory and other obligations, including approvals, licences, permits and consents
- issue-specific sub-plans that detail how construction activities would be managed and monitored to avoid or minimise impacts
- processes for managing non-conformances, including identifying and implementing corrective and preventative actions to rectify the non-conformance and prevent recurrence
- processes for demonstrating compliance with the commitments made in the EIS and relevant approval conditions
- responsibilities for planning, implementing, maintaining and monitoring environmental controls including the responsibilities of sub-contractors
- procedures for the control of environmental records
- a compliance tracking and auditing program
- environmental management training and awareness for construction staff.

The CEMP would be supported by issue-specific sub-plans, activity-specific procedures and strategies, and site-based control maps. An outline of the issue-specific sub-plans that would form part of the CEMP is provided in Figure 21–1. Development of plans and strategies is based on managing medium and high environmental risks as identified in Chapter 22 (Environmental risk analysis) and on best practice construction methods.

The CEMP and sub-plans would be reviewed and updated as required, including in response to audit findings, compliance monitoring results, and incidents and inspections that identify corrective and preventative actions.

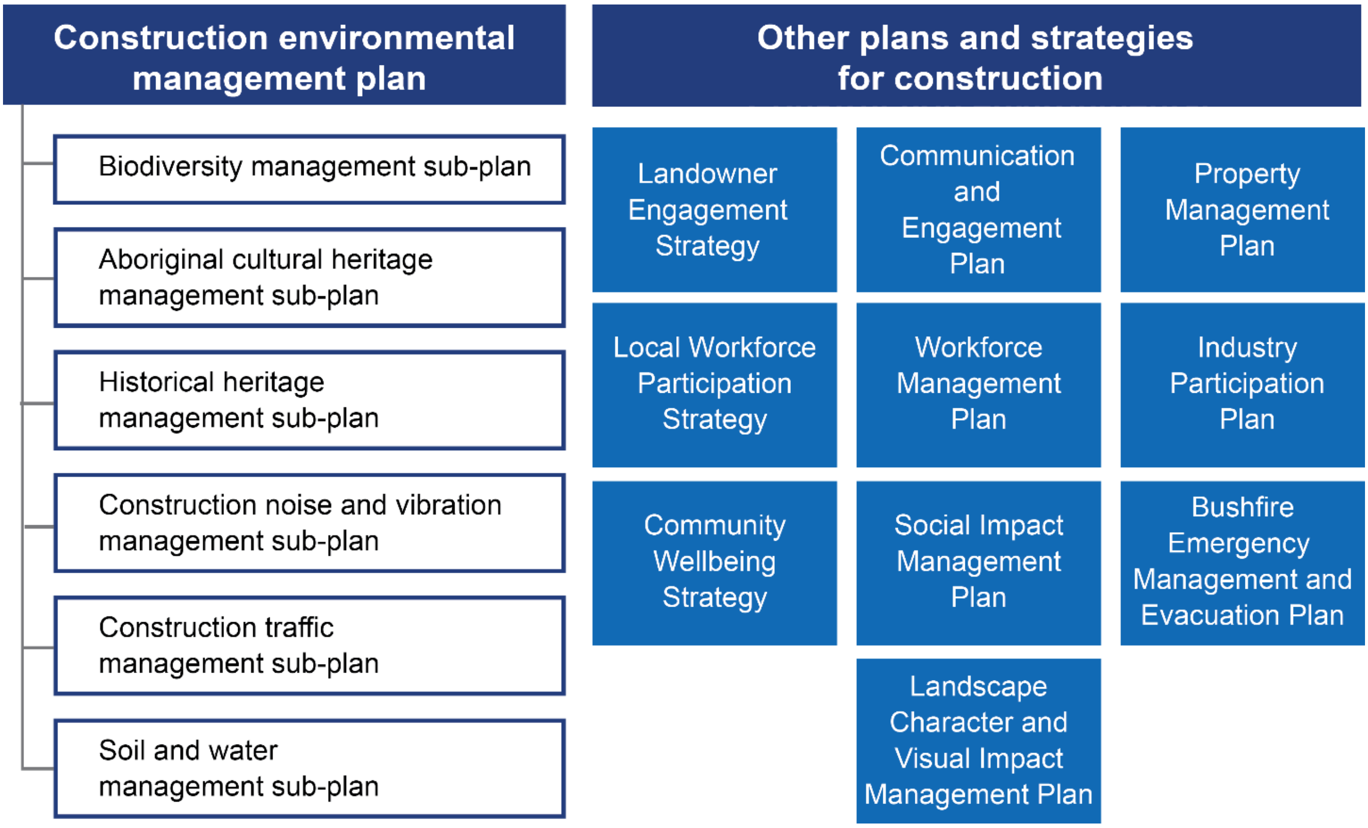


Figure 21–1 Construction environmental management – indicative plans and strategies

21.2.3 Community and stakeholder engagement

A construction communication and engagement plan will be development by the Network Operator. Throughout construction, the Network Operator will work closely with stakeholders and the community to ensure they are well informed regarding the construction works.

Stakeholders and the community will be informed of significant events or changes that affect or may affect individual properties, residences and businesses. These will include significant milestones, any proposed design changes, changes to traffic conditions and access arrangements, construction operations which will have a direct impact on stakeholders and the community including noisy works, interruptions to utility services or construction work outside of normal work hours.

Other plans and strategies in place during construction (refer to Figure 21–1) would also specify targeted engagement with the community and stakeholders to address key issues.

21.3 Operational environmental management

Operation of the project would be undertaken in line with Network Operator's procedures and processes and the operational management measures identified in this EIS. An OEMP (or equivalent) would be developed prior to commissioning of the project. The OEMP would include:

- the performance outcomes, commitments and mitigation measures identified in the EIS
- environmental policies, standards and principles to be applied to operation
- ongoing environmental risk analysis to identify new or changing environmental risks
- the roles and responsibilities of all key personnel
- procedures and plans to address key issues such as vegetation management and emergency responses
- a communication strategy for updating and liaising with the local community
- review, audit and/or monitoring processes to measure environmental performance and identify opportunities for improvement.

21.4 Summary of mitigation measures

A summary of the measures proposed to mitigate and manage the potential impacts of the project, as described in Chapter 7 to Chapter 20 of this EIS, is provided in Table 21-1. 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 project is approved, the project 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 Table 21-2 and the associated technical papers, the measures presented in Table 21-2 would take precedence.

Table 21-1 Proposed mitigation measures

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
Land use and property				
LP1	Land use	The design will continue to be refined to minimise potential impacts on existing land uses and properties as far as practicable.	Detailed design	All locations
LP2	Land requirements	Prior to the commencement of construction, land for the energy hubs will be acquired in consultation with landowners and in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW).	Detailed design	Energy hubs
LP3	Impacts to land use	Pre-condition assessments of the construction area will be undertaken to determine the existing condition of assets, infrastructure, utilities and the general condition of the land. This will inform requirements for rehabilitation within Property Management Plans established with landowners.	Pre-construction and construction	Construction area – transmission lines

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
LP4	Impacts to utilities and services	The location of all services and utilities within the construction area will be confirmed during detailed design, and any required protection or relocation will be designed in consultation with utility providers.	Detailed design	All locations
LP5	Indirect impacts on State forests	EnergyCo will consult with Forestry Corporation of NSW and any relevant stakeholders with regards to access limitations.	Pre-construction	Locations where the project intersects State Forests
LP6	Impacts to travelling stock reserves (TSRs)	Local Land Services will continue to be consulted during detailed design to confirm how impacts on travelling stock reserves will be managed during construction and operation. Alternative access arrangements will be made as required.	Detailed design	Barneys Reef TSR
LP7	Impacts to mine operations	To minimise disruption to mining activities, mine operators will be consulted on construction methodologies and activities as part of continued design development and prior to and during construction activities. This will include consultation relating to: • any adjustments to existing mining-related infrastructure (fences, tracks, mine roads, access tracks etc) • the timing and location of construction works, especially where there are some restrictions on vehicle or construction equipment movements • the timing and location of construction works which have the potential to impact mine operations, such as the stringing of transmission lines over existing mine infrastructure or active mining areas.	Pre-construction and construction	Mining areas
LP8	Impacts to existing biodiversity offset sites	EnergyCo will, in consultation with applicable regulatory authorities, Glencore, YanCoal and Peabody, identify and secure biodiversity offsets for impacts to existing biodiversity offset sites (associated with the Wilpinjong, Moolarben and Ulan coal mines approvals).	Pre-construction and construction	Existing biodiversity offset areas
LP9	Land disturbance	Disturbed areas will be stabilised and appropriately rehabilitated back to pre-construction condition where practical, or as agreed in consultation with the relevant landowner and documented in Property Management Plans.	Construction	Construction area
LP10	Land requirements	The permanent acquisition of land for the switching stations will be carried out by EnergyCo in consultation with landowners and in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW).	Detailed design	Switching stations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
LP11	Land requirements	Easements will be established for transmission lines by EnergyCo in consultation with landowners and in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW) and *Crown Lands Management Act 2016* (NSW) (as relevant) at the completion of construction.	Detailed design	Transmission lines
Agriculture				
AG1	Access impacts – construction	The location of any additional access tracks (temporary and permanent) will be confirmed in consultation with landowners to minimise impacts on agricultural activities. Where permanent tracks are required, a single access track will be designed to serve both temporary and permanent purposes, where practicable.	Detailed design and construction	All locations
AG2	Impact of structures	Where the positioning of transmission line structures and other associated permanent structures will impact: • cropping land • areas used for set up and pack up of agricultural equipment, entry points and turning areas • farm dams, or • locations of high biosecurity risk; consultation will be undertaken with the affected landowner to identify opportunities to avoid or minimise these impacts, where practicable, prior to the commencement of relevant works which will impact the applicable area, equipment and/or property infrastructure.	Detailed design and construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
AG3	Disruption Impacts – Property Management Plans	Individual Property Management Plans will be developed in consultation with each landowner directly affected by construction activities. The intent of the plans is to provide a flexible approach which balances the needs of existing agricultural operations and construction activities. The plans will address relevant matters including: • access arrangements and protocols • proposed timing and location of construction works, particularly where some restriction on vehicular, equipment, grazing or livestock movements will be necessary • grazing and cropping activities on and adjacent to the construction area during the construction period • farm infrastructure arrangements • any required adjustments to property infrastructure (fences, access tracks, etc) • noise intensive activities during sensitive periods of the livestock production cycle (e.g. lambing/calving) • vehicle movements and other activities within the vicinity of livestock • movement of stock away from potential stressors created by construction activities • details of any access tracks or other infrastructure provided for temporary construction activities that are to be retained and not restored to the pre-existing condition (where requested by the land owner prior to the completion of construction within the applicable area) • biosecurity requirements. • contact details for the person who will liaise with landowner to provide direct avenues of enquiry for information and issues management. Property Management Plans will be developed prior to the commencement of relevant works which will impact the applicable property, activity, equipment and/or property infrastructure. The requirements of the plans will be adhered to/implemented throughout the construction period.	Detailed design, pre-construction and construction	All relevant properties within the construction area

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
AG4	Disruption Impacts – General	To minimise disruption to agricultural activities: • property infrastructure (such as gates) will be managed in accordance with landowner requirements • any damage to property infrastructure caused by construction will be repaired in a timely manner in consultation with the landowner • use of existing roads, tracks and other existing disturbed areas will be prioritised over the construction of new access tracks where practicable • where access is required across open spaces, either within the easement or to the easement, care will be exercised to ensure that surface disturbance is minimised by confining vehicular and plant movements, as far as possible, to a single route.	Detailed design and construction	All relevant properties within the construction area
AG5	Biosecurity - construction	Biosecurity controls will be implemented during construction to minimise the risk of transport or spread of disease, pests or weeds. A Biosecurity Management Plan will be developed addressing the following protocols/matters including: • weed management controls, including inspection and cleaning of plant and equipment, and management of earthworks and clearing activities • development of specific controls where high biosecurity risks are identified. For example appropriate measures will be implemented with respect to foot and mouth disease to control any risk of introduction of the pathogen as a result of project activities • the specific controls applicable to a property will be consistent with property biosecurity plans where they are in place. Agreed protocols will be documented in the Biosecurity Management Plan • a monitoring program to track the effectiveness of the controls identified in the Biosecurity Management Plan • consultation with the owners of organic certified properties will be carried out to identify the specific risks and controls required to be implemented. The Biosecurity Management Plan will be prepared in consultation with relevant local council biosecurity officers in relation to the distribution of important weeds and the location of high biosecurity risk areas.	Construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
AG6	New weed infestations	In the event of new infestations of State priority weeds as a result of construction activities, the relevant control authority will be notified in accordance with the requirements of the *Biosecurity Act 2015* and Biosecurity Regulation 2017.	Construction	All locations
AG7	Access impacts – operation	Fencing and access arrangements, such as locked gates and requirements for opening and closing of gates, will be determined in consultation with landowners. Any damage caused by maintenance activities will be repaired promptly.	Operation	Transmission line
AG8	GPS impacts	In the event that nuisance impacts on agricultural precision farming GPS signals arises due to operation of the project, the cause of any such interference will be investigated. Any disruption due to operation of the project will be addressed in consultation with the affected landowner, and may include measures such as signal boosting equipment or antenna enhancements (where applicable).	Operation	Transmission line
AG9	Biosecurity – Operation	Biosecurity controls set out in the Biosecurity Management Plan will be implemented during operation to minimise the risk of transport or spread of disease, pests or weeds during maintenance activities.	Operation	All locations
AG10	Weed management	Where present within the transmission line easement and associated areas for permanent infrastructure, weeds will be managed in accordance with the *Biosecurity Act 2015*.	Operation	All locations
Landscape character and visual amenity				
LV1	Vegetation retention	Vegetation clearance for the project will be limited to the minimum extent necessary for construction and operation to maximise existing visual screening and retention of the existing landscape character. Retained vegetation will be clearly demarcated on site as 'no-go zones' prior to the commencement of construction. Construction personnel will be made aware of no-go zones as part of environmental site induction(s).	Pre-construction, Construction, Operation	Whole of project
LV2	Lighting control	Lighting at construction compounds and workforce accommodation camp(s) will be designed and operated in accordance with Australian and New Zealand Standard *AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting*.	Pre-construction and construction	Construction compound and workforce accommodation camp(s)

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
LV3	Private dwellings with a moderate or high visual impact	For private dwellings on non-host properties where the project is predicted to have a moderate or high visual impact, reasonable and feasible opportunities to reduce the visual impact (including the provision of screening vegetation) will be investigated. Appropriate visual screening or other options will be confirmed in consultation with the affected landowner (supported by detailed landscape plans where appropriate) and implemented either before or during construction. Maintenance of vegetative screening provided on privately owned land outside of the operation area will be the responsibility of the landowner.	Pre-construction, Construction	Private dwellings on non-host properties with a moderate or high visual impact
LV4	Lighting control	Lighting at the Energy Hubs and switching stations will be designed and operated in accordance with: • Australian and New Zealand Standard *AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting* • the design guidelines contained in the Siding Springs Dark Sky Planning Guideline (DPE 2016). This will include: — eliminating upward spill light — ensuring lighting is directed downwards — using shielded fittings — avoiding overlighting — switching lights off when not required, such as with the use of sensor lights — using energy efficient bulbs — using asymmetric beams if floodlighting is required — ensuring lights are not directed towards reflective surfaces — using warm white colours.	Pre-construction, Construction, Operation	Merotherie Energy Hub, Elong Elong Energy Hub, and switching stations
Biodiversity				
B1	Avoidance of threatened species and threatened ecological communities	Sensitive areas to be avoided during detailed design and sensitive areas (including species polygons, buffered threatened species locations (including off site features adjacent to the subject land and areas of Threatened Ecological Communities) will be identified on sensitive area plans using spatial data. The detailed design process will avoid and minimise impacts on sensitive areas where feasible and reasonable including: • micro siting of transmission line infrastructure • prioritising areas with a Vegetation Integrity score <17 as per section 9 of the Biodiversity Assessment Method (2020).	Detailed design Pre-construction	Identified sensitive areas

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
B2	Avoidance of threatened species and threatened ecological communities	Prior to construction activities taking place within the Little Eagle nest buffer and during the breeding season (from Spring until after young and fledged in early Summer), an ecologist will be engaged to determine if the species is present. If present, an impact assessment of proposed activities will be completed to determine what, if any, activities can take place within the buffer area, and what mitigation measures need to be implemented. Measures may include cessation of certain activities, amending the construction methodology including selecting alternative plant or equipment.	Detailed design Pre-construction	Within Little Eagle tree nest buffer area(s)
B3	Avoidance of threatened species and threatened ecological communities	Prior to construction activities taking place within 100 m of rocky areas containing caves, overhangs or crevices, cliffs or escarpments and during the breeding season for the Large-eared Pied Bat, Eastern Cave Bat, Large Bent-winged Bat (November to February), an ecologist will be engaged to determine if the species are present. If present, an impact assessment of proposed activities will be completed to determine what, if any, activities can take place within the 100 m and what mitigation measures need to be implemented. Measures may include cessation of certain activities, amending the construction methodology including selecting alternative plant or equipment.	Detailed design Pre-construction	Within 100 metres of rocky areas containing caves, or overhangs or crevices, cliffs or escarpments as mapped by Technical paper 4 – Biodiversity Development Assessment Report
B4	Micro-siting of associated works and access tracks	Micro-siting of construction infrastructure (including site offices, compounds and access tracks) will be undertaken to minimise vegetation clearing and disturbance of watercourses. This will include: • prioritising areas of low biodiversity value • utilising existing access tracks, where feasible • locating waterway crossings at located at narrow width locations • minimising the quantity of cut and fill activities.	Pre-construction Construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
B5	Connectivity corridors	Connectivity corridors are to be investigated in the form of installation of under-transmission line glider poles (in accordance with clearance requirements for transmission lines and infrastructure) where the construction area will impact habitat connectivity for arboreal species (see Appendix J of Technical paper 4 – Biodiversity Development Assessment Report for an examination of regional and terrestrial habitat connectivity and target species for mitigation). The exact location and design of under-transmission line glider poles and/or rope bridges will be nominated as part of a Connectivity Strategy guided by the locations of habitat connectivity outlined in Figure 14-14 and 14-15 of Technical paper 4 – Biodiversity Development Assessment Report. Where poles are proposed to be installed on land adjacent to the easement, they will be subject to landowner agreement and captured in the property management plan. This strategy will require ongoing management of connectivity corridors.	Pre-construction (Connectivity Strategy) Construction Operation (Corridor Management)	Relevant locations
B6	Impacts on availability of nesting hollows	A Supplementary Hollow and Nest Strategy will be developed and implemented for the creation of nest boxes or other hollow creation method to provide alternative roosting and/or nesting habitat for threatened fauna displaced during clearing. A target ratio for the provision of three artificial hollows/nest boxes for every occupied hollow removed will be implemented. Where supplementary hollows are proposed to be established on land adjacent to the easement, these will be subject to landowner agreement and captured in any property management plan.	Nest box/hollows are to be installed at least 3 months prior to commencement of clearing works where practicable in each construction area.	Relevant locations
B7	Biosecurity impacts	A Biosecurity Management Plan will be prepared an implemented to ensure biosecurity risks are suitably controlled. The plan will include protocols to be followed to minimise biosecurity risks including, but not limited to the cleaning of vehicles and machinery (incl. floor pans), boots and clothing to remove and/or kill pathogens and remove weed seed and/or plant bodies. All trucks containing loads of weed contaminated material will be covered. Mechanical and chemical weed control will be done in consultation with landowners.	Pre-construction Construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
B8	Biodiversity impacts	A Biodiversity Management Plan will be prepared and implemented for the duration of construction. The plan is to include (as a minimum): • the location and extent of areas of vegetation clearance and habitat disturbance, and how these will be suitably demarcated on site • the location and extent of areas to be protected (e.g. retained vegetation, hollow-bearing trees, nests, burrows and other habitat features (including applicable buffers to habitat features) located inside the construction or in close proximity to the clearing areas • measures to be implemented on site to clearly demarcate areas to be retained as 'no go areas' with suitable fencing or equivalent exclusion barrier.	Pre-construction To be installed prior to the commencement of clearing works in each construction area. 'No go area' fencing and other tags/marks must be maintained throughout the construction phase.	All locations
B9	Tree protection measures	Tree protection measures are to be installed and maintained in accordance with *AS 4970-2009 – Protection of Trees in Development Sites* throughout construction.	Pre-construction	Applicable trees
B10	Pre-clearing surveys	Pre-clearing surveys are to be completed prior to clearing at each location by a suitability qualified ecologist. The proposed clearing extents will be marked out on site prior to the pre-clearing surveys. During the surveys, the ecologist will: • survey the proposed clearing extent • identify any fauna that will require relocation prior to clearing, including inspection of any built structures and wooden fence posts to be demolished • 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.	Within 48 hours prior to the commencement of clearing works in each construction area.	All locations
B11	Ecology inductions, toolbox talks, targeted training	All relevant project personnel, including relevant sub-contractors are to be trained on biodiversity management protocols and 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. Inductions and training must be completed prior to commencement of work for all relevant personnel. Toolbox talks will be undertaken daily or as required.	Construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
B12	Retention of understorey vegetation in riparian areas	Understorey vegetation is to be protected within vegetated riparian zones where reasonable and feasible (within the definition of *Water Management Act 2000*). Vegetation clearing will be limited to the tree stratum and shrubs above two metres in height only, with trunk bases being retained in-situ.	N/A	Riparian environments disturbed as part of construction
B13	Rehabilitation of riparian areas	A Riparian Vegetation Management Plan (RVMP) will be developed and implemented for the project to manage activities within vegetated riparian zones to minimise impacts to aquatic environments. The plan will be prepared within 3 months prior to any disturbance to a riparian area. The plan will identify the measures to be implemented to minimise impacts from construction activities (such as temporary and permanent waterway crossings) within riparian and aquatic environments. A schedule of works will be stipulated within the approved RVMP. Riparian areas subject to disturbance will be progressively stabilised and rehabilitated.	Pre-construction Construction	Riparian environments disturbed as part of construction
B14	Installation of bird diverters	Bird diverters will be installed within one kilometre (at a minimum) of wetland/riverine habitats to reduce impacts on aerial fauna species from collision with transmission lines and infrastructure. The exact position and diverter model will be finalised during detailed design. Installation of the bird diverters will occur within two weeks of transmission line installation or as soon as practical, and will remain in place and/or replaced as required.	Construction	Relevant locations
B15	Vegetation offsets requirements	The predicted clearing of native vegetation by the project identified in Technical paper 4 – Biodiversity Development Assessment Report will be monitored against the recorded clearing. A revised Biodiversity Assessment Method (BAM-C) calculation on the project's final disturbance to biodiversity post construction will be completed. Any additional credit liability identified will be met as part of the biodiversity offset requirements within the biodiversity offset package.	Construction	Construction area
B16	Unexpected finds	A species unexpected finds protocol will be implemented if threatened ecological communities or flora and fauna species, not assessed in the biodiversity assessment, are identified in the disturbance area.	Construction	Construction area

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
B17	Water quality, watercourse geomorphology and aquatic habitat	Watercourse crossings will be designed to minimise disturbance and harm within riparian corridors and rehabilitate aquatic habitat to achieve a 'no net loss' of habitat within the affected area and catchment as a whole, in accordance with the following guidelines: • *Guidelines for controlled activities on waterfront land* (NRA, 2018) • *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull & Witheridge, 2003) • *Policy and guidelines for fish habitat conservation and management* (DPI, 2013).	Pre-construction and construction	All locations
B18	Operational guidelines and procedures	Develop and implement guidelines and procedures for maintenance of the project during operation as part of the OEMP or equivalent. These guidelines and procedures will cover the following: • vegetation clearing and maintenance commitments in the Biodiversity Development Assessment Report and Environmental Impact Statement • avoiding access and disturbance in areas of high biodiversity conservation significance; outside of the areas required for construction and • avoiding maintenance of vegetation that does not need to be maintained during operation.	Prior to operation	Operation area
B19	Minimise indirect impacts from light spill	Lighting designs to be in accordance with the *National Light Pollution Guidelines for Wildlife* (DCCEEW, 2023).	Detailed design	Operation area
Aboriginal heritage				
AH1	Impact avoidance and minimisation	The project will avoid impacts to the following identified Aboriginal objects and/or sites within the construction area: • the proposed workforce accommodation camps and construction activities at the Merotherie Energy Hub will establish a heritage protection zone to avoid SNI-GG02-GG09 inclusive • the proposed workforce accommodation camps and construction activities at Neeleys Lane will establish a heritage protection zone to avoid SNI-AS65 • a protection zone will also be implemented at the Elong Elong energy hub to protect cultural material within 150 m of the eastern bank of Laheys Creek (excluding the unavoidable impacts associated with the crossing of Laheys Creek by the transmission corridor, which will be minimised). Some guiding principles for consideration of avoidance are presented in Appendix F of Technical paper 5 (Aboriginal cultural heritage assessment report)	Pre-construction Construction	SNI-GG02 – GG09 inclusive, SNI-AS65; and 150 m of Laheys Creek

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
AH2	Impact avoidance and minimisation	The project will investigate the micro-siting of project infrastructure and construction activities in consultation with an Aboriginal heritage specialist to avoid or minimise impacts to: • rockshelters (#36-3-3794, #36-3-0449, #36-3-0570, #36-3-3790, SNI-RS01 – RS04 inclusive) • grinding groove sites (SNI-GG01 and SNI-GG15) • a culturally modified tree (SNI-CMT02) • high-density stone artefact sites (#36-3-1140, #36-3-1141), and • 150 m of Prospect Creek, Sandys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek and Copes Creek. Some guiding principles for consideration of avoidance and/or impact minimisation are presented in Appendix F of Technical paper 5 (Aboriginal cultural heritage assessment report).	Pre-construction Construction	#36-3-3794, #36-3-0449, #36-3-0570, #36-3-3790, SNI-RS01 – RS04 inclusive, SNI-GG01, SNI-GG15, SNI-CMT02, #36-3-1140, #36-3-1141, areas within 150 m of Prospect Creek, Sandys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek and Copes Creek
AH3	Impact avoidance and minimisation	On-Country meetings will be undertaken with participating Elders and key knowledge-holders of the project to discuss any potential view-line impacts of the project and places of cultural value, and their subsequent management.	Pre-construction Construction	SNI-CS4 – CS6 inclusive, and travelling routes #1 and #5 where they intersect the construction area.

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
AH4	Cultural heritage management	An Aboriginal Cultural Heritage Management Plan (ACHMP) will be developed by an Aboriginal heritage specialist in consultation with the Registered Aboriginal Parties (RAPs) and Heritage NSW. The contents and guiding principles for the management of identified site types for the ACHMP are presented in Appendix F of Technical paper 5 (Aboriginal cultural heritage assessment report), and include: • processes, timing, communication methods and project involvement for maintaining Aboriginal community consultation and participation through the remainder of the project • inputs and content of a cultural heritage induction package for all construction personnel and subcontractors • descriptions and methods for archaeological test/salvage excavations of rockshelters, stone artefact scatters, potential archaeological deposits, and cultural deposits that will be adversely affected by the project • descriptions and methods for surface collection of identified isolated objects and stone artefact scatters that will be adversely affected by the project • descriptions and method for mitigation and/or recovery of grinding grooves and culturally modified trees that will be adversely affected by the project • delineating and protecting Aboriginal and cultural sites within or in close proximity to the construction area, including clear marking, appropriate screen for any gender-specific areas, surface protection, etc • procedures for managing the unexpected discovery of Aboriginal objects, sites and/or human remains during the project • procedures for the curation and long-term management of recovered cultural materials • methods of post-excavation analysis and reporting of the archaeological investigations, including suitable collection and processing of stone artefacts, palaeo-environmental, chronological and other soils from archaeological activities; and • a monitoring regime for implementing the above measures.	Pre-construction Construction	Construction area, and all identified Aboriginal objects, sites and deposits in the Chapter 9 of Technical paper 5 that will be adversely impacted by the project.

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
AH5	Cultural heritage management	Additional archaeological field survey will be undertaken of the portions of the construction area inaccessible during the Aboriginal cultural heritage assessment. Any identified Aboriginal objects, sites, places and/or deposits during these works will be integrated into the ACHMP (AH04).	Pre-construction	Previously unsurveyed portions of the construction area
AH6	Cultural heritage management	Where construction is unable to avoid areas within 150 m of Prospect Creek, Sandys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek and Copes Creek, archaeological test excavations will be undertaken. Test excavations will adopt the methods outlined in Appendix F and/or developed in the ACHMP (AH04). The findings of the test excavations will be integrated into the ACHMP (AH04).	Pre-construction	The construction area, where it is located within 150 m of Prospect Creek, Sandys Creek, Laheys Creek, Browns Creek, Whites Creek, Sportsmans Hollow Creek, Deadmans Creek, Bora Creek, Cumbo Creek, Cockabutta Creek, Planters Creek, Wilpinjong Creek, Tallawang Creek, and Copes Creek
AH7	Cultural heritage management	An inspection will be undertaken by a qualified arboriculturist of all tentatively identified culturally modified trees to confirm whether they have formed through anthropogenic or natural processes. Where identified as of cultural formation, they will be integrated into the ACHMP (AH04). The findings of this investigation and subsequent management of the trees confirmed as being culturally modified will be integrated into the ACHMP (AH04) as required.	Pre-construction	#36-3-0565, #36-6-0626, #36-3-0638, #36-3-0103, #36-3-0643, SNI-CMT01, SNI-CMT02, SNI-CMT03, SNI-CMT06, SNI-CMT08, SNI-CMT11, SNI-CMT13, SNI-CMT15
AH8	Cultural heritage management	Archival recording will be undertaken of all rockshelters, grinding grooves, and culturally modified trees that may be adversely impacted by the project. Archival recording will be undertaken in accordance with relevant Heritage NSW guidelines.	Pre-construction	#36-3-3794, #36-3-0449, #36-3-0570, #36-3-3790, SNI-RS01 – RS04 inclusive, SNI-GG01, SNI-GG15, #36-3-1140, #36-3-114; and as required following AH03: #36-3-0565, #36-6-0626, #36-3-0638, #36-3-0103, #36-3-0643, SNI-CMT01, SNI-CMT02, SNI-CMT03, SNI-CMT06, SNI-CMT08, SNI-CMT11, SNI-CMT13, SNI-CMT15

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
AH9	Heritage interpretation	An Aboriginal heritage-interpretation strategy and plan will be developed by an Aboriginal heritage specialist, in consultation with Registered Aboriginal Parties, which will identify the interpretive values of the construction area (and specifically Aboriginal heritage values) and provide direction for interpretive installations and devices. The contents and guiding principles for the management of the strategy and plan are presented in Appendix F of Technical paper 5 and include the need to incorporate Registered Aboriginal Parties' views on traditional and contemporary values, local ethnographic and post-Contact information, and archaeological data developed for the project.	Construction Post-construction	Construction area
AH10	Aboriginal engagement	Consultation will be maintained with the Registered Aboriginal Parties during the finalisation of the assessment process and subsequent stages of the project where cultural heritage requires management.	Pre-construction Construction	-
AH11	Administrative	A copy of the Aboriginal cultural heritage assessment report and all relevant AHIMS site recording forms and information for the project will be lodged with Heritage NSW and provided to each of the RAPs.	Pre-construction Construction	All Aboriginal objects, sites and places described in Chapter 9 of Technical paper 5.
Non-Aboriginal heritage				
HH1	Avoidance of direct impacts to Tallawang Creek Archaeological Site 02	Prior to construction, an exclusion barrier (e.g. fencing or suitable alternative) will be installed to prevent construction activities or access into the portion of CWO-22-HH11 which extends into the construction area. The barrier would be maintained for the duration of construction.	Pre-construction Construction	CWO-22-HH011
HH2	Minimisation of direct impacts	Construction methodologies will be refined to avoid and/or minimise direct impacts to listed and potential historic heritage items where reasonable and feasible. [1] The final mitigation measure for the Tallawang Union and Catholic Churches (HH09b and HH09c) and cemetery depend on the outcome of the non-intrusive geophysical investigations	Pre-construction Construction	CWO-22-HH03 CWO-22-HH05a CWO-22-HH05b CWO-22-HH08 CWO-22-HH09a CWO-22-HH09b[1] CWO-22-HH09c[1] CWO-22-HH10 CWO-22-HH13 CWO-22-HH16 CWO-22-HH18 CWO-22-HH19 CWO-22-HH20 CWO-22-HH21
HH3	Minimisation and management of indirect impacts	Construction methodologies will be refined to avoid and/or minimise indirect impacts to listed and potential historic heritage items where reasonable and feasible.	Pre-construction Construction	CWO-22-HH06 CWO-22-HH22 CWO-22-HH23

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
HH4	Cultural heritage management	**Archival recording** If avoidance cannot be established during the detail design stage, an archival recording will be completed in accordance with the following guidelines, and be lodged with the Heritage NSW and local councils for access to researchers: • photographic recording of heritage items using film or digital capture (Heritage Office, 2006), and • how to prepare archival records of heritage items (NSW Heritage Office, 1998).	Pre-construction	CWO-22-HH08 CWO-22-HH10 CWO-22-HH18 CWO-22-HH19
HH5	Cultural heritage management	**Archaeological test excavation** If direct impacts to a heritage item cannot be reasonably and feasibly avoided during the detailed design stage, a program of archaeological test excavation will be undertaken (where the extent of the archaeological deposit is not known). This will include development of: • a detailed archaeological research design • consultation with Heritage NSW • systematic test excavation of historical archaeological sites that meet the 'relics' threshold identified for impact • where archaeological deposits are uncovered, sampled recovery of historic heritage relics will occur prior to disturbance. Once recorded and analysed artefacts will be offered to local heritage society/museum. A detailed excavation method and research design for this process will be included in the Historic Heritage Management Plan (HHMP).	Pre-construction Construction	CWO-22-HH03 CWO-22-HH05a CWO-22-HH13 CWO-22-HH16
HH6	Cultural heritage management	**Archaeological salvage excavation** Salvage excavation will be undertaken on archaeological sites subject to direct impacts where the extent of the archaeological deposit is known. This will include development of: • a detailed archaeological research design • consultation with Heritage NSW • systematic salvage excavation of historical archaeological sites. Once recorded and analysed, salvaged artefacts will be offered to local heritage society/museum. A detailed excavation method and research design for this process will be included in the HHMP. [1] The final mitigation measure for the Tallawang Union and Catholic Churches (HH09b and HH09c) and cemetery depend on the outcome of the non-intrusive geophysical investigations	Pre-construction	CWO-22-HH03 CWO-22-HH05a CWO-22-HH09a CWO-22-HH09b[1] CWO-22-HH09c[1] CWO-22-HH13 CWO-22-HH16

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
HH7	Cultural heritage management	**Unexpected finds procedure** Any items of potential heritage conservation significance or human remains discovered during construction and operation will be managed in accordance with an Unexpected Finds Procedure. Work in the vicinity of the find will stop if objects such as bonded bricks, timber or stones appearing in formation indicating a wall or floor for instance are found, or if soil with artefacts concentrations, is excavated. A description of the types of finds that will stop works within the vicinity of the finds will be determined prior to construction as part of the HHMP and staff involved in excavation work will be informed about how to apply it. The unexpected finds procedure will include actions such as: • stop work procedures and exclusion buffers • utilising the advice of a technical specialist • consultation with Heritage NSW • protocols for continuing work in the area after assessment. [1] The final mitigation measure for the Tallawang Union and Catholic Churches (HH09b and HH09c) and cemetery depend on the outcome of the non-intrusive geophysical investigations	Pre-construction Construction	CWO-22-HH03 CWO-22-HH05a CWO-22-HH05b CWO-22-HH09a CWO-22-HH09b[1] CWO-22-HH09c[1] CWO-22-HH10 CWO-22-HH11 CWO-22-HH17 CWO-22-HH20 CWO-22-HH21
HH8	Laheys Creek Cemetery	• A structural assessment of the standing headstones will be undertaken to determine if additional conservation works may be required to mitigate nearby construction works. • A vibration monitor will be installed within the cemetery at the closest point to construction works to confirm that vibration levels are compliant with applicable criteria.	Pre-construction Construction	CWO-22-HH06

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
HH9	Avoidance of direct and indirect impacts to Laheys Creek Cemetery	Prior to construction, an exclusion barrier (e.g. fence or suitable alternative) will be installed to provide a minimum 100 metre exclusion buffer around CWO-22-HH06 (Laheys Creek Cemetery) to ensure direct and indirect impacts to the cemetery are avoided. The nominated exclusion buffer for CWO-22-HH06 may be reduced on the following basis: • a report from a structural engineer assesses the stability of the headstones in the cemetery; and • the report can certify that a reduced buffer is unlikely to cause damage; and/or • the headstones identified as being at risk of collapse are stabilised and conserved; and/or • the report can provide and certify vibration criteria, vibration monitoring equipment is installed and vibration criteria are not exceeded; and • any damage sustained to the cemetery during construction or in the succeeding 12 month period is repaired and conserved by the proponent.	Pre-construction Construction	CWO-22-HH06
Social				
SI1	Property acquisition	A Landowner Engagement Strategy will be developed and implemented for the project which will include the following: • appointment of a dedicated Land Acquisition Manager to oversee the implementation of the strategy • ensure personnel appointed to engage with landowners have been suitably trained to undertake engagement with vulnerable people and those potentially affected by mental health issues.	Pre-construction, Construction	Properties hosting infrastructure

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
SI2	Workforce management	A Workforce Management Plan will include: • a code of conduct for workers, which will include a zero-tolerance policy relating to anti-social behaviour • cultural awareness training for the workforce • measures for the workforce residing at the workforce accommodation camps including recreation areas, internet connections etc. The plan will include strategies to promote wellbeing of the workforce and a positive interaction with local community, which may include promoting workforce participation in community life (sports, events, volunteering), providing healthy food options, implementing health and safety assessments, among others. The plan will be reviewed every six months to identify and manage any unanticipated impacts.	Pre-construction/ Construction	Regional social locality
SI3	Local workforce participation	A Local Workforce Participation Strategy will be prepared and implemented. It will include the following initiatives: • identification of local skills gaps and potential workforce skills and training requirements • investigate opportunities for the delivery of training and upskilling programs for local labour force • strategies for maximising local training and employment opportunities for residents, especially for First Nations People • initiatives to promote local employment, such as early engagement with local employment agencies and council, communication of employment opportunity via relevant local mediums of information, contract workers through existing local businesses, etc.	Pre-construction	Regional social locality

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
SI4	Industry participation	An Industry Participation Plan will be prepared and implemented which will: • identify services and goods that could be sourced locally (quarry materials, catering, transport, cleaning, stationery) • identify the capacity of local and Indigenous businesses and suppliers to be ready for potential additional demand • provide local and Indigenous procurement targets • identify tailored 'meet-the-contractor' events for local and Aboriginal businesses to learn about potential opportunities associated with the delivery of the project • monitor the availability of key goods and services to the local community when procured locally.	Pre-construction/ Construction	Regional social locality
SI5	Community engagement	A pre-construction and construction Communication and Engagement Plan will be prepared to ensure: • landowners, businesses and local residents with the potential to be affected by construction activities are notified in a timely manner about the timing of activities and potential for impacts, and the measures that will be implemented to minimise the potential for impacts on individual properties • include proactive methods of communication with affected parties and strategies to reach vulnerable members of the community such as doorknocking, text messages, newsletters and or phone calls • ensure receivers identified as eligible for noise mitigation treatments in Technical paper 9 – Noise and vibration are supported and engaged through the delivery process • provide further information in the local social locality about the regional energy strategy, including about community energy schemes, power purchasing agreements and other initiatives • enquiries and complaints are managed, and a timely response is provided for concerns raised and information about how solutions are being investigated is provided to the community.	Pre-construction/ Construction	Local social locality

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
SI6	First Nations liaison	A First Nations liaison group will be established. It will focus on identifying and implementing strategies to enhance and maximise opportunities for employment, procurement, education and other potential project related benefits. Members of the First Nations liaison group will be identified through collaboration with the existing Central-West Orana REZ Aboriginal Working Group, and will include local and regional members including: • Local Aboriginal Land Councils • Aboriginal Representative Organisations • relevant Aboriginal social, health and support services • educational organisations and services • employment agencies • Aboriginal business organisations/groups.	Pre-construction/ Construction	Regional social locality
SI7	Complaints management	A complaints management system will be maintained throughout the construction period and for a minimum of 12 months after the completion of construction. The complaints management system will include the following (at a minimum): • contact details for a 24-hour response line and email address for ongoing stakeholder contact throughout the project • details of all complaints received will be recorded • verbal and written responses describing what action will be taken will be provided to the complainant (or as otherwise agreed by the complainant).	Construction Initial 12 months of operation	Regional social locality

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
SI8	Social impact	A Social Impact Management Plan (SIMP) will be prepared that will: • describe the social impact mitigation measures to be implemented and the impacts that they are intended to address • set out how the community and stakeholders can provide feedback on the mitigation measures and the effectiveness of their implementation. Monitoring findings will be presented to the project's Community Reference Groups meetings (if active) and to an annual community meeting where feedback will be sought on the monitoring program and whether actions or targets require revision. EnergyCo will track implementation of the SIMP and review performance measures quarterly, to facilitate continual improvement. The SIMP will be reviewed annually and updated based on monitoring data and community and stakeholder feedback. In addition to the monitoring review, proposed mitigation measures will also be reviewed to assess whether they are still applicable and on track to meet the residual risk rating applied in the EIS. Any new issues or initiatives that have emerged and that should be included in ongoing mitigations and/or monitoring will be addressed. The results of SIMP reviews will be published on the EnergyCo website.	Pre-construction/ Construction	Regional social locality
SI9	Operational communications	An Operational Communication Plan will be developed and implemented, which will address the following: • maintaining communications with those located in close proximity to the transmission line to provide updated information and monitor experience and concerns. The Operational Communication Plan will be reviewed and updated on an annual basis.	Operation	Local social locality

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
Noise and vibration				
NV1	Construction noise (source controls)	As part of development of the detailed design and construction methodology, all reasonable and feasible mitigation measures will be considered, confirmed and implemented to minimise construction noise impacts and to avoid exceedances of the applicable noise goals at adjacent sensitive receivers where practicable. Measures that may achieve this outcome may include, but are not limited to the following: • portable temporary noise screens will be erected adjacent to stationary or long term static noise sources, or noise generating items, where reasonable and feasible • spotters, "smart" reversing alarms, or broadband reversing alarms will be used in place of traditional tonal beeper reversing alarms, particularly on equipment where reversing alarms are frequently in use such as rollers, loaders or compactors • noise source controls, such as the use of residential class mufflers, will be used reduce noise from all plant including cranes, excavators and trucks • the offset distance between noisy plant items and sensitive receivers will be maximised, where reasonable and feasible • machinery will be operated in a manner which reduces maximum noise level events such as shaking excavator buckets, dropping materials into trucks from a, height or steel on steel contact • construction plant and equipment will be turned off when not in use • helicopters will not be operated during evening and night-time periods. Where the use of drones is proposed during evening and/or night-time periods, an additional assessment(s) will be undertaken to identify appropriate operational limits to ensure that noise impacts to nearby sensitive receivers are acceptable.	Detailed design Pre-construction Construction	All locations where exceedances of the applicable construction noise criteria are predicted at sensitive receivers

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV2	Construction noise (administrative controls)	Opportunities to reduce exceedances of the applicable construction noise goals through the implementation of administrative controls will be examined, confirmed and implemented where reasonable and feasible. Controls to be considered will include, but not limited to the following: • environmental awareness training and inductions for site personnel will include noise mitigation techniques/measures to be implemented when on site and accessing the site • the avoidance of simultaneous construction activities during transmission line construction in the vicinity of the Energy Hubs will be investigated to minimise potential cumulative noise impacts • plant and equipment will be selected based on noise emission levels. This will include the consideration of alternative stringing methods, such as the use of drones instead of helicopters • noise-intensive works will be limited to less sensitive construction hours (i.e. away from early morning and late afternoon periods) as far as practicable, when working in the vicinity of sensitive receivers • plant and equipment will be well maintained to ensure that excessive noise is not generated • the provision of respite periods for helicopter take off/landing will be considered at the construction compounds • a blasting vibration and overpressure assessment will be required as part of any potential blast design. This assessment will determine the Maximum Instantaneous Charge to achieve the recommended ground vibration and overpressure limits. In addition, a Blast Management Strategy will be prepared in accordance with Section 4 of AS 2187.2-2006 for inclusion in the CNVMP • any works undertaken outside standard working hours will be further assessed in accordance with the ICNG and the CNVG during detailed design and an Out of hours works protocol will be developed to mitigate any identified impacts.	Detailed design Pre-construction Construction	All locations where exceedances of the applicable construction noise criteria are predicted at sensitive receivers.

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV3	Construction noise	Opportunities to reduce the impacts associated with construction noise levels through the implementation of proactive community consultation will be examined, confirmed and implemented where reasonable and feasible. Controls to be considered will include, but not limited to the following: • sensitive receivers potentially affected by the works will be notified of the commencement of construction activities at least five days prior to works starting. The notification will inform potentially impacted sensitive receivers of the nature of and duration of works, expected noise levels and contact details of where sensitive receivers can contact can project representatives • the community will be kept regularly informed of noise intensive activities in the immediate area • if noise complaints are received, the complainant will be offered the opportunity for noise monitoring to be carried out to confirm the noise level at the receiver. Where the noise monitoring confirms that the applicable noise predictions are being exceeded, the construction methodology will be reviewed and changes implemented to reduce construction noise levels to be compliant with noise predictions where reasonable and feasible. Additional mitigation measures such as respite periods have been outlined in Table 15-29 of Chapter 15 (Noise and Vibration) of the EIS.	Pre-construction	All locations where exceedances of the applicable construction noise criteria are predicted at sensitive receivers.

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV4	Construction vibration	Where construction is likely to result in vibration levels that exceed relevant criteria at sensitive receivers, mitigation and management will be implemented where practicable and appropriate. This will include (but is not limited to) the following measures: • avoid the use of vibration-intensive plant at distances where human discomfort will 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 • inform and consult with potentially affected receivers about upcoming vibration-intensive activities.	Detailed design Pre-construction	All locations where exceedances of the applicable construction vibration criteria are predicted at sensitive receivers.
NV5	Heritage vibration impacts	Vibration sensitive Aboriginal and non-Aboriginal heritage items which have potential to be impacted by the project works will be confirmed prior to the commencement of vibration generating works in proximity to relevant structures. Suitable, item specific criteria will be developed for heritage items and vibration impacts at these locations will be managed before commencement of construction. This may include the use of alternative construction methods which generate lower levels of ground vibration and the installation of vibration monitors while vibration intensive activities are conducted.	Detailed design	All heritage items where exceedances of the applicable construction vibration criteria are predicted.

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
NV6	Operational noise	An Operational Noise Review will be prepared to confirm the predicted noise impacts from the project (based on the final infrastructure locations). Where necessary, the operational mitigation measures to be implemented below will be revised so operational noise impacts are compliant with the project noise trigger levels, where feasible and reasonable. Where exceedances of the project specific noise trigger levels are predicted (i.e. transmission lines audible noise), feasible and reasonable operational noise and vibration mitigation measures will be further investigated prior to construction, in consultation with the affected receivers. This will include: • Transmission lines — Scheduling of maintenance activities during less sensitive times of day. — Noise control at the receiver, such as 'at property' treatment to upgrade aspects of the dwellings including the façade or ventilation systems. — Monitoring after the commissioning of the project to be conducted at each residence where potential operational noise levels are predicted to exceed project trigger levels. — If additional measures are found to be required during the compliance monitoring, these will be implemented as soon as practicable. • Energy hubs and switching stations — Adoption of lower generating noise equipment (where practicable). — Site layout designed to minimise noise impacts. — Restriction of operational parameters such as cooling fans where meteorological conditions are favourable. — Noise control at the receiver, such as 'at property' treatment to upgrade aspects of the dwellings including the façade or ventilation systems. — Monitoring after the commissioning of the project to be conducted at each residence where potential operational noise levels are predicted to exceed project trigger levels. — If additional measures are found to be required during the compliance monitoring, these will be implemented as soon as practicable.	Pre-construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
Hazard and risk				
BF1	Exposure of energy assets to radiant heat beyond the design tolerance of the asset	Asset Protection Zones (APZs) for switching stations and energy hubs (including the maintenance facility) will be established in accordance with the requirements of the NSW Rural Fire Service's documents Planning for Bushfire Protection 2019 (Appendix 4) and Standards for asset protection zones.	Pre-construction Construction	Key project assets in the operational area that require protection from the impact of radiant heat and direct flame contact associated with a bushfire
BF2	Exposure of energy assets to radiant heat beyond the design tolerance of the asset	Energy hubs, and switching stations, will be designed and constructed in accordance with bushfire attack level 29 in accordance with *AS3959-2018 Construction of Buildings in Bushfire Prone Areas*.	Pre-construction Construction	Operation area
BF3	Insufficient access to the construction and operation area for fire fighting	Access for firefighting appliances will be provided in accordance with Section 2 of the *NSW Rural Fire Service Fire Trails Standards*.	Pre-construction Construction Operation	All locations
BF4	Bushfire risk from construction	Hot work (activities involving high temperatures) and fire risk work (activities involving heat or with the potential to generate sparks) will be undertaken with appropriate safeguards to minimise the risk of ignition and spread of fire from construction activities, including suspension of hot work and fire risk work on days of elevated fire danger.	Construction	All locations
BF5	Bushfire risk from construction	Firefighting equipment will be maintained and made available for use during the construction phase in accordance with Planning for Bushfire Protection 2019 (NSW RFS 2019) including the following: • static water supply tanks with a minimum volume of 20,000 litres (each) will be provided at the construction compounds and workforce accommodation camps for firefighting purposes • 38 millimetre metal Storz outlets with a gate or ball valve will be provided as an outlet on each of the tanks • non-combustible water tanks and fittings will be used • firefighting equipment (inclusive of a slip on unit) will be maintained at and/or accessible to all active construction site personnel during the declared bushfire danger season and site personnel trained in its use.	Construction	All locations
HR1	Mine subsidence risk	Detailed design and construction planning will be undertaken in accordance with approvals issued by Subsidence Advisory NSW.	Detailed design Pre-construction	Mining areas

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
HR2	Impacts on underground utilities	The location of all services and utilities within the construction area will be confirmed prior to the commencement of construction (using Before-You-Dig searches, non-destructive digging and/or other appropriate methods). Any required protection or relocation will be designed in consultation with utility providers.	Detailed design Pre-construction	Construction area
AS1	Safety of aircraft movements	The final design of the project with transmission line and tower coordinates and elevations will be provided to the following stakeholders prior to construction: • Air Services Australia • Commonwealth Department of Defence • owners of Dalkeith, Tongy and Merotherie aircraft landing areas • NSW National Parks and Wildlife Service • property owners/occupiers within 5.5 km the transmission easement. Additional notification(s) will be undertaken if the final detailed design of the project alters the details previously supplied to these stakeholders, prior to the construction of the modified design elements.	Detailed design	Operation area
AS2	Aerial farming operations	At locations where the transmission lines will impact existing aerial farming operations, consultation will be undertaken with relevant landowners to identify appropriate mitigation arrangements such as the installation of aerial warning markers on the transmission lines (where feasible).	Detailed design	Operation area
AS3	Safety of aircraft movements	The following stakeholders will be notified of the scheduling of the use of cranes, drones and helicopters for the construction of the project, prior to the commencement of relevant works: • Air Services Australia • Commonwealth Department of Defence • property owners/occupiers within 5.5 km the transmission easement • owners at Dalkeith, Tongy and Merotherie aircraft landing areas • NSW Parks and Wildlife Service.	Pre-construction	Operation area

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
HA1	Storage and use of Dangerous Goods	Dangerous goods will be stored in accordance with suppliers' instructions and relevant legislation, Australian Standards, and applicable guidelines; and may include bulk storage tanks, chemical storage cabinets/containers or impervious bunds. Any storage areas will be designed in accordance with Australian Standard *AS1940: The storage and handling of flammable and combustible liquids* where applicable. All personnel required to work with Dangerous Goods and other hazardous material will be trained in their safe use and handling.	Construction Operation	All locations
HA2	Management of hazardous materials (design)	Further assessment of hazardous materials and dangerous goods will be undertaken during detailed design, when detailed information on material quantities and types, transport movements and BESS design details are known, to ensure the thresholds in Applying SEPP 33 are not exceeded. Safety in design will be considered and implemented in operational design in accordance with a Safety Management System (SMS) based on applicable Australian Standard and guidelines for the Lithium-ion packed batteries and Class 9 Dangerous Goods.	Detailed design	Energy hubs and switching stations
HA3	Battery Energy Storage System (BESS) thermal runaway and resultant fire	Prior to construction of the BESS, a Fire Safety Study will be prepared based on the final design of the BESS. The Fire Safety Study will be prepared in accordance with the *Hazardous Industry Planning Advisory Paper No. 2 'Fire Safety Study' guideline* (DoP, 2011c).	Detailed design	Merotherie Energy Hub
HA4	BESS thermal runaway and resultant fire	The BESS will be installed in accordance with *AS/NZS 5139 Electrical installations - Safety of battery systems for use with power conversion equipment*. Optimal operation conditions of the BESS will be maintained in accordance with the operational design requirements, Australian Standard *AS 1670: Fire detection, warning, control and intercom systems* and Best Practice Guide: Battery Storage Equipment – Electrical Safety Requirements (2018) or equivalent.	Detailed design	Merotherie Energy Hub
HA5	Pollutant release	The design of the BESS (if applicable) will identify containment measures to be provided for the containment of cooling water and oils to ensure no offsite discharge occurs.	Detailed design	Merotherie Energy Hub
HA6	Pollutants and smoke moving offsite	Emergency procedures will include details for the establishment of a downwind exclusion zone(s) and evacuation protocols to be implemented in the event of a fire at the BESS (depending on the severity of the event).	Operation	Merotherie Energy Hub

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
BF6	Bushfire risk during operation	The project APZ will be established at construction and managed during operation in accordance with Appendix 4 of *Planning for Bushfire Protection 2019* and the NSW Rural Fire Service's document *Standards for asset protection zones*.	Operation	All locations
Traffic and transport				
T1	Intersection and access point upgrades	As part of the detailed design process, an evaluation of the potential need for upgrades to the following intersections will be undertaken as detailed below: • intersection of Ulan Road/Neeleys Lane: Investigate and confirm if short channelised right and/or auxiliary left turn treatments (or suitable alternative) are required for safe access to the satellite workforce accommodation camp • intersection of Golden Highway/ Ulan Road: Investigate and confirm if a new short channelised right turn treatment (or suitable alternative) is required to provide safer intersection operation and to accommodate additional increases in traffic demand during construction. Where the need for intersection upgrades are required, these will be designed and constructed in accordance with Austroads Guidelines, relevant applicable standards and consider the appropriate design vehicles.	Detailed design	Intersections and access points to construction sites
T2	Road and traffic management	Traffic control plans will be prepared in consultation with the relevant road authorities. The plans will be implemented by licenced traffic management contractors. Necessary road occupancy licences and road related work approvals will be obtained prior to the commencement of relevant works (including site access and access tracks).	Construction	Construction routes, access tracks, construction compound and workforce accommodation camp accesses
T3	Road safety – design related	All accesses will be designed to accommodate the required construction vehicle(s) requiring access, and in accordance with relevant Austroads guidelines (where applicable). Road safety audits and routine inspections will be completed on a regular basis.	Construction	Construction routes, access tracks, construction compound and workforce accommodation camp accesses

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
T4	Road safety – driver related	The following road safety measures will be implemented with regard to driver management during construction: • a Driver Code of Conduct will be developed and implemented. The code will 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 • in-vehicle monitoring systems (IVMS) will be installed in relevant vehicles to monitor load limits and fatigue management • a Driver Fatigue Management Plan will be developed and implemented as part of the Construction Environmental Management Plan, and will incorporate appropriate measures to manage driver fatigue risks, including, but not limited to: — planning of regular breaks — mapping locations of driver rest areas along the proposed construction routes.	Construction	Construction routes, access tracks, construction compound and workforce accommodation camp accesses
T5	Rail safety	Early and ongoing consultation with the ARTC will be undertaken for works which will cross over existing rail lines. Relevant works will only proceed following receipt of applicable approvals/permits, including accreditations for workers requiring access within the rail corridor to undertake construction activities.	Construction	Where the transmission line requires access to rail corridor over railway tracks on select railway lines.
T6	Access track condition	Access tracks used for construction sites, construction compounds and workforce accommodation camps will be maintained to safe standard.	Construction	All areas affected by construction including construction routes, access tracks, construction compounds and workforce accommodation camp accesses
T7	Road condition	Pre-construction road dilapidation surveys and routine inspections will be completed along all nominated construction routes on local roads. Where rectification works are required due to project impacts, consultation with the appropriate road authority will be undertaken to confirm the scope of the work required.	Pre-construction Construction	Local roads

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
T8	Temporary lane closures or temporary road closures	Road Occupancy Licence(s) will be sought for all temporary lane closures (as required). Where road closures are likely to result in a significant traffic impact (e.g. short-term full road closure and long-term temporary lane/ road closures), prior consultation will be undertaken with potentially affected stakeholders (e.g. landowners, emergency services, transport services) and relevant approval(s) obtained from the relevant roads authority. Where feasible, temporary road closures will be planned to occur outside of the traffic peak periods to minimise impacts to the road network.	Construction	All roads that intersect with the transmission line alignment (for stringing of transmission lines) or on construction routes.
T9	Access to properties	Access to properties will be maintained throughout construction where feasible. Where this is not feasible, temporary alternative access arrangements will be provided following consultation with affected landowners and in accordance with the requirements of the pre-construction and construction Communication and Engagement Plan (as detailed in mitigation measure SI5). Disruptions to property access and traffic will be notified to landowners at least five days prior and in accordance with the relevant community consultation processes outlined in the Construction Environmental Management Plan.	Construction	All areas affected by construction
T10	Pedestrian and cyclist access	The project will actively consult with local bicycle groups, such as Central West Cycle (CWC) during construction, particularly regarding construction routes proposed on CWC's cycling route between Gulgong to Dunedoo. Safe pedestrian and cyclist access will be maintained where the project interacts with existing pedestrian or bicycle facilities. Where this is not feasible, temporary alternative access arrangements will be provided following consultation with affected stakeholders and the relevant roads authority.	Construction	All areas affected by construction.
T11	Heavy vehicles using road network	A Vehicle Movement Plan will be prepared which identifies the construction vehicle route(s) (including OSOM routes) to be used during construction. The Vehicle Movement Plan will also include details of activities of adjoining land uses and awareness of public safety measures (e.g. entering urban areas from the highways) to provide guidance to drivers of construction vehicles travelling to and from project locations. Ongoing consultation will be undertaken with Transport for NSW regarding the use of State roads for OSOM vehicle routes.	Pre-construction Construction	Construction routes.

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
T12	Access tracks maintenance and safety	The following maintenance and safety measures will be implemented at relevant locations along each of the access tracks, construction compounds and workforce accommodation camp access: • appropriate line marking and signage at access points • wheel cleaning facility as required at access points/intersections • signage to indicate trucks turning • potential use of road plates, propping (or similar) over culverts where required • improvements to existing roads at new access points which may include importing or stabilising material if required.	Construction	Access tracks, construction compound and workforce accommodation camp accesses
Waste				
WM1	Waste generation	Measures to minimise spoil generation, off-site disposal and reuse of material on-site will be investigated as part of the continued development of the project's design and construction methodology.	Pre-construction	All locations
WM2	Waste disposal	EnergyCo will explore further opportunities with Mid-Western Regional, Dubbo Regional, Warrumbungle Shire and Upper Hunter Shire councils to reduce landfill demand placed on local waste management facilities as a result of the project	Pre-construction	All locations
WM3	Waste generation	Where practicable, opportunities to re-use or recycle waste and wastewater generated during construction and operation will be investigated during continued development of the project's design and construction methodology, as well as during operation, subject to meeting water reuse quality requirements.	Pre-construction	All locations
WM4	Waste generation	All waste generated by the project will be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014a) and the relevant requirements of the Protection of the Environment Operations (Waste) Regulation 2014.	Construction and operation	All locations
WM5	Waste generation	Waste streams will be segregated to avoid cross contamination of materials and maximise reuse and recycling opportunities.	Construction and operation	All locations
WM6	Waste generation	All waste generated and surplus spoil to be removed from the construction and operation of the project will be transported to appropriately licensed waste disposal or transfer facilities or other facilities lawfully able to accept materials.	Construction and operation	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
Hydrology, flooding and water quality				
WA1	Construction water supply	Construction water supply arrangements will be confirmed during continued design development and detailed construction planning, based on further investigations that include ongoing consultation with water suppliers to access the local reticulated network, use of treated mine water, and use of water tanks within construction compounds.	Detailed design and pre-construction	All locations
WA2	Construction water supply	Opportunities to minimise water demand will be further explored during detailed design and construction planning, including: • capture and use rainwater at construction compounds and/or workforce accommodation camps • use of treated mine water, subject to any onsite reuse requirements • reuse/recycling of construction water (for example, water could be reused onsite for dust suppression, to assist with compaction) • treated wastewater and/or groundwater inflows • the use of additives in concrete mixtures to reduce the amount of water required • identification of alternative construction techniques which will reduce water use (where practicable).	Detailed design and pre-construction	All locations
WA3	Watercourse geomorphology	Where relevant, permanent erosion control measures will be designed and implemented at relevant energy hubs, switching stations and transmission line towers to minimise potential scour and erosion risks associated with surface water runoff during operation.	Detailed design and construction	Energy hubs, switching stations and transmission line towers
WA4	Dispersion of sediment into the environment	Areas disturbed as a result of construction activities will be managed in accordance with the requirements of *Managing Urban Stormwater Soils and Construction* (4th Edition) (Landcom, 2004). This will include the implementation of a range of erosion and sediment control measures which may include: • drainage control measures, e.g. flow diversion banks, straw bale berms and rock-lined chutes • sediment control measures, e.g. sediment fences, traps and basins and impervious covers • erosion control measures, e.g. covering of stockpiles, erosion control blankets, dust suppression measures (e.g. water trucks) and revegetation.	Construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
WA5	Water quality	A water quality monitoring program for construction will be prepared and implemented to monitor water quality conditions at perennial watercourses that the transmission lines will cross, and to facilitate monitoring of any changes in water quality that could be attributable to the project during construction. The program will detail: • water quality objectives and criteria for the project, in accordance with the *Murray–Darling Basin Plan 2012* (Murray–Darling Basin Authority, 2012) and *Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000* (ANZECC/ARMCANZ, 2000) • frequency, location and duration of sampling, as minimum will include at least two monitoring locations located downstream and upstream of the project on the Talbragar River, Talbragar River at Elong Elong (412042), Cudgegong River at Yamble Bridge (421019) and Wollar Creek • monitoring for total dissolved solids, dissolved oxygen, electrical conductivity, total suspended solids, total nitrogen and total phosphorus. In the event of exceedances of the project water quality criteria, soil and water management measures adopted as part of the Construction Environmental Management Plan will be reviewed and revised accordingly.	Pre-construction and construction	Relevant locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
FL1	Flooding	Detailed construction planning will consider flood risk at construction sites and support facilities, including: • reviewing construction work area layouts and staging construction activities in order to avoid or minimise obstruction of overland flow paths and limiting the extent of flow diversion required • designing the layout of construction facilities and implementing stormwater management controls during their establishment in order to manage the impact of flooding on construction personnel, equipment and materials • identifying and applying measures to not worsen flood impacts on the community and on other property and infrastructure during construction up to and including the 1% AEP flood event where practicable. Where warranted by the scale and nature of the proposed works this will include flood modelling and assessment to assess the extent of potential impacts and therefore the scope of mitigation measures that may be required • measures to mitigate alterations to local runoff conditions due to construction activities.	Detailed design	All locations
FL2	Flood behaviour (construction)	Stockpiles will be located in areas which are not subject to frequent inundation by floodwater, ideally outside the 10% AEP flood extent. The exact level of flood risk accepted at stockpile sites will depend on the duration of stockpiling operations, the type of material stored, the nature of the receiving drainage lines and also the extent to which it will impact flooding conditions in adjacent development.	Construction	All locations
FL3	Flood safety	Construction compounds and workforce accommodation will be located outside high flood hazard areas based on a 1% AEP flood event.	Detailed design	Construction compounds and workforce accommodation camps

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
FL4	Emergency management	Flood emergency management measures for construction of the project will be prepared and incorporated into relevant environmental and/or safety management documentation. This will include: • contingency planning for construction facilities that are located in areas that are inundated by mainstream flooding during a 1% AEP event • for construction facilities located within the floodplain the identification of how flood related risks to personal safety and damage to construction facilities and equipment will be managed • procedures to monitor accurate and timely weather data, and disseminate warnings to construction personnel of impending flood producing rain.	Pre-construction	All locations
FL5	Climate change adaptation	The impact of the project on flood behaviour will be confirmed during detailed design. This will include consideration of future climate change.	Detailed design	All locations
FL6	Impacts to existing flooding regime	The project will be designed to minimise adverse flood related impacts on: • surrounding development for storms up to 1% AEP in intensity • critical infrastructure, vulnerable development or increases in risk to life due to a significant increase in flood hazard for floods up to the PMF.	Detailed design	All locations
FL7	Flood impacts	The energy hubs and switching stations will be designed to manage adverse impacts on the receiving drainage lines as a result of changes in the depth, velocity, extent and duration of flow during storms up to 1% AEP in intensity.	Detailed design	Energy hubs and switching stations
FL8	Flood impacts	The energy hubs and switching stations, including their access road connections to existing roads, will be designed to ensure that the existing level of flood immunity of the road network is maintained and increases in flood depths and hazards along the road network are minimised.	Detailed design	Energy hubs and switching stations
FL9	Waterway impacts	Localised increases in flow velocities at drainage outlets and waterway crossings will be mitigated through the provision of scour protection and energy dissipation measures.	Detailed design and construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
Soils and contamination				
SC1	Mobilisation of saline soils	Prior to ground disturbance, a visual inspection will be undertaken in areas identified as potentially containing saline soils will be undertaken to look for the presence of saline soils. Areas where evidence of salting has been observed or recorded will be subject to further testing as required. If salinity is confirmed, excavated soils will be managed in accordance with *Book 4 Dryland Salinity: Productive use of Saline Land and Water* (NSW DECC 2008) to prevent impacts from salinity.	Construction	All locations
SC2	Impacts due to spontaneous combustion	Disturbance of areas of active (and previously active) surface mining, underground mine access and process routes will be avoided where practicable. Where this cannot be avoided, testing of the material(s) will be undertaken to confirm if High Carbon Material will be disturbed and/or exposed, and appropriate safeguards implemented to ensure the risk of spontaneous combustion is adequately controlled (in accordance with the *MDG Spontaneous Combustion Management Guideline* (Industry and Investment NSW, 2011)).	Detailed design, pre-construction and construction	Wilpinjong Coal Mine
SC3	Contamination exposure to human health and/or the environment	Disturbance to areas of medium to high risk of contamination will be avoided or minimised where practicable during construction. Management of contamination and any resulting remediation will be carried out in accordance with the relevant legislation, standards and guidelines, including but not limited to the National Environment Protection (Assessment of Contamination) Measure 1999, as amended 2013, and all relevant guidelines made or approved under the *Contaminated Land Management Act 1997* and the *Protection of the Environment Operations Act 1997*.	Detailed design and pre-construction	Areas of medium to high contamination risk
SC4	Contamination exposure to human health and/or the environment	Prior to construction activities within the Wilpinjong Coal Mine lease, areas subject to disturbance will be tested to confirm the presence/absence of contaminants of concern identified in Technical paper 16 – Contamination.	Detailed design and pre-construction	Wilpinjong Coal Mine site
SC5	Contamination exposure to human health and/or the environment	Additional intrusive investigations will be undertaken to confirm the presence/absence of the contaminants of concern prior to commencing ground disturbance within 50 metres of farm structures or farm dams (if applicable).	Detailed design and pre-construction	All locations
SC6	Impacts due to spontaneous combustion	Remediation areas disturbed during construction of the project will be capped in accordance with the Peabody Energy Wilpinjong Capping of Tailings Storage Facilities TD5 Procedure (WI-MIN-PRO-0119).	Construction	Wilpinjong Coal Mine site

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
SC7	Contamination impact to human health and/or the environment	An unexpected finds protocol will be developed and implemented to manage the discovery of previously unidentified contaminated material (including the discovery of high carbon material within mining lease areas outside of areas indicated by mine operators where this occurs).	Construction	All locations
SC8	Soil and/or water pollution	Construction materials, spoil and waste will be stored/ managed in accordance with applicable EPA requirements to minimise the potential for the project to result in the contamination of soil, groundwater, and/or surface water quality.	Construction	All locations
SC9	Soil and/or water pollution	All chemicals, fuels or other hazardous substances will be stored in accordance with the supplier's instructions and relevant legislation, Australian Standards, and applicable guidelines. The capacity of any bunded area will be at least 130 per cent of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s will be shown on site plans.	Construction Operation	All locations
SC10	Soil and/or water pollution	Incident response procedures will be implemented to avoid and manage accidental spillages of fuels, chemicals or fluids during operation and maintenance activities. Environmental spill kits will be provided at strategic, accessible locations, and staff will be trained in spill response procedures (as a minimum spill kits will be located at the energy hubs and New Wollar Switching Station).	Operation	All
Groundwater				
GW1	Lowering of groundwater levels due to interception and take of water	In the event that groundwater is encountered during excavations, any dewatering volumes will be recorded and managed in accordance with the *Water Management Act 2000*.	Construction	Areas of intercepted groundwater
GW2	Lowering of groundwater levels due to water extraction	Monitoring and recording of extraction volumes from water supply bores will be undertaken and regular analysis of extracted volumes will be completed against predicted volumes in Technical paper 17 (refer to Table 6-5), applicable water access licence and approval requirements.	Construction	Water supply bores at energy hubs
GW3	Impacts due to blasting	Control measures will be identified prior to blasting activities in relevant areas to avoid adverse impacts to sensitive groundwater receivers.	Construction	Finalised blasting locations if within 50 metres of high potential groundwater dependent ecosystems or existing bores

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
GW4	Damage to bore infrastructure	Direct impacts to registered bores will be avoided, where practicable. If the bores are not required to be removed during construction, then they will be clearly demarcated to protect the infrastructure. Where impact is unavoidable and a bore will require decommissioning, it will be replaced in a similar nearby location in consultation with landowner.	Construction	All locations
Air quality				
AQ1	Dust generation – general	Management measures to prevent or minimise dust generation and impacts to the local community and environment will include (but not be limited to): • use of water sprays or dust suppression surfactants as required for dust suppression where required and appropriate • adjusting the intensity of activities based on observed dust levels and weather forecasts • minimising the amount of material stockpiled and position stockpiles away from surrounding receivers • project construction vehicle movements are to adhere to designated entry/exit routes and parking areas • implementation of measures to minimise the tracking of material onto sealed roads (e.g., wheel wash) • covering of loads • stabilising disturbed areas as soon as practicable, including new access routes • minimising the extent of disturbance as far as practicable • regularly conducting visual inspections of dust emissions and applying additional controls as required • where practicable minimise concurrent construction activities near sensitive receivers that have a greater potential of the risk of dust impact.	Construction	All locations
AQ2	Vehicle and plant emissions	Where feasible, construction vehicles and machinery will be fitted with appropriate emission control equipment and maintained in a proper and efficient manner.	Construction	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
AQ3	Dust emissions from concrete batching plants	Measures will be implemented at concrete batching plants to minimise emissions to air as far as practicable. The measures will be regularly inspected with additional controls implemented as required. Measures to minimise emissions to air from concrete batching plants may include: • all aggregate and sand will be stored appropriately in storage bins or bays to minimise dust generation, and material will not exceed the height of the bay • cement silos and hoppers will be fitted with dust filters • all inspection points and hatches will be fully sealed • all dry raw materials to be transferred into the bowl of an agitator via front end loaders by maintaining adequate moisture levels and/or an enclosed conveyor • cement silos will be fitted with fitted with an emergency pressure alert and automatic cut off protection to prevent overfill • transfer of cement from storage to batching will occur via sealed steel augers.	Construction	Concrete batching plant(s)
AQ4	Dust emissions from crushing and screening plant	To minimise dust emissions associated with the proposed crushing and screening activities, the following measures will be implemented: • ensure screen covers are fitted to the screening operations • control dust emissions from screening operations using water sprinklers, where required and appropriate • inspect the water sprinklers on a regular basis 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.	Construction	Crushing and screening
AQ5	Vehicle emissions along construction routes	During high wind conditions (wind speeds greater than 5 metres per second), reduced speed limits for project heavy vehicles on unsealed roads will be implemented.	Construction	Construction routes

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
Climate change and greenhouse gas				
GHG1	Greenhouse gas emissions	A greenhouse gas (GHG) assessment and design refinement will be carried out during detailed design to identify opportunities to minimise GHG emissions during construction. Opportunities for consideration will include: • using low carbon concrete and steel in transmission line towers and civil infrastructure • giving preference to environmentally labelled products and materials, such as those with Environmental Product Declarations • implementing product stewardship schemes to take back, reuse or recycle materials/products used during construction to minimise waste and associated emissions • minimising vegetation clearing during construction to preserve carbon sinks • implementing efficient construction practices, such as modular construction and off-site fabrication to minimise construction time and associated emissions.	Detailed design	All locations
GHG2	Greenhouse gas emissions	A GHG assessment and design refinement will be carried out during detailed design to identify opportunities to minimise GHG emissions during operation. Opportunities for consideration will include: • designing and implementing energy-efficient transmission infrastructure to minimise energy losses during operation and lower GHG emissions • investigating the use of non-SF6 technologies for transformers and switchgear. If SF6 is required, leak detection systems will be considered, and regular inspections and maintenance undertaken to reduce the risk of SF6 leaks • incorporating solar energy technologies, such as installing solar panels, at energy hubs and switching stations to reduce energy consumption within the National Electricity Market which still includes fossil fuel generated electricity • transitioning to zero-emission vehicles for operation and maintenance equipment, such as battery electric vehicles or hydrogen fuel cell vehicles • implementing advanced monitoring and control systems for transmission infrastructure to optimise energy efficiency and reduce energy losses • implementing demand-side management strategies to actively manage electricity consumption, reduce energy demand and associated GHG emissions.	Detailed design, operation	All locations

Reference	Impact	Mitigation measures	Timing	Applicable location(s)
CC1	Climate change	A detailed climate change risk assessment will be carried out during detailed design in accordance with AS5334-2013.	Detailed design	All locations
CC2	Climate change	Following the detailed climate change risk assessment under mitigation measure CC1, adaptation measures will be developed to address climate change risks associated with bushfire, extreme heat, drought and increased rainfall intensity.	Detailed design	All locations

21.5 Project uncertainties and approach to design refinements

21.5.1 Project uncertainties

The project as presented in this EIS has been developed to avoid and minimise impacts wherever possible and has been designed to a level where the potential impacts of the project can be appropriately identified and assessed Some flexibility has been factored into the design as described in this EIS to allow for certain design elements and construction methodologies to be refined as part of the design development and construction planning process.

Key uncertainties and/or aspects of the design or construction methodologies that may be subject to further refinement are summarised in Table 21-2. Where aspects of the design or construction methodology are uncertain, the assessment has adopted a conservative approach by assuming a worst-case scenario.

Table 21-2 Project uncertainties

Uncertainty	Proposed resolution	Timing
Design		
Impacts on utilities as part of early works or main works to be defined in detail.	The location of utilities, services and other infrastructure, and requirements for access to, diversion, protection and/or support, and the timing of these works would be confirmed prior to construction. This would include (as required), undertaking utilities investigations, including intrusive investigations, and consultation and agreement with service providers.	Detailed design
Final transmission line tower locations, including the specific location, height and type of transmission line towers.	The type and arrangement of the transmission line towers would continue to be refined as part of the finalisation of the project design, with a view to further minimising environmental impacts, within the identified transmission line easement, wherever practicable.	Detailed design
Final layouts of the construction compound and workforce accommodation camp sites within the construction area.	The final layout of the construction compounds and workforce accommodation camps would be determined prior to commencement of construction.	Detailed design
Construction methods and staging, including the staging of the 330 kilovolts (kV) switching stations to reflect the delivery of renewable energy projects in the REZ.	Construction of the project would occur in stages and across multiple work fronts. This would mean that at any one time, construction activities would be occurring at several locations within the construction area at the same time. The sequencing of construction activities and phases would be confirmed as part of detailed construction planning.	Detailed design

Uncertainty	Proposed resolution	Timing
Use of helicopters or drones during construction.	Helicopters and/or drones (if available), would be used to string transmission lines. For the purpose of ensuring a conservative and robust assessment, helicopter use has been assessed as worst case scenario.	Detailed design
Inclusion of battery energy storage system (BESS) at Merotherie Energy Hub.	The Merotherie Energy Hub would comprise 500 kV and 330 kV switchyards and 500/330 kV substations including synchronous condensers; one of which may potentially be replaced with a BESS, subject to further technical investigations and feasibility considerations. For the purpose of ensuring a conservative and robust assessment, the construction and operation of the BESS has been assessed as worst case scenario.	Detailed design
Final volumes of water required for construction and confirmed water sources.	The actual water usage during construction is expected to vary during the construction period depending on the nature and extent of construction activities taking place. Opportunities to minimise water demand would be identified during detailed construction planning and implemented where feasible. Further investigation of options for the provision and storage of construction water would be undertaken during continued development of the project design and detailed construction planning, in consultation with local councils, water utility companies, licence holders and mine operators, as relevant. The preferred sources of construction water and the method of construction water storage would be confirmed prior to the start of construction.	Detailed design
Assessment matters		
Final operational noise mitigation requirements.	An Operational Noise Review would be prepared to confirm the predicted noise impacts from the project (based on the final infrastructure locations). Where necessary, the operational mitigation measures to be implemented below will be revised so operational noise impacts are compliant with the project noise trigger levels, where feasible and reasonable. Where exceedances of the project specific noise trigger levels are predicted (i.e. transmission lines audible noise), feasible and reasonable operational noise and vibration mitigation measures will be further investigated prior to construction, in consultation with the affected receivers.	Detailed design Pre-construction
Limited field investigation coverage within the study area for Technical paper 5 – Aboriginal cultural heritage assessment report.	A refined predictive model was developed using the initial predictions of cultural materials across the construction area, combined with the additional information from the desktop review to identify known and/or potential cultural materials, sites and places that may be present in the construction area to be targeted for field investigations. Weather and access constraints has limited survey coverage within the study area. Additional archaeological field survey would be undertaken of the portions of the construction area inaccessible during the ACHA. Any identified Aboriginal objects, sites, places and/or deposits during these works would be integrated into a revised Aboriginal Cultural Heritage Assessment, which would be submitted as part of the submissions report.	Pre-construction
Tentative significance assessment of culturally modified trees in the Technical paper 5 – Aboriginal cultural heritage assessment report.	Given the uncertainty in relation to identified culturally modified trees, it is recommended that additional specialist investigations are undertaken prior to approval of the project, and/or before the commencement of construction to clarify their status, and ultimately the management of these sites. Such analysis should include, but not be limited to inspection by an arboriculturist to provide further advice. A revised Aboriginal Cultural Heritage Assessment incorporating additional investigation would be submitted as part of the submissions report.	Pre-construction

Uncertainty	Proposed resolution	Timing
Limited field survey coverage within the study area for Technical paper 4 – Biodiversity Development Assessment Report.	Weather and access constraints has limited survey coverage within the study area. Where this has occurred, the assessment has assumed presence for threatened species or has relied upon existing mapping and aerial photography for plant community types until surveys can be completed.	Pre-construction
Potential to encounter contaminated soils.	Prior to ground disturbance, further testing and investigations would be completed to confirm contaminants present at areas with medium to high risk of contamination.	Detailed design Pre-construction Construction
Cumulative impacts based on limited project information and unknown or estimated project timeframes.	EnergyCo and the Network Operator will coordinate with other projects to manage potential cumulative impacts during construction and operation. This would involve collaboration and scheduling measures to minimise the potential cumulative impacts to sensitive receivers and maximise employment opportunities in local communities.	Detailed design Pre-construction

21.5.2 Approach to design refinements

Refinements to optimise project design outcomes and construction method would be carried out, where feasible, to:

- further avoid impacts on the community and/or environment during construction and/or operation
- respond to community and stakeholder feedback
- respond to final designs and timing for renewable energy generation and storage projects that interface with the project
- promote innovative outcomes and technological improvements
- reduce the construction timeframe
- improve the operation of the project without increasing the potential environmental impacts.

Refinements would generally occur within the construction and/or operational area as assessed, and in areas that are already subject to survey (in particular, ecological and heritage). Some refinements may be required in areas that have not been subject to assessment or survey. In such circumstances, additional survey and assessments would occur as required before confirming the change.

The final design would be reviewed for consistency with the approved project. This would consider if the design refinement:

- complies with the conditions of approval
- is consistent with the objectives and operation of the project as described in the EIS
- results in a change to the approved project that is not considered significant
- results in a potential environmental or social impact of a similar scale and nature as those considered in this EIS.

If a proposed refinement is not consistent, it would be considered a project modification. Approval for any modification would be sought in accordance with the requirements of Division 5.2 of the EP&A Act.

22 Environmental risk analysis

To identify the potential environmental, social and economic impacts that may arise as a result of the project and to determine the required level of assessment in accordance with the *State significant infrastructure guidelines – preparing a scoping report* (DPIE, 2021a) (Scoping Report guidelines), a preliminary environmental risk analysis was completed as part of the *Central-West Orana Renewable Energy Zone Transmission Project Scoping Report* (EnergyCo, 2022c) (Scoping Report). The preliminary environmental risk analysis was based on a preliminary design for the project and limited environmental information available at that time.

The preliminary environmental risk analysis has been updated to reflect the additional design development undertaken since the Scoping Report, the results of field investigations, assessment of impacts and feedback from property owners, community and stakeholders. The updated analysis identifies the impacts likely to remain after management and mitigation measures are applied (or residual impacts).

22.1 Environmental risk analysis methodology

The environmental risk analysis was undertaken in accordance with the principles of the Australian and New Zealand standard *AS/NZS ISO 31000:2018 Risk Management — Guidelines* (Standards Australia, 2018b). The approach included the following steps:

- reviewing the preliminary environmental risk analysis to identify any new potential impacts
- rating the risk of each identified potential impact by identifying the consequences of the impact and the likelihood of each impact occurring. This involved an update to the risk analysis completed in the Scoping Report, which was informed by the more detailed project description, community and stakeholder engagement outcomes and information gathered during the development of this Environmental Impact Statement (EIS)
- considering the probable effectiveness of the management and mitigation measures to determine the likely residual risk of each impact.

The definitions of likelihood are provided in Table 22-1 and the definitions of consequences are provided in Table 22-2. In determining the consequence, the scale of the impact (severity, geographical extent, and duration) and sensitivity of the receiving environment is considered (including values held by stakeholders and vulnerability to change).

The risk rating for each potential issue was then determined by combining the consequence and likelihood to identify the level of risk as shown in the matrix provided in Table 22-3.

Table 22-1 Risk analysis likelihood definitions

Likelihood	Definition
Certain	Expected to happen routinely during the project life.
Likely	Could easily happen and has occurred on a previous similar project.
Unlikely	Possible, but not anticipated.

Table 22-2 Risk analysis consequence definitions

Consequence level	Definition
Minor	• Minor effects on biological, social, economic or physical environment/values, both built and natural (actual or perceived). • Minor short to medium term damage to small area of limited significance, easily rectified and/or effectively mitigated.
Moderate	• Moderate effects on biological, social, economic or physical environment/values, both built and natural (actual or perceived). • Moderate short to medium term widespread impacts. More difficult to rectify and/or effectively mitigate.
Major	• Serious effects on biological, social, economic or environment/values, both built or natural (actual or perceived). • Relatively widespread medium to long term impacts. Rectification or effective mitigation difficult or impossible. Offsets may be required.

Table 22-3 Risk rating matrix

Likelihood	Consequence		
	Minor	Moderate	Major
Certain	Medium	High	High
Likely	Low	Medium	High
Unlikely	Low	Low	Medium

22.2 Environmental risk analysis

Using the framework described above, the environmental risk analysis results for the project are presented in Table 22-4. This identifies an initial risk rating for each of the environmental impacts and the residual risk rating derived after the application of management and mitigation measures as described in this EIS.

Table 22-4 Environmental risk analysis

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Land use and property									
Creation of an easement or acquisition of land for project infrastructure resulting in changes or limitations on land use (including private/public land, offset areas).	Direct	Construction/ Operation	Major (acquisition) Minor (easement)	Certain	High (acquisition) Medium (easement)	The acquisition of land and the creation of easements would occur in consultation with landowners, and in accordance with the *Land Acquisition (Just terms) Compensation Act 1991*. Land use would change where permanent infrastructure is located. In areas where an easement but no permanent infrastructure is required, the existing land use would continue subject to certain limitations.	Major (acquisition) Minor (easement)	Certain	High (acquisition) Medium (easement)
Temporary restrictions to land use due to the leasing and use of land for the construction area, access and ancillary facilities.	Direct	Construction	Moderate	Certain	High	EnergyCo will enter into a lease or other agreement with landholders where temporary use of private property is required for construction activities. These agreements would guide the management of construction impacts on private properties, thereby reducing the consequence. On completion of construction, land subject to a temporary lease agreement would be rehabilitated to its pre-existing condition where feasible and reasonable.	Minor	Certain	Medium
Impacts on state forests due to restrictions on adjacent land use during construction.	Indirect	Construction	Minor	Unlikely	Low	The project would not directly impact any state forests. However due to the proximity of the construction area to the boundary of the Tuckland State Forest, for safety reasons there may be temporary impacts to the normal use of the state forest during construction. EnergyCo would consult with the relevant stakeholders to establish appropriate measures and communication requirements.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Conflicts with aviation operations, such as aerial agricultural spraying, in the vicinity of transmission line infrastructure and associated construction activities including cranes, helicopters and drones.	Indirect	Construction/ Operation	Moderate	Likely	Medium	Information will be provided to relevant aviation operators and stakeholders on construction activities and permanent infrastructure that could pose a risk to aviation to reduce the likelihood of a conflict occurring.	Minor	Likely	Low
Impacts on mining leases and licences such that mine operations are affected.	Indirect	Construction/ Operation	Moderate	Likely	Medium	EnergyCo have engaged with mine operators on a regular basis throughout development of the project alignment, and where possible, avoided or minimised interactions with active mining areas, thereby minimising the disruptions to mining operations during construction. Engagement would continue during detailed design to further manage any interaction with mining operations.	Moderate	Unlikely	Low
Effects on access to properties and adjustments to infrastructure (fences/gates) as a result of changes to private access roads and internal access arrangements.	Direct	Construction/ Operation	Moderate	Likely	Medium	The development of individual property management plans would seek to reduce the impacts of the project on property access, and ensure any adjustments to infrastructure are planned, and undertaken in consultation with the landowner, taking into consideration their operational requirements.	Minor	Likely	Low
Impacts on services and utilities.	Direct	Construction	Moderate	Likely	Medium	Consultation with utility providers and the confirmation of services and utilities within the construction area will allow for the early planning of any protection and relocation works required. This would minimise the impacts to the users of these services and utilities.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Effects to access to Travelling Stock Reserves and other stock movements.	Direct	Construction	Minor	Likely	Low	Local Land Services will continue to be consulted during development of the project design to confirm how impacts on travelling stock reserves would be managed during construction and operation. Alternative access arrangements would be made as required.	Minor	Unlikely	Low
Agriculture									
Impacts on agricultural productivity and/or farming operations due to restrictions during operation (such as disruption to cropping and irrigation practices (including limitations on ground and aerial equipment or activities), limitations on stock movements and impacts to resources (water, soil, etc).	Direct/ Indirect	Operation	Moderate	Certain	High	During continued development of the project design, impacts from the operation of the project on agricultural productivity and agricultural operations would be investigated in consultation with affected landowners. This consultation would identify appropriate mitigation arrangements to minimise impacts to agricultural productivity and agricultural operations, where practicable. Although mitigation measures are expected to assist with reducing impacts, it is possible that the community would continue to have concerns about impacts.	Moderate	Likely	Medium

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Impacts on agricultural productivity and/or farming operations due to restrictions during construction (such as disruption to cropping and irrigation practices (including limitations on ground and aerial equipment or activities), limitations on stock movements, biosecurity risks, impacts to resources (water, soil, etc), impacts to livestock (due to construction noise and lighting)).	Direct/ Indirect	Construction	Moderate	Certain	High	Individual Property Management Plans would be prepared and implemented to reduce the potential impacts of the project on agricultural productivity or agricultural operations, and would seek to ensure any restrictions on agricultural operations are communicated and planned with individual landowners. Property Management Plans would be developed in consultation with each landowner to agree measures that would reduce the likelihood of impact.	Moderate	Likely	Medium
Impacts to biophysical strategic agricultural land (BSAL).	Direct	Construction/ Operation	Moderate	Likely	Medium	Route corridor planning sought to avoid areas of high value agricultural land such that only a small percentage of the area impacted during construction and operation is classified as BSAL. Where BSAL occurs within the construction and operation areas, it is largely located within the transmission line alignment with loss of BSAL land limited to permanent infrastructure such as tower locations. During operation, some agricultural activities can continue. Mitigation measures to minimise impacts to agricultural activities more broadly would minimise the consequence of this impact.	Minor	Likely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Introduction of biosecurity risks due to the movement and storage of machinery and materials, including the spread of weeds and pathogens.	Indirect	Construction	Moderate	Unlikely	Low	The implementation of biosecurity controls during construction would seek to minimise the risk of transporting or spreading disease, pests or weeds. Biosecurity management plans would address key matters and specific controls where high biosecurity risk are identified.	Moderate	Unlikely	Low
Landscape character and visual amenity									
Adverse impacts on landscape character and visual amenity from private/public places due to construction activities (e.g. vegetation clearing and earthworks), construction traffic, ancillary infrastructure and workforce accommodation camps.	Indirect	Construction	Moderate	Likely	Medium	Opportunities for retaining vegetation would be explored. However, vegetation would have a limited effect in minimising the visual impacts of the project from the public domain due to the height of the transmission line towers and the time taken for vegetation to establish.	Moderate	Likely	Medium
Light spill during the nighttime from construction and operational facilities.	Indirect	Construction/ Operation	Minor	Likely	Low	Lighting at construction , compounds, workforce accommodation camps, energy hubs and switching station would be orientated to minimise light spill and would be designed in accordance with Australian and New Zealand Standard *AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting*, thereby reducing the likelihood of impacts to visual amenity.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Adverse impacts on landscape character and visual amenity from private/public places due to permanent infrastructure.	Indirect	Operation	Major	Certain	High	Opportunities would be explored to retain or provide vegetation screening, where feasible, to minimise visual impacts. However, this would have a limited effect in minimising the visual impact at highly impacted residences due to the height of transmission towers and time taken for vegetation to establish.	Major	Certain	High
Biodiversity									
Clearing of native vegetation resulting in loss of fauna habitat, habitat fragmentation and loss of connectivity.	Direct/ Indirect	Construction	Major	Certain	High	Connectivity corridors will be investigated in the form of installation of under-transmission line glider poles where the construction area will impact habitat connectivity for arboreal species. The location and design of these glider poles and/or rope bridges will be nominated as part of a Connectivity Strategy. Opportunities to further minimise the removal of native vegetation would be considered during detailed design. However, around 1,032 hectares of native vegetation would be directly impacted and offsets would need to be secured.	Major	Certain	High
Impacts on listed threatened fauna, threatened flora species and endangered terrestrial ecological populations and communities.	Direct/ Indirect	Construction	Major	Certain	High	A series of mitigation measures aimed at minimising the impacts to listed threatened species and threatened ecological communities (TECs) would seek to reduce the consequence of impacts. EnergyCo will seek to offset residual impacts which cannot be avoided.	Moderate	Certain	High

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Increased native fauna mortality from risk of collision with construction vehicles.	Direct	Construction	Minor	Likely	Low	Access tracks near areas of fauna habitat would be designed to minimise impacts and the implementation of road signs and speed limits would ensure the consequence of vehicle strikes remains minor.	Minor	Likely	Low
Impacts to native vegetation (including EECs) and threatened species due to the transport of weeds and pathogens.	Indirect	Construction	Moderate	Unlikely	Low	The implementation of biosecurity protocols during construction would seek to reduce the consequence of the transport of weeds and pathogens.	Minor	Unlikely	Low
Increased native bird mortality from risk of collision with transmission lines.	Indirect	Operation	Moderate	Likely	Medium	The installation of bird diverters (at locations to be determined) would seek to reduce the frequency of fauna collisions, thereby reducing the consequence of fauna collisions with transmission lines.	Minor	Likely	Low
Impacts to native fauna due to electric and magnetic fields.	Indirect	Operation	Moderate	Unlikely	Low	There is currently no conclusive evidence to suggest that such effects would have a significant effect on the long-term viability of local bird populations. Bird diverters would be installed near wetland/riverine habitats to reduce fauna collisions with infrastructure and reduce impacts from electric and magnetic fields.	Moderate	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Impacts on aquatic ecology and threatened species, including as a result of riparian vegetation removal or changes in geomorphology, water quality and/or fish passage.	Direct/ Indirect	Construction/ Operation	Moderate	Likely	Medium	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, and temporary crossings designed in accordance with relevant guidelines. This would reduce the likelihood of impacts on aquatic ecology and threatened species.	Moderate	Unlikely	Low
Impacts on groundwater dependent ecosystems (GDE).	Indirect	Construction	Moderate	Unlikely	Low	Impacts to groundwater (quality or quantity) due to construction activities or water extraction would be unlikely to impact GDEs. Direct impacts (clearing) would impact around 45 hectares of GDEs.	Moderate	Unlikely	Low
Impacts on fauna due to increased dust, sedimentation and erosion, noise and light.	Indirect	Construction/ Operation	Minor	Likely	Low	The implementation of industry standard sediment and erosion control measures (including erosion and sediment control plans) would minimise the likelihood of impacts to fauna. Impacts to fauna from light spill have been assessed as negligible, and lighting would be designed in accordance with relevant standards and guidelines, thereby further reducing the likelihood of impacts.	Minor	Unlikely	Low
Impacts on the biodiversity values of protected and sensitive lands, including wetlands, National Parks and ecological conservation areas.	Direct/ Indirect	Construction/ Operation	Major	Certain	High	Direct impacts to Durridgere State Conservation Area would predominantly impact native vegetation (PCT1661), which provides habitat for threatened species. EnergyCo would seek to obtain offsets for these potential impacts.	Major	Certain	High

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Aboriginal heritage									
Impacts on registered Aboriginal heritage sites.	Direct/ Indirect	Construction/ Operation	Major	Certain	High	An Aboriginal Cultural Heritage Management Plan (ACHMP) will be developed by an Aboriginal heritage specialist in consultation with the Registered Aboriginal Parties (RAPs) and Heritage NSW and implemented for the duration of construction. Where possible, Aboriginal heritage sites would be avoided through tailoring of the construction methodology. If a heritage site cannot be avoided, archaeological investigation and salvage or archival recording would be undertaken. These mitigation measures would potentially reduce the number of sites impacted and therefore reduce the risk of this impact.	Moderate	Likely	Medium
Impacts on areas of known Aboriginal cultural sensitivity.	Direct/ Indirect	Construction/ Operation	Major	Certain	High		Moderate	Likely	Medium
Impacts on unidentified Aboriginal heritage sites or areas of archaeological sensitivity of cultural value.	Direct/ Indirect	Construction	Major	Likely	High		Moderate	Unlikely	Low
Non-Aboriginal heritage									
Impacts on listed heritage items	Indirect	Construction/ Operation	Minor	Likely	Low	Where possible, non-Aboriginal heritage items would be avoided through tailoring of the construction methodology. If a heritage site cannot be avoided, archaeological investigation and salvage or archival recording may be undertaken. These mitigation measures would reduce the consequence of this impact.	Minor	Likely	Low
Impacts on unknown/unlisted heritage items and areas of archaeological potential.	Direct/ Indirect	Construction	Moderate	Likely	Medium		Minor	Likely	Low
Social									
Refer to the residual risk analysis presented in section 13.8.3.									

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Economic									
Adverse economic impacts resulting from changes in agricultural productivity due to land acquisition or easement restrictions.	Direct	Construction/ Operation	Moderate	Certain	High	Construction of the project would result in a temporary reduction in the land available for agricultural activity. Individual Property Management Plans would be prepared and implemented to reduce the potential impacts. Outside of permanent infrastructure, agricultural activities within easements could continue during operation of the project, subject to restrictions. Consultation with affected landowners would continue to minimise impacts at each property through positioning of transmission towers and other infrastructure or management and access practices. Impacts would still occur but the consequence would be reduced.	Minor	Certain	Medium
Impacts (positive and negative) on other industries and businesses due to increased demand for services and materials.	Indirect	Construction	Moderate	Likely	Medium	Where these impacts cannot be avoided, a range of mitigation measures would be implemented, including a Workforce Management Plan and Industry Participation Plan. The economic consequences of these impacts would be both positive and negative.	Moderate	Likely	Medium
Employment impacts in the region (positive and negative) due to local employment opportunities, competition for workers or increased expenditure by the project workforce.	Direct/ Indirect	Construction	Moderate	Likely	Medium		Moderate	Likely	Medium

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Noise and vibration									
Potential exceedances of airborne noise management levels from activities within and outside standard construction hours, including activities at construction compounds and workforce accommodation camps.	Direct	Construction	Moderate	Certain	High	Standard and site-specific mitigation measures would be implemented to reduce noise impacts. Examples include selecting of quieter equipment and erecting temporary noise screens. Implementation of these measures would reduce noise exceedances and therefore the consequence. Opportunities to reduce the impacts associated with construction noise levels through the implementation of proactive community consultation will be examined, confirmed and implemented where reasonable and feasible.	Minor	Certain	Medium
Construction traffic resulting in an increase in traffic noise greater than two decibels.	Direct	Construction	Moderate	Certain	High	Construction traffic will be managed through a traffic management sub-plan to manage impacts. Measures in the sub-plan would include a driver code of conduct and scheduling of deliveries which will contribute to reducing the consequence of impact during construction.	Minor	Certain	Medium
Potential exceedances of vibration levels during construction or work within safe working distances to structures.	Direct	Construction	Minor	Certain	Medium	Standard and site-specific mitigation measures would be implemented to reduce vibration impacts. Examples include establishing a buffer around vibration sensitive heritage items and selecting of lower vibration/impact methods and avoiding overlap of vibration generating activities in close proximity. Implementation of these measures would reduce vibration impacts and likelihood of vibration exceedances.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Airborne noise impacts from the use of helicopters for transmission line stringing.	Direct	Construction	Major	Likely	High	Use of drones or helicopters for stringing transmission lines between towers may be required for short periods and would progress along the alignment. Helicopters will not be used during the evening and night.	Moderate	Likely	Medium
Noise impacts from operation of energy hubs, switching stations and transmission lines.	Direct	Operation	Moderate	Likely	Medium	Noise monitoring after the commissioning of the project will occur at each residence where potential operational noise levels are predicted to exceed project noise trigger levels. At-property treatments to reduce noise impacts would be determined in consultation with the landowner. Implementation of these measures will reduce the consequence of this risk.	Minor	Unlikely	Low
Potential exceedances of vibration levels during operation.	Direct	Operation	Minor	Unlikely	Low	Impacts are not anticipated and mitigation measures are not proposed.	Minor	Unlikely	Low
Hazard and risk									
Potential risks to the project by bushfire.	Direct/ Indirect	Construction/ Operation	Major	Likely	High	Preventative measures such as asset protection zones are proposed to minimise the impact on project infrastructure. However the risk remains major and likely.	Major	Likely	High

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Bushfire risks due to the project in bushfire prone areas.	Direct/ Indirect	Construction/ Operation	Major	Likely	High	Design and management measures would be implemented to reduce the likelihood of the project causing ignition of a bushfire. Preventative measures such as asset protection zones, emergency protocol, and regular maintenance and monitoring would be implemented to minimise the likelihood of the project causing ignition(and as noted in a recent Standing Committee on State Development (Parliament NSW, 2023) the risk of a bushfire being ignited by high voltage transmission lines is low). However, the consequence remains major.	Major	Unlikely	Medium
Potential incidents associated with transport and storage of hazardous materials and dangerous goods.	Direct	Construction/ Operation	Moderate	Unlikely	Low	Hazardous materials and chemicals used during construction would be handled and transported in accordance with relevant standards and regulations to ensure the risk remains low.	Moderate	Unlikely	Low
Potential incidents associated with operation of the potential battery energy storage system (BESS) such as thermal runway.	Direct	Operation	Major	Unlikely	Medium	Prior to construction of the BESS, a Fire Safety Study will be prepared based on the final design of the BESS. The BESS will be installed in accordance with *AS/NZS 5139 Electrical installations – Safety of battery systems for use with power conversion equipment*. Emergency procedures will include details for the establishment of a downwind exclusion zone(s) and evacuation protocols to be implemented in the event of a fire at the BESS (depending on the severity of the event).	Moderate	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Impacts to the project due to mining subsidence.	Direct	Construction/ Operation	Moderate	Unlikely	Low	As advised by the NSW Subsidence Advisory, the risk of mine subsidence impacting the project is low. Design and construction methods would be completed in accordance with the advice from the NSW Subsidence Advisory, reducing the consequence.	Minor	Unlikely	Low
Unexpected impacts to utilities causing significant disruption to services.	Direct	Construction	Moderate	Unlikely	Low	Preventative measures such as completing a Before You Dig search to identify and avoid underground utilities will be implemented to ensure the risk remains low.	Moderate	Unlikely	Low
Health risks to the surrounding community due to electric and magnetic fields from transmission lines, energy hubs and switching stations.	Indirect	Operation	Moderate	Unlikely	Low	Electric and magnetic fields would be compliant with the applicable reference levels to avoid health impacts at receivers and mitigation measures were not proposed. However, concerns in the community would remain.	Moderate	Unlikely	Low
Impacts to other aviation activities due to erection of transmission line towers, use of cranes and drones or helicopters during construction.	Indirect	Construction/ Operation	Moderate	Unlikely	Low	Mitigation measures to notify and provide details to relevant stakeholders on construction activities and transmission line tower locations and elevations that could pose a risk to aviation activities would be implemented to ensure the risk remains low.	Minor	Unlikely	Low
Traffic and transport									
Changes to road network performance due to construction vehicle movements (including workforce) and temporary road/lane closures.	Direct	Construction	Minor	Likely	Low	Mitigation measures in relation to traffic management, possible intersection treatments and stakeholder engagement would reduce the consequence and likelihood of any impacts on the road network performance or conflicts with other road users.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Impacts to condition of roads due to increased vehicular traffic.	Direct	Construction	Minor	Certain	Medium	The completion of dilapidation assessments before commencement of construction for construction routes, with requirements for routine inspections and any required rectification works, would reduce the likelihood of any adverse impacts to road condition.	Minor	Likely	Low
Impacts on access to and within properties.	Direct	Construction	Minor	Certain	Medium	Maintaining access to property, where feasible, or providing alternative arrangements with the affected landowner where existing access cannot be maintained would reduce the likelihood of impacts.	Minor	Likely	Low
Temporary disruptions to rail operations during transmission line stringing works.	Direct	Construction	Minor	Unlikely	Low	Temporary disruptions are unlikely as works would likely occur during rail maintenance periods or during rail possessions. Necessary approvals from Australian Rail Track Corporation (ARTC) would be obtained prior to any works in the rail corridor.	Minor	Unlikely	Low
Impacts to the performance of the road network during operation.	Direct	Operation	Minor	Unlikely	Low	Operations would generate minimal light vehicle traffic during routine inspections and maintenance, and mitigation measures are not required.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Cumulative impacts									
Potential temporary cumulative impacts with other major projects.	Direct/ Indirect	Construction	Moderate	Likely	Medium	Numerous projects have the potential to be under construction at the same time as the project, leading to potential cumulative impacts including biodiversity, visual, noise and traffic. However, these impacts are not likely to be major, generally due to these projects being located across a large geographic area (resulting in dispersal of cumulative impacts). There may be additional cumulative impacts on resources including water and local waste management capacity, however these would be managed through ongoing consultation with councils and water suppliers. Consultation with other project proponents to seek information on the timing of the other projects and understand their project impacts would be undertaken prior to construction.	Moderate	Likely	Medium
Potential permanent cumulative impacts with other major projects.	Direct/ Indirect	Operation	Moderate	Certain	High	For most matters, permanent cumulative impacts are minor, however there would be significant permanent cumulative visual impacts at a number of receivers, in addition to significant cumulative biodiversity impacts. Mitigation opportunities for cumulative visual impact are limited, and cumulative biodiversity impacts would be managed through offset planning and avoidance measures of the project and other projects.	Moderate	Likely	Medium

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Waste management									
Generation of excess spoil and other waste that cannot be reused on site (unsuitable for reuse or insufficient space) and needs to be disposed of.	Direct	Construction	Minor	Unlikely	Low	Waste streams will be segregated on-site to maximise reuse and recycling opportunities. The project would also target a cut-fill balance and would investigate approaches to minimise waste generation through design and/or construction methodologies.	Minor	Unlikely	Low
Impacts on local and regional waste management facilities due to increased demand from project generated construction wastes.	Direct	Construction	Moderate	Likely	Medium	Measures to minimise spoil generation, off-site disposal and reuse of material on-site will be investigated as part of the continued development of the project's design and construction methodology. EnergyCo will explore further opportunities with local councils to reduce landfill demand placed on local waste management facilities as a result of the project alongside ways to reduce waste generated during construction..	Moderate	Likely	Medium
Inappropriate management of waste generated during construction.	Direct	Construction	Moderate	Unlikely	Low	All waste generated by the project will be assessed, classified, managed and disposed of in accordance with the *Waste Classification Guidelines* (NSW EPA, 2014a) and the relevant requirements of the Protection of the Environment Operations (Waste) Regulation 2014, and transported to appropriately licensed facilities, reducing the consequence of impacts.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Inappropriate management of waste generated during operation.	Direct	Operation	Minor	Unlikely	Low	All waste generated by the project will be assessed, classified, managed and disposed of in accordance with relevant guidelines and regulations, reducing the likelihood of impacts. All waste generated will be transported to appropriately licensed waste disposal or transfer facilities or other facilities lawfully able to accept materials.	Minor	Unlikely	Low
Hydrology, flooding and water quality									
Surface water quality impacts due to erosion and sedimentation, contamination, leaks and spills, instream works and offsite discharge of water from concrete batching plants.	Indirect	Construction	Moderate	Likely	Medium	A range of measures would be implemented so that impacts to surface water quality would remain minor and unlikely. This includes measures to manage erosion and sediment, instream works or works near riparian areas, and potential sources of pollutants (e.g. materials stored on site, accidental spills, contaminated soil/groundwater). Runoff collected or wastewater generated by construction would be suitably managed, and treated appropriately before discharge.	Minor	Unlikely	Low
Potential exposure of soil salinity/saline soils resulting in off-site discharge of saline water resulting in exceedances of water quality trigger levels.	Indirect	Construction	Minor	Unlikely	Low	Further testing would be completed where required and feasible, and any confirmed saline soils would be managed in accordance with relevant guidelines so that discharges that leads to an impact would remain unlikely.	Minor	Unlikely	Low
Potential exposure of acid sulfate soils resulting in off-site discharge of acidic water.	Indirect	Construction	Minor	Unlikely	Low	Further testing would be completed as required, and any confirmed disturbance of acid sulfate soils (and any acidic water) would be effectively managed so that discharges that leads to an impact would remain unlikely.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Adverse impacts on flooding due to changes in overland flow paths and existing drainage paths as a result of the interruption of flow paths by temporary construction structures, materials, plant and equipment, etc.	Indirect	Construction	Minor	Unlikely	Low	Detailed construction planning would consider flood risk in order to avoid or minimise obstruction of overland flood paths and the extent of flow diversions, and to not worsen flood impacts on the community or other infrastructure.	Minor	Unlikely	Low
Impact to regional or local water supply due to construction water demands.	Direct	Construction	Moderate	Likely	Medium	Construction water supply options and measures to reduce water demand would continue to be explored during continued design development and detailed construction planning. Any water supply options and management would also occur in accordance with agreements between the construction contractor and relevant suppliers, reducing consequence.	Minor	Likely	Low
Adverse impacts on flooding due to changes in overland flow paths as a result of the interruption of flow paths by permanent structures and infrastructure (energy hubs , transmission towers).	Indirect	Operation	Moderate	Unlikely	Low	The impact on flood behaviour would be minor and localised, and changes in flow velocity or flood extent would be minimised through design, further reducing the consequence of impacts.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Impacts on hydrology due to changes to flow patterns (e.g. volume, rate, timing and velocity) and/or drainage patterns due to earthworks, stockpiling and other temporary changes to landform, dewatering or works in waterways for access tracks.	Direct	Construction	Minor	Unlikely	Low	Detailed construction planning would consider flood risk in order to avoid or minimise obstruction of overland flood paths and the extent of flow diversions that could lead to impacts on hydrology. In-stream works or works near watercourse would be conducted in accordance with the *Guidelines for controlled activities on waterfront land* (DPE, 2018c) and *Policy and guidelines for fish habitat conservation and management* (DPI, 2013) to minimise impacts on geomorphology.	Minor	Unlikely	Low
Impacts on hydrology due to changes to flow patterns (e.g. volume, rate, timing and velocity) and/or drainage patterns due to permanent structures and infrastructure (energy hubs, switching stations and transmission towers).	Direct	Operation	Minor	Unlikely	Low	Where feasible, permanent operational infrastructure and landforms would be designed to minimise any potential scour and erosion risks associated with changes to surface water runoff from impervious surfaces.	Minor	Unlikely	Low
Impact to local water supply due to operational water demands.	Direct	Operation	Minor	Unlikely	Low	Water demand during operation would be low. Opportunities to recycle wastewater generated during operation will be investigated during continued development of the project's design, as well as during operation, subject to meeting water reuse quality requirements.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Groundwater									
Impacts to nearby groundwater bores and groundwater dependent ecosystems due to groundwater drawdown, groundwater extraction for water supply, changes to groundwater quality and quantity and/or flow paths.	Indirect	Construction	Moderate	Unlikely	Low	Monitoring and recording of groundwater extraction during excavation and use of groundwater bores for construction water supply would be undertaken to ensure the risk remains low.	Moderate	Unlikely	Low
Impacts on groundwater quality due to mobilisation of contaminants, acidification or leaks and spills.	Indirect	Construction/ Operation	Minor	Unlikely	Low	Hazardous materials and chemicals would be handled and stored in accordance with relevant standards, and areas of potential contamination would be avoided where possible or subject to further investigation to ensure appropriate management of any contamination risk, thereby reducing the consequence of any impact.	Moderate	Unlikely	Low
Damage to existing groundwater bore infrastructure.	Direct	Construction	Moderate	Likely	Medium	Direct impacts to registered bores will be avoided, where possible. Where impact is unavoidable and a bore is destroyed, the consequence will be reduced by replacing the bore in a similar nearby location in consultation with landowners.	Minor	Likely	Low
Soils and contamination									
Erosion as a result of the disturbance of soils, particularly in soil landscapes characterised by dispersive soils.	Direct	Construction	Minor	Likely	Low	The management of soils, including dispersive soils, in accordance with the *Managing Urban Stormwater Soils and Construction 4th Edition* (Landcom, 2004) would reduce the likelihood of an impact arising during construction.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Disturbance of contaminated soils, and subsequent mobilisation resulting in impacts at adjacent receivers.	Direct	Construction	Minor	Likely	Low	The identification and subsequent management of areas identified as having a medium to high risk of existing contamination would reduce the likelihood of impacts occurring at adjacent sensitive receivers due to the mobilisation of contaminated soils.	Minor	Unlikely	Low
Exposure of acid sulfate soils or soil salinity during earthworks, and subsequent impacts to receiving environments and/or sensitive receivers.	Direct/ Indirect	Construction	Minor	Likely	Low	Further testing would be completed where required and feasible, and any confirmed saline soils would be managed in accordance with relevant guidelines, thereby reducing the likelihood of impacts occurring at sensitive receiving environments or receivers.	Minor	Unlikely	Low
Adverse impacts to structures due to underlying soil/geology suitability, salinity and acid sulfate soils.	Direct	Operation	Minor	Unlikely	Low	Geotechnical investigations indicated that soils range from non-aggressive to moderate for both concrete and steel, and the project would be designed in accordance with *AS 2159-2009: Piling – Design and Installation*.	Minor	Unlikely	Low
Contamination of soil due to leaks and spills.	Direct	Construction/ Operation	Minor	Likely	Low	With the implementation of standard mitigation measures with regards to the storage and use of chemicals, fuels or other hazardous substances (including incident response procedures), the potential for the contamination of surrounding soils would be low.	Minor	Unlikely	Low

Impact descriptor	Nature of impact	Project phase	Environmental risk screening (unmitigated)			Effect of key management and mitigation measures	Residual risk rating		
			Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating
Air quality									
Local air quality impacts due to dust generation (from exposed soil/stockpiles, excavation, concrete batching and vehicle movements) or emissions from construction plant and equipment.	Indirect	Construction	Minor	Likely	Low	A range of mitigation measures would be implemented in relation to dust-generating activities and emissions from concrete batching plants that would reduce the likelihood of impacts arising at sensitive receivers.	Minor	Unlikely	Low
Local air quality impacts during operation.	Indirect	Operation	Minor	Unlikely	Low	Operations would generate minimal emissions to air during routine inspections and maintenance, and mitigation measures are not required.	Minor	Unlikely	Low
Climate change and greenhouse gas									
Impact of climate change on energy infrastructure and operations.	Direct	Operation	Moderate	Likely	Medium	A detailed climate risk assessment would be undertaken during detailed design to identify adaptation to address climate change risks associated with bushfire, extreme heat, drought and increased rainfall intensity.	Minor	Likely	Low
Emissions of greenhouse gases during construction from embodied energy in materials, or emissions from construction plant and vehicles.	Direct	Construction/ Operation	Moderate	Likely	Medium	Opportunities to further reduce greenhouse gas emissions would be explored during detailed design and construction planning, reducing the consequence.	Minor	Likely	Low

22.3 Conclusion and next steps

The environmental risk analysis has identified that the following issues would have a high or medium residual risk after the implementation of management and mitigation measures outlined in this EIS:

- land use and property
- agriculture (medium only)
- landscape and visual
- biodiversity
- social
- economic (medium only)
- Aboriginal heritage (medium only)
- noise and vibration (medium only)
- hazard and risk
- cumulative (medium only)
- waste management (medium only).

For these issues, further reductions in the risk level will be investigated through the detailed design, construction methodology and development of management and mitigation measures where required. This would include (where practicable):

- resolving residual impacts through detailed design refinements
- development of construction methodologies and planning with the future construction contractor to ensure that management and mitigation measures are effectively implemented
- implementing a process of continuous improvement through the review, correction and audit of the mitigation measures and environmental management plans as detailed in Chapter 21 (Environmental management).

Issues with a low residual risk include:

- non-Aboriginal heritage
- traffic and transport
- hydrology, flooding and water quality
- groundwater
- soils and contamination
- air quality
- climate change and greenhouse gas.

Issues that have a low residual risk can be adequately managed through detailed design and construction, and by the implementation of standard management measures so that all necessary environmental criteria and guidelines would be achieved.

23 Justification and conclusion

This chapter provides the reasons justifying the carrying out of the project, considering the environmental, social and economic impacts assessed in this Environmental Impact Statement (EIS) and the requirements of the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation). The justification incorporates the strategic need for the project, demonstrates how the project objectives are achieved and provides an evaluation of the overall findings of the EIS, including how it addresses the relevant statutory requirements.

23.1 Strategic considerations

23.1.1 Summary of strategic need

The Australian Government is committed to coordinated global action to reduce greenhouse gas emissions in line with the Paris Agreement and has set targets to reduce emissions by 43 per cent below 2005 levels by 2030 and to net zero by 2050. Independently, the NSW Government has set a goal to achieve net-zero emissions by 2050 (DPIE, 2020a). Achieving these goals requires transformative low emissions technologies to be deployed at scale across all sectors of the economy. This includes the electricity generation sector which is currently Australia's largest source of greenhouse gas emissions, accounting for 33 per cent of Australia's total annual emissions in 2020 (Climate Change Authority, 2020).

Coal-fired generation is withdrawing faster than anticipated (AEMO, 2022a), due to large coal-fired power plants, such as the Eraring and Bayswater power stations, closing ahead of originally anticipated retirement dates (Eraring power station to potentially close by 2025 and Bayswater Power Station to close by 2033, in addition to the closure of the Liddell Power Station in April 2023). This highlights the urgent need to develop and connect new renewable energy projects to the National Electricity Market (NEM), to continue to have enough energy to meet future demand, while meeting Australia's carbon emissions policy commitments.

The Central-West Orana REZ was formally declared on 5 November 2021 under the *Electricity Infrastructure Investment Act 2020*. As NSW's first REZ, the Central-West Orana REZ will play a pivotal role in underpinning NSW's transition to a clean, affordable and reliable energy sector. The Central-West Orana REZ declaration (November 2021) provides for an initial intended network capacity of three gigawatts. The NSW Government is proposing to amend the declaration to increase the intended network capacity to six gigawatts, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network.

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 able to connect to the network. The existing transmission network is not capable of transferring the scale of new electricity generation identified for the Central-West Orana REZ. Development of new electricity generation and storage projects in the Central-West Orana REZ will require new high voltage transmission infrastructure in the region.

The project would enable 4.5 gigawatts of new network capacity to be unlocked by the mid-2020s and enable renewable energy generators within the Central-West Orana REZ who are successful in their bids to access the new transmission infrastructure to export electricity to the rest of the network.

The transition towards renewable energy technology responds to the need to reduce the emission intensity of the electricity sector and to secure alternatives sources of electricity supply to replace coal-fired power, which is scheduled to withdraw from the NEM. Investment in renewable energy projects is focused on regional areas of NSW with the best renewable energy resources. To enable new renewable energy generation to connect to the existing electricity network and to supply clean and affordable electricity to end users, investment in new transmission infrastructure is needed. Projects such as the Central-West Orana REZ Transmission project will strengthen the transmission infrastructure in regional locations and facilitate continued investment in renewable energy.

23.1.2 Achieving the project objectives

The project would contribute towards meeting the NSW Government's objective of encouraging and coordinating generation, storage and network investment in the Central-West Orana REZ under the *NSW Electricity Infrastructure Roadmap* (DPE, 2020). The strategic challenges, objectives and intended outcomes for the project are presented in Figure 23-1, while the challenges, objectives and intended outcomes for project delivery are presented in Figure 23-2.

Strategic

Challenges	Objectives	Outcomes
Ability to meet emission reduction targets set by the NSW Government and the Australian Government	• Support government decarbonisation targets and the transition of the NEM from traditional energy sources to lower emission alternatives based on renewable energy.	• Reduced emissions and a greater mix of renewable energy in the NEM.
Planned closure of aging major coal-fired power generators over the coming decade will create power shortages if this generation capacity is not replaced	• Develop the architecture for the Central-West Orana REZ so that it encourages delivery of, and reduce barriers to the development of viable grid-scale renewable energy projects within the REZ in the near term to deliver a source of affordable and reliable energy. • Deliver the Central-West Orana Transmission Project, a key element of the NSW Electricity Strategy and Electricity Infrastructure Roadmap, by the mid 2020's before the retirement of key coal-fired power stations. • Provide high-capacity connections to mature grid-scale generation projects within the Central-West Orana REZ to enable earlier delivery of bulk power.	• Improved reliability and energy security, by delivering large amounts of new energy supply into the NEM. • Unlock major investment in new renewable energy and regional economies. • Placing downward pressure on customer bills through lower energy generation costs and increased competition.
Increased demand for electricity as technology and industry shifts towards electrification	• Design the Central-West Orana REZ to meet current bulk energy demands and enable efficient expansion to meet future demand as this grows.	• Network infrastructure that will: – meet current and future needs efficiently, reducing ongoing impacts to the community by building it right the first time; and – support ongoing development and investment in renewable energy projects within the REZ to meet growth in demand.
Traditional sources of inertia and stability in the network are lost as fossil fuel generators are retired	• Design the Central-West Orana REZ to address issues of inertia and stability by including equipment and technology within the design of the Central-West Orana REZ to ensure stability and reliability.	• Delivery of a transmission network that can efficiently and reliably deliver bulk power from renewable sources at reliability levels consumers expect of the NEM.

Figure 23-1 Strategic project challenges, objectives and outcomes

Project		
Challenges	**Objectives**	**Outcomes**
Delivering a project that minimises impacts to local communities along the transmission route during construction and operation	• Engage in open and honest dialogue with the community and stakeholders during the development and delivery of the project, to improve the design and reduce impacts to the community and landowners where reasonable and feasible. • Through corridor development and refinement, avoid large centres of population. • Work with landowners to identify how the project may impact their properties and businesses and develop measures to manage and mitigate those impacts.	• Deliver a project that is supported by the local community and landowners by engaging in an open and transparent consultation process through the development of the projects design, as well as its construction and operation.
Potential for the project to result in conflict with other valued land uses such as agriculture	• Plan for, design and deliver a project that: – Seeks to utilise previously disturbed land to avoid and minimise impacts to other valued land uses. – Minimises the amount of prime agricultural land required for construction and permanent operational infrastructure. – Allows for continued agricultural land uses and farming practices within the Central-West Orana REZ.	• Impacts to agricultural land and farming practices would be avoided and minimised as much as possible throughout construction and operation of the project.
Cumulative impacts of network infrastructure and generation projects	• Plan and deliver transmission and generation projects in a coordinated manner and in consultation with stakeholders, including generators. • Reduce cumulative impacts from construction and operation of the project with other renewable energy projects in the Central-West Orana REZ.	• Efficient and coordinated delivery of network infrastructure and generation projects. • Reduced impacts on local communities during construction and operation.
Potential for the project to result in adverse environmental impacts	• Plan for, design and deliver a project that protects natural and cultural resources, and minimises impacts to: – natural systems, including biodiversity – Aboriginal and non-Aboriginal cultural heritage – visual amenity – water resources and water quality. • Implement strategies to mitigate and offset impacts and to recreate important environmental values in the region.	• Environmental impacts of the project during construction and operation would be avoided and minimised where feasible. • The scale of the project allows new environmental values to be recreated for the benefit of the region. • The project will support the delivery of viable grid-scale renewable energy to reduce the need for fossil fuel generators.

Figure 23-2 Project delivery challenges, objectives and outcomes

23.2 Biophysical, economic and social considerations

Potential impacts on the environment were identified early in the project development process, and approaches to avoid or reduce impacts were identified during the options assessment, corridor refinement and reference design development. Engagement with stakeholders and the community has contributed to the understanding of potential impacts and has enabled the design and construction methodology to respond to and minimise potential impacts, where practicable.

23.2.1 Actions taken to avoid or minimise the impacts of the project

The project has undergone a process of development and evaluation of alternative transmission corridor options from feasibility to early design development. The development of the project from the identification of the revised study corridor through to the current EIS study corridor has sought to avoid or minimise potential impacts, noting that in some circumstances, a number of competing environmental and technical constraints are present which requires adopting a balanced approach to corridor planning to determine the most appropriate project alignment. Broadscale environmental constraints criteria have been generally applied throughout the project development process as described in Chapter 2 (Strategic context).

The planning and design process for the project has been carried out to avoid and minimise environmental, economic and social impacts as much as possible. Key environmental and social considerations that have influenced the project and how the project has been refined to avoid and minimise potential impacts are summarised in Table 23-1.

Table 23-1 Key strategies to avoid and minimise impacts

Aspect	Design refinements to avoid and minimise impacts
Property and land use	• The alignment has been collocated where feasible with land planned to be used for other renewable energy generation projects to minimise further cumulative impacts to property and land use. • The alignment has been developed in consultation with mine operators with the aim of minimising impacts on the operation of the Wilpinjong, Moolarben and Ulan coal mines.
Agriculture	• A large area mapped as biophysical strategic agricultural land (BSAL) has been avoided to the north-east of Merotherie and between the Merotherie Energy Hub and the New Wollar Switching Station. • The alignment has been developed to avoid as much cropping land as possible. Where the alignment is located on private agricultural land, it has been developed in consultation with landowners (where possible) and sought to utilise areas used for grazing where practicable.
Visual	• The transmission line alignment has been co-located within previously disturbed land, including three active coal mines and next to existing transmission line easements between the Merotherie Energy Hub and New Wollar Switching Station to minimise impacts to private residential dwellings and property. • The distance between the project and existing dwellings and towns along the transmission line easement has been maximised by following a route which is located away from the towns of Gulgong and Dunedoo. • The New Wollar Switching Station has been positioned close to the existing Wollar substation to utilise a location which is away from a large number of residential receivers.

Aspect	Design refinements to avoid and minimise impacts
Biodiversity	• Areas of dense vegetation associated with the Goulburn River National Park have been avoided by the project. • The revised transmission line alignment through Moolarben has minimised the extent of Regent Honeyeater habitat impacted by the project. • The location of the Merotherie Energy Hub has avoided impact to identified breeding habitat for the Little Eagle at Merotherie. • The project has avoided known populations of threatened flora species north of the Elong Elong Energy Hub in Cobbora. • The transmission line alignment between the energy hubs traverses the narrowest section of intact vegetation within Tuckland State Forest, and the alignment has been located in areas devoid of threatened ecological communities (TECs) e.g. east and west of Wallerawang Gwabegar Railway. • Selection of the energy hubs was based on having large portions of land mostly devoid of TECs and with little to no native vegetation. • The location of Merotherie Energy Hub enabled the transmission line alignment connection to proposed wind farms to the north-east of the project to be in areas predominantly devoid of TEC's. • Other biodiversity avoidance measures have also been implemented as detailed in Section 10.5, and Chapter 7 of Technical paper 4 – Biodiversity Development Assessment Report.
Aboriginal heritage	• The construction area has been relocated to avoid two of the most significant griding groove sites at Prospect Creek and Talbragar River, found during field investigations. • The transmission line alignment has been shifted in the vicinity of Cockabutta Creek, southeast of the Merotherie Energy Hub following the identification of culturally important places by registered Aboriginal parties (RAPs). • The construction area has been refined to the east of the Wilpinjong Coal Mine to avoid/minimise impacts on documented cultural sites and places.
Non-Aboriginal heritage	• The project has avoided direct impacts to the following unlisted heritage items: — Dapper Homestead (CWO-22-HH01) — Dapper Hut and Shed (CWO-22-HH02) — Avondale Homestead (CWO-22-HH04) — Cope Road Archaeological Site (CWO-22-HH14) — Moolarben Archaeological Site (CWO-22-HH15).

23.2.2 Summary of biophysical impacts

The most significant impact to the biophysical environment arising from the project would be on biodiversity due to the extent of vegetation clearing required to facilitate construction and operation of the project. Construction of the project would result in direct impacts to around 1,032 hectares of native vegetation, including 22 plant community types (PCT). Four of the 22 PCTs expected to be impacted are listed as TECs listed under the *Biodiversity Conservation Act 2016* (BC Act) and three are listed as TECs under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In addition, construction of the project has the potential to directly impact 33 threatened flora and fauna species, or their habitats. Indirect impacts during construction have all been assessed as negligible or low impact except for inadvertent impacts on adjacent habitat or vegetation, and the loss of breeding habitat such as hollow-bearing trees and burrows and fallen timber, which has the potential to affect native animals within and adjacent to the construction area of the project.

Biodiversity offsets would be required for impacts to PCTs, threatened species and/or populations. Offsets would be secured in stages to reflect the progressive delivery of the 500 kV and 330 kV network infrastructure. The final offset requirements, strategy and proposed delivery approach would be confirmed by EnergyCo during detailed design and once the final construction area is confirmed.

Other biophysical impacts include potential impacts to groundwater and surface water and potential hazards such as bushfire. Impacts to water quality due to construction activities and ongoing maintenance activities would be minimal and manageable through the implementation of standard mitigation measures such as erosion and sedimentation controls and procedures for the safe handling of materials. Construction and operational activities would not result in permanent inflow or take of groundwater. The project is predicted to generally have a limited impact to groundwater, which would be further reduced with the implementation of mitigation measures outlined within the Construction Environmental Management Plan (CEMP) and the Soil and Water Management sub-plan.

Potential hazards during construction of the project would be temporary and associated with the use, storage and transportation of low volumes of dangerous goods and hazardous materials and bushfire risks as a result of construction, and to the project from external sources. Mitigation measures, such as procedures for the safe handling and storage of dangerous goods, would be implemented to minimise these risks during construction. During operation, ignition of bushfires has the potential to occur during maintenance of the project infrastructure and from operation of project infrastructure, for example from equipment malfunction or lightning strike. Asset protection zones (APZs) and transmission line easements managed as APZs would be established within the operation area to minimise the risk of ignition from project infrastructure and risk to infrastructure from bushfires.

23.2.3 Summary of economic impacts

Construction and operation of the project would provide positive economic activity to the regional and NSW economy. The direct and indirect impacts on the regional economy during construction are estimated at up to $512 million in average annual output (the gross value of business turnover in a region). During the peak construction period, it is expected around 1,800 full time equivalent construction workers would be employed.

Increases in labour demand from the project could potentially lead to short term increases in construction wages and associated labour shortages in other areas of the economy. The operation of the project would create only a small demand for regional labour resources and regional inputs to production. Consequently, no wage or price increases or production shortages are anticipated.

Construction of the project would result in a reduction in the land available for agricultural activity. The agricultural impacts of the project during construction are less than 0.3 per cent of agricultural economic activity in the region and a fraction of the economic activity gains from the project. Following construction, the project would result in smaller reduction in agricultural land due to the comparatively smaller operational area.

23.2.4 Summary of social impacts

The key social impacts from the project are associated with land use, Aboriginal heritage, non-Aboriginal heritage, traffic and amenity impacts such as visual and noise impacts. The most significant impacts to the community would be from land use change, in particular the loss of agricultural land. The project would require the use of agricultural land either permanently (for operation) or temporarily until construction activities are completed. Once operational, around 825 hectares of agricultural land would be permanently removed to accommodate the establishment of permanent infrastructure (which would be confirmed during detailed design, and may increase at Elong Elong to accommodate its initial operation at 330 kV). The remainder of the agricultural land in the operation area would consist of transmission line easements, where land could continue to be used for grazing and other agricultural activities such as cropping, where possible and subject to certain restrictions.

Amenity impacts from the project would occur during construction and operation. Noise and visual impacts during construction would have the greatest amenity impact to private dwellings, with other lesser construction amenity impacts associated with dust emissions and traffic generation. Noise level exceedances are predicted at many residential receivers in the vicinity of the project particularly during construction. Generally, earthworks associated with establishing transmission line tower foundations, energy hubs and switching stations are identified as the nosiest work stage during construction. Use of drones or helicopters for stringing transmission lines between towers may be required for short periods and would progress along the alignment. Where required, this activity would result in additional exceedances during the daytime (including outside of construction hours) as noise levels would be approximately 4 dB greater than the noisiest earthworks. Furthermore, these impacts would generally be transient, as work moves along the transmission line alignment.

Noise would be generated from the operation of project infrastructure and maintenance activities with noise exceedances predicted at five properties. Noise exceedances predicted at five receivers would be confirmed during operation and where necessary receiver-based noise treatment is considered feasible and reasonable to manage audible noise from transmission lines. Any at-property noise treatment would be completed in consultation with the landowner.

Temporary and permanent landscape and visual impacts would occur, primarily due to the introduction of new large scale structures including energy hub infrastructure and transmission line towers during operation, the removal of vegetation and the associated construction activities and sites. During operation, the presence of permanent project infrastructure would have negligible to moderate landscape character impacts from public viewpoints. Of the 26 public viewpoints assessed, the majority would experience a moderate to high magnitude of change given the prominence of the project within a rural landscape with limited large-scale structures. Of the 91 assessed private viewpoints, it was identified that 10 host properties and three non-host properties would experience a high visual impact, and seven host properties and 13 non-host properties would experience a moderate visual impact. However, these impacts may potentially be reduced through the implementation of mitigation measures to be investigated further in consultation with affected property owners.

There are 37 Aboriginal sites and 17 unlisted non-Aboriginal heritage items located partially or wholly within the construction area, which have conservatively been assessed as potentially subject to direct impacts due to physical disturbance during construction and/or operation. Several Aboriginal sites and non-Aboriginal heritage items would also be indirectly impacted during construction and operation. To minimise and manage potential impacts on heritage significance within the construction area, a range of mitigation measures would be implemented. Where possible, heritage sites would be avoided through refinements to the construction methodology or micro-siting of transmission line towers. If a heritage site cannot be avoided, a number of heritage management actions may be implemented, including non-intrusive geophysical investigations, archaeological test excavations, salvage or archival recording may be undertaken. Prior to construction, an Aboriginal Cultural Heritage Management Plan (a sub-plan to the CEMP) would be developed by a heritage specialist in consultation with the registered RAPs to manage and avoid impacts to Aboriginal heritage within the construction area.

23.2.5 Community views

The project is a large and complex infrastructure project with a high level of interest from the community and stakeholders, including renewable energy supplier generation projects in the Central-West Orana REZ. Engagement with communities and stakeholders about proposed new transmission network infrastructure in the Central-West Orana REZ has been ongoing since 2020. The key issues raised by the community and stakeholders include:

- concerns about the consultation process, including a view in the community that there has been inadequate consultation on the project, but also feedback that there was broader consultation fatigue as a result of the large number of development projects (and associated consultation processes) in the region
- the impact of construction, including disturbance of private land, disruption of social services, use of accommodation camps for the construction workforce and traffic management
- impacts to agricultural activities during construction and operation including any restrictions on activities as a result of the easement
- environmental impacts including vegetation clearing, erosion and waste generation
- visual impacts from project infrastructure
- bushfire risks associated with the transmission line as a source of ignition
- clarification of the process for the development of the alignment including any alternatives considered
- REZ planning and governance including the need and approach taken to developing the REZ
- feedback on the proposed locations for transmission infrastructure
- property impacts including acquisition and land values
- socio-economic impacts including business impacts and community benefits.

23.2.6 Ecologically sustainable development

Section 192(1)(f) of the EP&A Regulation requires an EIS must contain the reasons justifying the carrying out of the development, activity or infrastructure, considering biophysical, economic and social factors, including the principles of ecologically sustainable development set out in section 193.

The project is consistent with the four principles of ecologically sustainable development outlined in clause 193 of the EP&A Regulation as follows.

Precautionary principle

The precautionary principle (as defined as in clause 193(2) of the EP&A Regulation) provides that '...if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation'. In applying the precautionary principle, public and private decisions should be guided by:

- careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment
- an assessment of the risk-weighted consequences of various options.

Biodiversity and Aboriginal heritage field investigations commenced early in the project development phase with the aim of gathering data on the existing environmental condition of the project and surrounding land to integrate environmental considerations into project development decisions and to provide a scientific evidence base for impact assessment in the EIS. This field data, along with desktop data, has informed the development of the project including the evaluation of the environmental risks of alternative transmission corridor options with the aim to avoid or minimise potential impacts to the fullest extent possible.

The assessments undertaken and documented in the EIS and technical papers are consistent with accepted scientific and assessment methodologies and have considered relevant statutory and agency requirements and guidelines. Where uncertainties were identified in assessment, a conservative approach was applied. For example:

- where weather and access constraints have limited ecology survey coverage, the assessment has assumed presence for threatened species or has relied upon existing mapping and aerial photography for PCTs until surveys can be completed
- where building conditions of sensitive receivers are unknown or final construction methodology is to be determined, the most conservative assumptions have been used in the noise modelling and vibration assessment for construction and operation
- monitoring and further investigation have been proposed to verify assessment findings, including noise and surface water monitoring and further investigation of areas of contamination concern with a medium or higher risk.

The assessment of potential biodiversity impacts considered the potential direct and indirect impacts of the project on native vegetation and habitats, threatened species, protected areas and key threatening processes. This included assessment of potential serious and irreversible impacts (SAII) on threatened species, populations, or ecological communities.

Two of the four TECs are listed as being at risk of SAII, and direct impacts to one EPBC listed TEC (White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland) are identified as being potentially significant. Two threatened flora species, *Euphrasia arguta* and *Commersonia rosea*, assumed to be present in the construction area are identified as being at risk of an SAII. Five threatened fauna species are also identified as being at risk of an SAII. This includes two threatened microbat species (Eastern Cave Bat and Large-eared Pied Bat), Brush-tailed Rock-wallaby, Broad-headed snake, and the Regent Honeyeater.

The project would impact some areas within 100 metres of potential breeding habitat for two threatened microbat species, which would comprise potential foraging habitat only. Habitat areas for the Brush-tailed Rock-wallaby and broad-headed snake would be impacted. However, construction would not directly impact on irreplaceable habitat features for these species.

The project would impact around 96 hectares of mapped 'important habitat' for the Regent Honeyeater, which represents around 0.32 per cent of the species' geographical range. This would result in localised fragmentation of the species habitat. However the population is not currently considered to be severely fragmented (based on EPBC Act criteria and regulations), and therefore there is no evidence that the population would become unviable.

Mitigation and management measures have been proposed, where feasible, to minimise and manage potential impacts to biodiversity where impacts have not been able to be avoided (refer to Chapter 21 (Environmental management)). Based on the assessments undertaken in the EIS, including the application of mitigation measures, the project is not anticipated to result in serious or irreversible damage to the environment.

Intergenerational equity

The principle of inter-generational equity (as defined in clause 193(4) of the EP&A Regulation) provides that '...the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.'

The project would support the transition of the NSW Transmission System (as part of the NEM) from traditional energy sources to lower emission alternatives based on renewable energy. Reduction of greenhouse gas emissions is a key strategy in slowing the effects of climate change for future generations.

The project would also facilitate the development of the Central-West Orana REZ to meet current bulk energy demands and enable efficient expansion to meet future demand. Improving the reliability of the NEM would benefit current and future generations.

Although the project would result in environmental and social impacts, particularly during construction, the important role of the project in relation to emissions reduction and security of energy supply would benefit current and future generations and help to facilitate intergenerational equity.

Conservation of biological diversity and ecological integrity

The principle of conservation of biological diversity and ecological integrity (as defined in clause 193(5) of the EP&A Regulation) provides that '...the conservation of biological diversity and ecological integrity should be a fundamental consideration.'

A biodiversity assessment was undertaken in accordance with the Biodiversity Assessment Method (DPIE, 2020b) to identify potential adverse impacts on biodiversity. The project would result in the clearing of vegetation to facilitate construction and maintain asset protection zones and easements around project infrastructure during operation to meet operational safety requirements, including bushfire risk management. The construction and operation areas have been refined throughout the development of the project to minimise this impact as much as is feasible, and to conserve native vegetation and fauna habitat as far as practicable, while endeavouring to balance the potential for limitations to the project delivery and safe operation. Mitigation measures are proposed to minimise and manage significant impacts on native vegetation and flora and fauna. Biodiversity offsets would be implemented to address the impacts that cannot be avoided.

Improved valuation, pricing and incentive mechanisms

The principle of improved valuation, pricing and incentive mechanisms (as defined in clause 193(6) of the EP&A Regulation) provides that environmental factors should be included in the valuation of assets and services such as:

- polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement
- the users of goods and services should pay prices based on the full life cycle of the costs of providing the goods and services, including the use of natural resources and assets and the ultimate disposal of waste.
- Established environmental goals should be pursued in the most cost effective way by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

A range of mitigation measures to minimise and avoid impact during construction and operation have been identified in this EIS. The implementation of these measures would increase both the construction and operating costs of the project, which signifies that environmental resources have been included in the valuation of assets and services in the design and assessment of the project.

The reference design for the project has been developed with an objective of minimising potential impacts on the surrounding environment. The extra cost of designs, project elements, management measures and impact offset or mitigation packages, selected to avoid and minimise environmental and/or social impacts, are included in the total estimated project cost.

The costs of design development, mitigation measures and biodiversity offsets, adopted to avoid and minimise environmental and/or social impacts, are included in the total estimated project cost.

23.3 Statutory considerations

The project is Critical State significant infrastructure (CSSI) and requires approval from the NSW Minister for Planning under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The project is also a controlled action under the EPBC Act and is to be assessed under the NSW Assessment Bilateral Agreement, which provides for certain actions that are state significant 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. Although the project will be assessed under the Bilateral Agreement, a separate EPBC Act approval from the Commonwealth Minister for the Environment and Water is still required before the project can proceed.

This EIS has been prepared to support EnergyCo's application for approval of the project in accordance with the requirements of Division 5.2 of the EP&A Act. The EIS addresses:

- the Secretary's environmental assessment requirements (SEARs), including the Supplementary SEARs that set out the EPBC assessment requirements
- the requirements of the EP&A Regulation.

The EIS has been prepared with regard to the *State significant infrastructure guidelines* (DPE, 2022i) (in particular *State significant infrastructure guidelines – preparing an environmental impact statement*.

Other approvals required for the project include:

- approval under section 138 of the *Roads Act 1993* (NSW) where works are required on or over certain public roads
- a water access licence under the *Water Management Act 2000* (NSW) for any groundwater take for construction supply and water take during excavation that is greater than three megalitres per year.

The project's compliance with the statutory requirements is further outlined in Appendix C (Statutory compliance).

23.4 Justification and conclusion

The project comprises the construction and operation of new electricity transmission infrastructure and new energy hubs and switching stations within the Central-West Orana REZ. The project will enable 4.5 gigawatts of new network capacity to be unlocked by approximately the mid-2020s and enable renewable energy generators within the Central-West Orana REZ to access the new transmission infrastructure to export electricity to the rest of the network. As such, the project is critically important in securing new sources of electricity to replace coal-fired power and in supporting NSW and Commonwealth Government climate change commitments to reduce emissions in the electricity sector, benefitting current and future NSW residents through the provision of a clean, affordable and secure source of electricity.

Projects of this scale and geographical spread inevitably have impacts on the local environment and community, particularly during construction. A number of competing environmental, social and technical constraints are present which have required adopting a balanced approach to corridor planning to determine the most appropriate project alignment. The most significant impact to the biophysical environment would be on biodiversity due to the extent of vegetation clearing required along the approximately 250 kilometre transmission corridor. While efforts have been made to avoid biodiversity impacts, for example, by locating the alignment in previously disturbed areas such as mining areas and adjacent to existing transmission lines, some impacts have not been able to be avoided and will be addressed through biodiversity offsets. Impacts to surface and groundwater have the potential to occur during construction, however they would be temporary and minor. The project is not anticipated to cause impacts that would lead to serious and irreversible environmental damage.

The most significant impacts to the community would be from land use change, in particular the loss of agricultural land and amenity impacts such as noise and visual impacts. The project would require the use of agricultural land either permanently (for operation) or temporarily until construction activities are completed. The permanent loss of agricultural land is equivalent to approximately 0.04 per cent of the total area of agricultural land use in the four local government areas where the project is located. There would also be potential impacts on First Nations cultural values due to changes to the landscape, access and sites of cultural heritage significance. Further investigation will be undertaken during the detailed design stage to avoid and minimise impacts on important cultural heritage sites in consultation with RAPs.

Construction and operation of the project would provide positive economic activity to the regional and NSW economy. The direct and indirect impacts on the regional economy during construction are estimated at up to $512 million in average annual output (the gross value of business turnover in a region).

Construction of the project would result in a reduction in the land available for agricultural activity. The agricultural impacts of the project during construction are less than 0.3 per cent of agricultural economic activity in the region and a fraction of the economic activity gains from the project.

A range of mitigation measures identified in Chapters 7 to 20 of this EIS would be implemented during construction and operation to manage and minimise potential impacts.

The project is consistent with the principles of ecologically sustainable development identified in the EP&A Regulation as detailed below:

- Precautionary principle: through the integration of environmental considerations into project development and design, the project would not cause serious or irreversible environmental damage. The assessment of potential environmental impacts of corridor and design options has drawn on a combination of desk-top data and a comprehensive program of field investigations which reduces the level of uncertainty of potential impacts.
- Intergenerational equity: the important role of the project in relation to emissions reduction and security of energy supply would benefit current and future generations and help to facilitate intergenerational equity.

- Conservation of biological diversity and ecological integrity: while the project will result in impacts to native vegetation, given its scale and geographic spread, the development of the project has sought to avoid areas of high biodiversity value by locating the alignment in previously disturbed areas where possible. Refinement of the design has sought to further minimise biodiversity impacts with biodiversity offsets required for those impacts that cannot be avoided or mitigated.
- Improved valuation, pricing and incentive mechanisms: The costs of design development, mitigation measures and biodiversity offsets, adopted to avoid and minimise environmental and/or social impacts, are included in the total estimated project cost, such that the projects are internalised within the project cost and act as an incentive to reduce impacts.

Having regard to all of the matters considered in this EIS, it is considered that the project is justified, as the need for, and the benefits of the project would outweigh the residual impacts.

During the continued development of the project design and the construction methodology, opportunities to further minimise potential impacts will be sought and ongoing input from stakeholders and the community will be taken into account. The potential residual construction and operational impacts of the project are considered manageable with the implementation of the proposed mitigation and management measures.

24 References

ABARES (Australian Bureau of Agriculture and Resource Economics and Sciences) (2016) *The Australian Land Use and Management Classification* Version 8, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra.

ABS (Australian Bureau of Statistics) (2006), *Australian and New Zealand Standard Industrial Classification (ANZSIC)*.

ABS (2016), *Census of Population and Housing*. Accessed from: www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2008.0~2016~Main%20Features~Topic%20release%20schedule~140.

ABS (2021), *Census of Population and Housing*. Accessed from: www.abs.gov.au/census/find-census-data/search-by-area.

ABS (2022), TableBuilder - 2021 Census - employment, income and education.

ABS (2022), *Australian National Accounts: Input-Output Tables Methodology, IOIG (2015) to ANZSIC06 Concordance*.

ACEN Australia (2023), *Narragamba Solar – Renewable Energy from ACEN – Scoping Report*. Accessed from: https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=PDA-60314708%2120230718T094314.474%20GMT.

Acid Sulfate Soil Management and Advisory Committee (1998), *Acid Sufalte Soil Manual*.

ACT Emergency Services Agency (2018), *Solar farms will 'cut' bushfire risk. The Canberra Times*. Accessed from: www.canberratimes.com.au/story/6152076/solar-farms-will-cut-bushfire-risk/.

AdaptNSW (2022), *Interactive climate change projections maps – Central West and Orana*. Accessed from: www.climatechange.environment.nsw.gov.au/projections-map.

AEMO (Australian Energy Market Operator Services Limited) (2018), *Integrated System Plan – July 2018*. Accessed from: https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/isp/2018/integrated-system-plan-2018_final.pdf?la=en&hash=40A09040B912C8DE0298FDF4D2C02C6C.

AEMO (2019), *2019 Electricity Statement of Opportunities – A report for the National Electricity Market*.

AEMO (2020), *2020 Integrated System Plan – July 2020*. Accessed from: https://aemo.com.au/-/media/files/major-publications/isp/2020/final-2020-integrated-system-plan.pdf?la=en&hash=6BCC72F9535B8E5715216F8ECDB4451C.

AEMO (2021), *2021 Infrastructure Investment Objectives Report – December 2021*. Accessed from: https://aemo.com.au/-/media/files/about_aemo/aemo-services/iio-report-2021.pdf?la=en.

AEMO (2022a), *2022 Integrated System Plan – June 2022*. Accessed from: https://aemo.com.au/-/media/files/major-publications/isp/2022/2022-documents/2022-integrated-system-plan-isp.pdf?la=en.

AEMO (2022b), *2022 Infrastructure Investment Objectives Report – December 2022*. Accessed from: https://aemoservices.com.au/-/media/services/files/publications/iio-report/2022/224213-2022-iio-report_con5.pdf?la=en.

AEMO (2023), *Draft 2023 Infrastructure Investment Objectives Report – May 2023*. Accessed from: https://aemoservices.com.au/-/media/services/files/publications/iio-report/2023/231604-2023-iio-report-final.pdf?la=en&hash=950511E55FFB9BA69261CECDE4AE6CAB.

AHIMS (2023), *Aboriginal Heritage Information Management System (AHIMS).* Accessed from: www.environment.nsw.gov.au/awssapp/login.aspx.

Angulo, L, Angueira, P, Cañizo, J, Cascón, I, Guerra, D, de la Vega, D and Wu, Y (2014), *Impact analysis of wind farms on telecommunication services*, Renewable and Sustainable Energy Reviews.

ANZECC (Australian and New Zealand Environment and Conservation Council) (1990), *Technical Basis for Guidelines to Minimise Annoyance Due to Blast Overpressure and Ground Vibration*.

ANZECC/ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand) (2018), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*.

ARPANSA (Australian Radiation Protection and Nuclear Safety Agency) (2022), *Extremely low frequency electric and magnetic fields*. Accessed from: www.arpansa.gov.au/understanding-radiation/what-is-radiation/non-ionising-radiation/low-frequency-electric-magnetic-fields.

Australasian Fire and Emergency Service Authorities Council (2018), *Wind Farms and Bushfire Operations*. Accessed from: https://www.energy.nsw.gov.au/sites/default/files/2022-08/2018_10_AFAC_windfarmsbushfiresoperations.pdf.

Australia ICOMOS (International Council on Monuments and Sites) (2013), *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*, Australia International Council on Monuments and Sites, Burwood, Victoria.

Australian Energy Council (2017), *Capacity factors: Understanding the misunderstood*. Accessed from: www.energycouncil.com.au/analysis/capacity-factors-understanding-the-misunderstood/.

Australian Geomechanics Society (2007), *Landslide risk management guidelines*.

Australian Greenhouse Office (2006), *Climate Change Impact and Risk Management – A Guide for Business and Government*.

Australian Institute for Disaster Resilience (2017), *Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia, Handbook 7*.

Australian Institute of Landscape Architects (2018), *Guidance Note for Landscape and Visual Assessment*.

Austroads (2009), *Guide to Pavement Technology Part 6: Unsealed Pavements*.

Austroads (2020), *Guide to Traffic Management*.

Austroads (2021), *Guide to Road Design*.

Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I (2019), *Australian Rainfall and Runoff: A Guide to Flood Estimation*, Commonwealth of Australia, Canberra, ACT.

Bayne, B. and West, G. (1988) *GRIT – Generation of Regional Input-Output Tables: Users Reference Manual*. Australian Regional Developments No. 15, Office of Local Government, Department of Immigration, Local Government and Ethnic Affairs, AGPS.

British Standard Institution (1993), *BS 7385-2:1993 – Evaluation and measurement for vibration in buildings. Guide to damage levels from groundborne vibration.*

BOM (Bureau of Meteorology) (2022a), *Groundwater Dependent Ecosystems Atlas*. Accessed from: http://bom.gov.au/water/groundwater/gde/.

BOM (2022b), *Australia Groundwater Explorer*.

BOM (2022c), *Long-range weather and climate*. Accessed from: www.bom.gov.au.

Carrington, K, Hogg, R, McIntosh, A and Scott, J (2012), *Crime Talk, FIFO Workers and Cultural Conflict on the Mining Boom Frontier*. Australian Humanities Review.

Castlereagh Bush Fire Management Committee (2013), *Bush Fire Risk Management Plan*.

CEC (Clean Energy Council) (2018), *Community Engagement Guidelines For Building Powerlines For Renewable Energy Developments – A guide for proponents, landholders and communities*.

CEC (2022), *Energy security in Australia*. Accessed from: www.cleanenergycouncil.org.au/advocacy-initiatives/energy-transformation/energy-security.

CEC (2023), *Solar and agriculture could be a perfect match*. Accessed from: www.cleanenergycouncil.org.au/news/agrisolar.

Clean Energy Regulator (2022), *Global warming potentials*. Accessed from: www.cleanenergyregulator.gov.au/NGER/About-the-National-Greenhouse-and-Energy-Reporting-scheme/global-warming-potentials.

Climate Change Authority (2020), *Fact sheet on Australia's electricity sector*. Accessed from: www.climatechangeauthority.gov.au/sites/default/files/2021-03/2021Fact%20sheet%20-%20Electricity.pdf.

Climate Change in Australia, (2021), *Climate Change in Australia Thresholds Calculator*.

Commonwealth of Australia (2013), *Matters of National Environmental Significance Significant Impact Guidelines 1.1.*

CSIRO (Commonwealth Scientific and Industrial Research Organisation) (2011), *CSIRO Australian Soil Resource Information System*.

CSIRO (2015), *Climate Change in Australia Technical Report 2015*.

Cudgegong Bush Fire Management Committee (2020), *Bush Fire Risk Management Plan*.

DAWE (Department of Agriculture, Water and the Environment) (2020), *PFAS National Environmental Management Plan 2.0*.

DAWR (Australian Department of Agriculture and Water Resources) (2013), *Guidelines for groundwater quality protection in Australia: National Water Quality Management Strategy*.

DAWR (2018), *National Water Quality Management Strategy*.

DCCEEW (Australian Department of Climate Change, Energy, the Environment and Water) (2022), *National Pollutant Inventory*. Accessed from: www.npi.gov.au/.

DCCEEW (2022b), *National Greenhouse Gas Accounts Factors.*

DCCEEW (2023), *National Light Pollution Guidelines for Wildlife*.

DEC (Department of Environment and Conservation) (2006), *Environmental Noise Management – Assessing Vibration: a technical guideline*, Department of Environment and Climate Change, Sydney.

DEC (2006), *NSW Water Quality and River Flow Objectives*, Department of Environment, Climate Change and Water, Sydney.

DEC (2007), *Guidelines for the Assessment and Management of Groundwater Contamination.*

DECC (Department of Environment and Climate Change) (2007), *Floodplain Risk Management Guideline – Practical Consideration of Climate Change*.

DECC (2008a), *Managing Urban Stormwater: Soils and Construction 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, Sydney.

DECC (2008b), *Book 4 Dryland Salinity: Productive Use of Saline Land and Water.* Department of Environment, Climate Change and Water, Sydney.

DECC (2009), *Interim Construction Noise Guideline*, Department of Environment and Climate Change, Sydney.

DECCW (Department of Environment, Climate Change and Water) (2010a), *Aboriginal Cultural Heritage Consultation Requirements for Proponents.*

DECCW (2010b), *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*, Department of Environment, Climate Change and Water, Sydney.

DECCW (2010c), *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW*, Department of Environment, Climate Change and Water, Sydney.

DECCW (2011), *NSW Road Noise Policy*, Sydney

DECCW (2010b), *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW.*

Department of Planning (DoP) (2003), *Aquatic Ecology in Environmental Impact Assessment – EIA Guideline Series*, Prepared by Marcus Lincoln Smith, Brookvale, NSW.

Deloitte Access Economics (2012), *Economic and social impacts of the Warkworth Extension Project*, prepared for Singleton Council.

Department of Planning and Infrastructure (2011), *Assessment Guideline – Multi-Level Risk Assessment*.

Deutsches Institut für Normung (DIN) (1999), *DIN 4150-3:1999 Structural vibration – Part 3: Effects of vibration on structures.*

DISER (Australian Government Department of Industry, Science, Energy and Resources) (2021a), *Australia's Long-Term Emissions Reduction Plan – A whole-of-economy Plan to achieve net zero emissions by 2050*.

DISER (2021b), *National Greenhouse Accounts Factors.*

DISER (2022), *Australia's Nationally Determined Contribution – Communication 2022*.

DLWC (Department of Land and Water Conservation) (2000), *Soil and Landscape Issues in Environmental Impact Assessment*, Technical Report No. 34, 2nd edition, NSW Department of Land and Water Conservation, Sydney.

DLWC (2002), *NSW State Groundwater Dependent Ecosystems Policy*.

DLWC (2002), *Site Investigations for Urban Salinity*, Sydney.

DUAP and NSW EPA (Department of Urban Affairs and Planning and the NSW Environmental Protection Agency) (1998), *Managing Land Contamination: Planning Guidelines SEPP 55 –Remediation of Land*.

Dubbo Regional Council (2016), *Dubbo Regional Council Local Government area economic profile*. Accessed from: www.dubbo.nsw.gov.au/ArticleDocuments/358/Dubbo%20Region%20Economic%20Profile%20September%202016.pdf.

Dubbo Regional Council (2020), *Dubbo Local Strategic Planning Statement*.

Dubbo Regional Council (2022), *Towards 2040 Community Strategic Plan*.

DoP (2011a), *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33.*

DoP (2011b), *Hazardous Industry Planning Advisory Paper No. 6 – Guideline for Hazard Analysis*, New South Wales Government.

DoP (2011c), *Hazardous Industry Planning Advisory Paper No. 2 - Fire Safety Study guideline*.

DPE (Department of Planning and Environment) (2003), *The Bioregions of New South Wales*, Published by the National Parks and Wildlife Service.

DPE (2013), *Strategic Regional Land Use Policy (SRLUP) - Strategic agricultural land - biophysical*. Accessed from: https://datasets.seed.nsw.gov.au/dataset/srlup-salbiophysical

DPE (2016), *Dark Sky Planning Guideline*. Accessed from: https://www.planning.nsw.gov.au/policy-and-legislation/environment-and-heritage/dark-sky/dark-sky-planning-guideline

DPE (2017), *Central West and Orana Regional Plan 2036*.

DPE (2018a), *Transmission Infrastructure Strategy 2018*.

DPE (2018b), *NSW Renewable Energy Action Plan*.

DPE (2018c), *Controlled activities – Guidelines for riparian corridors on waterfront land.*

DPE (2020), *Electricity Infrastructure Roadmap.*

DPE (2020a), *NSW Landuse 2017 v1.2*, accessed from The Sharing and Enabling Environmental Data Portal (https://datasets.seed.nsw.gov.au/dataset/nsw-landuse-2017-v1p2-f0ed#:~:text=This%20is%20version%201.2%20of,Satellite%20imagery%20available%20for%20NSW).

DPE (2022a), *Central West and Orana Regional Plan 2041*.

DPE (2022b), *Cumulative groundwater impact assessment approaches*. Information paper prepared for the Water Division, NSW Department of Planning and Environment as part of the Groundwater Assessment Toolbox Project.

DPE (2022c), *Groundwater assessment toolbox for major projects in NSW – Overview document*. Technical guideline prepared for the Water Division, NSW Department of Planning and Environment as part of the Groundwater Assessment Toolbox Project.

DPE (2022d), *Guidelines for Groundwater Documentation for SSD/SSI Projects*. Technical guideline prepared for the Water Division, NSW Department of Planning and Environment as part of the Groundwater Assessment Toolbox Project.

DPE (2022), *Large-Scale Solar Energy Guideline, Technical Supplement Landscape and Visual Assessment (Technical Supplement)*.

DPE (2022e), *Minimum groundwater modelling requirements for Major Projects in NSW*. Technical guideline prepared for the Water Division, NSW Department of Planning and Environment as part of the Groundwater Assessment Toolbox Project.

DPE (2022e), *State Significant Infrastructure Guidelines – preparing an environmental impact statement*

DPE (2022f), *NSW Planning Portal*. Accessed from: www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address.

DPE (2022g), *eSpade Version 2.2*. Accessed from: www.environment.nsw.gov.au/eSpade2Webapp.

DPE (2022h), *Undertaking Engagement Guidelines for State Significant Projects.*

DPE (2022i), *State Significant Infrastructure Guidelines*.

DPE (2022j), *State Significant Infrastructure Guidelines – preparing an environmental impact statement: Appendix B to the state significant infrastructure guidelines*.

DPE (2022k), *State significant infrastructure guidelines – preparing a scoping report: Appendix A to the state significant infrastructure guidelines*

DPE (2022l), *Practice Note – Engaging with Aboriginal Communities*.

DPE (2023b), *Social Impact Assessment Guideline.*

DPE (2023c), *Technical Supplement - Social Impact Assessment Guideline for State Significant Projects.*

DPE Department of Water (2023), *Guidelines and e-tools for controlled activity.*

DPI (Department of Primary Industries) (2012), *NSW Aquifer Interference Policy: NSW Government policy for the licensing and assessment of aquifer interference activities*, NSW Department of Primary Industries, a division of NSW Department of Trade and Investment, Regional Infrastructure and Services.

DPI (2013), *Policy and guidelines for fish habitat conservation and management*, NSW Department of Primary Industries, a part of the Department of Trade and Investment, Regional Infrastructure and Services.

DPI (2014), *Salinity Training Manual.*

DPI (2018), *Infrastructure proposals on rural land.*

DPI (2018), *Assessing groundwater applications.*

DPI (2021), *Draft state significant agricultural land mapping*. Accessed from: https://nswdpi.mysocialpinpoint.com/ssal/map#/.

DPI (2022), *Biosecurity Information System - Weeds, 2017-2020*. Accessed from trade.maps.arcgis.com/apps/webappviewer/index.html?id=a62b0f927ca441f1ba60b2dbfde5e9be.

DPI (2022b) *NSW WeedWise website.* Accessed from weeds.dpi.nsw.gov.au/.

DPIE (Department of Planning, Industry and Environment) (2014a), Environmental Planning Instrument - Groundwater Vulnerability Dataset.

DPIE (2014b), Environmental Planning Instrument – Landslide risk dataset.

DPIE (2019a), *NSW Electricity Strategy*. Accessed from: www.energy.nsw.gov.au/sites/default/files/2022-08/2019_11_NSW_ElectricityStrategyOverview.pdf.

DPIE (2019b), *Community Participation Plan*.

DPIE (2020a), *Net Zero Plan Stage 1: 2020–2030.*

DPIE (2020b), *Biodiversity Assessment Method*.

DPIE (2020c), *Soil Landscapes of Central and Eastern NSW version 2.1*, NSW Office of Environment and Heritage, Sydney.

DPIE (2020d), *Environmental Management Plan Guidelines for Infrastructure Projects*

DPIE (2020e), *Independent Audit Post Approval Requirements*

DPIE (2021a), *State significant infrastructure guidelines – preparing a scoping report*.

DPIE (2021b), *NSW Waste and Sustainable Materials Strategy 2041 – Stage 1: 2021-2027*.

DPIE (2021c), *Planning Circular PS 21-006 – Considering flooding in land use planning: guidance and statutory requirements*.

DPIE (2021e), *Climate Risk Ready NSW Guide*.

DPIE (2022a), *Cumulative Impact Assessment Guidelines for State Significant Projects*.

DPIE (2022b), *Practice Note – Engaging with Aboriginal communities. Social Impact Assessment Practice Notes*.

Ekström, M. et al. (2015), *Central Slopes Cluster Report, Climate Change in Australia Projections for Australia's Natural Resource Management Regions*.

Elliott, P and Wadley, D (2002), *The Impact of Transmission Lines on Property Values: Coming to Terms with Stigma. Property Management*.

EMM (2021), *Cobbora Solar Farm – Scoping report.* Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/cobbora-solar-farm.

EMM (2022a), *Birriwa Solar and Battery Project - Environmental Impact Statement*. Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/birriwa-solar-farm.

EMM (2022b), *Sandy Creek Solar Farm – Scoping Report.* Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/sandy-creek-solar-farm.

Energy NSW (2022), *First Nations Guidelines*. Accessed from: www.energy.nsw.gov.au/government-and-regulation/electricity-infrastructure-roadmap/first-nations-guidelines.

EnergyCo (2022a), *Community Feedback Report – Central-West Orana Renewable Energy Zone Revised study corridor consultation (June 2022)*.

EnergyCo (2022b), *Living and working near transmission line easements (September 2022)*. Accessed from: www.energyco.nsw.gov.au/sites/default/files/2022-09/cwo-rez-fact-sheet-living-working-transmission.pdf.

EnergyCo (2022c), *Central-West Orana Renewable Energy Zone Transmission project Scoping Report – September 2022.* Accessed from:

https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=PDA-48312206%2120220908T233216.666%20GMT.

EnergyCo (2023), *Community feedback report*. Accessed from: https://www.energyco.nsw.gov.au/sites/default/files/2023-06/cwo-rez-report-community-feedback.pdf.

EnergyCo (2023a), *NSW Network Infrastructure Strategy*. Accessed from: www.energyco.nsw.gov.au/sites/default/files/2023-05/network-infrastructure-strategy.pdf.

EnergyCo (2023b), *Central-West Orana Renewable Energy Zone: Coordinating Community Impacts and Benefits in the REZ*. Accessed from: www.energyco.nsw.gov.au/sites/default/files/2023-03/cwo-rez-report-research-impacts-benefits.pdf.

EnergyCo (2023c), *Right-sizing Renewable Energy Zone to power NSW's future*. Accessed from: www.energyco.nsw.gov.au/right-sizing-renewable-energy-zone-power-nsws-future.

Environment Protection and Heritage Council, the Natural Resource Management Ministerial Council & the Australian Health Ministers' Conference (2006), *National Guidelines for Water Recycling*. Accessed from: www.waterquality.gov.au/guidelines/recycled-water.

EPA (Environment Protection Authority) (2014a), *Waste Classification Guidelines*, NSW Environment Protection Authority, Sydney South.

EPA (2014b), *Waste Avoidance and Resource Recovery Strategy 2014–21*, NSW Environment Protection Authority, Sydney South.

EPA (2015), *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*.

EPA (2017a*), Contaminated Land Management – Guidelines for the NSW Site Auditor Scheme*, Third Edition.

EPA (2017b), *Noise Policy for Industry*, Environment Protection Authority, Sydney.

EPA (2020a), *Consultants reporting on contaminated land – Contaminated Land Guidelines*, NSW Environment Protection Authority, Parramatta, NSW.

EPA (2020b), *Draft Construction Noise Guideline*, NSW Environment Protection Authority, NSW Environment Protection Authority, Parramatta, NSW.

EPA (2016), *Approved methods for the sampling and analysis of water pollutants in NSW*, NSW Environment Protection Authority, Parramatta, NSW.

EPD Australasia (2023), *EPD Database*. Accessed from: https://epd-australasia.com/epd-search/.

EPD International (2023), EPD Library. Accessed from: www.environdec.com/.

Epuron (2017), *Liverpool Range Wind Farm Environmental Impact Statement*. Accessed from: https://www.planningportal.nsw.gov.au/major-projects/projects/liverpool-range-wind-farm.

Extent Heritage Advisors (2017), *Bathurst Regional Local Government Area Aboriginal Heritage Study: Public Release Version.*

Fairfull, S and Witheridge, G (2003), *Why do fish need to cross the road? Fish passage requirements for waterway crossings*. NSW Fisheries, Cronulla.

Fire and Rescue NSW (2023*), Battery Energy Storage Systems*. Accessed from: www.fire.nsw.gov.au/page.php?id=9390.

Former Mudgee Shire Heritage Committee (2004), *Former Mudgee Shire Community-Based Heritage Study*.

GHD (2017), *Neoen Australia Pty Ltd Gilgandra 40MW Solar Farm Environmental Impact Statement*. Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/gilgandra-solar-farm.

Go Green Services (2002), *Wiradjuri Heritage Study For the Wagga Wagga Local Government Area of New South Wales.*

Green Bean Design (2017), *Liverpool Range Wind Farm Landscape and Visual Impact Assessment*. Accessed from: https://www.planningportal.nsw.gov.au/major-projects/projects/liverpool-range-wind-farm.

Greenwood, P (2013), *Land of the Wiradjuri: Traditional Wiradjuri Culture. Wagga Wagga*, NSW: Riverina Environmental Education Centre.

Han, HJ and Elliott, P (2013), *Impact of High Voltage Overhead Transmission Lines on Property Value*. In Proceedings of the 19th CIB World Building Congress, Brisbane. Accessed from: https://wbc2013.apps.qut.edu.au/papers/cibwbc2013_submission_332.pdf.

Heritage Branch Department of Planning (2009), *Assessing Significance for Historical Archaeological Sites and 'Relics'*.

Heritage Council of NSW (2021), *Investigating Heritage Significance*.

Heritage Office (2001), *Assessing Heritage Significance*.

Heritage Office (2002), *Statements of Heritage Impact Guidelines* (as part of the NSW Heritage Manual).

Heritage Office (2006), *Photographic Recording of using Film or Digital Capture.*

Heritage Office and Department of Urban Affairs and Planning (2002), *Statements of Heritage Impact Guidelines*.

Heritage Office and Department of Urban Affairs and Planning (1996), *Archaeological Assessments: Archaeological Assessment Guidelines*.

IAP2 (International Association for Public Participation) (2015), *Quality Assurance Standard for Community and Stakeholder Engagement*.

IAQM (Institute of Air Quality Management) (2014), *Guidance on the assessment of dust from demolition and construction*, Institute of Air Quality Management.

ICNIRP (International Commission on Non-Ionising Radiation Protection) (2020), *Guidelines for Limiting Exposure to Time-varying Electric and Magnetic Fields (1Hz to 100 kHz)*, Health Physics 99(6):818-836; 2010.

ICOMOS (2011), *Guidance on Heritage Impact Assessments for Cultural World Heritage Properties*.

IEEE (Institute of Electrical and Electronics Engineers) (2002), *C95.6-2002 – IEEE Standard for Safety Levels With Respect to Human Exposure to Electromagnetic Fields, 0-3 kHz.*

IESCA (International Erosion Control Association) (2008), *Best Practice Erosion and Sediment Control*. Accessed from: www.austieca.com.au/publications/best-practice-erosion-and-sediment-control-bpesc-document.

Industry and Investment (2021), *Guidelines MDG 1006 – Technical Reference; Technical Reference for Spontaneous Combustion Management Guideline*.

Infrastructure NSW (2018), *State Infrastructure Strategy 2018-2038*.

ISO (International Organisation for Standardisation) (1994*), ISO 8297-1994; Acoustics — Determination of sound power levels of multisource industrial plants for evaluation of sound pressure levels in the environment — Engineering method.*

ISO (2018a), *ISO 14064-1:2018 Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removal*.

ISO (2018b), *ISO 31000-2018; Risk Management – Principles and Guidelines.*

ISO (2019), *ISO 14064-1:2019 Specification with guidance at the project level for quantification, monitoring and reporting of greenhouse gas emission reductions or removal enhancements*.

Jacobs (2022), *Dapper Solar Farm Scoping Report*. Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/dapper-solar-farm.

Kass, T (2001), *Wellington Thematic History*.

Kass, T (2003), *Thematic history of the Central West: comprising the NSW historical regions of Lachlan and Central Tablelands.* NSW Heritage Office, Sydney.

Landcom (2004), *Managing Urban Stormwater: Soils and construction – Volume 1*, New South Wales Government.

Landscape Institute (UK) (2019), *Technical Guidance Note (06/19) Visual Representation of development proposals.*

Landscape Institute and Institute of Environmental Management & Assessment (LIIEMA) (2013), *Guidelines for Landscape and Visual Impact Assessment*.

Liverpool Range Bush Fire Management Committee (2010), *Bush Fire Risk Management Plan*.

Local Land Services (2017), *Central Tablelands Regional Strategic Weed Management Plan 2017-2022*.

Local Land Services (2017), *Central West Regional Strategic Weed Management Plan 2017-2022*.

Local Land Services (2017), *Hunter Regional Strategic Weed Management Plan 2017-2022*.

Local Land Services (2018), *Central Tablelands Regional Strategic Pest Animal Management Plans 2018-2023*.

Local Land Services (2018), *Central West Regional Strategic Pest Animal Management Plans 2018-2023*.

Local Land Services (2018), *Hunter Regional Strategic Pest Animal Management Plans 2018-2023*.

Mid-Western Regional Council (2017a), *Mid-Western Regional Draft Comprehensive Land Use Strategy (Revision E)*. Prepared by Parsons Brinckerhoff for Mid-Western Regional Council.

Mid-Western Regional Council (2017b), *Towards 2030 – Mid-Western Region 2030 Community Plan*.

Miller. C, Plucinski. M, Sullivan. A, Stephenson. A, Huston. C, Charman. K, Prakash. M, Dunstall. S (Miller et al), (2017), *Electrically caused wildfires in Victoria, Australia are over-represented when fire danger is elevated*, Landscape and Urban Planning, Volume 167.

Moir Landscape Architecture Pty Ltd (2021), *Barneys Reef Wind Farm Preliminary Landscape and Visual Impact Assessment*.

Moir Landscape Architecture Pty Ltd (2022), *Valley of the Winds Wind Farm - Landscape Visual Impact Assessment*.

Monitor Heritage Consultants (2019), *Warrumbungle Shire Thematic History*.

Murphy B.W. and Lawrie J.W (1998), *Soil Landscapes of the Dubbo 1:250 000 Sheet*. Department of Land and Water Conservation.

Murray–Darling Basin Authority (2012), *Murray–Darling Basin Plan 2012.*

National Environment Protection Council (2013), *National Environment Protection (Assessment of Site Contamination) Measure*.

National Environment Protection Council (2021), *National Environment Protection (Air Toxics) Measure*.

National Environment Protection Council (2021), *National Environment Protection (Ambient Air Quality) Measure*

National Heavy Vehicle Regulator (2020), *New South Wales Class 1 Load Carrying Combination (Hunter Region) Mass and Dimension Exemption Notice Operator's Guide*.

National Parks and Wildlife Service (NPWS) (2020), *Developments adjacent to National Parks and Wildlife Service lands - Guidelines for consent and planning authorities*.

National Resource Management Ministerial Council, Environment Protection and Heritage Council and Australian Health Minister's Conference (2006), *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)*.

National Transport Commission (2023), *Australian Code for the Transport of Dangerous Goods by Road and Rail*.

NGH Environmental (2017a), *Environmental Impact Statement – Beryl Solar Farm*. Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/beryl-solar-farm.

NGH Environmental (2017b), *Environmental Impact Statement – Wellington Solar Farm.* Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/wellington-solar-farm.

NGH Environmental (2018), *Environmental Impact Statement – Wellington North Solar Plant.* Accessed from www.planningportal.nsw.gov.au/major-projects/projects/wellington-north-solar-farm.

NGH Environmental (2019), *Environmental Impact Assessment – Wollar Solar Farm.* Accessed from: *www.planningportal.nsw.gov.au/major-projects/projects/wollar-solar-farm.*

NGH Environmental (2020), *Environmental Impact Statement – Dunedoo Solar Farm*. Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/dunedoo-solar-farm.

NGH Environmental (2021), *Environmental Impact Statement – Forest Glen Solar Farm*. Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/forest-glen-solar-farm.

NGH Environmental (2023), *Environmental Impact Assessment – Orana Battery Energy Storage System.* Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/orana-battery-energy-storage-system.

Niche Environment and Heritage Pty Ltd (2015), *Wilpinjong Extension Project: Historical heritage assessment*.

NSW Climate and Energy Action (2023), *Wind Energy*. Accessed from: www.energy.nsw.gov.au/nsw-plans-and-progress/major-state-projects/shift-renewables/wind-energy.

NSW Forestry Corporation (2022), Forestry Corporation of NSW Open Data Site, accessed at https://data-fcnsw.opendata.arcgis.com/maps/forest-management-zones

NSW Government (2005), *NSW Floodplain Development Manual 2005*, Department of Infrastructure, Planning and Natural Resources, Sydney.

NSW Government (2019), *Property Acquisition Standards*. Accessed from: www.nsw.gov.au/housing-and-construction/property-acquisition/about-us/standards-and-principles/standards.

NSW Government (2020), Renewable Energy Zones. Accessed from: www.energy.nsw.gov.au/renewables/renewable-energy-zones.

NSW Government (2021), Travelling Stock Reserves: State-wide Plan of Management, NSW Local Land Services. Accessed from https://www.lls.nsw.gov.au/__data/assets/pdf_file/0005/1200857/Travelling-Stock-Reserves-State-wide-Plan-of-Management.pdf.

NSW Land Registry Services (2022), *Water Access Licence Register*. Accessed from: https://www.nswlrs.com.au/Public-Register/WAL-Register.

NSW Parliamentary Council's office (1997), *Protection of the Environment Operations Act 1997*. Accessed from: https://legislation.nsw.gov.au/view/html/inforce/current/act-1997-156.

OEH (Office of Environment and Heritage) (2003), *Goulburn River National Park and Munghorn Gap Nature Reserve, Plan of Management*. NSW National Parks and Wildlife Service.

OEH (2011), *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW*, Office of Environment and Heritage, Sydney South.

OEH (2012a), *The Land and Soil Capability Scheme: A general rural land evaluation system for NSW*.

OEH (2012b), *Erosion and Sediment Control on Unsealed Roads – A field guide for erosion and sediment control maintenance practices*.

OEH (2013), *Interim protocol for site verification and mapping of biophysical strategic agricultural land*.

OEH (2014a), *Statement of Management Intent, Durridgere State Conservation Area, Community Conservation Area Zone 3*. NSW National Parks and Wildlife Service, Sydney.

OEH (2014b), *Statement of Management Intent, Goodmani State Conservation Area, Community Conservation Area Zone 3*. NSW National Parks and Wildlife Service, Sydney.

OEH (2014c), *Statement of Management Intent, Dapper Nature Reserve. NSW National Parks and Wildlife Service*, Sydney.

OEH (2015), *Guidelines for managing salinity in rural areas*, NSW Office of Environment and Heritage, Sydney, NSW.

OEH (2016), *NSW Climate Change Policy Framework*, NSW Office of Environment and Heritage, Sydney, NSW.

OEH (2017), *Risk-based Framework for Considering Waterway Health Outcomes in Strategic Land-use Planning Decisions.*

OEH (2017), *Travelling Stock Reserves State Classification Map*. Accessed from: https://www.lls.nsw.gov.au/help-and-advice/growing,-grazing-and-land/travelling-stock-reserves

OEH (2019a), *BioNet Atlas user manual.*

OEH (2019b), *NSW Government Resource Efficiency Policy.*

Orana Bush Fire Management Committee (2021), *Bush Fire Risk Management Plan.*

Ozark Environment and Heritage Pty Limited (2007), *Aboriginal Heritage Study: Dubbo Local Government Area Stage 2: Field Survey.*

Rural Fire Service (2015), *Guide for Bushfire Prone Land Mapping*.

Rural Fire Service (2019), *Planning for Bush Fire Protection*, NSW Rural Fire Service, Granville, NSW.

Rural Fire Service (undated), *Standards for Asset Protection Zones*, NSW Rural Fire Service, Granville, NSW.

Parliament NSW (2023) *Feasibility of undergrounding the transmission infrastructure for renewable energy projects.* Available at: https://www.parliament.nsw.gov.au/committees/inquiries/Pages/inquiry-details.aspx?pk=2966

Peabody (2021), *Spontaneous combustion management plan for the Wilpinjong Coal Mine.* Accessed from: www.peabodyenergy.com/Peabody/media/MediaLibrary/Operations/Australia%20Mining/New%20South%20Wales%20Mining/Wilpinjong%20Mine/WI-ENV-MNP-0010_SCMP_V_7-1.pdf.

Pitt & Sherry (2018), *Maryvale Solar Farm Environmental Impact Statement.* Accessed from: https://www.planningportal.nsw.gov.au/major-projects/projects/maryvale-solar-farm.

Ramboll (2022), *Valley of the Winds Environmental Impact Statement.* Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/valley-winds-wind-farm.

Ramboll (2023), *Orana Wind Farm – Scoping report*. Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/orana-wind-farm.

Resilience NSW (2018), *NSW Critical Infrastructure Resilience Strategy*.

Resource NSW (2003), *NSW Waste avoidance and resource recovery strategy 2003.*

SafeworkNSW (2014), *Managing asbestos in or on soil*, Gosford, NSW.

Safe Work Australia (2020), *How to manage and control asbestos in the workplace – Code of Practice*.

SES (State Emergency Service) (2007), *Warrumbungle Shire Local Flood Plan.*

SES (2013a), *Dubbo City Local Flood Plan.*

SES (2013b), *Mid-Western Regional Local Flood Plan.*

SES (2013c), *Upper Hunter Shire Local Flood Plan.*

Sobyra, R, Sigler, T and Charles-Edwards, E (2022), *Unbalanced growth in the labourscape: explaining regional employment divergence*. Regional Studies, Volume 56, No. 7, pp. 1059-1070.

Sorensen, A (1990), *Virtuous Cycles of Growth and Vicious Cycles of Decline: Regional Economic Change in Northern NSW*. Change and Adjustment in Northern New South Wales. Ed D.J. Walmsley, University of New England, Armidale.

Squires, H. (2017), *Agricultural land use mapping resources in NSW - User's guide*.

Standards Australia (2005), *Australian Standard AS1158.3.1:2005 Lighting for roads and public spaces.*

Standards Australia (2006a), *Australian and New Zealand Standard AS/NZS 1680:2006 Interior and workplace lighting*.

Standards Australia (2006b), *Australian Standard AS2187.2-2006 Explosives – Storage and Use – Part 2: Use of explosives.*

Standards Australia (2010), *Australian Standard AS 3745:2010 Planning for emergencies in facilities.*

Standards Australia (2012), *Australian and New Zealand Standard AS/NZS 1547:2012 On-site domestic wastewater management.*

Standards Australia (2013), *Australian Standard AS5334:2013 Climate Change Adaptation for Settlements and Infrastructure – A risk based approach*.

Standards Australia (2016), *Australian Standard AS2067:2016 Substations and high voltage installations exceeding 1 kV a.c.*

Standards Australia (2016), *Australian Standard AS2344:2016 Limits of electromagnetic interference from overhead alternating current powerlines and high voltage equipment installations in the frequency range 0.15 Megahertz (MHz) to 3000 MHz*.

Standards Australia (2017), *Australian Standard AS1940:2017 The storage and handling of flammable and combustible liquids.*

Standards Australia (2018a), *Australian Standard AS1055:2018 Acoustics - Description and measurement of environmental noise*.

Standards Australia (2018b), *Australian Standard AS3959:2018 Construction of buildings in bushfire-prone areas*.

Standards Australia (2018c), *Australian Standard AS 1670:2018 Fire detection, warning, control and intercom systems*.

Standards Australia (2019a), *Australian and New Zealand Standard AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting*.

Standards Australia (2019b), *Australian and New Zealand Standards AS/NZS 5139:2019 Electrical installations - Safety of battery systems for use with power conversion equipment.*

Strahler, A.N. (1952), *Dynamic basis of geomorphology*, Bulletin of the Geological Society of America, 63, 923–938.

Strahler, A.N. (1957), *Quantitative analysis of watershed geomorphology*, Transactions of the American Geophysical Union, 38, No. 6, 913–920.

Tindale, N.B. (1974), *Aboriginal tribes of Australia: Their terrain, environmental controls, distribution, limits, and proper names*. Canberra: Australian National University Press.

Transgrid (2021a), *Study Corridor Identification Report*. Accessed from: www.transgrid.com.au/media/bufgiwyy/211012-cworezt-study-corridor-identification-report.pdf.

Transgrid (2021b), *Central-West Orana REZ Transmission Community Engagement Feedback Report December 2020 – September 2021*.

Transport Authorities Greenhouse Group (TAGG) (2013), *Greenhouse Gas Assessment Workbook for Road Projects*.

Transport for NSW (2013), *Transport Management Plans for oversize and/or overmass movements in NSW*.

Transport for NSW (2018a), *NSW Heavy Vehicle Access Policy Framework*.

Transport for NSW (2018b), *Carbon Estimate and Reporting Tool*.

Transport for NSW (2020a), *Additional Access Conditions – Oversize and overmass heavy vehicles and loads*.

Transport for NSW (2022a), *2026 Road Safety Action Plan*.

Transport for NSW (2022b), *Traffic control at work sites – Technical Manual (Version 6.1)*.

Transport for NSW (2022c) *Construction Noise and Vibration Guideline*

Transport for NSW (2023), *Guideline for Landscape Character and Visual Impact Assessment – Environmental impact assessment practice note EIA-N04*, Transport for NSW, Centre for Urban Design, Rozelle, NSW.

Transport for NSW (2023), *NSW Schedule of Classified Roads and Unclassified Regional Roads (Version 16).*

Umwelt (2022a), *Environmental Impact Statement - Tallawang Solar Farm*. Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/tallawang-solar-farm.

Umwelt (2022b), *Ulan Coal Modification 6 Underground Mining Extension Modification Report November 2022*. Accessed from: https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=MP08_0184-MOD-6%2120221117T095920.971%20GMT.

Umwelt (2023a), *Social Infrastructure Analysis Preliminary Report Draft*.

Umwelt (2023b), *Goulburn River Solar Farm – Environmental Impact Statement*. Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/goulburn-river-solar-farm-0.

Upper Hunter Shire Council (2017), *Upper Hunter Land Use Strategy*.

Upper Hunter Shire Council (2020), *Draft Upper Hunter Shire Council Local Strategic Planning Statement*.

WA Department of Health (2009), *Guidelines for the Assessment, Remediation and Management of Asbestos – Contaminated Sites in Western Australia*.

Warrumbungle Shire Council (2013), *Warrumbungle Shire Council Land Use Strategy*.

Warrumbungle Shire Council (2019a), *Warrumbungle Shire Local Strategic Planning Statement*.

Warrumbungle Shire Council (2019b), *Cobbora Land Use Planning Strategy*.

Warrumbungle Shire Council (2019c), *Warrumbungle Shire Economic Development and Tourism Strategy 2019–2023.*

Warrumbungle Shire Council (2019d), *Warrumbungle Shire Community Strategic Plan (Reviewed) 2017-2032*.

Warrumbungle Shire Council (2022), *About Warrumbungle Shire*. Accessed from: www.warrumbungle.nsw.gov.au/our council/community-and-economic-profile/about-the-shire/about-warrumbungle-shire.

WaterNSW (2019), *Onsite domestic wastewater management, Designing and Installing On-Site Wastewater Systems*.

WaterNSW (2022a), *NSW Water Register,* Accessed from: https://waterregister.waternsw.com.au/water-register-frame.

WaterNSW (2022b), *Continuous water monitoring network*. Accessed from: https://realtimedata.waternsw.com.au/.

Weeds Australia (2022), *Weed profiles*. Accessed from https://weeds.org.au/weeds-profiles/.

West, G. (1993) *Input-Output Analysis for Practitioners*, Version 7.1, User's Guide.

Wildlife Health Australia (2018), *National Wildlife Biosecurity Guidelines September 2018 – Version 1.0*, Sydney, NSW.

Wilpinjong Coal Pty Limited (2005), *Wilpinjong Coal Project – Environmental Impact Statement.* Accessed from: www.peabodyenergy.com/Operations/Australia-Mining/New-South-Wales-Mining/Wilpinjong-Mine/Approvals,-Plans-Reports.

Wind Prospect CWM Pty Limited (2012), *Crudine Ridge Wind Farm Environmental Assessment.* Accessed from: www.planningportal.nsw.gov.au/major-projects/projects/crudine-ridge-wind-farm.

WorkCover NSW (2005), *Storage and Handling of Dangerous Goods Code of Practice*, Gosford, NSW.

World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) (2012), *Greenhouse Gas Protocol*.

Yancoal (2021), *Moolarben Coal Complex UG2 Modification: Modification report.* Accessed from: https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=MP08_0135-MOD-4%2120211124T222922.900%20GMT.

Appendix A

Secretary's Environmental Assessment Requirements checklist

A1 Secretary’s Environmental Assessment Requirements (SEARs) checklist

A1.1 SEARs

Table A-1 identifies the sections of the EIS where the SEARS requirements of the project have been addressed.

Table A-1 Statutory compliance requirements for the project

Item	Requirement	Where addressed in the EIS
General Requirements	The Environmental Impact Statement (EIS) must meet the minimum form and content requirements as prescribed by Part 8, Division 5 of the *Environmental Planning and Assessment Regulation 2021* (EP&A Regulation) and must have regard to the State Significant Infrastructure Guidelines.	Appendix C (Statutory compliance)
	In particular, the EIS must include: • A stand-alone executive summary;	Summary of the EIS main report
	• A summary of the background to the project, including alternatives that were considered to the project;	Chapter 1 (Introduction) — Section 1.1 (Renewable Energy Zones (REZs) — Section 1.2 (Central-West Orana REZ) Chapter 2 (Strategic context) — Section 2.5 (Strategic options assessment)

Item	Requirement	Where addressed in the EIS
	• 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 3 (Project description) Appendix B (Project description mapping)
	• 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; — the need for the project and why the proposed project is preferred over other alternatives, including detailed consideration of alternative options and routes (including other existing easements and connections to other transmission lines and opportunities for shared infrastructure with proposed developments in the region) and justification for the preferred routes;	Chapter 2 (Strategic context) Chapter 4 (Statutory context) Chapter 20 (Cumulative Impacts) Appendix C (Statutory compliance) Appendix E (Cumulative impact assessment)
	• the relevant statutory context for the project, including: — the assessment pathway for the project under the *Environmental Planning and Assessment Act 1979* (EP&A Act); — the approvals required before the project may be carried out; — any relevant matters for consideration;	Chapter 4 (Statutory context) Appendix C (Statutory compliance)
	• 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 5 (Engagement) — Section 5.1 to Section 5.5 Appendix D (Engagement summary)

Item	Requirement	Where addressed in the EIS
	• 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 of the site and existing or proposed developments in the region taking into consideration any — relevant legislation, environmental planning instruments, guidelines, policies, plans and industry codes of practice including Cumulative Impact Assessment Guideline (DPIE, November 2021); — actions proposed to deal with any uncertainties associated with the assessment; and — a detailed evaluation of the merits of the project as a whole.	Chapter 5 (Engagement) — Section 5.1 to Section 5.5 Chapters 7 to 20 Chapter 21 (Environmental management) Chapter 22 (Environmental risk analysis) Chapter 23 (Justification and conclusion) Appendix D (Engagement summary)
	The EIS must also be accompanied by: • a report from a AIQS Certified Quantity Surveyor or RICS Chartered Quantity Surveyor providing a detailed calculation of the capital investment value (CIV) (as defined in Schedule 7 of the EP&A Regulation) of the proposal, including details of all assumptions and components from which the CIV calculation is derived. The report shall be prepared on company letterhead and indicate applicable GST component of the CIV and include certification that the information provided is accurate at the time	EnergyCo has provided the capital investment value of the project to DPE.
	• an estimate of the jobs that will be created during the construction and operational phases of the proposed project.	Chapter 14 (Economic) — Section 14.4.1 (Construction expenditure and workforce) — Section 14.5.1 (Operational outputs, expenditure and workforce)

Item	Requirement	Where addressed in the EIS
Key Issues		
Biodiversity	• an assessment of the biodiversity impacts of the project, including impacts associated with transport route road upgrades, in accordance with the NSW *Biodiversity Conservation Act 2016* and the Biodiversity Assessment Method (BAM) 2020, and documented in a Biodiversity Development Assessment Report (BDAR);	Chapter 10 (Biodiversity) Technical paper 4 – Biodiversity Development Assessment Report
	• 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;	Chapter 10 (Biodiversity) Technical paper 4 – Biodiversity Development Assessment Report — Chapter 7 (Avoid and minimise impacts) — Chapter 8 (Impact assessment) — Chapter 9 (Serious and irreversible impacts) — Chapter 10 (Impact summary) — Chapter 11 (Biodiversity credit report)
	• an assessment of the impacts of the project on listed aquatic threatened species, populations or ecological communities, scheduled under the Fisheries Management Act 1994, and a description of the measures to minimise and rehabilitate impacts; and	Chapter 10 (Biodiversity) — Section 10.4 (Potential impact - construction) — Section 10.5 (Potential impact - operation) Technical paper 4 – Biodiversity development assessment report — Chapter 8 (Impact assessment)
	• if an offset is required, details of the measures proposed to address the offset obligations;	Chapter 10 (Biodiversity) — Section 10.6.3 (Biodiversity offset strategy) Technical paper 4 – Biodiversity Development Assessment Report — Chapter 10 (Impact summary) — Chapter 11 (Biodiversity credit report)

Item	Requirement	Where addressed in the EIS
Heritage	• an assessment of the impact to Aboriginal cultural heritage items (cultural and archaeological) including impacts associated with transport route road upgrades, in accordance with the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH, 2011) and the Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW (DECCW, 2010) including results of archaeological test excavations (if required);	Chapter 11 (Aboriginal heritage) Technical paper 5 – Aboriginal cultural heritage assessment report — Chapter 5 (Existing Environment) — Chapter 7 (Archaeological context) — Chapter 8 (Field investigation) — Chapter 9 (The archaeological resource) — Chapter 10 (Significant assessment) — Chapter 11 (Impact assessment) — Chapter 12 (Management strategy and recommendations)
	• evidence of consultation with Aboriginal communities in determining and assessing impacts, developing options and selecting options and mitigation measures (including the final proposed measures), having regard to the Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010); and	Chapter 11 (Aboriginal heritage) Technical paper 5 – Aboriginal cultural heritage assessment report — Chapter 4 (Aboriginal consultation)

Item	Requirement	Where addressed in the EIS
Water and soils	• an assessment of the impacts of the project on the quantity and quality of the region's surface water resources, including the Talbragar River, Coolaburragundy River, and the Castlereagh, Macquarie-Bogan and Hunter catchment areas, having regard to NSW Water Quality Objectives;	Chapter 19 (Other impacts) — Section 19.1 (Hydrology, flooding and water quality) Technical paper 14 – Hydrology and water quality — Chapter 2 (Legislative and policy context) • Section 2.3.4 (Water resource plans) — Chapter 4 (Existing environment) • Section 4.3 (Water resources) — Chapter 5 (Construction assessment) • Section 5.2 (Water supply, water resources and wastewater) • Section 5.3.7 (Summary of water quality impacts) — Chapter 6 (Operational assessment) • Section 6.2 (Water supply and water resources) • Section 6.3 (Water quality)

Item	Requirement	Where addressed in the EIS
	• details of water requirements, supply arrangements and wastewater disposal arrangements for construction and operation;	Chapter 3 (Project description) — Section 3.3.4 (Resource use) — Section 3.5.9 (Resources and materials) Chapter 19 (Other impacts) — Section 19.1 (Hydrology, flooding and water quality) — Section 19.1.4 (Potential impact – construction) — Section 19.1.5 (Potential impact – operation) Technical paper 14 – Hydrology and water quality — Chapter 5 (Construction assessment) • Section 5.2 (Water supply, water resources and wastewater) — Chapter 6 (Operational assessment) • Section 6.2 (Water supply and water resources) • Section 6.3 (Water quality)

Item	Requirement	Where addressed in the EIS
	• 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 19 (Other impacts) — Section 19.3 (Groundwater) Technical paper 17 – Groundwater — Chapter 5 (Risk assessment) — Chapter 6 (Construction impact assessment) — Chapter 7 (Operational impact assessment) — Chapter 8 (Aquifer interference policy – minimum impact considerations) Technical paper 4 – Biodiversity Development Assessment Report — Section 4.7 (Groundwater dependent ecosystems) — Section 8.3 (Prescribed impacts)
	• an assessment of the potential flooding impacts and risks of the project	Chapter 19 (Other impacts) — Section 19.1 (Hydrology, flooding and water quality) Technical paper 15 – Flooding — Chapter 5 (Construction Impact assessment) — Chapter 6 (Operational Impact assessment)
	• where the project involves works within 40 metres of the high bank of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with the DPI Guidelines for Controlled Activities on Waterfront Land (2018) and (if necessary) Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI 2003); and Policy & Guidelines for Fish Habitat Conservation & Management (DPI, 2013); and	Technical paper 4 – Biodiversity Development Assessment Report — Section 6 (Identifying prescribed impacts) — Section 8.3.1.6 (Waterbodies, water quality and hydrological processes)

Item	Requirement	Where addressed in the EIS
	• a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with the Managing Urban Stormwater: Soils & Construction series, including Volumes 1, 2A and 2C (Landcom);	Chapter 19 (Other impacts) — Section 19.1 (Hydrology, flooding and water quality) — Section 19.1.6 (Management of impacts) Technical paper 14 – Hydrology and water quality — Chapter 7 (Recommended management and mitigation measures)
Land	• an assessment of impacts of the project on soils and land capability of the site and surrounds;	Chapter 8 (Agriculture) Chapter 19 (Other impacts) — Section 19.2 (Soils and contamination) Technical paper 2 – Agriculture — Chapter 5 (Construction impacts) • Section 5.2 (Land and soil capability) — Chapter 6 (Operational impacts) • Section 6.2 (Land and soil capability) Technical paper 16 – Contamination — Chapters 4–6

Item	Requirement	Where addressed in the EIS
	• an assessment of the risk of soil contamination and disturbance of land (including associated with naturally occurring asbestos, acid sulfate soils and salinity in the vicinity of the site); and	Chapter 19 (Other impacts) — Section 19.2 (Soils and contamination) Technical paper 16 – Contamination — Chapter 4 (Existing Environment) — Chapter 5 (Construction assessment) • Section 5.1 (potential to encounter contamination) • Section 5.2 (Potential impacts to the project from existing sources of contamination) • Section 5.3 (Potential impacts to the soil environment from construction activities) — Chapter 6 (Operational assessment)

Item	Requirement	Where addressed in the EIS
	• assessment of impact of the project on agricultural land, biosecurity, land reserved under the *National Parks and Wildlife Act 1974*, Crown lands including State Forests and travelling stock reserves, mineral resources and exploration licenses, rail reserves and pipeline corridors;	Chapter 7 (Land use and property) Chapter 8 (Agriculture) Technical paper 2 – Agriculture — Chapter 5 (Construction impacts) • Section 5.3 (Biosecurity) • Section 5.10 (Travelling stock reserves and livestock routes) — Chapter 6 (Operational Impacts) — Section 6.10 (Travelling stock reserves and livestock routes) In terms of pipeline corridors, there are no petroleum or high-pressure gas pipelines that intersect or are adjacent to the study area
Traffic and transport	• an assessment of the potential transport impacts for all stages of the project on the capacity, condition, safety and efficiency of the local and State road network and the rail network;	Chapter 17 (Traffic and transport) Technical paper 13 – Traffic and transport — Chapter 5 (Construction assessment) — Chapter 6 (Operational assessment) — Chapter 7 (Management and mitigation measures)
	• a cumulative impact assessment of traffic from nearby developments;	Chapter 20 (Cumulative impacts) Appendix E (Cumulative impact assessment)

Item	Requirement	Where addressed in the EIS
	• details of the ongoing maintenance works required to service assets, outlining the measures to maintain the road; and	Chapter 17 (Traffic and transport) — Section 17.5 (Potential impacts – construction) — Section 17.6 (Management of impacts) Technical paper 13 – Traffic and transport — Chapter 6 (Operational assessment)
	• provide details of measures to mitigate and/or manage potential impacts including a schedule of all required road upgrades and any other traffic control measures, developed in consultation with the relevant road and/or rail authority;	Chapter 17 – Traffic and transport — Section 17.6 (Management of impacts) Technical paper 13 – Traffic and transport — Chapter 7 (Management and mitigation measure)
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, and the Siding Spring Observatory in accordance with the Dark Sky Planning Guideline (2016); and	Chapter 9 (Landscape character and visual amenity) Technical paper 3 – Landscape character and visual impact — Chapter 5 (Landscape character assessment) • Section 5.2 (Assessment of daytime landscape character) • Section 5.3 (Assessment of landscape character impacts at night) — Chapter 6 (Visual impact assessment) • Section 6.2 (Assessment of daytime visual impacts - public domain) • Section 6.3 (Assessment of visual impact – private dwellings)

Item	Requirement	Where addressed in the EIS
	• an assessment of the construction, operational and road noise, vibration and blasting impacts of the project, including any corona discharge noise;	Chapter 15 (Noise and vibration) Technical paper 9 – Noise and vibration
Air	• an assessment of the air quality impacts of the project, including from dust.	Chapter 19 (Other impacts) — Section 19.4 (Air quality) Technical paper 18 – Air quality — Chapter 5 (Construction assessment) — Chapter 6 (Operational assessment)
Hazards and risks	• Health: — 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); — a preliminary risk screening completed in accordance with the Department's Applying SEPP 33. If the screening indicates that the development is 'potentially hazardous', a Preliminary Hazard Analysis (PHA) must be prepared in accordance with the Department's *Hazardous Industry Planning Advisory Paper* No. 6, *'Hazard Analysis'* and Multi-Level Risk Assessment. The EIS and PHA must also verify that the development can comply with all relevant standards and codes of practice, including *Australian Standards AS1940: The storage and handling of flammable and combustible liquids;*	Chapter 16 (Hazard and risk) Technical paper 11 – Preliminary hazard analysis — Chapter 5 (Risk screening) — Chapter 6 (Preliminary hazard analysis) — Chapter 7 (Recommended management and mitigation measures) Technical paper 12 – Electro magnetic field assessment — Chapter 4 (Impact Assessment)
	• Telecommunications: — identify possible effects on telecommunications systems, including all licenced government microwave links, and assess impacts and mitigation measures including undertaking a detailed assessment to examine the potential impacts as well as analysis and agreement on the implementation of suitable options to avoid potential disruptions to radio communication services, such as transmission tower exclusion zones;	Chapter 16 (Hazard and risk)

Item	Requirement	Where addressed in the EIS
	• Bushfire and Emergency — an assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation, and demonstrate compliance with Planning for Bush Fire Protection 2019;	Chapter 16 (Hazard and risk) — Section 16.4.1 (Potential impacts – construction (bushfire)) — Section 16.5.1 (Potential impacts – operation (bushfire)) Technical paper 10 – Bushfire — Chapter 4 (Existing environment and bushfire history) — Chapter 5 (Bushfire risk assessment – construction) — Chapter 6 (Bushfire risk assessment – operation) — Chapter 7 (Emergency egress and evacuation) — Chapter 8 (Summary – compliance with Planning for Bushfire Protection)
	• Pipeline — where the proposal is adjacent to or on land in a high-pressure gas pipeline corridor, report on consultation outcomes with the operator of the pipeline; and	Chapter 16 (Hazard and risk) — Section 16.4.5 (Utilities)
	• Aviation Safety — defined air traffic routes, aircraft operating heights, approach / departure procedures, radar interference, communication systems, navigation aids, use of emergency helicopter access, aerial baiting and culling in the National Parks, safe and efficient aerial application of agricultural fertilizers and pesticide; — identify aerodromes within 30 km of the transmission line and consider the — impact to nearby aerodromes and aircraft landing areas; and or address impacts on obstacle limitation surfaces;	Chapter 16 (Hazard and risk) Technical paper 1 – Aviation — Chapter 5 (Aviation impact assessment)
Waste	• identify, quantify and classify the likely waste streams to be generated throughout all stages of the project, and describe the measures to be implemented to reduce waste generation, manage, reuse, recycle and safely dispose of this waste;	Chapter 18 (Waste management)

Item	Requirement	Where addressed in the EIS
Social	• an assessment of the social impacts in accordance with Social Impact Assessment Guideline (DPIE, July 2021) and consideration of construction workforce accommodation;	Chapter 13 (Social) Technical paper 7 – Social — Chapter 5 (Engagement) — Chapter 7 (Operational assessment)
Economic	• an assessment of the benefits of the project for the region and the State as a whole, including consideration of any increase in demand for community infrastructure and services, and details of how the construction workforce will be managed to minimise local impacts, including a consideration of the construction workforce accommodation and an assessment of the impacts to State Forests.	Chapter 7 (Land use and property) — Section 7.4 (Potential impacts – construction) — Section 7.5 (Potential impacts – operation) Chapter 13 (Social) Technical paper 7 – Social — Section 6.1 (Community) — Section 6.4 (Accessibility)
Plans and documents	The assessment of the key issues listed above must take into account relevant guidelines, policies, and plans as identified. A list of some of the legislation, policies and guidelines that may be relevant to the assessment of the project can be found at: • https://www.planning.nsw.gov.au/policy-and-legislation/planning-reforms/rapid-assessment-framework/improving-assessment-guidance • https://www.planningportal.nsw.gov.au/major-projects/assessment/policies-and-guidelines; and • https://www.dcceew.gov.au/environment/epbc/publications#assessments	Chapter 7 – Chapter 20 Appendix C (Statutory compliance)
Expiry date	If you do not lodge an EIS for the infrastructure within 2 years of the issue date of these SEARs, your SEARs will expire. If an extension to these SEARs will be required, please consult with the Planning Secretary 3 months prior to the expiry date.	Not Applicable

A2 Supplementary SEARs

A2.1 SEARs

Table A-2 Statutory compliance requirements for the project

Item	Requirement	Where addressed in the EIS
Introduction	1. On 2 March 2023, a delegate of the Federal Minister for the Environment determined Central-West Orana Renewable Energy Zone Transmission Project was a controlled action under section 75 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The EPBC Act controlling provisions for the proposed actions are: i. listed threatened species and communities (sections 18 and 18A) ii. listed migratory species (sections 20 and 20A)	N/A
	2. The proposed action will 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 to that Agreement, including, addressing the matters outlined in Schedule 4 of the *Environment Protection and Biodiversity Conservation Regulations 2000* (EPBC Regulations).	Chapter 10 (Biodiversity) Appendix C (Statutory compliance) — Section C1.5 (Commonwealth legislation) Technical paper 4 – Biodiversity development assessment report
	3. The proponent must undertake an assessment of all protected matters that may be impacted by the development under the controlling provision identified in paragraph 1. The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) considers that the proposed action is likely to have a significant impact on threatened species and communities and migratory species listed in Appendix A.	Chapter 10 (Biodiversity) Technical paper 4 – Biodiversity development assessment report — Section 8 (Impact assessment) Appendix C (Statutory compliance) — Section C1.5 (Commonwealth legislation)
	4. The proponent must consider each of the protected matters under the triggered controlling provisions that may be impacted by the action. Note that this may not be a complete list and it is the responsibility of the proponent to undertake an analysis of the relevant impacts and ensure all protected matters that are likely to be impacted are assessed for the Commonwealth Minister's consideration	Chapter 10 (Biodiversity) Technical paper 4 – Biodiversity development assessment report

Item	Requirement	Where addressed in the EIS
Relevant requirements	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.	Chapter 10 (Biodiversity) Technical paper 4 – Biodiversity development assessment report
Project description	6. The title of the action, background to the action and current status.	Chapter 2 (Strategic context) Chapter 3 (Project description) Chapter 4 (Statutory context)
	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 National Environmental Significance (MNES)	Chapter 3 (Project description) Appendix B
	8. How the action relates to any other actions that have been, or are being taken in the region affected by the action.	Chapter 1 (Introduction) — Section 1.4 (Related development) Chapter 20 (Cumulative impacts) Appendix E (Cumulative impact assessment)
	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.	Chapter 3 (Project description)
Impacts	10. The EIS must include an assessment of the relevant impacts of the action on the matters protected by the controlling provisions, including: i. 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; ii. a statement whether any relevant impacts are likely to be unknown, unpredictable or irreversible; iii. analysis of the significance of the relevant impacts; and iv. any technical data and other information used or needed to make a detailed assessment of the relevant impacts.	Chapter 10 (Biodiversity) Technical paper 4 – Biodiversity development assessment report

Item	Requirement	Where addressed in the 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: i. a description, and an assessment of the expected or predicted effectiveness of the mitigation measures; ii. any statutory policy basis for the mitigation measures; iii. the cost of the mitigation measures; iv. 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; v. the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	Chapter 2 (Strategic context) — Section 2.11 (Avoidance and minimisation of impacts) — Chapter 10 (Biodiversity) Technical paper 4 – Biodiversity development assessment report — Chapter 7 (Avoid and minimise impacts) — Section 8.4 (Mitigating residual impacts – management measures and implementation) The quantum of biodiversity offsets required for the project is identified in Technical paper 4 (Biodiversity development assessment report). The final cost of the offsets is however subject to the confirmation of the final area impacted by the project, and market conditions for biodiversity credits (where applicable) at the time of purchase. The costs associated with non-offset related mitigation measures (e.g. establishment of connectivity corridors, installation of bird diverters and under-transmission glider poles) would be confirmed as part of the detailed design process and finalisation of the Connectivity Strategy.

Item	Requirement	Where addressed in the EIS
		The endorsement or approval of each mitigation measure or monitoring program would be the responsibility of the Commonwealth Department of Climate Change, Energy, the Environment and Water (as applicable to the EPBC Act) and the NSW Department of Planning and Environment (as applicable to the EP&A Act), in accordance with the approval process under the Commonwealth/NSW bilateral assessment agreement (inclusive of Amending Agreement No. 1).
	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.	Chapter 10 (Biodiversity) Technical paper 4 – Biodiversity development assessment report
	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: i. conservation advice or recovery plan for the species or community; ii. relevant threat abatement plan for the species or community; iii. wildlife conservation plan for the species; and iv. any strategic assessment.	Technical paper 4 – Biodiversity development assessment report — Chapter 10 (Impact summary) — Chapter 11 (Biodiversity credit report)
	14. In addition to the general requirements described above, specific information is required with respect to each of the determined controlling provisions. These requirements are outlined in paragraphs 15-18.	Refer to the response to paragraphs 15-18

Item	Requirement	Where addressed in the EIS
Key issues		
Biodiversity	15. The EIS must identify <u>each</u> 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	Chapter 10 (Biodiversity) Technical paper 4 – Biodiversity development assessment report — Section 4.3.2 (EPBC Act listed threatened ecological communities) — Chapter 5 (Habitat suitability for threatened species) — Chapter 8 (Impact assessment) Appendix C (Statutory compliance) — Section C1.5 (Commonwealth legislation)
	16. For <u>each</u> 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: i. 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 plans; ii. 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; iii. description of the relevant impacts of the action having regard to the full national extent of the species or community's range iv. description of the specific proposed avoidance and mitigation measures to deal with relevant impacts of the action v. identification of significant residual adverse impacts likely to occur after the proposed activities to avoid and mitigate all impacts are taken into account; vi. a description of any offsets proposed to address residual adverse significant impacts and how these offsets will be established vii. 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; and viii. 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	Chapter 10 (Biodiversity) Technical paper 4 – Biodiversity development assessment report — Section 4.3.2 (EPBC Act listed threatened ecological communities) — Chapter 5 (Habitat suitability for threatened species) — Chapter 8 (Impact assessment) — Chapter 10 (Impact summary) — Chapter 11 (Biodiversity credit report)

Item	Requirement	Where addressed in the EIS
	17. Any significant residual impacts not addressed by the BAM may need to be addressed in accordance with the EPBC Act 1999 Environmental Offset Policy. https://www.dcceew.gov.au/environment/epbc/publications/epbc-act-environmental-offsets-policy	Chapter 10 (Biodiversity) Technical paper 4 – Biodiversity development assessment report — Chapter 10 (Impact summary) — Chapter 11 (Biodiversity credit report)
Other approvals and conditions	18. 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.	Chapter 7 – Chapter 20 Appendix C (Statutory compliance)
Environmental record of person proposing to take the action	19. 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.	Appendix C (Statutory compliance)
Information sources	20. 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.	Chapter 10 (Biodiversity) — Section 10.7.3 Technical paper 4 – Biodiversity development assessment report — Section 1.5 (Information sources) — Section 2.2.1 (Review of existing information) — Section 2.3 (Threatened flora survey method)

Appendix B

Project description mapping

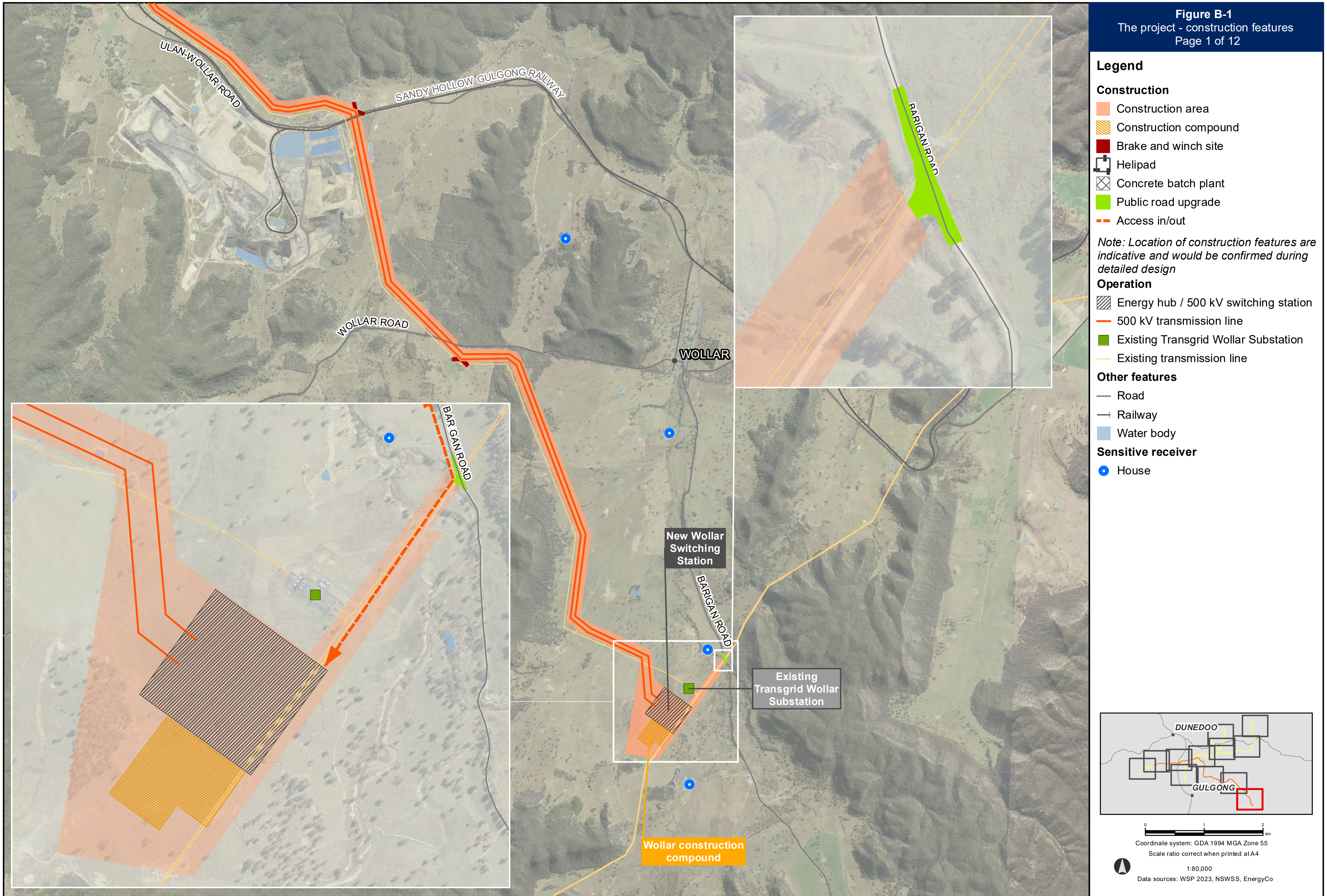


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Figure B-1
The project - construction features
Page 2 of 12

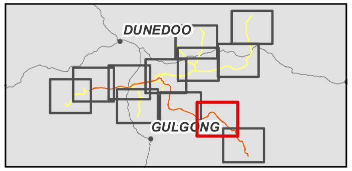
Legend

Construction
- Construction area
- Brake and winch site

Operation
- 500 kV transmission line
- Existing transmission line

Other features
- Road
- Railway
- Watercourse
- Water body

Sensitive receiver
- House
- School



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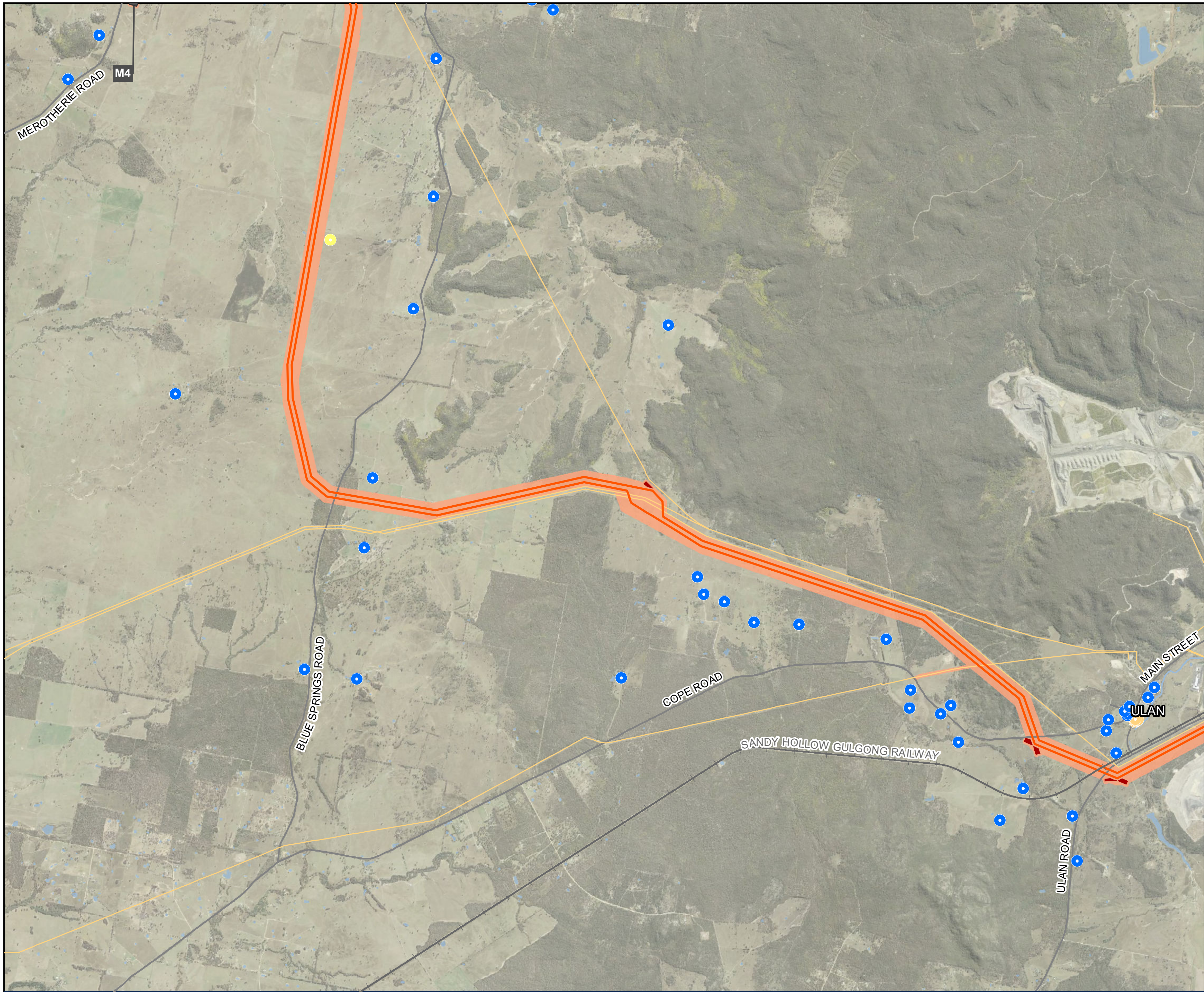
Data sources: WSP 2023, NSWSS, EnergyCo



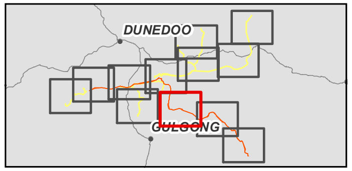
Legend

Construction
- Construction area
- Brake and winch site

Operation
- 330 kV switching station
- 500 kV transmission line
- Existing transmission line

Other features
- Road
- Railway
- Watercourse
- Water body

Sensitive receiver
- House
- School
- DA approved (no structure)



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Data sources: WSP 2023, NSWSS, EnergyCo

Figure B-1
The project - construction features
Page 4 of 12

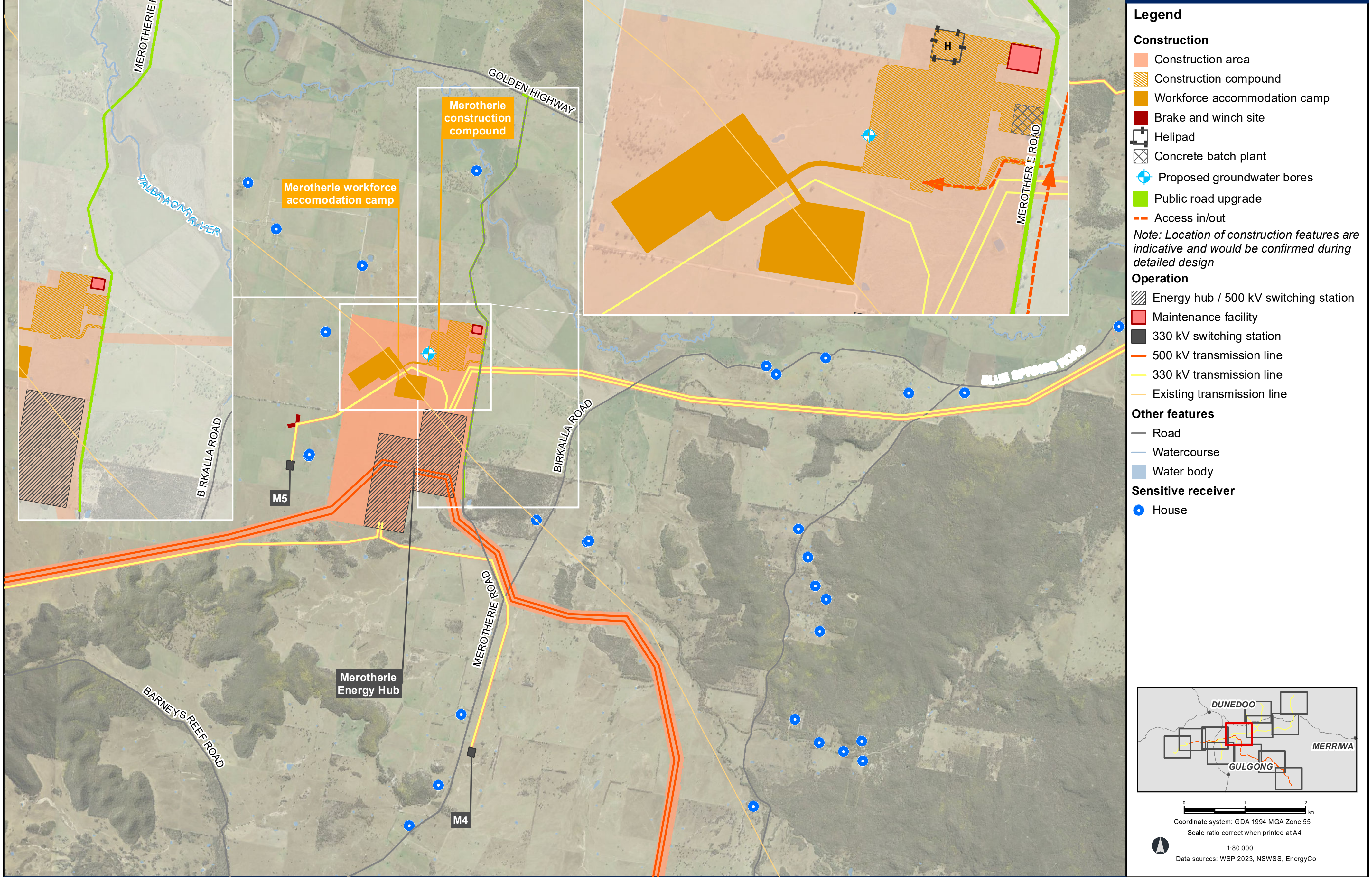

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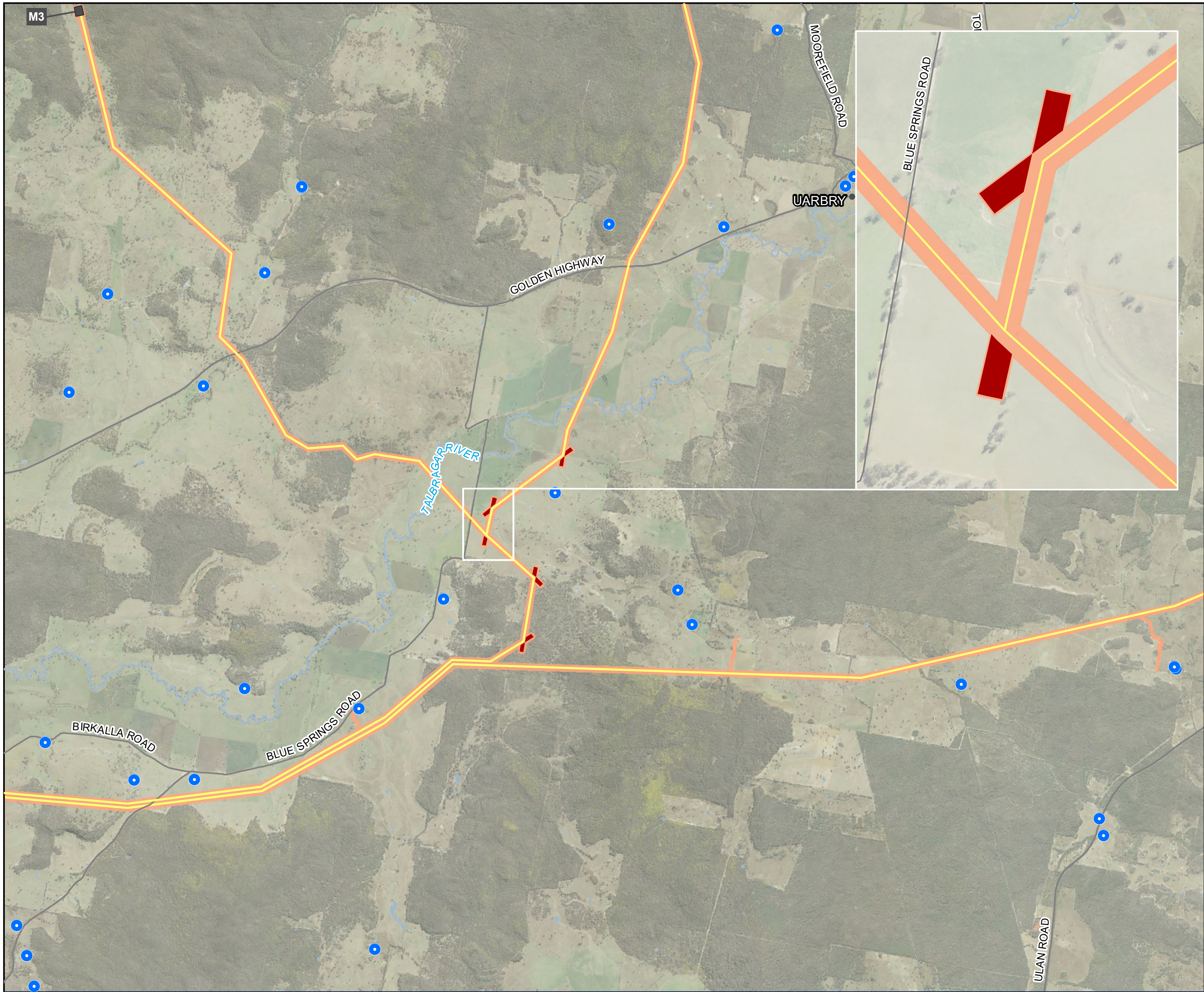
Figure B-1
The project - construction features
Page 5 of 12



Legend

Construction
- Construction area
- Brake and winch site

Operation
- 330 kV switching station
- 330 kV transmission line

Other features
- Road
- Watercourse
- Water body

Sensitive receiver
- House

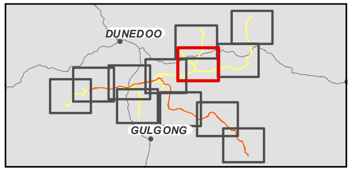


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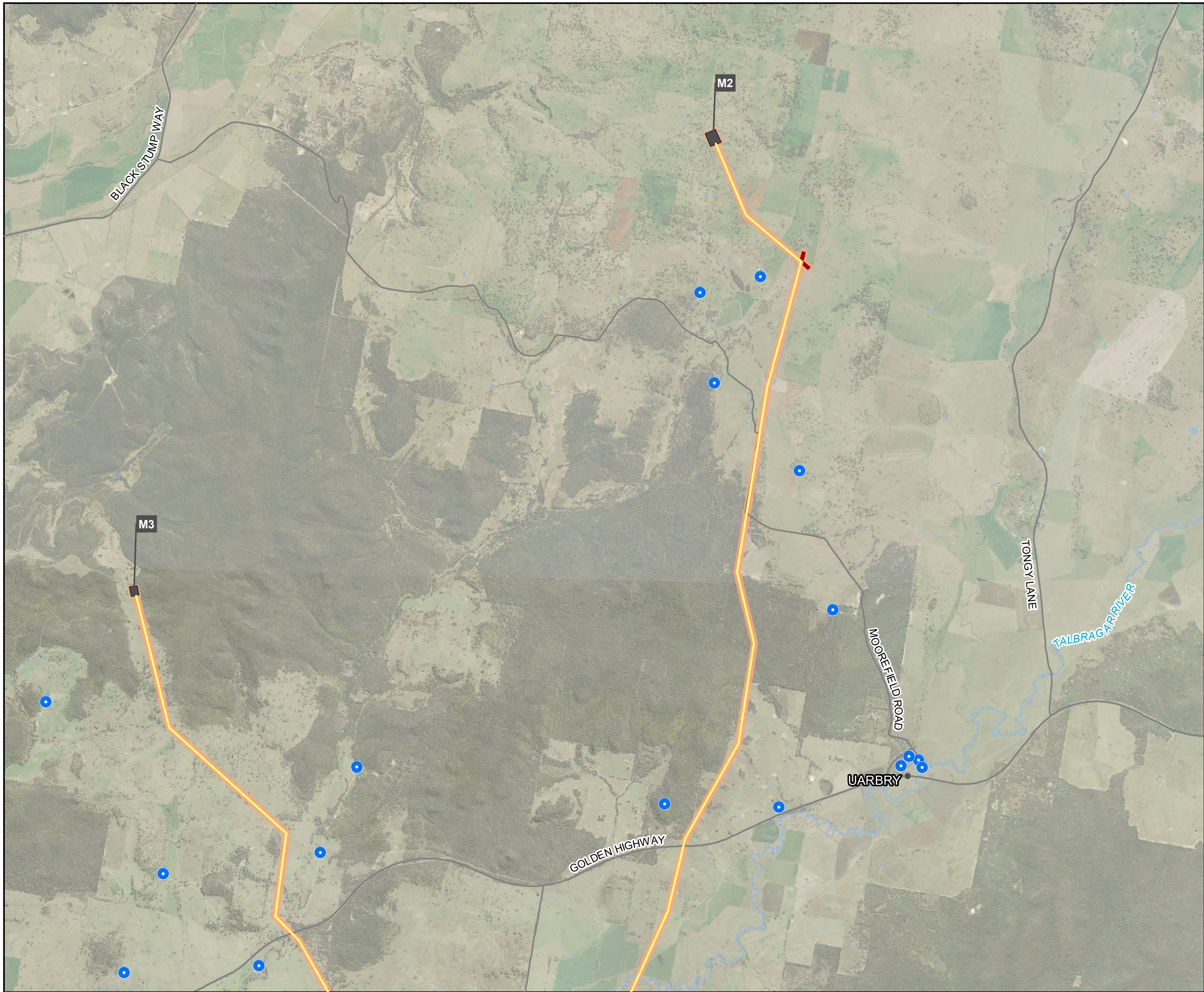
Figure B-1
The project - construction features



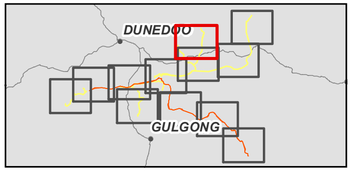
Legend

Construction
- Construction area
- Brake and winch site

Operation
- 330 kV switching station
- 330 kV transmission line

Other features
- Road
- Watercourse
- Water body

Sensitive receiver
- House



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Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
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Data sources: WSP 2023, NSWSS, EnergyCo

Figure B-1
The project - construction features
Page 7 of 12

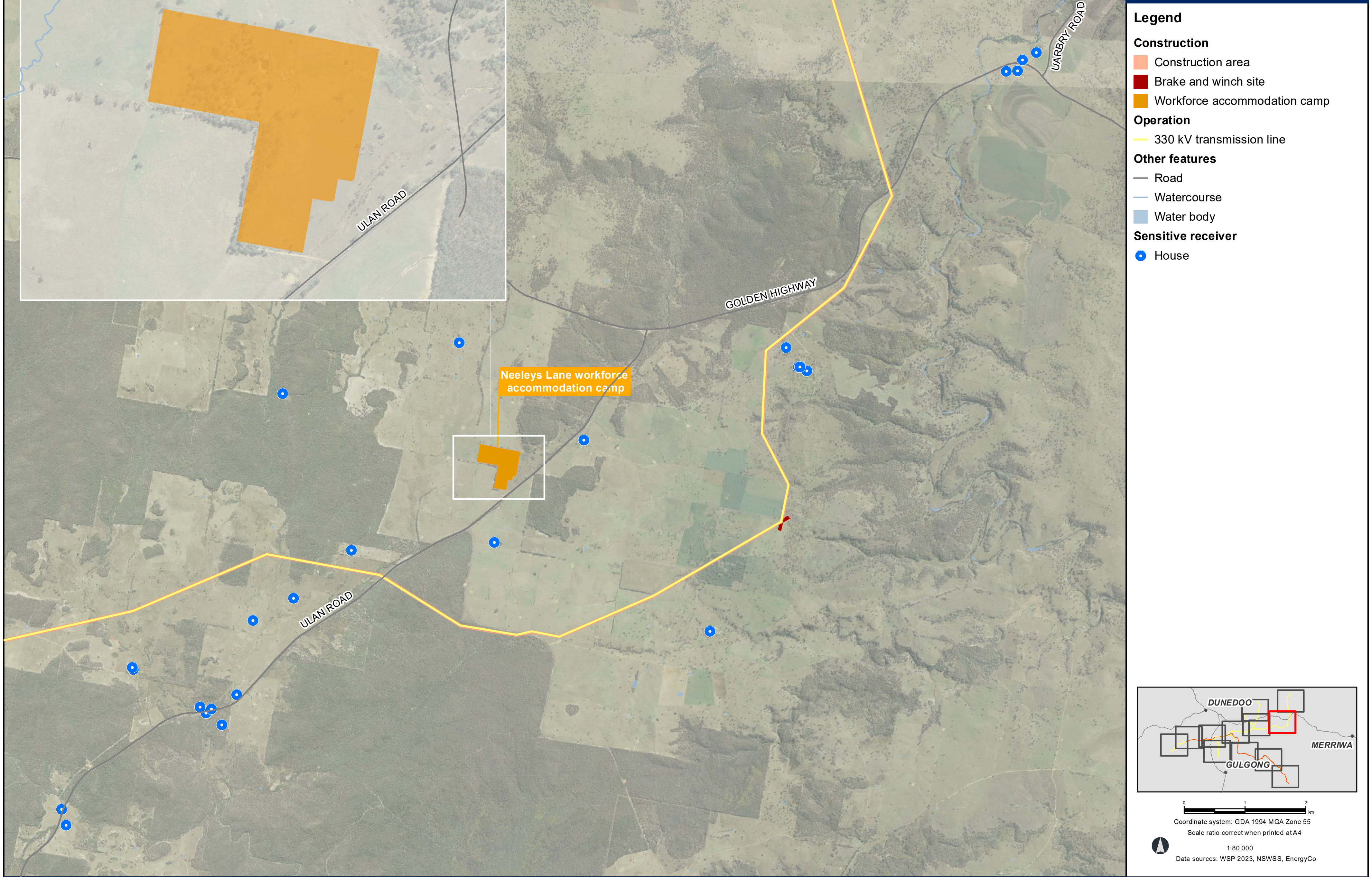

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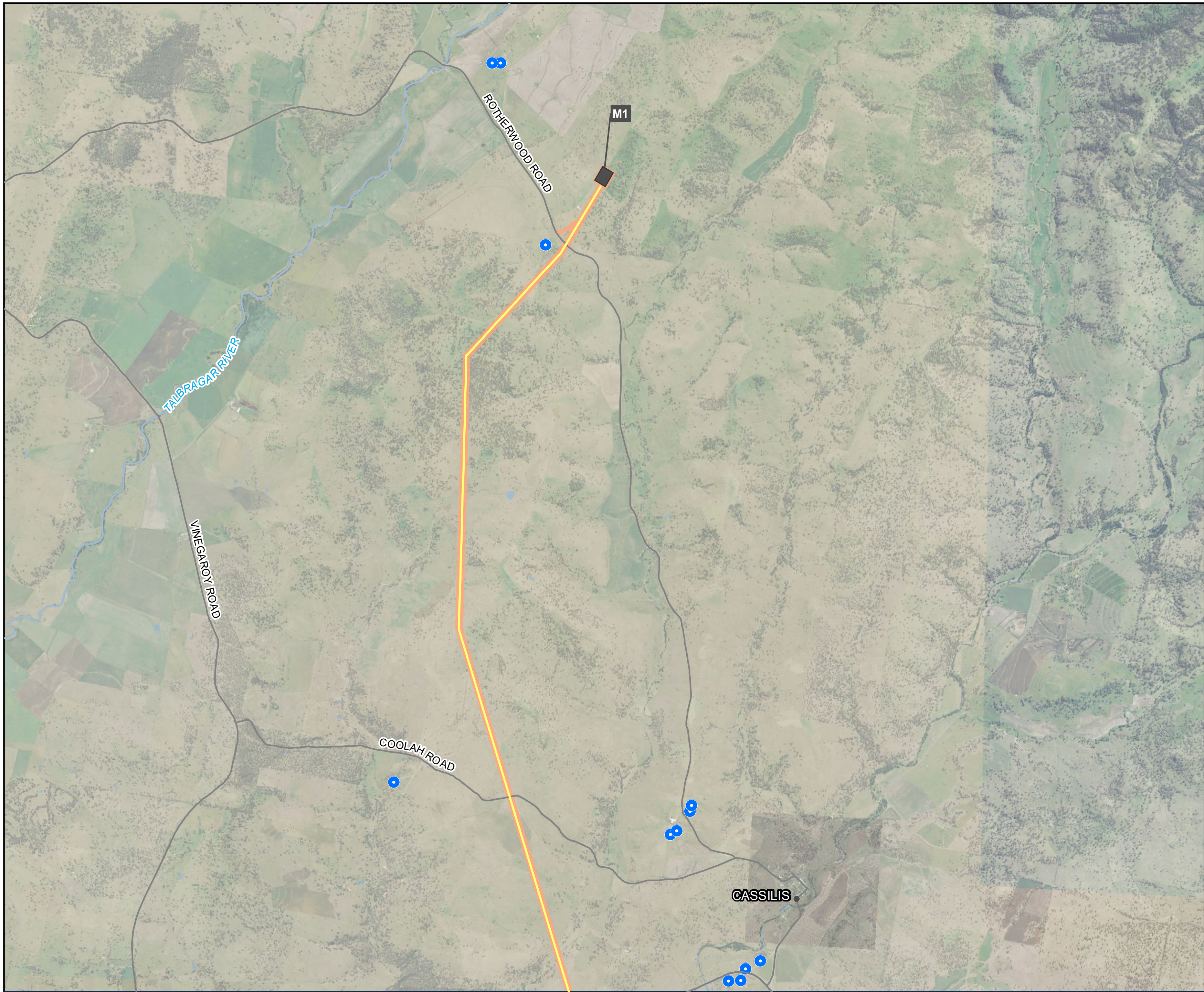
Figure B-1
The project - construction features
Page 8 of 12



Legend

Construction

- Construction area

Operation

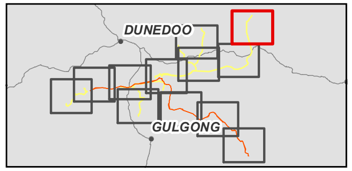
- 330 kV switching station
- 330 kV transmission line

Other features

- Road
- Watercourse
- Water body

Sensitive receiver

- House



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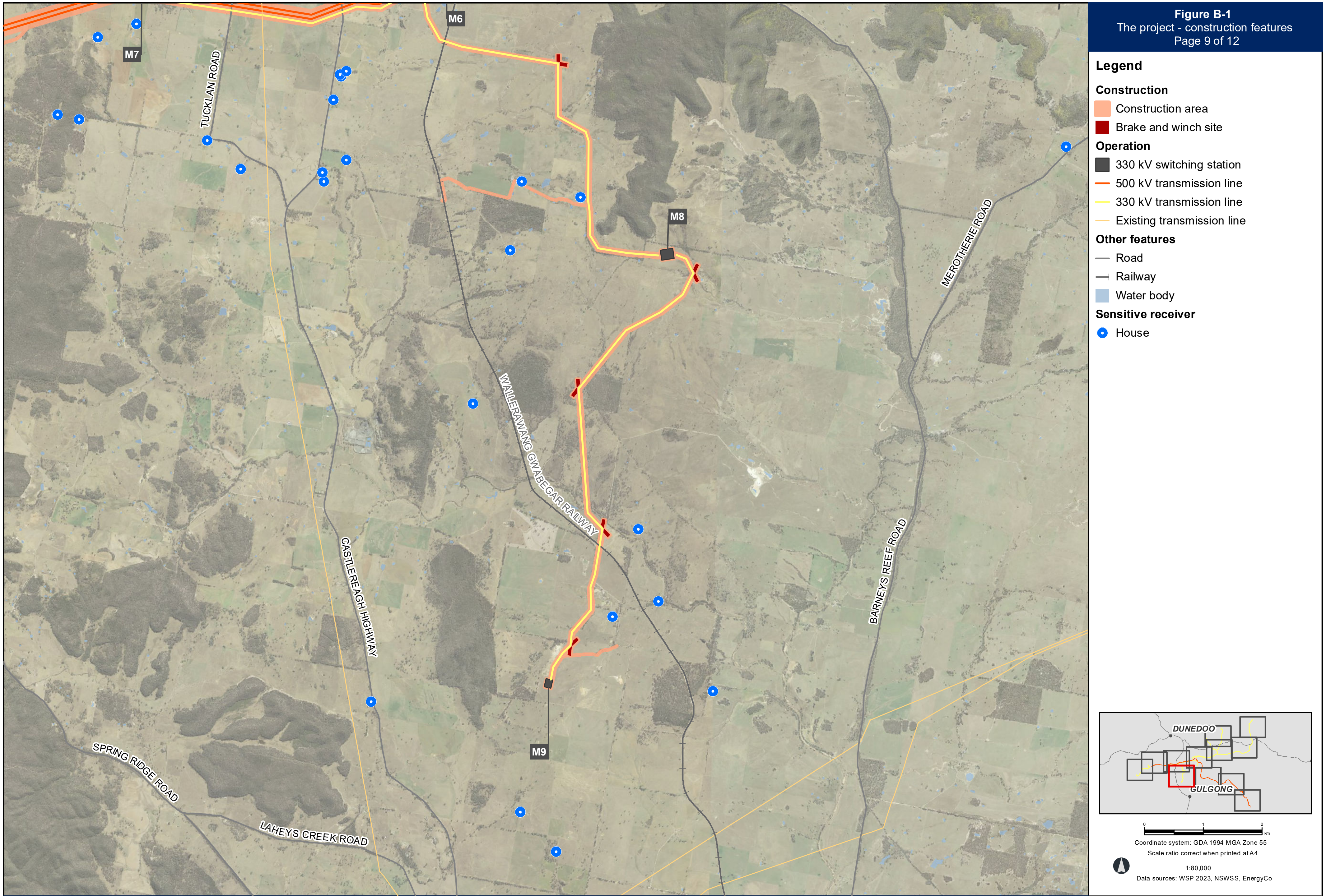
M6
M7
M8
M9
TUCKLAN ROAD
MEROTHERIE ROAD
WALLERAWANG GWABEGAR RAILWAY
CASTLEREAGH HIGHWAY
BARNEYS REEF ROAD
SPRING RIDGE ROAD
LAHEYS CREEK ROAD
Legend
Construction
Construction area
Brake and winch site
Operation
330 kV switching station
500 kV transmission line
330 kV transmission line
Existing transmission line
Other features
Road
Railway
Water body
Sensitive receiver
House
DUNEDOO
GULGONG
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
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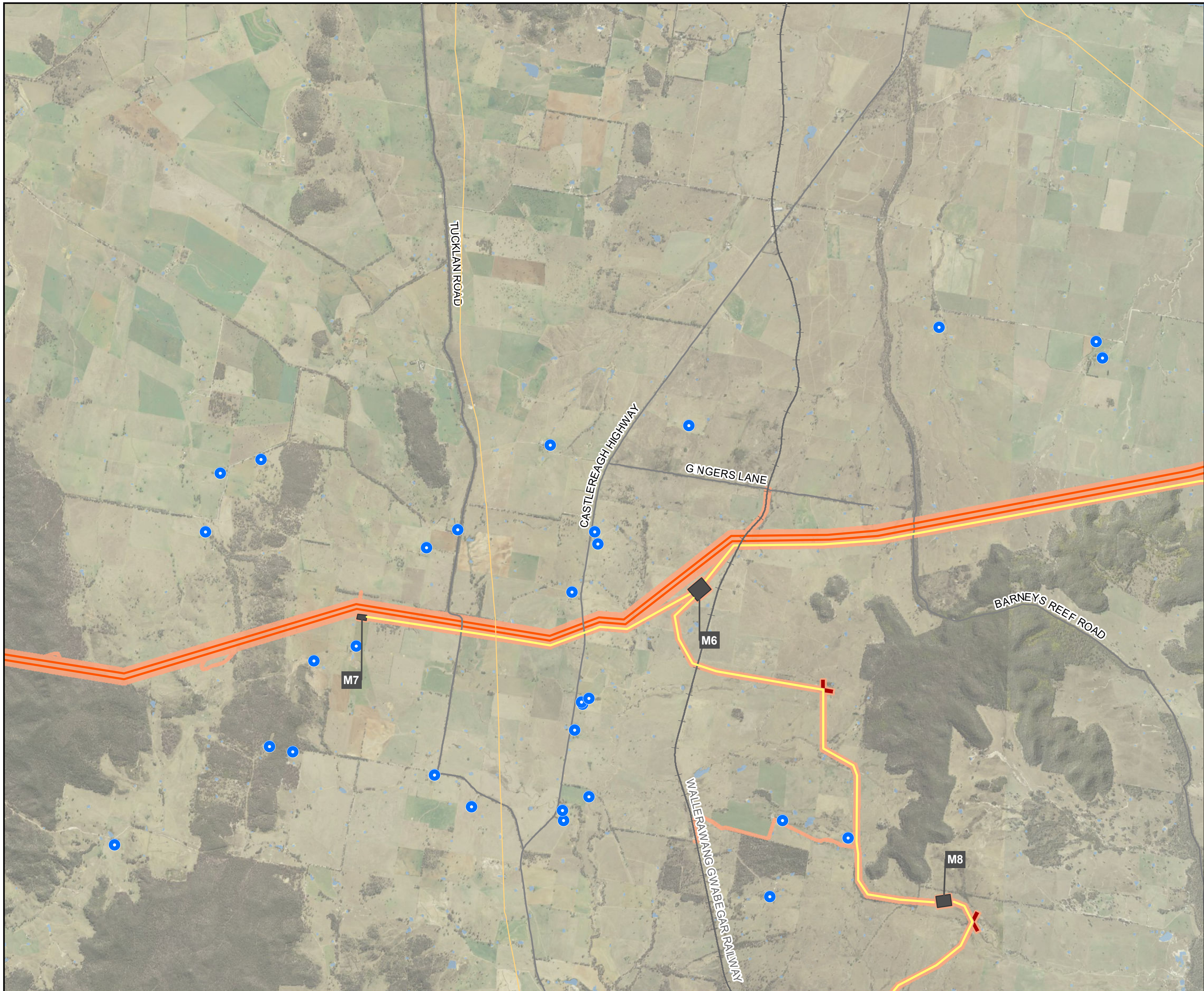
Data sources: WSP 2023, NSWSS, EnergyCo

Figure B-1
The project - construction features
Page 10 of 12



Legend

Construction
- Construction area
- Brake and winch site

Operation
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Existing transmission line

Other features
- Road
- Railway
- Watercourse
- Water body

Sensitive receiver
- House

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
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Data sources: WSP 2023, NSWSS, EnergyCo

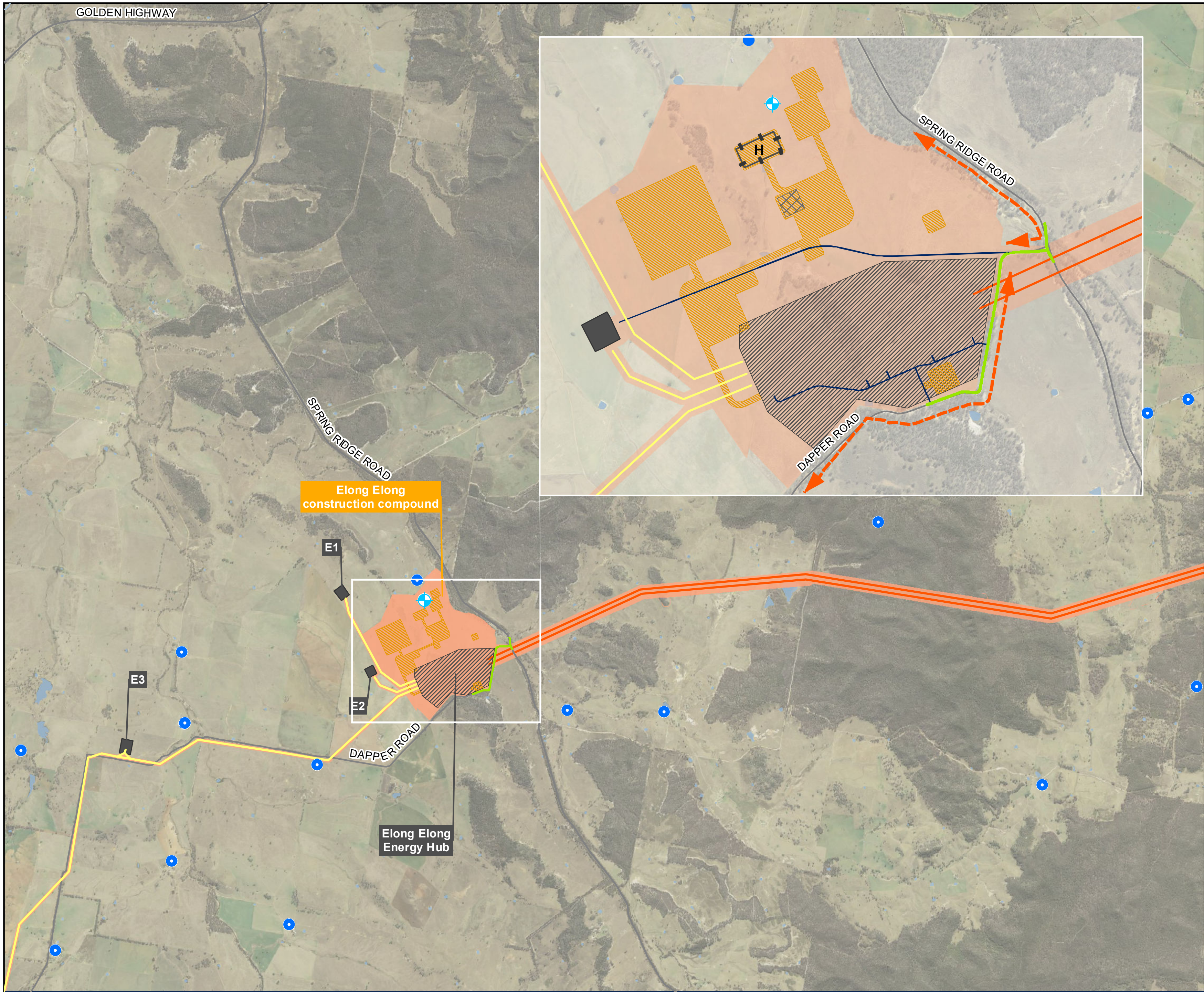

Figure B-1
The project - construction features
Page 11 of 12

Legend

Construction
- Construction area
- Construction compound
- Helipad
- Concrete batch plant
- Proposed groundwater bores
- Public road upgrade
- Access in/out

Note: Location of construction features are indicative and would be confirmed during detailed design

Operation
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line

Other features
- Road
- Watercourse
- Water body

Sensitive receiver
- House

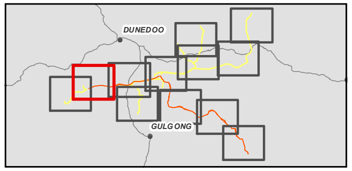

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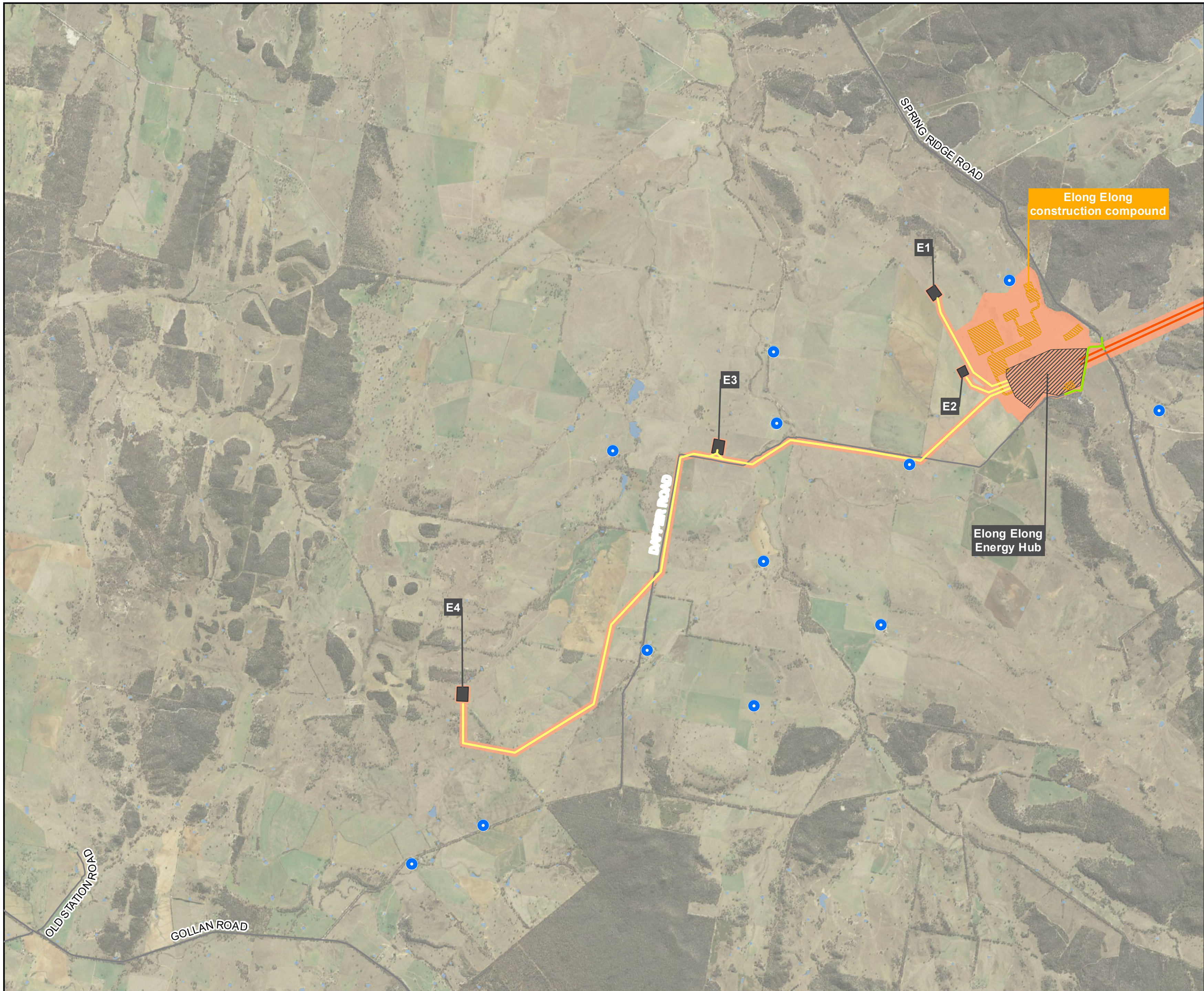
Figure B-1
The project - construction features
Page 12 of 12



Legend

Construction
- Construction area
- Construction compound
- Public road upgrade

Operation
- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line

Other features
- Road
- Water body

Sensitive receiver
- House

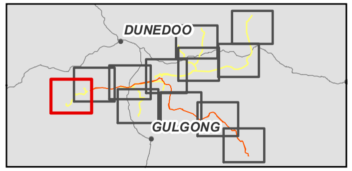


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Figure B-2
The project - operational features
Page 1 of 12

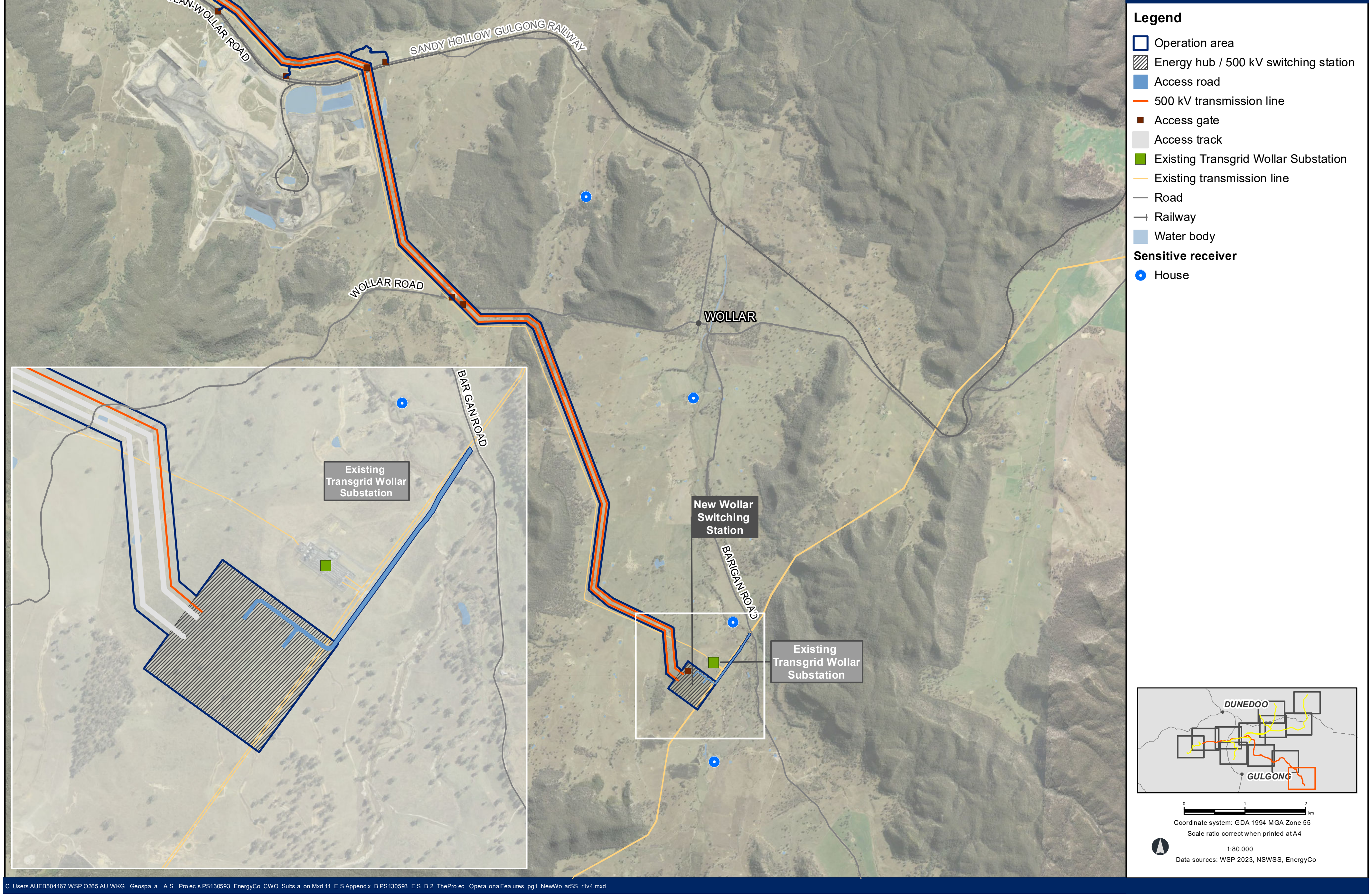
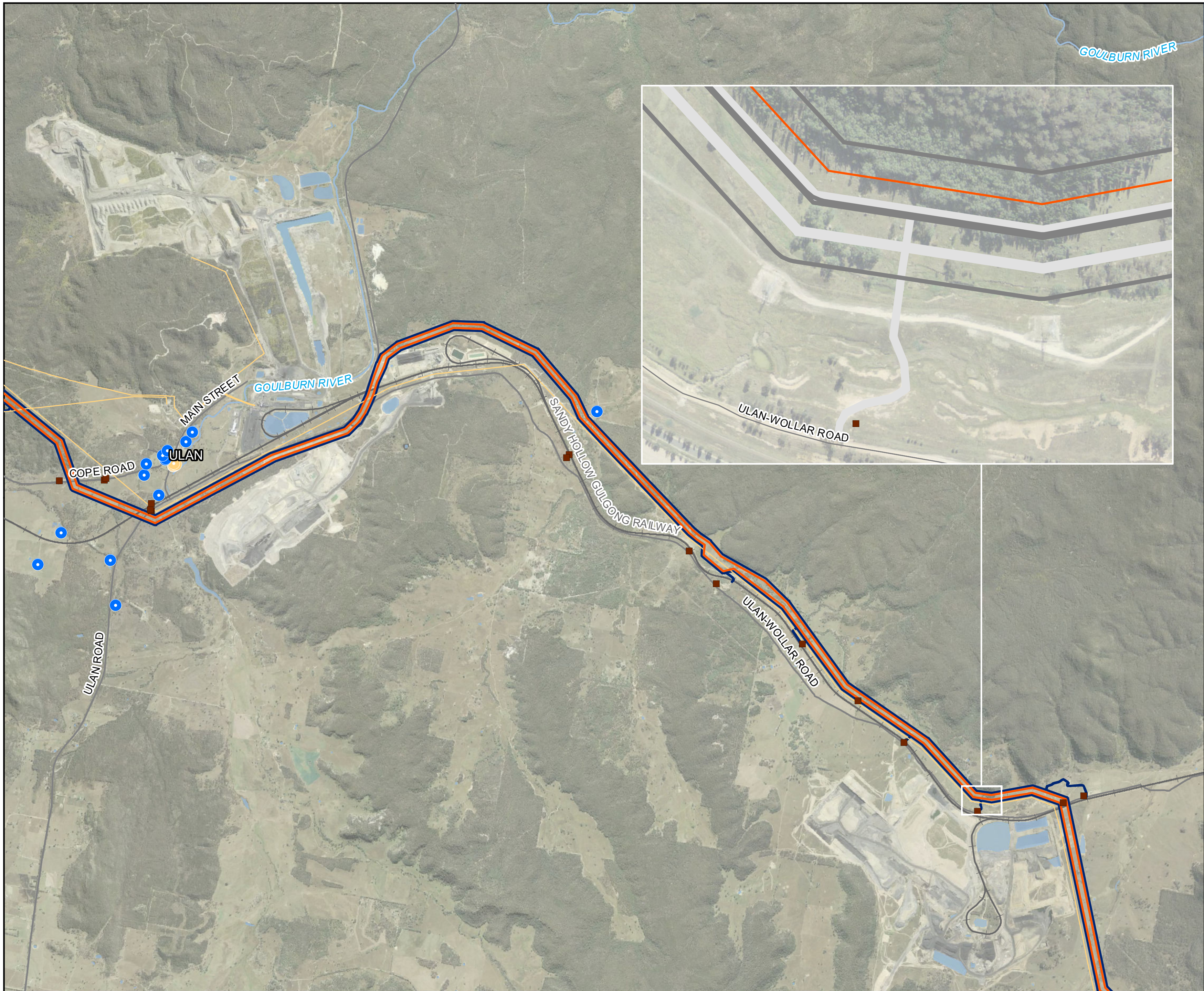


Figure B-2
The project - operational features
Page 2 of 12

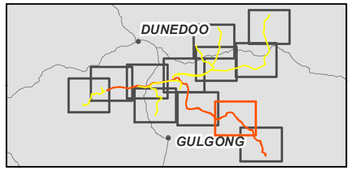


Legend

- Operation area
- 500 kV transmission line
- Easement
- Access gate
- Access track
- Existing transmission line
- Road
- Railway
- Watercourse
- Water body

Sensitive receiver

- House
- School



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Data sources: WSP 2023, NSWSS, EnergyCo

Figure B-2
The project - operational features
Page 3 of 12

Legend

- Operation area
- 330 kV switching station
- 500 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse
- Access gate
- Water body

Sensitive receiver

- House
- School
- DA approved (no structure)

Coordinate system: GDA 1994 MGA Zone 55
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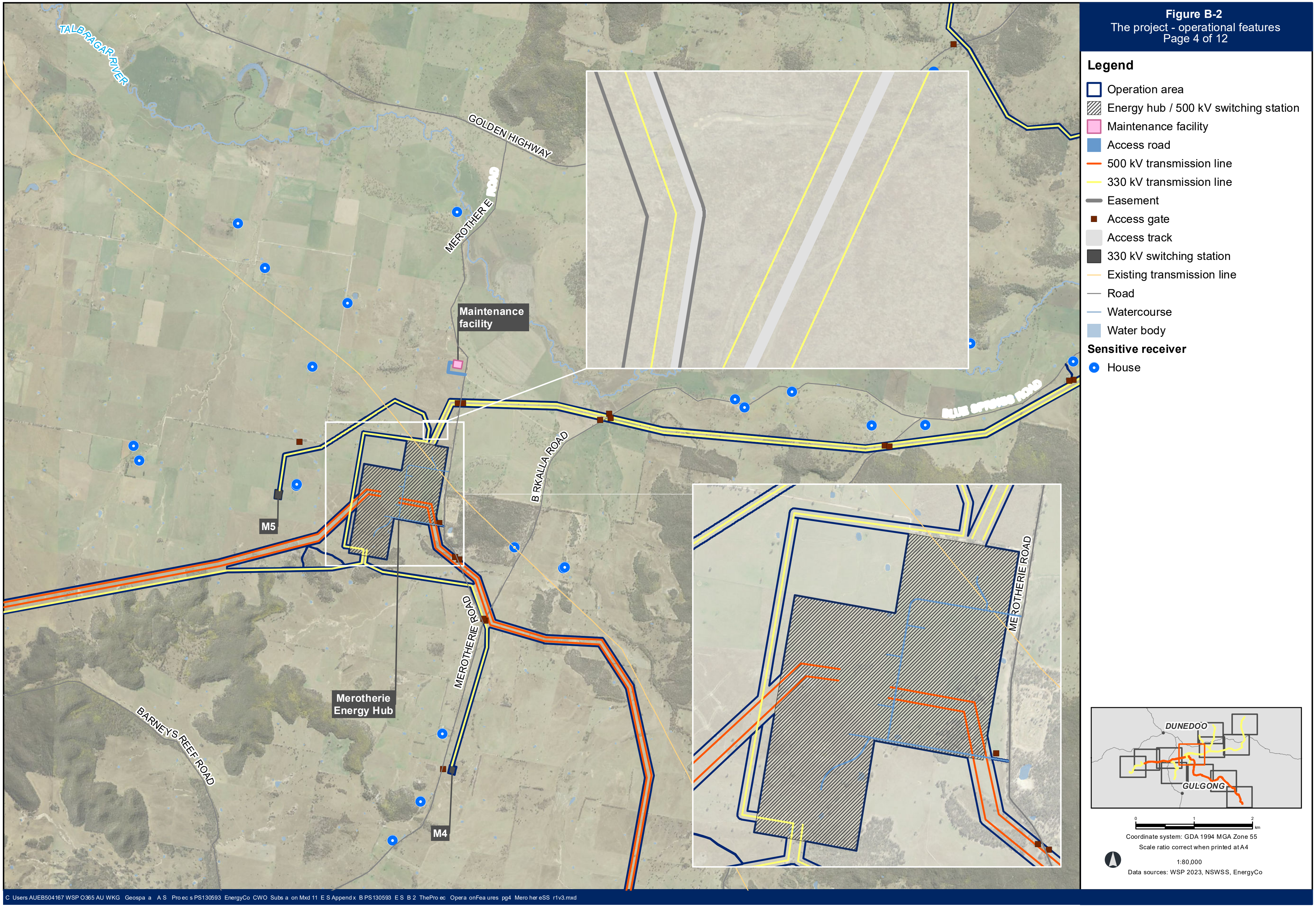


Figure B-2
The project - operational features
Page 4 of 12

Figure B-2
The project - operational features
Page 5 of 12

Legend

- Operation area
- 330 kV transmission line
- Easement
- Access gate
- Access track
- 330 kV switching station
- Road
- Watercourse
- Water body

Sensitive receiver

- House

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:80,000
Data sources: WSP 2023, NSWSS, EnergyCo

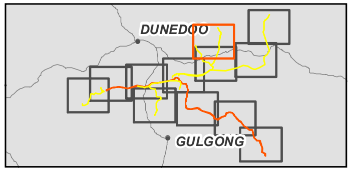
Figure B-2
The project - operational features

Legend

- Operation area
- 330 kV switching station
- 330 kV transmission line
- Road
- Watercourse
- Access gate
- Water body

Sensitive receiver

- House



0 1 2 km

Coordinate system: GDA 1994 MGA Zone 55
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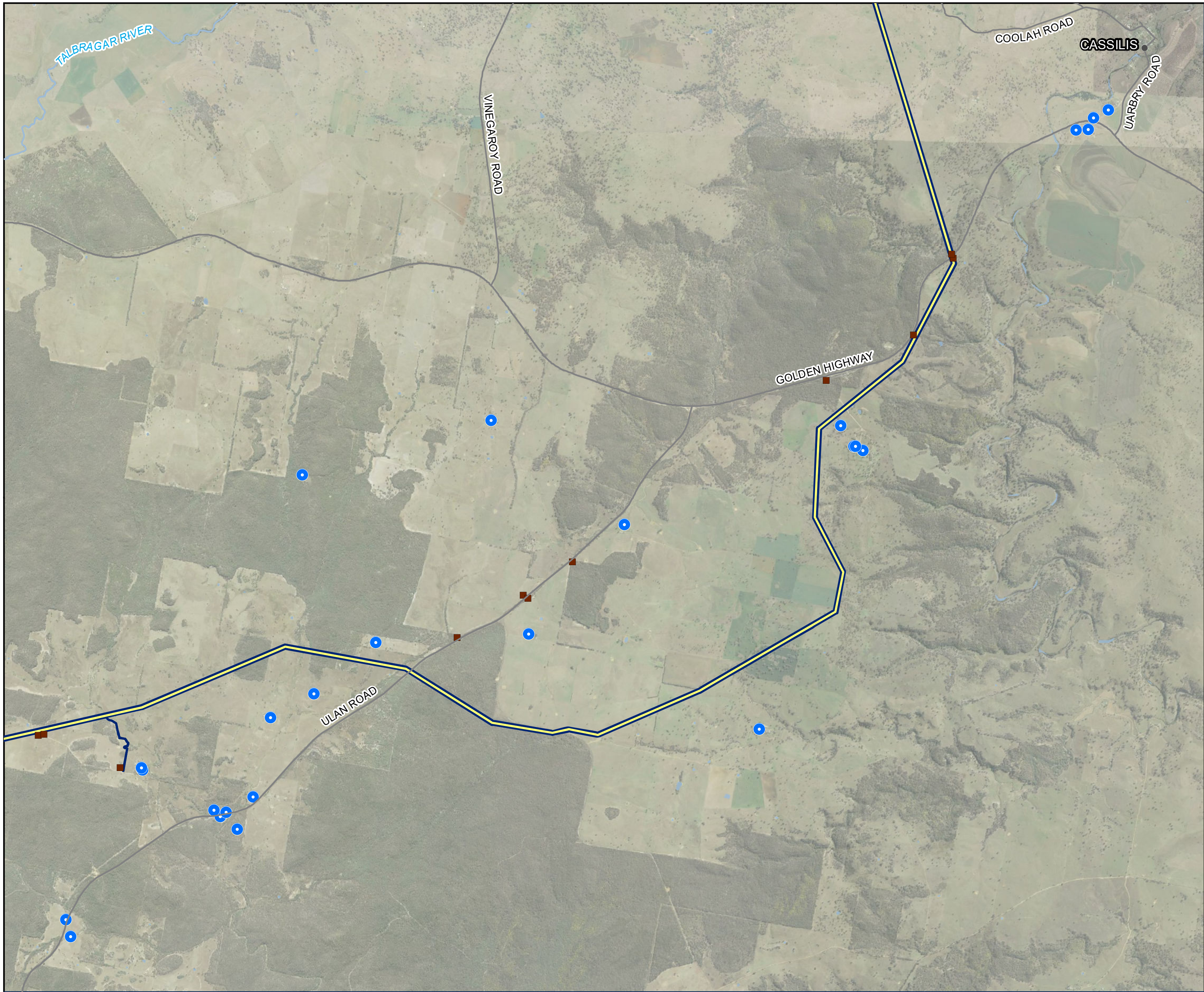
Data sources: WSP 2023, NSWSS, EnergyCo

Figure B-2
The project - operational features
Page 7 of 12

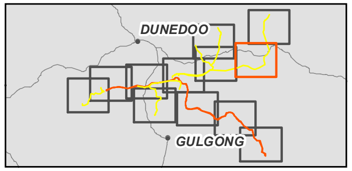


Legend

- Operation area
- 330 kV transmission line
- Road
- Watercourse
- Access gate
- Water body

Sensitive receiver

- House



0 1 2 km

Coordinate system: GDA 1994 MGA Zone 55
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Data sources: WSP 2023, NSWSS, EnergyCo

Figure B-2
The project - operational features
Page 8 of 12

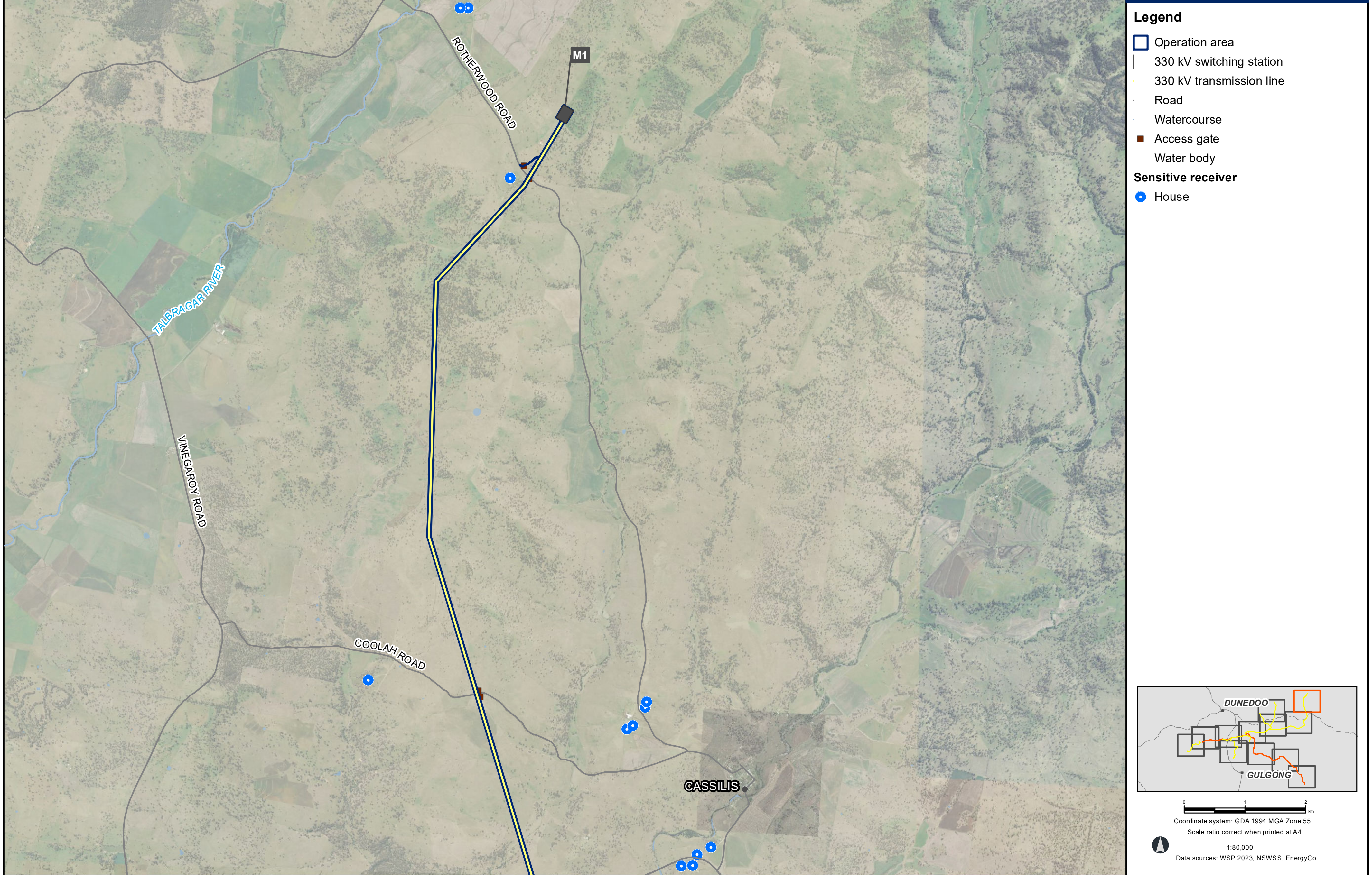
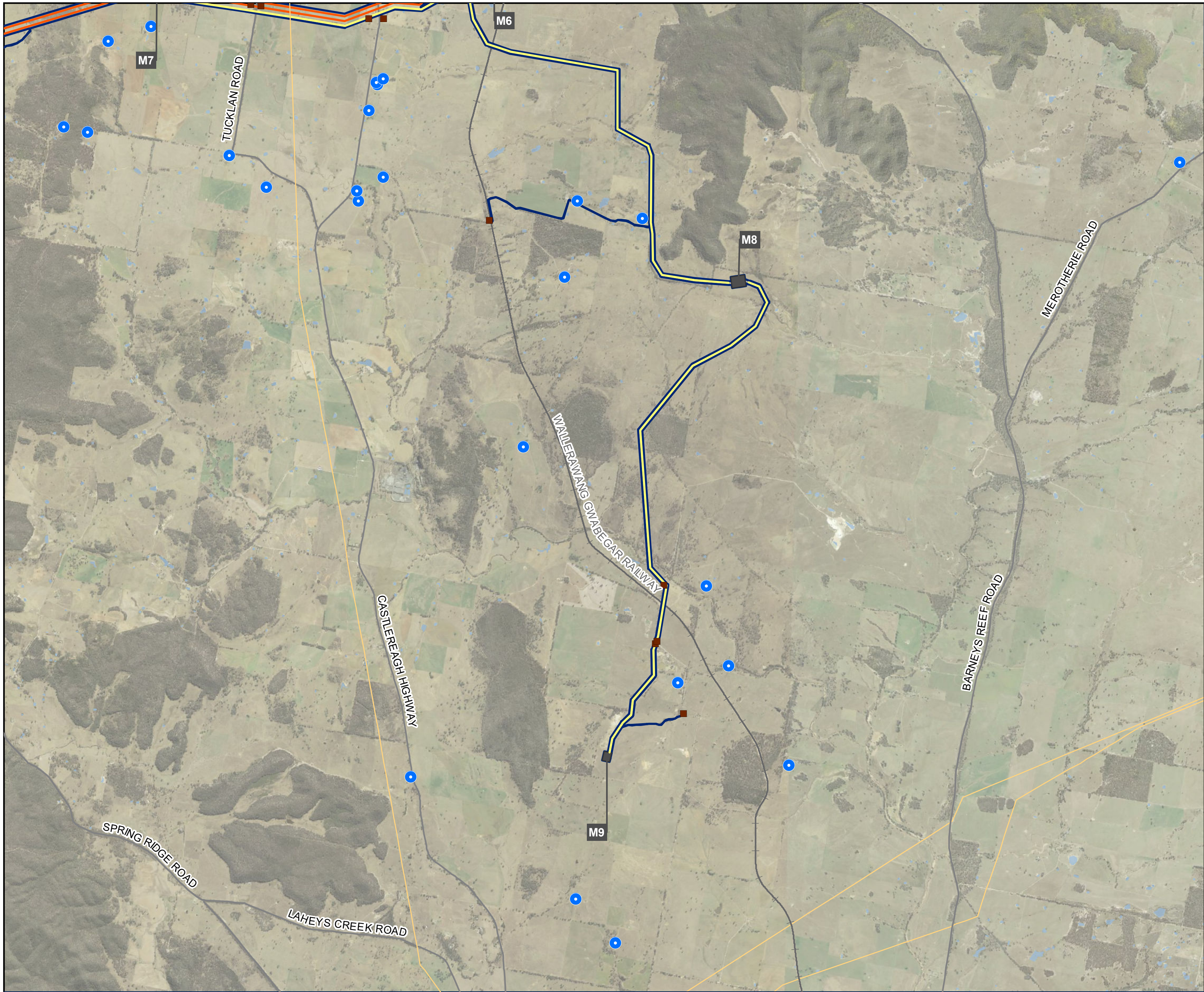


Figure B-2
The project - operational features
Page 9 of 12

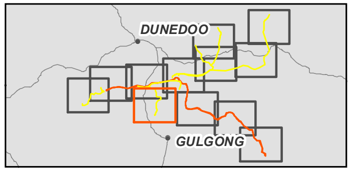


Legend

- Operation area
- 330 kV switching station
- 330 kV transmission line
- 500 kV transmission line
- Existing transmission line
- Road
- Railway
- Access gate
- Water body

Sensitive receiver

- House



0 1 2 km
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Scale ratio correct when printed at A4
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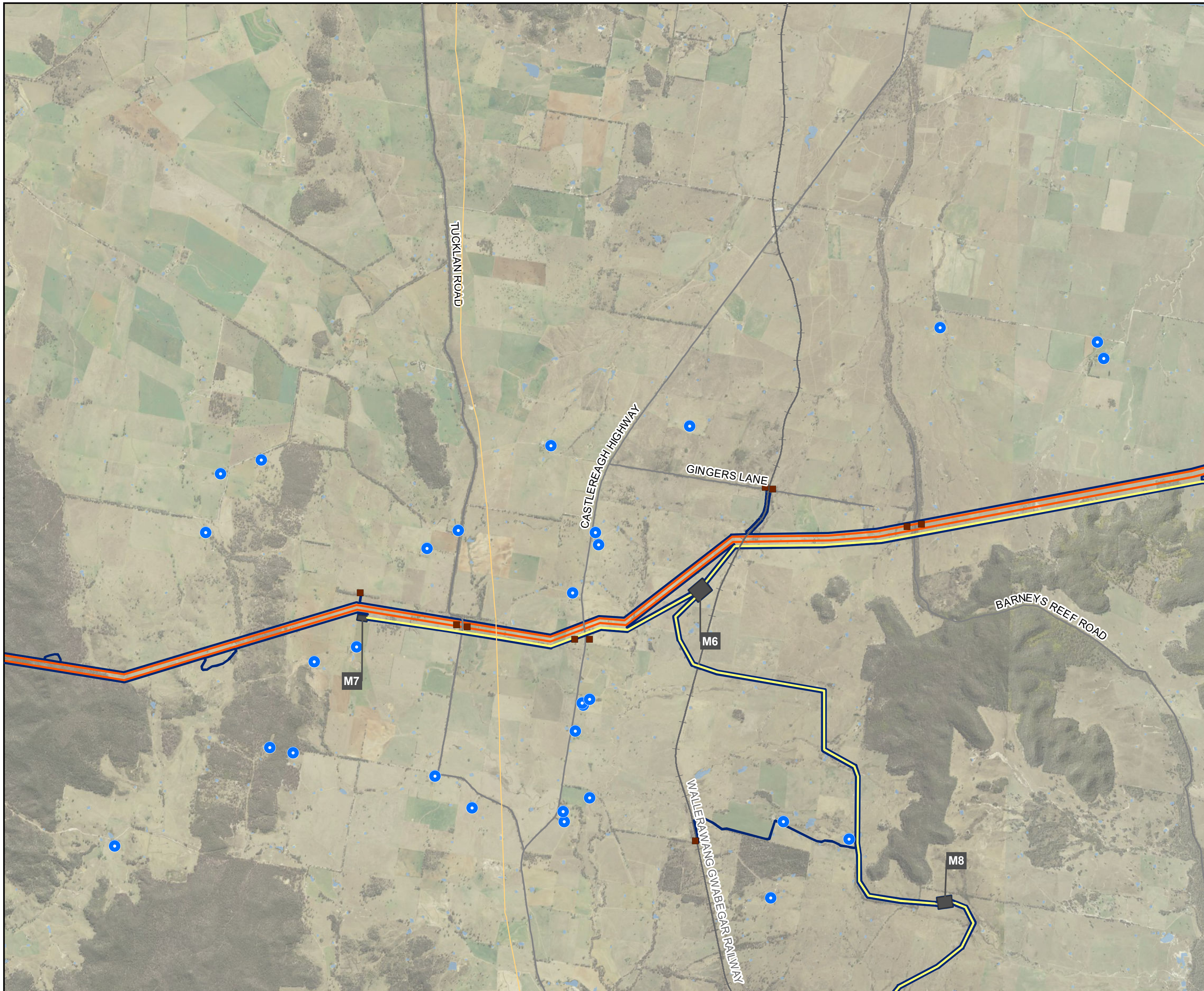
Data sources: WSP 2023, NSWSS, EnergyCo

Figure B-2
The project - operational features
Page 10 of 12

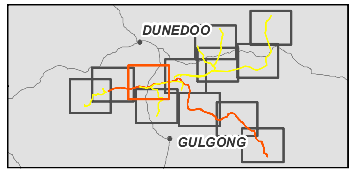


Legend

- Operation area
- 330 kV switching station
- 330 kV transmission line
- 500 kV transmission line
- Existing transmission line
- Road
- Railway
- Watercourse
- Access gate
- Water body

Sensitive receiver

- House



0 1 2 km

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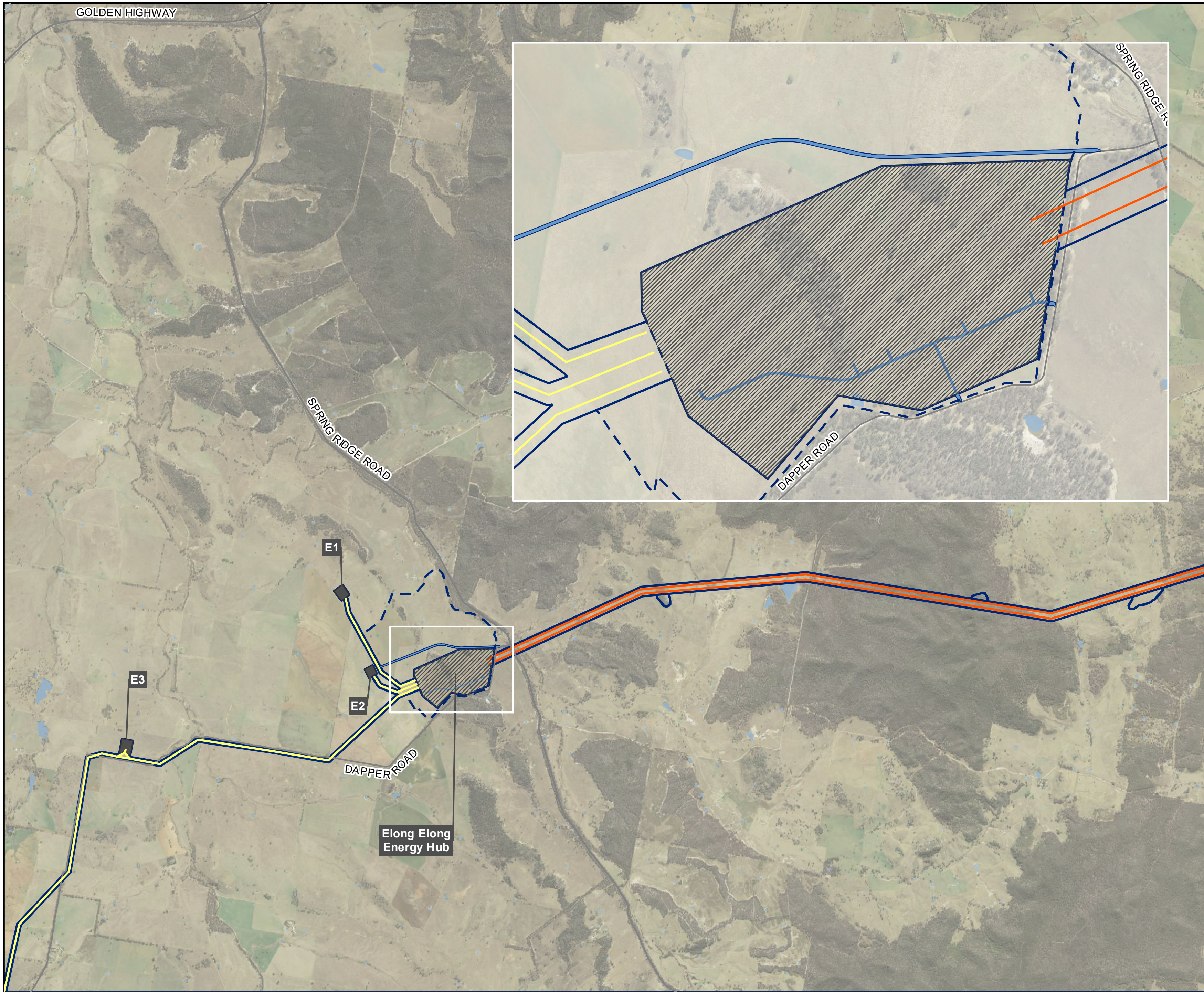

Figure B-2
The project - operational features
Page 11 of 12

Legend

- Operation area
- Energy hub / 500 kV switching station
- Potential future expansion
- 330 kV switching station
- Access road
- 330 kV transmission line
- 500 kV transmission line
- Road
- Watercourse
- Water body

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:80,000
Data sources: WSP 2023, NSWSS, EnergyCo

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Figure B-2
The project - operational features

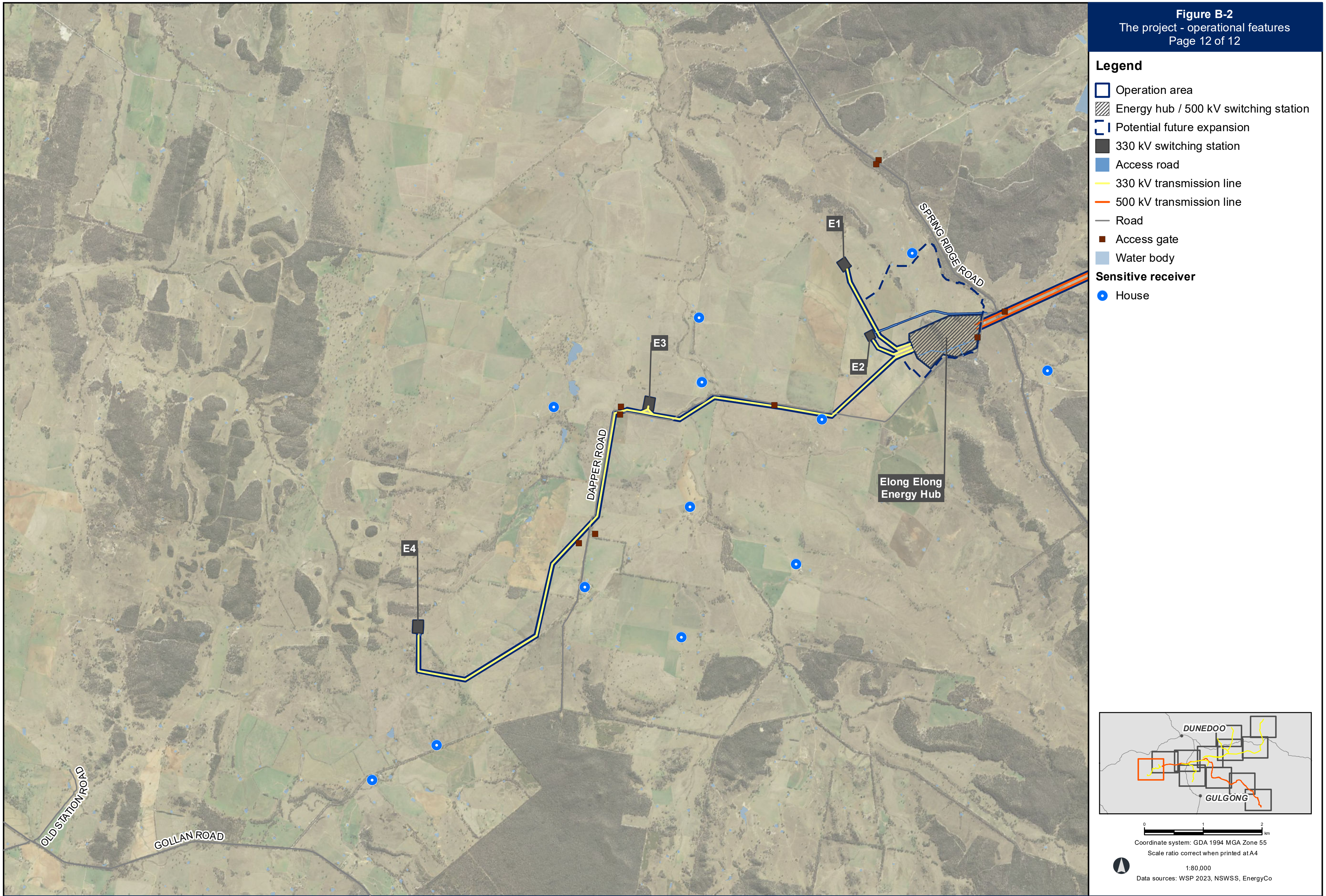

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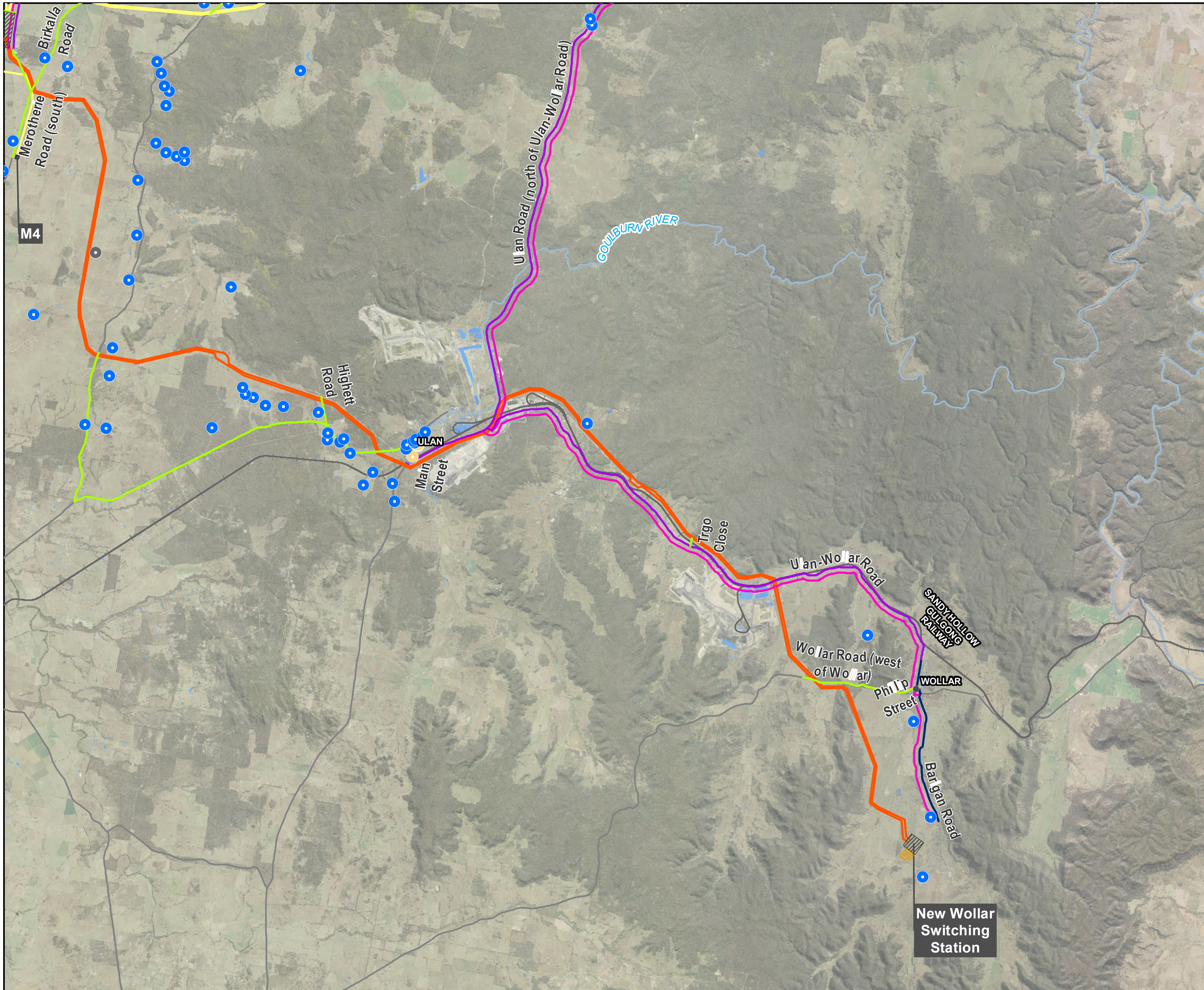
Figure B-3
Construction routes and peak construction volumes
Page 1 of 4



Legend

- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Construction compound
- Road
- Railway
- Watercourse
- Water body
- OSOM construction route

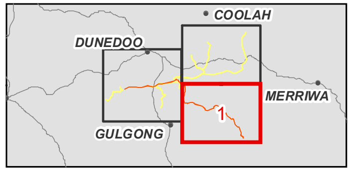
General construction routes

Vehicle movements per hour (light and heavy vehicles)

- 25
- 50
- 75

Sensitive receiver

- House
- School
- DA approved (no structure)



0 2.5 5 km

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
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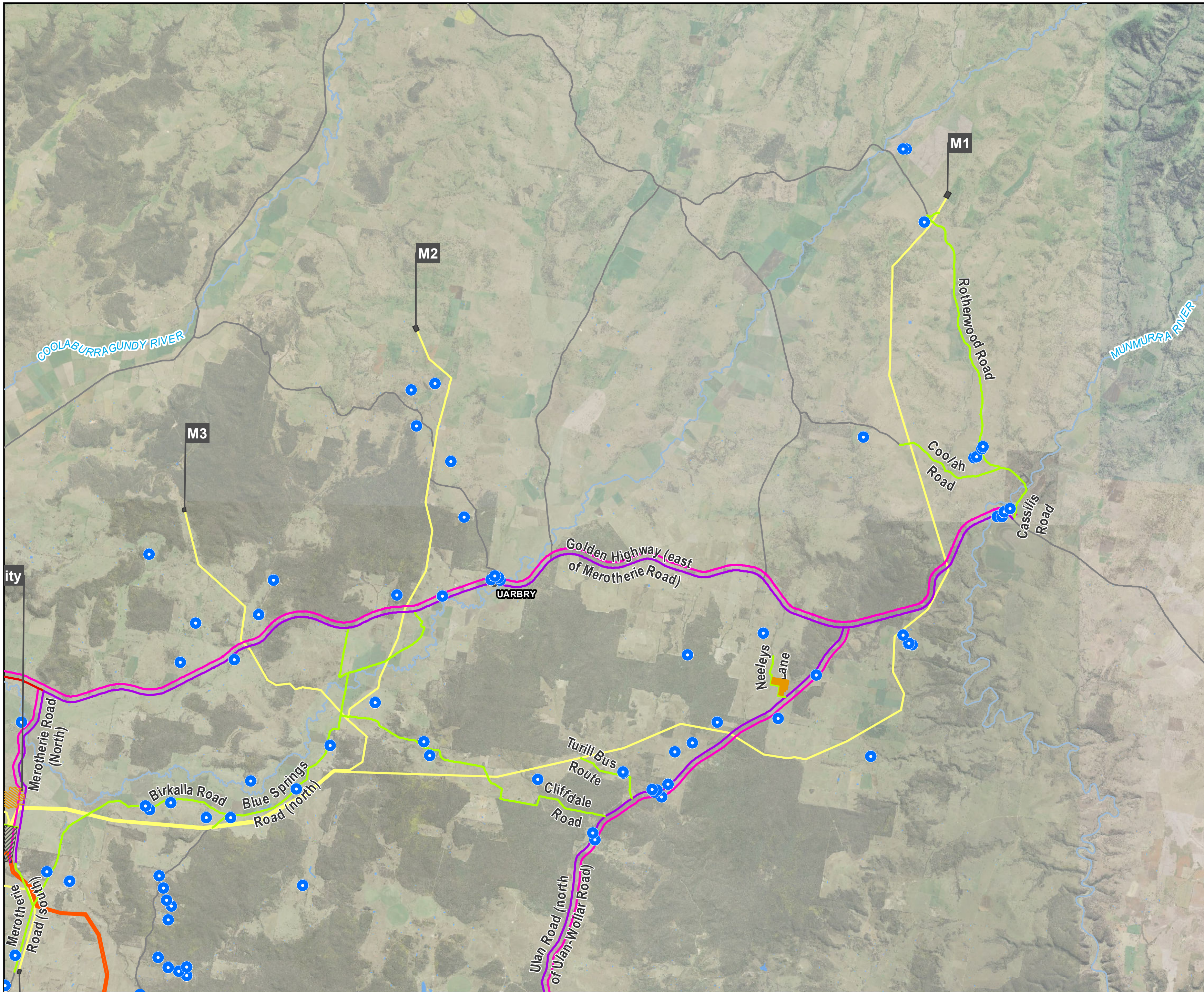
Data sources: WSP 2023, EnergyCo, NSWSS

Figure B-3
Construction routes and peak construction volumes
Page 2 of 4



Legend

- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Workforce accommodation camp
- Construction compound
- Road
- Watercourse
- Water body
- OSOM construction route

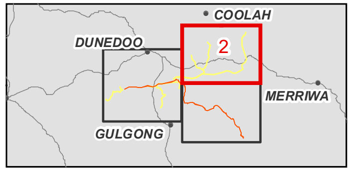
General construction routes

Vehicle movements per hour (light and heavy vehicles)

- 50
- 75
- 100

Sensitive receiver

- House



0 2.5 5 km

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Data sources: WSP 2023, EnergyCo, NSWSS

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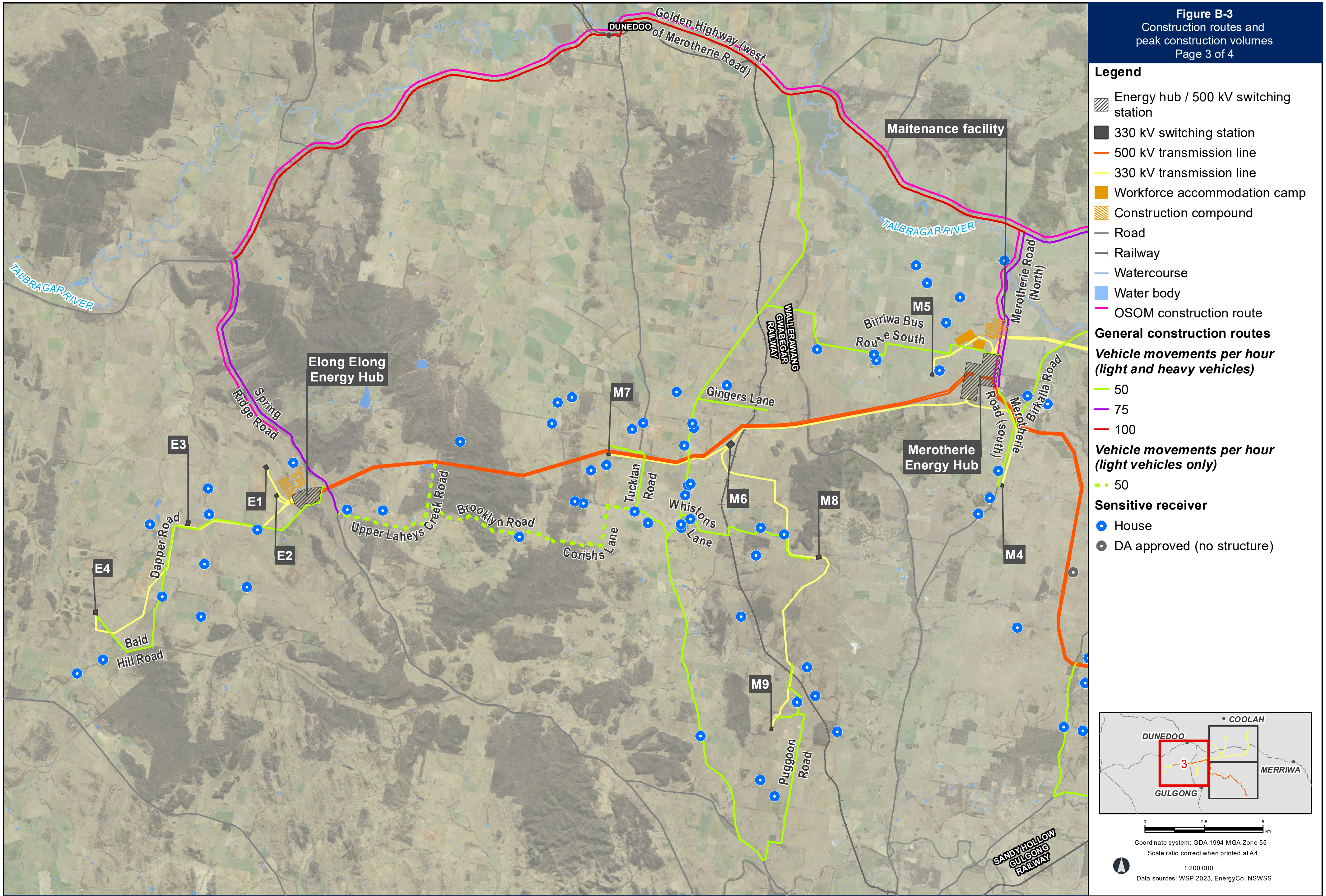

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Appendix C
Statutory compliance

C1 Statutory compliance

This appendix outlines the statutory compliance requirements and explains the environmental impact assessment and planning approval process for the project. This appendix supports the information provided in Chapter 4 (Statutory context) as well as the assessment chapters in this Environmental Impact Statement (EIS). The appendix is consistent with the requirements of *State Significant Infrastructure Guidelines* (DPE, 2022h), which proponents must have regard to under the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation).

C1.1 Statutory requirements for the project

Table C-1 summarises the statutory requirements for the project in accordance with Table 2 of Section 3.5 of the *State significant infrastructure guidelines – preparing an environmental impact statement* (DPE, 2022e).

Table C-1 Statutory compliance requirements for the project

Category	Requirement
Power to grant approval – NSW	The *Environmental Planning and Assessment Act 1979* (EP&A Act) and the Environmental Planning and Assessment Regulation 2021 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 (EPIs), including State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs). Sections 5.12 and 5.13 of the EP&A Act provide for the declaration of State significant infrastructure (SSI) and critical State significant infrastructure (CSSI). On 23 November 2020, the New South Wales (NSW) Minister for Planning and Public Spaces made the Environmental Planning and Assessment Amendment (Central-West Orana Renewable Energy Zone Transmission Order) 2020. The Order declares the whole Central-West Orana Renewable Energy Zone (REZ) Transmission project to be CSSI by adding that project as a new clause, gazetted on 16 December 2020, in Schedule 5 of the State Environmental Planning Policy (State and Regional Development) 2011, now clause 23 in Schedule 5 of the State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP), as follows: *23 Central-West Orana REZ Transmission project* *(1) Development for the purposes of the Central-West Orana REZ Transmission project.* *(2) The Central-West Orana REZ Transmission project is a program of works to construct and operate the high-voltage electricity transmission infrastructure required to connect energy generation and storage projects within the Central-West Orana REZ to the existing electricity network.* *(3) The Central-West Orana REZ Transmission project includes the following—* *(a) the construction and operation of new electricity transmission lines connecting from the existing electricity network south-west of Merriwa to south-west of Dunedoo and then to the existing electricity network west of Lake Burrendong,* *(b) the construction and operation of new electricity substations,* *(c) the augmentation of the existing electricity substation at Wollar,* *(d) ancillary development including, but not limited to the following—* *(i) the carrying out of works to upgrade or augment existing electricity transmission lines and substation infrastructure,* *(ii) the construction and operation of access roads,* *(iii) the installation and operation of communication infrastructure and facilities, excluding microwave technology,* *(iv) the installation and operation of construction accommodation, compounds and power supplies.*

Category	Requirement
	(4) The development is to be carried out on land in the following local government areas— *(a) Dubbo Regional,* *(b) Mid-Western Regional,* *(c) Upper Hunter Shire,* *(d) Warrumbungle Shire.* *(5) In this section—* *Central-West Orana REZ means the Central-West Orana Renewable Energy Zone.* *development does not include—* *(a) tests or investigations for the assessment of the Central-West Orana REZ Transmission project including, but not limited to, the carrying out of the following—* *(i) surveys,* *(ii) sampling,* *(iii) environmental investigations,* *(iv) geotechnical borehole drilling,* *(v) test drilling,* *(vi) test excavations, or* *(b) the construction of temporary access tracks and temporary site facilities to allow for the carrying out of tests or investigations described in paragraph (a), or* *(c) minor works within existing switchyards* On the 21 February 2023, the (then) NSW Minister for Planning (the relevant minister now is the Minister for Planning and Public Spaces) made the Environmental Planning and Assessment Amendment (Central-West Orana Renewable Energy Zone Transmission Order) 2023. The Order amended the declaration to include: *(3) (b1) the construction and operation of battery energy storage systems,* and exclude: *(5) (d) upgrading, relocating or widening existing public roads—* *(i) carried out on land in the Central-West Orana REZ, and* *(ii) subject to a determination under the Act, Division 5.1.* Division 5.2 of the EP&A Act establishes the assessment and approval regime for SSI and CSSI projects. As CSSI, the project requires the approval of the NSW Minister for Planning and Public Spaces under section 5.14 of the EP&A Act.
Power to grant approval – Commonwealth	Matters of national environmental significance (MNES), such as Commonwealth listed threatened species and ecological communities, are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Under the EPBC Act, proposed actions that are likely to have a significant impact on MNES must be referred to the Australian Minister for the Environment. The Minister will determine whether the action is a controlled action and therefore requires approval from the Minister under the EPBC Act. The Minister will also determine the method under which the environmental impact of the action will be assessed. Energy Corporation of New South Wales (EnergyCo) referred the project to the Minister on 2 February 2023 (referral no. 2022/09353). The Australian Government's Department of Climate Change, Energy, the Environment and Water (DCCEEW), as delegate for the Australian Minister for the Environment and Water, determined on 2 March 2023 that the project is a controlled action on the basis of likely significant impacts to the following listed threatened species and communities (sections 18, 18A of the EPBC Act) and migratory species (sections 20 and 20A of the EPBC Act): • Regent Honeyeater (*Anthochaera phrygia*) • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland threatened ecological community (TEC) • Satin Flycatcher (*Myiagra cyanoleuca*). Two TECs and 37 species were also identified as having some risk of significant impact and identified for further consideration. DCCEEW also determined that the project would be assessed under the NSW Assessment Bilateral Agreement.

Category	Requirement
	The NSW Assessment Bilateral Agreement provides for certain actions that are State significant development (SSD) 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. However, a separate EPBC Act approval is still required. The NSW Department of Planning and Environment (DPE) issued Supplementary Secretary's Environmental Assessment Requirements (SEARs) on 28 March 2023 to include the relevant Commonwealth requirements under the NSW Assessment Bilateral Agreement. This EIS has been prepared to address these requirements (refer to Appendix A (SEARs checklist)).
Permissibility	State Environmental Planning Policy (Transport and Infrastructure) 2021 (Transport and Infrastructure SEPP) is a key environmental planning instrument that sets out the permissibility of infrastructure development and subsequently under which part of the EP&A Act it is assessed. Clause 2.44 of the Transport and Infrastructure SEPP permits development for the purpose of electricity transmission or distribution network to be carried out by or on behalf of an electricity supply authority or public authority without consent on any land. However, development may not be carried out on land reserved under the *National Parks and Wildlife Act 1974* (NP&W Act) without consent unless the development is (in general terms) authorised under that Act. This includes development that 'is carried out on land to which the NP&W Act applies over which an easement has been granted and is not contrary to the terms or nature of the easement'. The project falls within the definition of an 'electricity transmission or distribution network' under clause 2.43 of the Transport and Infrastructure SEPP, which defines that term as including the following components: • above or below ground electricity transmission or distribution lines (including related bridges, cables, conductors, conduits, poles, towers, trenches, tunnels, access structures, access tracks and ventilation structures) and telecommunication facilities that are related to the functioning of the network • above or below ground electricity switching stations or electricity substations, feeder pillars or transformer housing, substation yards or substation buildings • systems for electricity storage associated with a component specified in paragraphs a. and b. EnergyCo is constituted under section 7(1) of the *Energy and Utilities Administration Act 1987*. Under section 36(1)(e) of that Act, EnergyCo is, for the purposes of any Act, a statutory body representing the Crown. As such, it is a 'public authority' within the meaning of section 1.4(1) of the EP&A Act. Accordingly, it is a 'public authority' within the meaning of clause 2.3(1) of the Transport and Infrastructure SEPP and is, therefore, a 'public authority' for the purposes of clause 2.44 of that SEPP. Around 2.5 kilometres of the proposed Cassilis connection would traverse a section of land reserved under the NP&W Act, being the Durridgere State Conservation Area. Section 153 of the NP&W Act empowers the Minister administering the NP&W Act (the NSW Minister for Environment and Heritage) to grant an easement through a state conservation area for the 'erection of standards, posts, wires and appliances for the conveyance or transmission of electricity'. EnergyCo has commenced discussions with the NSW National Parks and Wildlife Service concerning the creation of an easement for the project within the Durridgere State Conservation Area. The project is permissible without consent pursuant to clause 2.44 of the Transport and Infrastructure SEPP as it is defined as an electricity transmission or distribution network, and would be carried out by or on behalf of EnergyCo (a public authority), subject to securing an easement in accordance with section 153 of the NP&W Act prior to any determination by the NSW Minister for Planning and Public Spaces under the EP&A Act. Under clause 2.44(2) of the Transport and Infrastructure SEPP, a reference to development for the purpose of an electricity transmission or distribution network includes a reference to certain activities associated with the development, including (but not limited to) construction works, emergency or routine maintenance works and environmental management works. Certain maintenance and vegetation management works are considered exempt development under the provisions of clause 2.46 of the Transport and Infrastructure SEPP.

Category	Requirement
Other NSW legislation and approvals	A number of other approvals under NSW legislation have been integrated into the CSSI approval process under the EP&A Act, and are either not required to be separately obtained for the project, or are required to be substantially consistent with the approved CSSI. Approvals or authorisations that cannot be refused if they are necessary for carrying out approved CSSI and are substantially consistent with the Division 5.2 approval, including: • an approval under Part 3 of the *Coal Mine Subsidence Compensation Act 2017* (CMSC Act) • an environment protection licence (EPL) under Chapter 3 of the *Protection of the Environment Operations Act 1997* (POEO Act) • consent under section 138 of the *Roads Act 1993* (Roads Act) 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 the CMSC Act, EnergyCo would require approval as parts of the project would be located within the Mudgee mine subsidence district. With respect to EPLs, Schedule 1 of the POEO Act does not define electrical transmission lines or associated infrastructure (such as switching stations and substations) as a scheduled activity requiring an EPL. The project is unlikely to exceed the criteria listed in Schedule 1 of the POEO Act for the following scheduled activities: • crushing, grinding or separating materials (clause 16), as the project would not process more than 150 tonnes of materials per day or 30,000 tonnes of materials per year • helicopter-related activities (clause 20), as the activity at each construction compound would not have an intended capacity of more than 30 flight movements per week (where take-off and landing are separate flight movements) • sewage treatment (clause 36), as each plant would not have a processing capacity that exceeds 2,500 persons equivalent (as determined in accordance with guidelines established by an NSW Environment Protection Authority (EPA) Gazettal notice), or exceeds 750 kilolitres per day (whichever is the greater). With respect to Road Occupancy Licences, the project would potentially require temporary/partial closure(s) of classified and unclassified roads for the construction of the project (during, for example, stringing of transmission lines over public roads). Road works may also be required as part of the project to establish new access points for the energy hubs and to the transmission line alignment. EnergyCo requires consent form the relevant roads authority under section 138 of the Roads Act to undertake work on or over classified roads. However, by reason of clause 5(1) of Schedule 2 of the Roads Act, EnergyCo, as a public authority, is not required to obtain approval to carry out work on unclassified roads other than a Crown road (subject to that clause ceasing to have effect by proclamation). Approvals of potential relevance to the project which are not required under section 5.23(1) of the EP&A Act, include: • a permit under sections 201, 205 or 219 of the *Fisheries Management Act 1994* (FM Act) • an approval under Part 4, or an excavation permit under section 139 of the *Heritage Act 1977* (Heritage Act) • an Aboriginal heritage impact permit under section 90 of the NP&W Act • a bushfire safety authority under section 100B of the *Rural Fires Act 1997* • various approvals under the *Water Management Act 2000* (WM Act), including water use approval under section 89, a water management work approval under section 90, and an activity approval (other than aquifer interference approvals) under section 91. Section 5.23(2) of the EP&A Act specifies that Division 8 of Part 6 of the Heritage Act does not apply to prevent or interfere with the carrying out of approved SSI.

Category	Requirement
	Section 5.23(3) of the EP&A Act specifies that 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 project would be: • an interim protection order (within the meaning of the NP&W Act) • 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 • a remediation direction under Division 3 (Remediation directions) of Part 6A of the NP&W Act • an order or direction under Part 11 (Regulatory compliance mechanisms) of the *Biodiversity Conservation Act 2016* (BC Act) • an environment protection notice under Chapter 4 of the POEO Act • an order under section 124 of the *Local Government Act 1993.* Refer to Table C-2 of this appendix for further detail, including other NSW legislation that continues to apply to the project.
Pre-conditions to exercising the power to grant approval	No pre-conditions to exercising the power to grant approval have been identified as relevant to this project.
Mandatory matters for consideration	Refer to Section C1.2 of this appendix.

C1.2 Matters for consideration relevant to the EP&A Act

As noted in Chapter 4 (Statutory context), section 5.22 of the EP&A Act provides that EPIs (such as LEPs and SEPPs) do not, with some exceptions, apply to SSI projects. Notwithstanding, an approval authority will consider certain matters within these instruments in deciding whether to grant approval.

A complete list of the EPIs that have been considered in addition to the Transport and Infrastructure SEPP and Planning Systems SEPP (as discussed in Section C1.1), as a matter of good practice in respect of addressing environmental impacts, is provided in Table C-2.

Table C-2 Matters for consideration

Instrument	Considerations	EIS reference
State Environmental Planning Policies		
State Environmental Planning Policy (Resources and Energy) 2021 (Resources and Energy SEPP)	The Resources and Energy SEPP contains provisions to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources. The project would include a section of the transmission line alignment that would cross land that is subject to mining leases and exploration licences. Pursuant to clause 2.15(2)(a) of the SEPP, development for the purpose of the construction, maintenance and use of electricity distribution lines is complying development if it is on the site of an approved mine or approved extractive industry. However, as the project has been declared as CSSI under the Transport and Infrastructure SEPP, and therefore not subject to development consent, the provisions of the Resources and Energy SEPP do not apply.	Potential impacts of the project on mine operations have been considered in Chapter 7 (Land use and property).

Instrument	Considerations	EIS reference
State Environmental Planning Policy (Biodiversity and Conservation) 2021 (Biodiversity and Conservation SEPP)	The Biodiversity and Conservation SEPP contains provisions for the conservation and management of areas of natural vegetation that provide habitat for koalas. The policy applies to a number of local government areas (LGAs) across NSW, including the following LGAs within which the project would be located: • Mid-Western Regional • Warrumbungle • Upper Hunter • Dubbo Regional. While the requirements of this SEPP would not apply to the project (as it would not be subject to consent under Part 4 of the EP&A Act), potential impacts on koala populations have been considered as part of the EIS. The assessment has identified that offsets for this species would be required.	Consideration of the potential impacts to koalas has been included in the biodiversity impact assessment for the project (refer to Chapter 10 (Biodiversity) and Technical paper 4 – Biodiversity development assessment report (Technical paper 4)).
State Environmental Planning Policy (Primary Production) 2021 (Primary Production SEPP)	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 (SSAL). A draft SSAL map has been published by the NSW Department of Primary Industries and has been considered in the EIS to assess potential impacts on high value agricultural land. Overall, the project is not considered to adversely affect the objectives of this SEPP.	The project has been designed to minimise impacts on important agricultural land, and where practicable, utilise previously disturbed corridors such as existing electrical easements or mining areas (refer to Chapter 2 (Strategic context)). The project would still however impact on agricultural land, including land mapped as SSAL (draft). The impacts to agricultural land have been considered in Chapter 8 (Agriculture) and Technical paper 2 – Agriculture.
State Environmental Planning Policy (Resilience and Hazards) 2021 (Resilience and Hazards SEPP)	Chapter 3 of the Resilience and Hazards SEPP aims to impose conditions on potentially hazardous or offensive development to reduce or minimise any adverse impacts. During construction and operation of the project, potentially dangerous goods and hazardous substances are likely to be transported to and from the project, and may be stored on site. Typically, the materials and chemicals would only be required in small amounts and below an amount that would trigger requirements for consideration as a hazardous or offensive industry under the Resilience and Hazards SEPP. The Merotherie Energy Hub may also include a battery energy storage system (BESS), which can pose a hazard in the event that a fault in the battery storage system escalates into a fire.	Potential risks related to dangerous goods and hazardous materials during construction and operation, or risks related to the potential BESS at the Merotherie Energy Hub have been discussed in Chapter 16 (Hazard and risk) and Technical paper 11 – Preliminary hazard analysis.
	Chapter 4 of the Resilience and Hazards 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 4.6(1) of the Resilience and Hazards SEPP, 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.	Consideration of potential contamination impacts associated with the project are addressed in Chapter 19 (Other impacts) and Technical paper 16 – Contamination (Technical paper 16).

Instrument	Considerations	EIS reference
	A Phase 1 contamination investigation has been undertaken for the project to inform the development of the project's design and EIS process. The outcomes of the contamination investigations concluded that based on the available data, the project area is considered suitable for the project, subject to implementation of standard measures and management controls during site development. Operational phase contamination risk management is also considered to be manageable with the implementation of standard controls and procedures.	
Local Environmental Planning Policies		
Warrumbungle Local Environmental Plan 2013 Mid-Western Regional Local Environmental Plan 2012 Dubbo Regional Local Environmental Plan 2022 Upper Hunter Local Environmental Plan 2013	Section 5.10 of each of the relevant LEPs identifies the need to conserve Aboriginal objects and Aboriginal places of heritage significance within each of the LGAs.	The potential Aboriginal heritage impacts associated with the project have been discussed in Chapter 11 (Aboriginal heritage) and Technical paper 5 – Aboriginal cultural heritage assessment report (Technical paper 5).
	Section 5.10 of each of the relevant LEPs identifies the need to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views within each of the LGAs. Each of the LEPs identify a schedule of registered heritage items and conservation areas.	The potential non-Aboriginal heritage impacts associated with the project have been discussed in Chapter 12 (Non-Aboriginal heritage) and Technical paper 6 – Non-Aboriginal heritage (Technical paper 6).
	Part 2 of each of the LEPs identifies the relevant land zonings for each of the LGAs and the applicable permitted and prohibited development types. The zoning which is applicable to the project includes the following: • RU1 Primary Production • C1 National Parks and Nature Reserves • C3 Environmental Management • RU5 Village • IN3 Heavy Industrial • SP2 Infrastructure.	While the LEPs listed guide local development within the LGA, the EP&A Act expressly provides that LEPs do not apply to SSI and CSSI projects. However, the EIS has considered potential impacts to land use/land zoning in Chapter 7 (Land use and property) and Chapter 8 (Agriculture).
	Section 5.21 of each of the relevant LEPs identifies flood-related planning controls relevant to each of the LGAs including allowance for development on land that is compatible with the flood function and behaviour on the land, taking into account projected changes as a result of climate change.	The potential flooding impacts associated with the project have been discussed in Section 19.1 and Technical paper 15 – Flooding.

C1.3 Other NSW legislation of relevance to the project

As summarised in Chapter 4 (Statutory context), in accordance with sections 5.23 and 5.24 of the EP&A Act, some environmental planning legislation does not apply to approved CSSI or must be applied consistently with an approval for CSSI. These matters have been discussed in Section 4.2.3.

Environmental planning related legislation and regulations that may still be applicable to approved CSSI and, based on the scope of this project, may be relevant are outlined in Table C-3.

Table C-3 Other NSW legislation of relevance to the project

Instrument	Requirement and/or considerations	EIS reference
Aboriginal Land Rights Act 1983	The *Aboriginal Land Rights Act 1983* Act establishes the NSW Aboriginal Land Council and local Aboriginal land councils (LALCs) and requires these bodies to: • take action to protect the culture and heritage of Aboriginal persons in the LALC's area, subject to any other law • promote awareness in the community of the culture and heritage of Aboriginal persons in the LALC's area. Under this Act, LALCs can claim Crown Land. If the claim is determined in favour of the LALC, the relevant land is transferred as freehold title to the LALC. 'Claimable Crown lands' includes Crown Lands that are not lawfully used or occupied and that are not needed, nor likely to be needed, for an essential public purpose.	The construction area for transmission lines would cross two parcels of Crown Land which are subject to undetermined land claims under the *Aboriginal Land Rights Act 1983*. This includes a small parcel of Crown Land adjacent to Laheys Creek one parcel to the south of the Golden Highway, where temporary access would be required to facilitate construction. EnergyCo would continue to liaise with the Local Land Services (LLS) and/or the relevant LALC (depending on the status of this claim) to gain access to these land parcels. EnergyCo is continuing to consult with the relevant LALCs in relation to the project. This is discussed in Chapter 7 (Land use and property).
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 the BC Act, SSI (including CSSI) projects are required to prepare a biodiversity development assessment report (BDAR) to identify and assess biodiversity impacts under the provisions of the Act and offset those impacts by retiring biodiversity credits, determined using the Biodiversity Assessment Methodology (BAM).	Biodiversity impacts associated with the project have been assessed in accordance with the BC Act. The results of this assessment are presented in Technical paper 4 and summarised in Chapter 10 (Biodiversity).
Biosecurity Act 2015 (Biosecurity Act)	The *Biosecurity Act 2015* (Biosecurity Act) 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 Biosecurity 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, 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.	This EIS has included an assessment of biodiversity impacts including consideration of weeds (refer to Chapter 10 (Biodiversity) and Technical paper 4).

Instrument	Requirement and/or considerations	EIS reference
Coal Mine Subsidence Compensation Act 2017 (CMSC Act)	The CMSC Act 2017 establishes a scheme under which property owners are entitled to compensation for damage to improvements or goods owned by the property owner from subsidence due to the extraction of coal. Property owners are also entitled to compensation to meet the reasonable and necessary expenses incurred or to be incurred as a result of such damage, as well as compensation for preventative or mitigative expenses. Part 3 of the Act contains provisions in relation to development within mine subsidence districts. Under section 21 of the CMSC Act, a person must not carry out work, or cause work to be done, in connection with the erection or alteration of an improvement within a mine subsidence district, except in accordance with the approval Subsidence Advisory NSW. For the purposes of the Act 'improvement' includes infrastructure, whether above or below the surface of the land. The project would require approval from Subsidence Advisory NSW as it would be located within the Mudgee mine subsidence district. Subsidence Advisory NSW has developed and applied surface development guidelines in accordance with the CMSC Act, to mitigate or eliminate the damage to surface structures from mine subsidence within mine subsidence districts.	Potential impacts on project infrastructure due to mine subsidence have been considered in Chapter 16 (Hazard and risk). Consultation with Subsidence Advisory NSW has been carried out for the project to identify subsidence related design requirements for the project (refer to Chapter 5 (Community and stakeholder engagement)). These requirements would be incorporated into the continued development and refinement of the project design (refer to Chapter 3 (Project description)).
Contaminated Land Management Act 1997 (CLM Act)	The CLM Act outlines the circumstances in which notification to the EPA is required in relation to the contamination of land. The study area is mostly used for agricultural purposes and the risk of encountering and disturbing contaminated soils is generally low for most the construction area. The exception is: • where the project traverses active mining areas and rehabilitation areas at Moolarben Coal Mine and Wilpinjong Coal Mine, respectively. These sites present a low to high contamination risk during construction • at several farm dams within the construction area that may be impacted, which present a medium risk for isolated contamination due to the potential accumulation of nutrients and pesticides from adjacent agricultural activities.	A Phase 1 contamination investigation (refer to Technical paper 16) has been undertaken for the project to inform the continued development of the project design and EIS process. Further consideration of contamination risks and proposed measures to mitigate and manage these risks are summarised in Section 19.2 of Chapter 19 (Other impacts).
Crown Land Management Act 2016 (Crown Land Act)	This Act sets out the requirements for the management of Crown Land in NSW. This includes the permissions and authorisations needed when planning the development of activities on Crown Land as well as the process for the acquisition of Crown Land. The project would pass through one parcel of Crown Land associated with the travelling stock reserve which extends along Barneys Creek Road, as well as parcels of land associated with Crown roads (including paper roads), and watercourses including Laheys Creek and Wilpinjong Creek).	Impacts to Crown Land have been discussed in greater detail in Chapter 7 (Land use and property).
Electricity Infrastructure Investment Act 2020 (Electricity Infrastructure Investment Act)	The Electricity Infrastructure Investment Act aims, among other things, to co-ordinate investment in new generation, storage and network infrastructure in NSW. It establishes a process under which the NSW Minister for Energy can declare a geographical area of the State a REZ and specify the generation, storage or network infrastructure that will be implemented in that zone. There are currently five REZs declared in the Act, including the Central-West Orana REZ. The Act also provides for the appointment of an Infrastructure Planner to, among other things, investigate, plan, co-ordinate and carry out planning, design, construction and operation of storage and network infrastructure.	On 5 November 2021, the Central-West Orana REZ was formally declared by the (then) Minister for Energy and Environment (the relevant minister now is the Minister for Energy) and EnergyCo was appointed as the Infrastructure Planner to lead the delivery of REZs in NSW. Future connections to the project will be managed through the access scheme for the Central-West Orana REZ.

Instrument	Requirement and/or considerations	EIS reference
	The Electricity Infrastructure Investment Act also gives power to the Minister to declare "access schemes" that operate in REZs. A REZ access scheme authorises (or prohibits) access to, and the use of, specified network infrastructure by operators of generation and storage infrastructure within a REZ. The declaration of an access scheme may specify how access rights are to be conferred on participants and the fees payable. These access schemes are intended to support investment in the network and provide investors with comfort that their project will be authorised to access a stable grid connection.	
Fisheries Management Act 1994	A permit under section 219 of the *Fisheries Management Act 1994* is required for the blocking of fish passage. This approval is not required in accordance with section 5.23 of the EP&A Act if planning approval is obtained as the project has been declared SSI (including CSSI).	Biodiversity impacts associated with the project have been assessed in accordance with the BC Act. The results of this assessment are presented in Technical paper 4 and summarised in Chapter 10 (Biodiversity).
Heritage Act 1977 (Heritage Act)	Section 139 of the Heritage Act 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 of the Heritage Act requires that the discovery or location of a relic must be notified to the Heritage Council of NSW unless the Heritage Council of NSW is aware of the relic's location. The Heritage Council of NSW must be notified if a relic is uncovered during construction and if it is reasonable to believe that the Heritage Council of NSW is unaware of the location of the relic. Under the SSI (including CSSI) provisions for the project, 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. A number of heritage sites would be impacted by the project. The majority of these are not listed on a statutory heritage register. The comprise of built and potential archaeological sites.	Notwithstanding the application of the SSI provisions, the heritage impacts associated with the project have been assessed in accordance with the Heritage Act. The results of this assessment are presented in Technical paper 5, Technical paper 6 and summarised in Chapter 11 (Aboriginal heritage) and Chapter 12 (Non-Aboriginal heritage) respectively.
Land Acquisition (Just Terms Compensation) Act 1991 (Land Acquisition Act)	The Land Acquisition Act applies to the acquisition of land (by agreement or compulsory process) by a public authority authorised to acquire the land. It sets out the process for land acquisition and the matters which must be taken into account in determining compensation payable to a landowner for the acquisition of the relevant interest in land. The provisions of the Land Acquisition Act would apply to the acquisition of land (and interests in land) by EnergyCo for the project.	Further discussion of potential land acquisition associated with the project is discussed in Chapter 5 (Community and stakeholder engagement) and Chapter 7 (Land use and property).

Instrument	Requirement and/or considerations	EIS reference
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, state conservation areas 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. The project would traverse through one portion of the Durridgere State Conservation Area. Several other areas protected by the NP&W Act are located near the project, including the Goulburn River National Park, Dapper Nature Reserve, Munghorn Gap Nature Reserve, Yarrobil National Park, Goodiman State Conservation Area, Coolah Tops National Park and other portions of the Durridgere State Conservation Area. 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. 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. Under the provisions of section 153 of the EP&A Act, the Minister administering the NP&W Act (the NSW Minister for Environment and Heritage) has the power to grant an easement through a state conservation area for the 'erection of standards, posts, wires and appliances for the conveyance or transmission of electricity'. EnergyCo has commenced discussions with the NSW National Parks and Wildlife Service concerning the creation of an easement for the project within the Durridgere State Conservation Area. An easement would be secured prior to any project determination by the NSW Minister for Planning and Public Spaces under the EP&A Act.	Notwithstanding the provisions of section 5.23(1) of the EP&A Act, a detailed assessment of potential impacts to Aboriginal heritage associated with the project has been undertaken. The results of this assessment are presented in Technical paper 5 and summarised in Chapter 11 (Aboriginal heritage). Consideration of the potential impacts on biodiversity values of nature conservation areas near the project has been included in Chapter 10 (Biodiversity) and Technical paper 4.
Native Title New South Wales Act 1994 (Native Title (NSW) Act)	The Native Title (NSW) Act provides for the recognition of native title in relation to land or waters in NSW in accordance with the *Commonwealth Native Title Act 1993* (refer to Section C1.5). 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 (NSW) Act. The project would not affect land to which an Indigenous Land Use Agreement applies. Searches of the registers maintained by the National Native Title Tribunal identified two known native title claims under the (Commonwealth) *Native Title Act 1993* (NC2011/006 and NC2018/002) in the project area, which have not been determined.	Consultation with relevant Aboriginal groups has been undertaken as part of the preparation of the Aboriginal cultural heritage assessment report (Technical paper 5). The Aboriginal cultural heritage assessment report (Technical paper 5) for the project includes an assessment of native title and Aboriginal heritage impacts. The status of the undetermined claims has been considered as part of the assessment (refer to Chapter 11 (Aboriginal heritage)). EnergyCo would continue to liaise with the LLS and/or the relevant LALC (depending on the status of this claim) to gain access to these land parcels. EnergyCo is continuing to consult with the relevant LALC in relation to the project.

Instrument	Requirement and/or considerations	EIS reference
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act establishes, among other things, pollution management, pollution incident reporting and the procedures for issuing licences for environmental protection on aspects such as waste, air, water and noise pollution control. An EPL is required under Chapter 3 of the POEO Act to undertake a scheduled activity (listed in Schedule 1 of the Act) or scheduled development work (outlined in section 47 of the Act). The project is unlikely to meet the requirements of a scheduled activity as defined in Schedule 1 of the POEO Act (refer to Table C-1).	Appropriate management and mitigation have been identified in relation to these aspects, including in Chapter 15 (Noise and vibration), Chapter 18 (Waste management), Chapter 19 (Other impacts) and Chapter 21 (Environmental management).
Rail Safety Act 2008 (Rail Safety Act)	The principal object of the Rail Safety Act of relevance to the project is the regulation of the carrying out of various activities within in railway corridors. The project would cross two existing railways. Key railway line crossings would consist of: • three crossings of the Sandy Hollow/Gulgong Railway line which is operated by Australian Rail Track Corporation (ARTC) and is referred to as the Ulan Line. The crossings are located along Ulan Road and the Ulan-Wollar Road adjacent to the existing mining operations • three crossings of the Wallerwang/Gwabegar Railway line which is operated by ARTC and UGL Regional Linx Country Rail Network. One crossing is located about four kilometres south of the rail line's intersection with the Castlereagh Highway and the other crossings are located about two and 11 kilometres further south. Activities associated with the project that would occur across these rail corridors would predominantly be related to stringing conductors over the rail corridors.	EnergyCo has met with ARTC to brief them about the project, to identify locations where the alignment would cross ARTC operated rail line and to understand ARTC requirements in relation access to their property by external parties. EnergyCo would continue to consult with ARTC in relation to design development and construction planning to minimise impacts on rail operations during construction and operation of the project. Potential requirements associated with impacts on rail operations during transmission line stringing have been considered as part of Technical paper 13 – Traffic and transport (Technical paper 13) and are summarised in Chapter 17 (Traffic and transport). These requirements would be incorporated into the continued development and refinement of the project design (refer to Chapter 3 (Project description)).
Roads Act 1993 (Roads Act)	The principal object of the Roads Act of relevance to the project 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. With respect to Road Occupancy Licences, the project would potentially require temporary/partial closure(s) of classified and unclassified roads for the construction of the project (during, for example, stringing of transmission lines over public roads). Road works may also be required on unclassified roads as part of the project to establish new access points for the energy hubs and to the transmission line alignment. EnergyCo would require consent from the relevant roads authority under section 138 of the Roads Act to undertake work on or over classified roads. However, by reason of clause 5(1) of Schedule 2 of the Roads Act, EnergyCo, as a public authority, is not required to obtain approval to carry out work on unclassified roads other than a Crown road (subject to that clause ceasing to have effect by proclamation).	Potential requirements associated with impacts to existing roads as a result of the construction and operation of the project have been considered as part of Technical paper 13 and are summarised in Chapter 17 (Traffic and transport). Roads works are proposed to a number of local unclassified roads identified in Chapter 17 (Traffic and transport). Chapter 17 also identifies that road occupancy licences may be required for unclassified and classified roads during construction.

Instrument	Requirement and/or considerations	EIS reference
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 NSW. Section 100B applies to bushfire prone land and empowers the Commissioner of the NSW Rural Fire Service to issue a bushfire safety authority. The bushfire safety authority authorises certain types of development, subject to compliance with matters considered by the Commissioner to be necessary to protect persons, property and/or the environment. Under the provisions of section 5.23(1) of the EP&A Act, this authority that would otherwise be required under section 100B of the RF Act is not required for approved SSI (including CSSI) projects.	Potential hazards associated with bushfire risk to the project and as a result of the project (including during construction), have been considered as part of Technical paper 10 – Bushfire and summarised in Chapter 16 (Hazard and risk).
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 project would consume some natural resources and would produce waste. Waste and resource impacts associated with the project have been assessed in Chapter 18 (Waste management).
Water Management Act 2000 (WM Act) and Water Management (General) Regulation 2018	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 confer 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 of the WM Act, 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. 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 (including CSSI). Under the WM Act, a water access licence is required where water is taken for consumptive use or incidentally by an aquifer interference activity from a water source (rivers, lakes, estuaries and groundwater) where a water sharing plan has commenced, unless an exemption applies. Exemptions from water licence and approval requirements are outlined in Schedule 4 of the Water Management (General) Regulation 2018. Exemptions that apply to public authorities (such as EnergyCo) for requiring an access licence include: • dust suppression (Schedule 4 1(5)) • the taking of up to three megalitres of groundwater from a groundwater source in a water year when groundwater is intercepted during excavation required for the construction of a building, road or infrastructure, if the taking of that groundwater is not for the purpose of its consumption or supply (Schedule 4 1(7)).	Extraction of groundwater (e.g. for construction water supply) and groundwater dewatering would be required during construction. Consideration of the NSW Aquifer Interference Policy and the requirement for a water access licence for the project have been included in Section 19.3 of Chapter 19 (Other impacts) and Technical paper 17 – Groundwater.

Instrument	Requirement and/or considerations	EIS reference
	The NSW Aquifer Interference Policy (DPI, 2012) provides a framework for the regulation, licencing and assessment of groundwater activities to meet the requirements of the WM Act to ensure that the granting of water licences and approvals results in 'no more than minimal harm' to any water source or dependent ecosystem. As discussed in Section 19.1 (Hydrology, flooding and water quality), 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 where practicable. Extraction of groundwater is also proposed as part of the requirements for water during construction. As such, a water access licence would be required for the project under sections 56 and 61 of the WM Act. A water access licence entitles licence holders to specified volumetric entitlements in the available water within a particular water management areas or water source and to take water at specified times, rates or circumstances from specified areas or locations. The volumetric entitlement is measured by the number of units assigned to the water access licence and the annual volumetric value of a unit for that water source as determined by the Minister administering the WM Act. Units can be transferred from one water access licence to another. A water access licence is held personally and may be transferred and otherwise dealt with in accordance with the WM Act. In addition, groundwater dewatering may occur where excavations or piles intersect with the groundwater table, and is likely to exceed three megalitres of groundwater per year, meaning that licences or approvals under the water regulatory regimes may be required. Dewatering estimates and the need for water access licences would be confirmed during detailed design.	

C1.4 Environmental Planning and Assessment Regulation 2021 checklist

Table C-4 identifies the form and content requirements of the EIS in accordance with clauses 190 and 192 of the EP&A Regulation and indicates where they have been addressed in the EIS.

Table C-4 Environmental Planning and Assessment Regulation 2021 checklist

Requirement	EIS reference
190. Form of the environmental impact statement	
21. An environmental impact statement must contain the following information—	
a. the name, address and professional qualifications of the person who prepared the statement,	Refer to certification at the front of the EIS
b. the name and address of the responsible person,	
c. the address of the land:	
i. to which the development application relates, or	
ii. on which the activity or infrastructure to which the statement relates will be carried out,	
d. a description of the development, activity or infrastructure	

Requirement	EIS reference
e. an assessment by the person who prepared the statement of the environmental impact of the development, activity or infrastructure, dealing with the matters referred to in this Division.	
22. The person preparing the statement must consider — b. for State significant infrastructure — the State Significant Infrastructure Guidelines.	Preparation of the EIS has had regard to the *State Significant Infrastructure Guidelines* (DPE, 2022h) while meeting the requirements of the SEARs (issued 7 October 2022 and supplementary SEARs (issued on 28 March 2023).
23. An environmental impact statement must also contain a declaration by a relevant person that — a. the statement has been prepared in accordance with this Regulation, and b. the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure, and c. the information contained in the statement is not false or misleading, and d. for State significant infrastructure — the statement contains the information required under the *Registered Environmental Assessment Practitioner Guidelines*.	Refer to declaration page at the front of the EIS
24. In this section — registered environmental assessment practitioner means a person who is registered or certified under a professional scheme that is specified as a registered environmental assessment practitioner scheme in the *Accredited Registered Environmental Assessment Practitioner (REAP) Schemes* published on the NSW Planning Portal on 1 July 2021. Registered Environmental Assessment Practitioner Guidelines means the Registered Environmental Assessment Practitioner Guidelines prepared by the Planning Secretary as in force from time to time and published on the Department's website. relevant person means — a. for State significant infrastructure — a registered environmental assessment practitioner, or b. otherwise — the person who prepares the environmental impact statement.	Refer to declaration page at the front of the EIS
192. Content of environmental impact statement	
4. An environmental impact statement must contain the following —	
a. a summary of the environmental impact statement,	Executive Summary
b. a statement of the objectives of the development, activity or infrastructure,	Chapter 2 (Strategic context)
c. an analysis of feasible alternatives to the carrying out of the development, activity or infrastructure, considering its objectives, including the consequences of not carrying out the development, activity or infrastructure,	Chapter 2 (Strategic context)
d. an analysis of the development, activity or infrastructure, including — i. a full description of the development, activity or infrastructure, and	Chapter 3 (Project description)
ii. a general description of the environment likely to be affected by the development, activity or infrastructure and a detailed description of the aspects of the environment that are likely to be significantly affected, and	Chapter 2 (Strategic context) Chapter 7 to Chapter 20

Requirement	EIS reference
iii. the likely impact on the environment of the development, activity or infrastructure, and	Chapter 7 to Chapter 20
iv. a full description of the measures to mitigate adverse effects of the development, activity or infrastructure on the environment, and	Chapter 7 to Chapter 20
v. a list of the approvals that must be obtained under another Act or law before the development, activity or infrastructure may lawfully be carried out,	Chapter 4 (Statutory context) and this appendix
e. a compilation, in a single section of the environmental impact statement, of the measures referred to in paragraph (d)(iv),	Chapter 21 (Environmental management)
f. the reasons justifying the carrying out of the development, activity or infrastructure, considering biophysical, economic and social factors, including the principles of ecologically sustainable development set out in section 193.	Chapter 23 (Justification and conclusion)

C1.5 Commonwealth legislation

C1.5.1 Environmental Planning and Biodiversity Conservation Act 1999

Matters of national environmental significance (MNES), such as Commonwealth listed threatened species and ecological communities, are protected under the EPBC Act. Under the EPBC Act, proposed actions that are likely to have a significant impact on MNES must be referred to the Australian Minister for the Environment. The Minister will determine whether the action is a controlled action and therefore requires approval from the Minister under the EPBC Act. The Minister will also determine the method under which the environmental impact of the action will be assessed.

EnergyCo referred the project to the Minister on 2 February 2023 (referral no. 2022/09353). DCCEEW, as delegate for the Australian Minister for the Environment and Water, determined on 2 March 2023 that the project is a controlled action on the basis of likely significant impacts to the following listed threatened species, TEC (sections 18, 18A of the EPBC Act) and migratory species (sections 20 and 20A of the EPBC Act):

- Regent Honeyeater (*Anthochaera phrygia*)
- White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland TEC
- Satin Flycatcher (*Myiagra cyanoleuca*).

Two TECs and 37 species were also identified as having some risk of significant impact and identified for further consideration.

DCCEEW also determined that the project would be assessed under the NSW Assessment Bilateral Agreement.

The NSW Assessment Bilateral Agreement provides for certain actions that are SSD 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. However, a separate EPBC Act approval is still required.

DPE issued Supplementary SEARs on 28 March 2023 to include the relevant Commonwealth requirements under the NSW Assessment Bilateral Agreement. This EIS has been prepared to address these requirements (refer to Appendix A (SEARs checklist)).

Matters of National Environmental Significance

As detailed in Chapter 10 (Biodiversity) and Technical paper 4, the assessment has concluded that the project is likely to have a significant impact on one EPBC listed threatened flora species, two EPBC listed threatened fauna species and one EPBC listed TEC. No significant impact is expected on threatened migratory species.

A summary of the potential impacts on MNES as a result of the project is presented in Table C-5.

Table C-5 Potential impacts on MNES under the EPBC Act

MNES	Matters within the project area
World heritage properties	The project would not impact on any items of world heritage.
National heritage places	The project would not impact on any items of national heritage or national heritage places.
Wetlands of international importance	The project would not impact on any wetlands of national or international importance.
Commonwealth listed threatened species and ecological communities	The results of likelihood of occurrence assessments have identified 11 EPBC listed threatened flora species and 22 EPBC listed threatened fauna species with a moderate or higher likelihood of occurrence within the biodiversity study area (refer to Chapter 10 (Biodiversity) and Technical paper 4). Based on the significance assessments completed for these species (refer to Technical Paper 4), it was identified that the project is likely to have a significant impact on one EPBC listed threatened flora species, Bluegrass (*Dichanthium setosum*) (listed as vulnerable), and two EPBC listed threatened fauna species, the Regent Honeyeater (*Anthochaera Phrygia*) and Large-eared Pied Bat (*Chalinolobus dwyeri*) (listed as critically endangered and vulnerable, respectively). Offsets for these species, alongside other EPBC-listed fauna and flora species, have been identified in the EIS and Technical paper 4. Three threatened ecological communities (TECs) listed under the EPBC Act would be directly impacted by the project. These include: • Central Hunter Valley eucalypt forest and woodland – Critically Endangered • Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia – Endangered • White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland – Critically Endangered. Based on the significance assessments completed for these TECs, it was concluded that the project is likely to have a significant impact on the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland ecological community. Offsets for all three TECs have been identified in the EIS and Technical paper 4.
Commonwealth listed migratory species	The results of likelihood of occurrence assessments identified nine migratory species that have a moderate or higher likelihood of occurrence within the biodiversity study area (refer to Appendix C of Technical paper 4). This includes the Satin Flycatcher (*Myiagra cyanoleuca*), White-throated Needletail (*Hirundapus caudacutus*), Black-faced Monarch (*Monarcha melanopsis*), Yellow Wagtail (*Motacilla flava*), Rufous Fantail (*Rhipidura rufifrons*), Common Sandpiper (*Actitis hypoleucos*), Sharp-tailed Sandpiper (*Calidris acuminata*), Latham's Snipe (*Gallinago hardwickii*) and Fork-tailed Swift (*Apus pacificus*). None of these species have been recorded in the biodiversity study area. As documented in Technical paper 4 (where further detail is provided), the project is considered unlikely to substantially modify, destroy or isolate an area of important habitat for any EPBC Act listed migratory species, unlikely to result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, and is unlikely to seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds.
Nuclear action	The project would not result in any nuclear action nor would any nuclear activity need to be undertaken.

MNES	Matters within the project area
Commonwealth marine area	The project would not result in any impacts to Commonwealth marine areas. The Fork-tailed Swift, a migratory marine species, has a moderate likelihood of occurrence within the biodiversity study area (refer to Chapter 10 (Biodiversity) and Technical paper 4). As outlined earlier within this table, the project is unlikely to have a significant impact on this species. 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 project.
Great Barrier Reef Marine Park	The project would not impact on the Great Barrier Reef Marine Park.
Protection of water resources from coal seam gas development and large coal mining	The project is not related to a coal seam gas development and large coal mining development.

C1.5.2 Environment Protection and Biodiversity Conservation Regulations 2000

Table C-6 identifies the form and content requirements of the EIS in accordance with Schedule 4 of the EPBC Regulation as required by the supplementary SEARs and indicates where they have been addressed in the EIS.

Table C-6 Environment Protection and Biodiversity Conservation Regulations 2000 checklist

Requirement	EIS reference
Schedule 4 Matters to be addressed by draft public environment report and environmental impact statement	
5. Other approvals and conditions	
5.01 Information given under paragraph 2.01(f) must include: a. details of any local or State government planning scheme, or plan or policy under any local or State government planning system that deals with the proposed action, including:	Chapter 4 (Statutory context) This appendix
i. what environmental assessment of the proposed action has been, or is being, carried out under the scheme, plan or policy;	Chapters 7 to 20 Technical papers 1 to 18
ii. how the scheme provides for the prevention, minimisation and management of any relevant impacts;	Chapters 7 to 20 Chapter 21 (Environmental management) Technical papers 1 to 18
b. a description of any approval that has been obtained from a State, Territory or Commonwealth agency or authority (other than an approval under the Act), including any conditions that apply to the action;	This appendix
c. a statement identifying any additional approval that is required;	This appendix
d. a description of the monitoring, enforcement and review procedures that apply, or are proposed to apply, to the action.	Chapter 21 (Environmental management)

Requirement	EIS reference
6. Environmental record of person proposing to take the action	
6.01 Details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against: a. the person proposing to take the action; and b. for an action for which a person has applied for a permit, the person making the application.	There are no current or previous proceedings under a Commonwealth, State or Territory law for the protection of the environment or the conservation and sustainable use of natural resources against the person (EnergyCo) proposing the action.
6.02 If the person proposing to take the action is a corporation--details of the corporation's environmental policy and planning framework.	EnergyCo is a NSW Government statutory authority established under the Energy and *Utilities Administration Act 1987*. The NSW Government has appointed EnergyCo in November 2021 as the Infrastructure Planner responsible for delivering the transmission network in REZs in NSW. EnergyCo operates under the direction of the NSW Minister for Energy. EnergyCo is in the process of finalising their Environmental Policy Statement. It states that EnergyCo is committed to conducting its activities and services in a manner that protects the environment, prevents pollution and meets compliance obligations. To uphold this commitment the EnergyCo Central-West Orana REZ will: • conduct its activities in an environmentally responsible and competent manner so as to manage the potential for pollution and environmental impact • integrate environmental management considerations into the planning, design, siting, construction, maintenance and operation of its infrastructure • develop a sense of environmentally responsibility throughout all levels of EnergyCo Central-West Orana REZ • establish a program for periodical review of the environmental objectives and targets as identified by EnergyCo Central-West Orana REZ • promptly implement preventative and corrective actions wherever identified • liaise with and encourage our suppliers and subcontractors to achieve a high level of environmental performance • regularly monitor assess and review our activities in relation to environmental performance to ensure compliance with environmental commitments • engage with the community, customers, employees, government and other stakeholders regarding potential environmental or cultural impacts associated with our plans and activities. EnergyCo Central-West Orana REZ will maintain a commitment to continual improvement in its environmental performance in the way it operates to support achievement of the Central-West Orana REZ project objectives.

C1.5.3 Other Commonwealth legislation

Native Title Act 1993

The *Native Title Act 1993* provides for the recognition of native title and establishes ways in which future dealings affecting native title may proceed, sets the standards for those dealings and establishes a mechanism for determining claims to native title. Section 8 states that the *Native Title Act 1993* is not intended to affect the operation of any law of a state or a territory that is capable of operating concurrently with the Act. 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.

The Register of Indigenous Land Use Agreements did not identify any agreements that apply to the construction or operational area. The project would not impact the three existing native title claims identified within the study area applied to the assessment of impacts to land use and property (refer to Chapter 7 (Land use and property)).

Appendix D
Engagement summary

D1 Engagement summary

This appendix provides a summary of the various key issues raised by the community, local councils, agencies and other stakeholders in meetings, briefings information sessions, and via email and phone during the preparation of the Environmental Impact Statement (EIS).

D1.1 Community views

A summary of the issues raised by the community and where this has been addressed in this EIS is provided in Table D-1.

Table D-1 Community views

Category	Topic	Issue raised	Where addressed in the EIS
Consultation	Consultation fatigue	Local community and landowners are tired from consultation with multiple parties over a long time period and do not have the time or resources to maintain this level of consultation.	Consideration of consultation fatigue is included in Social Impact Assessment outlined in: • Chapter 13 (Social) • Technical paper 7 – Social.
		Community members should be paid or provided with resources to allow them to participate in consultation more effectively.	The approach to engagement and communications considered different stakeholder needs and expectations. No compensation was provided to community members to participate. Further detail on engagement is outlined in Chapter 5 (Community and stakeholder engagement).
	Inadequate consultation	EnergyCo should have community representatives on the ground in the region to engage with community and landowners on a regular basis and not just through periodic consultation events.	EnergyCo has opened an office in Dubbo and established a team of place managers and land agents based in the region. Local meetings and in person engagement with landowners has been undertaken. Further engagement will be undertaken as detailed in Chapter 5 (Community and stakeholder engagement).
		Need a range of communication channels to recognise some residents have limited access to internet. For example, make greater use of radio advertising and community notice boards on Facebook pages to advertise community events.	A range of communication methods have been used and will continue to be used going forward as detailed in Chapter 5 (Community and stakeholder engagement).
		Consultation occurs too far away from where impacted people are located. The lack of consultation event in Coolah in March 2022 (following publication of the Revised Study Corridor) meant that many affected people could not participate in the community week events.	Subsequent community information sessions have included Coolah. In addition, the locally based team of place managers and land agents continues to meet with landowners and stakeholders on a regular basis. Further engagement will be undertaken as detailed in Chapter 5 (Community and stakeholder engagement).

Category	Topic	Issue raised	Where addressed in the EIS
		Approach to consultation needs to take account of the community context, including communities suffering from mental health issues and stress following repeated natural disasters such as the Sir Ivan Bushfire, mouse plague, drought and floods.	The approach to engagement and communications outlines a range of methods for providing information, receiving information and engaging with stakeholders in recognition of the diversity of needs and expectations. Further detail on engagement (past and planned) is outlined in Chapter 5 (Community and stakeholder engagement). Issues related to community and landowners stress are also identified in: • Chapter 13 (Social) • Technical paper 7 – Social.
		The approach to Social Impact Assessment (SIA) interviews did not allow sufficient time to involve and gain feedback from the wider community.	The SIA was completed in accordance with Social Impact Assessment Guidelines prepared by the NSW Department of Planning and Environment (2022). Detail on the approach to SIA consultation is in: • Chapter 13 (Social) • Technical paper 7 – Social.
		Very important that property owners are provided with sufficient advance notice prior to any investigation or construction activities on their property.	Notifications of field investigation work have been provided to landowners where field work has been carried out. Access agreements were arranged with landowners in advance of accessing properties. Access to properties during construction would be undertaken in consultation with the landowners as described in: • Chapter 3 (Project description) • Chapter 7 (Land use and property) • Chapter 8 (Agriculture).
		Poor quality mapping presented at the community consultation events in March 2022 made it difficult for landowners and community members to locate the transmission infrastructure relative to their properties or communities.	Noted. An online map is available on the EnergyCo website and the EIS will include detailed mapping that will show the location of the transmission line and associated infrastructure.
Construction	Disturbance	Provide more information on how construction vehicles would access the easement	Details on construction access is provided in: • Chapter 3 (Project description) • Chapter 17 (Traffic and transport).
		Explain the extent of clearing required within the construction area during construction	The extent and approach to clearing is detailed in: • Chapter 3 (Project description) • Chapter 10 (Biodiversity) • Technical paper 4 – Biodiversity development assessment report.

Category	Topic	Issue raised	Where addressed in the EIS
		How are creek lines and watercourses protected during construction.	Mitigation measures to address impact to watercourses are detailed in: • Chapter 10 (Biodiversity) • Technical paper 4 – Biodiversity development assessment report • Section 19.1 (Hydrology, flooding and water quality) • Technical paper 14 – Hydrology and water quality.
		People seeking access to private property should implement a Safe Work Method Statement (SWMS).	Health and Environment Safety Plans/ SWMSs have been implemented for all onsite EIS investigations and will be implemented for construction and operation of the project.
		Concerns about impacts of construction disturbance on livestock.	Impacts to agricultural operations (including impacts to livestock as a result of construction operations) and the associated mitigation measures are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
	Disruptions to social services	Concerns about the ability of towns in the vicinity of the project to service workers, for example, Coolah does not have a GP. How will medical and other services be provided to construction workers without impacting on the already limited services in the region.	Impacts to social services, including medical services, were assessed as part of the SIA and mitigation measures were identified as detailed in: • Chapter 13 (Social) • Technical paper 7 – Social. The project would provide a dedicated medical service to its construction workers which will reduce the demand on existing medical services in the region. In addition, the cumulative impact assessment (Chapter 20) identifies REZ wide initiatives being developed by EnergyCo with other government agencies and councils including initiatives related to reducing the impact of the REZ on medical services in the region.
	Accommodation camps	Recommend that accommodation camps are located close to towns so that towns benefit economically.	Temporary workforce accommodation camps would be located in Merotherie and Cassilis near the construction area. This minimises the distance the workers need to travel to construction areas on a daily basis, supporting health and safety outcomes for workers and program objectives for the projects.

Category	Topic	Issue raised	Where addressed in the EIS
		EnergyCo and generators should be required to design accommodation camps in a way that creates a legacy value to communities after construction.	The workforce accommodation camps would be demobilised at the end of construction. Approach to accommodation workforce camps is provided in Chapter 3 (Project description). In addition, the cumulative impact assessment (Chapter 20) identifies REZ wide initiatives being developed by EnergyCo with other government agencies and councils including initiatives related to housing legacy.
Design	Transmission alignment	Community and landowner perception that the alignment has been influenced by 'loud voices' pushing the alignment/impact on to others.	Approach to transmission line alignment development considered a range of factors including technical (e.g. topography, ground conditions), environmental (biodiversity and heritage constraints, distance to dwellings) and landowner sentiment as detailed in Chapter 2 (Strategic context). The engagement undertaken to date is detailed in Chapter 5 (Community and stakeholder engagement).
		Transmission lines should be moved further away from people's residence, including planned future residences, to reduce visual amenity.	Approach to transmission line alignment development has sought to avoid main population centres. Detailed discussions with landowners hosting transmission infrastructure have investigated options to locate the transmission line away from the residence to the extent possible. A detailed description of the process to develop the alignment is provided in Chapter 2 (Strategic context). Visual impacts and associated mitigation measures are detailed in: • Chapter 9 (Landscape character and visual amenity) • Technical paper 3 – Visual and landscape character.
		What alternative transmission alignments were considered including the option to put the alignment underground.	The alternative transmission line alignments considered are outlined in Chapter 2 (Strategic context).
		Unclear if EnergyCo has coordinated planning and design of the transmission line with the renewable energy generators as there appears to be conflicts between transmission and generation infrastructure.	EnergyCo has engaged extensively with developers of renewable energy projects to coordinate their connections to the transmission line via the energy hubs. The energy hubs have been located centrally to the generator locations minimising the overall length of connections to the hubs. Approach to transmission line alignment development and selection is provided in Chapter 2 (Strategic context).

Category	Topic	Issue raised	Where addressed in the EIS
		Locate transmission lines in lower quality farming land such as forested areas or rocky outcrops, avoided open paddocks.	EnergyCo's approach to developing the project study corridor over time has combined engineering and design development detail, environmental considerations and feedback from the community and stakeholders. Approach to transmission line alignment development and selection is provided in Chapter 2 (Strategic context).
		Transmission lines should be located to avoid disturbance to livestock.	Approach to transmission line alignment development and selection is provided in Chapter 2 (Strategic context). Impacts to agricultural operations and the associated mitigation measures are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
		Transmission lines should be located away from sensitive cultural heritage areas.	The project has been refined where feasible to avoid Aboriginal heritage sites and places. Specific environmental constraints that have been avoided or minimised through the project development process are described in Chapter 2 (Strategic context). Impacts on Aboriginal heritage and associated mitigation measures are detailed in: • Chapter 11 (Aboriginal heritage) • Technical paper 5 – Aboriginal cultural heritage assessment report.
		Will EnergyCo/the Network Operator provide gates in each fence that intersect the easement?	Gates would not be provided in each fence intersected. Where existing access is unsuitable and access arrangements are in place as negotiated with landowners, the future Network Operator may install lockable and signed access gates to access the easement. The proposed access to the transmission line easement is described in Chapter 3 (Project description). Impacts to properties and associated mitigation measures are detailed in: • Chapter 7 (Land use and property) • Chapter 8 (Agriculture).
		Clarify if the easement will be fenced?	The proposed transmission line easement will not be fenced. Description of the transmission line easement is provided in Chapter 3 (Project description).
		How is access to the transmission easement obtained?	Access to the proposed transmission line easements is described in Chapter 3 (Project description.
		Opposed to transmission line connecting Liverpool Range Wind Farm to Uarbry energy hub, splitting communities and neighbours.	Approach to transmission line alignment development and selection is provided in Chapter 2 (Strategic context).

Category	Topic	Issue raised	Where addressed in the EIS
Environment	Biodiversity	Concerns about cumulative impacts to biodiversity from the transmission line and the renewable energy projects.	Development of the transmission project alignment has sought to avoid areas of important biodiversity values as required by the Biodiversity Assessment Method (BAM) and documented in the Biodiversity Development Assessment Report (BDAR). Where impacts cannot be avoided, biodiversity offsets will be acquired and retired. Other projects would be required to follow a similar process. Assessment of cumulative biodiversity impacts is provided in: • Chapter 20 (Cumulative impacts) • Appendix E (Cumulative impact assessment).
		The project should avoid loss of any vegetation because of biodiversity values and carbon sequestration function.	Specific environmental constraints that have been avoided or minimised through the project development process are described in Chapter 2 (Strategic context). Biodiversity impacts and associated mitigation measures are detailed in: • Chapter 10 (Biodiversity) • Technical paper 4 – Biodiversity development assessment report.
		Existing biodiversity offsets should be avoided.	Locating the transmission alignment through the mining areas has avoided impacts on biodiversity and other environmental and social values in other parts of the REZ, but increased the risk of impacting on existing biodiversity offsets associated with approved mines. While the alignment has sought to avoid offset areas, some offset areas associated with mining areas would be impacted by the project. The approach to transmission line alignment development and selection is provided in Chapter 2 (Strategic context). Biodiversity impacts and associated mitigation measures are detailed in: • Chapter 10 (Biodiversity) • Technical paper 4 – Biodiversity development assessment report.
		The biodiversity assessment should be based on a detailed surveys of biodiversity values rather than a desk top assessment.	Extensive field surveys have been undertaken for the biodiversity assessment. The methodology for the biodiversity assessment is provided in: • Chapter 10 (Biodiversity) • Technical paper 4 – Biodiversity development assessment report.

Category	Topic	Issue raised	Where addressed in the EIS
		The transmission line should avoid the Narrogamba Swamp and Cockabutta Creek Basin because of the high biodiversity values, including bird life.	The alignment avoids these areas. The approach to transmission line alignment development and selection, including minimising impacts to areas of high biodiversity value are described in Chapter 2 (Strategic context). Biodiversity impacts and associated mitigation measures are detailed in: • Chapter 10 (Biodiversity) • Technical paper 4 – Biodiversity development assessment report.
		Why aren't transmission lines being routed through National Parks?	The process to develop the transmission alignment has considered a range of technical, environmental and community and landowner factors as detailed in Chapter 2 (Strategic context). National Parks are areas of high biodiversity value which the alignment has sought to avoid to the extent possible. A small section of the alignment is located through the Durridgere Special Conservation Area. In addition to their biodiversity values, National Parks present other challenges to the development a transmission line include topography and bushfire risk.
	Bushfire	The transmission lines increase the risk of bushfire as they are a potential source of ignition in the land.	The design of the transmission line includes an approach to vegetation management which creates separation distances between the transmission line and vegetation to reduce the risk of bushfire. Bushfire risks and the associated mitigation measures are detailed in: • Chapter 16 (Hazard and risk) • Technical paper 10 – Bushfire.
		The transmission lines and wind turbines may hinder the ability of firefighting using aerial appliances.	Bushfire risks, aviation impacts and the associated mitigation measures are detailed in: • Chapter 16 (Hazard and risk) • Technical paper 1 – Aviation • Technical paper 10 – Bushfire.
		If farm dams are impacted by the transmission lines, this may limit the use of dam water for fire fighting.	Where the positioning of transmission line structures and other associated permanent structures will impact farm dams consultation will be undertaken with the affected landowner to identify opportunities to avoid or minimise these impacts, where practicable. Bushfire risks and the associated mitigation measures are detailed in: • Chapter 16 (Hazard and risk) • Technical paper 10 – Bushfire.

Category	Topic	Issue raised	Where addressed in the EIS
	Electromagnetic fields	General concerns about living too close to transmission lines, including potential impacts due to electromagnetic fields (EMF), noise and visual impact.	Assessment of EMF is detailed in: • Chapter 16 (Hazard and risk) • Technical paper 18 – Electro magnetic field assessment.
	General environmental impacts	Positive that the alignment is using existing disturbed areas such as mining areas.	The positive support for the use of disturbed areas is noted.
	Heritage	Concerns about impacts to graves, church and school sites at Tallawang.	Impacts to heritage sites at Tallawang are assessed and associated mitigation measures identified in: • Chapter 12 (Non-Aboriginal heritage) • Technical paper 6 – Non-Aboriginal heritage.
	Landscape character and visual amenity	Concern about visual impact of towers, transmission lines and energy hubs and the impact on the visual amenity of rural properties.	Visual impacts and associated mitigation measures are detailed in: • Chapter 9 (Landscape character and visual amenity) • Technical paper 3 – Visual and landscape character.
		EnergyCo should provide access to visual impact assessment photography so that affected landowners can better understand the visual impact of the transmission line. Landowners should not have to wait until the EIS is published to see the photography.	Visual impacts and associated mitigation measures are detailed in: • Chapter 9 (Landscape character and visual amenity) • Technical paper 3 – Visual and landscape character. Photomontages for visual impacts at private dwellings have been shown to landowners prior to public exhibition of the EIS [DN: this has not happened yet but will happen prior to EIS exhibition.
		Will EnergyCo provide vegetation screening to reduce visual impacts?	For private dwellings on non-host properties where the project is predicted to have a moderate or high visual impact, opportunities for the provision of screening vegetation or other forms of mitigation will be investigated with the property owner. Visual impacts and associated mitigation measures are detailed in: • Chapter 9 (Landscape character and visual amenity) • Technical paper 3 – Visual and landscape character.
	Soils and geology	Concerns about erosion that will occur as a result of vegetation clearing.	Erosion impacts and associated mitigation measures are detailed in: • Section 19.1 (Hydrology, flooding and water quality) • Section 19.2 (Soils and contamination) • Technical paper 14 – Hydrology and water quality

Category	Topic	Issue raised	Where addressed in the EIS
General	General opposition to the project	The transmission lines and associated renewable energy have a significant impact on farming, forcing families and businesses off the land.	Cumulative impacts of the project on agricultural land alongside other projects is considered in: • Chapter 20 (Cumulative impacts) • Appendix E (Cumulative impact assessment) • Technical paper 2 – Agriculture.
		Disagree with the concept of a Renewable Energy Zone (REZ) as the concentration of renewable energy infrastructure in one region represents an industrialisation of a rural and regional landscape and a conflict with the long established farming land uses in the region.	Approach to development of the REZs is provided in Chapter 2 (Strategic context). Impacts on land use and associate mitigation measures are detailed in Chapter 7 (Land use and property).
	REZ governance	Numerous different organisations involved in delivering the REZ makes it complex and difficult to understand for communities and landowners.	The role of EnergyCo as the Infrastructure Planner for the CWO REZ is explained in Chapter 1 (Introduction).
		Lack of wholistic planning.	The strategic policy and planning context for the development of Renewable Energy Zones including the CWO REZ is provided in Chapter 2 (Strategic context). EnergyCo has worked closely with renewable energy developers to coordinate the location of transmission infrastructure in relation to generation projects to reduce the overall length of connections to the energy hubs. In addition, EnergyCo has led coordination efforts with a range of government agencies and councils to develop initiatives to reduce the overall impacts of the REZ on communities in the region and develop community benefit opportunities.
		Confusion about transition from Transgrid to EnergyCo and Epuron to Tilt and associated alignment changes. Unclear to the community and property owners who is responsible for developing the REZ and individual projects within the REZ.	The transition of the project from Transgrid to EnergyCo is described in Chapter 2 (Strategic context). The development of renewable energy generation projects in the Central-West Orana REZ is the responsibility of private generators and subject to separate planning and environmental approvals. However, EnergyCo, as the Infrastructure Planner for the REZ has a coordinating role as described in Chapter 1 (Introduction).
Property	Acquisition	The transmission line has a significant impact on the entire farm business, therefore, EnergyCo should acquire the full property and not just the easement. Provide further explanation of property acquisition process and next steps.	Easements and property acquisition for the project is described in Chapter 3 (Project description). Property and agricultural impacts and the associated mitigation measures are detailed in: • Chapter 7 (Land use and property) • Chapter 8 (Agriculture) • Technical Paper 2 – Agriculture.

Category	Topic	Issue raised	Where addressed in the EIS
		Provide greater clarification on the property acquisition process and the link to the planning approval. Can acquisition be undertaken prior to the planning approval being obtained.	Property acquisition for the project is described in Chapter 3 (Project description). The approach to engagement is detailed in Chapter 5 (Community and stakeholder engagement).
	Biosecurity	Concern about spread of weeds by field survey and investigation teams.	Biosecurity measures were employed during field investigations for the EIS. Biosecurity risks associated with the construction and operation of the project are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture • Technical paper 4 – Biodiversity development assessment report.
		Concerns about spread of foot and mouth disease by field survey and investigation teams.	Biosecurity measures were employed during field investigations for the EIS. Biosecurity risks associated with the project are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
		Many properties have biosecurity quarantine signs erected at the front gate. All project personnel visiting properties must abide by the instructions contained in the sign.	Biosecurity measures were implemented during field investigations including property specific requirements.
		Site access teams should provide their own washdown facility to disinfect vehicles prior to entering property.	Biosecurity measures were implemented during field investigations including washdown protocols.
	Compensation	Will compensation be paid for visual impacts to my property where the infrastructure is being hosted by a neighbouring property.	EnergyCo will consult with neighbouring landowners where the visual impact assessment has assessed the impact from transmission infrastructure as moderate or high, to investigate the options for screening or other forms of mitigation. Visual impacts and associated mitigation measures are detailed in: • Chapter 9 (Landscape character and visual amenity) • Technical paper 3 – Visual and landscape character.
	Land use impacts	Limitations on the use of agricultural machinery under transmission lines.	Impacts to agricultural operations and the associated mitigation measures are detailed in: • Chapter 8 (Agriculture) • Technical Paper 2 – Agriculture.
	Limitations to aerial applications	Transmission lines and wind turbines will lead to disruption to aerial applications	Impacts to aviation operations and the associated mitigation measures are detailed in: • Chapter 8 (Agriculture) • Chapter 16 (Hazard and risk) • Technical paper 1 – Aviation.

Category	Topic	Issue raised	Where addressed in the EIS
	Property access	Site visits and construction activities should be planned to avoid any disturbance during the lambing season.	Impacts to agricultural operations and the associated mitigation measures are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
Socio-economic	Agriculture impacts	Concerns about the impact of transmission lines on private air strips.	Impacts to aviation operations and the associated mitigation measures are detailed in: • Chapter 7 (Land use and property) • Chapter 16 (Hazard and risk) • Technical paper 1 – Aviation.
		Tower locations should avoid highly productive black soil paddocks to minimise impacts on farming.	Impacts to agricultural land and the associated mitigation measures are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
		Easement positioned over stocking yard and silos, impacting farm enterprise. Transmission line should be moved to avoid impacts on farm infrastructure.	Approach to transmission line alignment development and selection is provided in Chapter 2 (Strategic context). Impacts to agricultural infrastructure and the associated mitigation measures are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
		Concerns about damage to newly installed fencing.	Impacts to agricultural infrastructure and the associated mitigation measures are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
		Property owners need the acquisition process to move faster and with greater certainty. Property owners delaying investment because of uncertainty whether infrastructure will be built and timing.	Property acquisition for the project is described in Chapter 3 (Project description).
	Business impacts	Impact to farm operations particularly where a lot of investment and planning has been put into long term farm planning.	Impacts to agricultural operations and the associated mitigation measures are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
		Uncertainty over transmission route and timing affecting ability of landowners to undertake long term planning for their property/farms	The transmission lien route and construction timing are described in Chapter 3 (Project description).
		Ability to obtain insurance for farm business is impacted because of the proximity of renewable energy projects to the farm.	Consideration of impacts on private insurance is not within the scope of this EIS. Impacts to agricultural operations and the associated mitigation measures are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
	Community benefits	Further information required on the community benefits framework including how much money would be made available, timing and governance arrangements.	Approach to community benefit initiatives is outlined in Chapter 5 (Community and stakeholder engagement).

Category	Topic	Issue raised	Where addressed in the EIS
	Societal impacts	Impact on social services such as health services due to the influx of project workforce, particular on towns with no or limited health services.	Impacts on social services and the associated mitigation measures are considered in: • Chapter 13 (Social) • Technical paper 7 – Social.
Traffic and transport	Access road impacts	Concern about the capacity of local roads and whether road upgrades would be undertaken to support the project.	Traffic impacts and associated mitigation measures are detailed in: • Chapter 17 (Traffic and transport) • Technical paper 13 – Traffic and transport.

D1.1.1 Council feedback

A summary of the issues raised by Councils and where this has been addressed in this EIS is provided in Table D-2.

Table D-2 Local council feedback

Category	Topic	Key issues raised	Where addressed in the EIS
Accommodation camps	Location	EIS to confirm the location and capacity of the accommodation camps.	Location and capacity of the two workforce accommodation camps are provided in Chapter 3 (Project description).
	Transport routes	EIS to confirm the routes proposed for transport of workers between the camps and construction compounds, including the means of transport and traffic volumes.	The approach to the workforce accommodation camps is described in Chapter 3 (Project description). Construction traffic routes are described and assessed in: • Chapter 17 (Traffic and transport) • Technical paper 13 – Traffic and transport.
Transport	Road upgrades	EnergyCo to confirm the road upgrades required to enable the REZ including for Over Size and Over Mass movements and funding responsibility.	Upgrades to public roads to support development of the project would be undertaken under separate approvals as described in the section on related development in Chapter 1 (Introduction) of the EIS.
Housing	Affordability / availability	Concern about the impact of an influx of temporary works on rental accommodation availability and affordability.	EnergyCo acknowledges Council's concern about the potential impact of a temporary workforce on housing affordability and availability. As detailed in Chapter 3 of the EIS, the transmission project will provide temporary workforce accommodation to meet the needs of the workforce, reducing any impact on housing affordability and availability.
Benefits	Housing	Council interested in opportunities for the REZ to provide legacy benefits to Councils and communities, such as social housing.	The cumulative impact assessment (Chapter 20) identifies REZ wide initiatives being developed by EnergyCo with other government agencies and councils including initiatives related to opportunities for legacy benefits associated with housing.

Category	Topic	Key issues raised	Where addressed in the EIS
Easement	Restriction on activities	Council seeking clarification on what agricultural activities can and cannot be undertaken within an easement and any restrictions on access to the easement.	Management of transmission line easements is described in Chapter 3 (Project description).
Biodiversity	Offsets	Council requesting further information on the approach to biodiversity offsets and whether EnergyCo intends to acquire land, or enter into agreements with landowners, for offsets in the Council area.	The biodiversity offset strategy is described in: • Chapter 10 (Biodiversity) • Technical paper 4 – Biodiversity development assessment report.
Project description	Main project parameters	EIS to clearly explain the proposed development including overall length of the corridor, easement widths and heights of structures.	A detailed description of the project is provided in Chapter 3 (Project description).
	Battery storage	EIS to confirm details of any proposed battery storage.	A description of the potential battery energy storage system (BESS) is provided in: • Chapter 3 (Project description) • Technical paper 11 – Preliminary hazard analysis.
	Temporary workforce accommodation	EIS to describe the overall project workforce including how it would change over time.	The workforce numbers are described in: • Chapter 3 (Project description) • Chapter 14 (Economic) • Technical paper 8 – Economic.
		Detailed descriptions of the workforce accommodation camps are required to allow Council to provide meaningful feedback. This includes location, size, workforce numbers, and services that are required to support the camps.	The workforce accommodation camps is described in Chapter 3 (Project description).
	Construction hours	EIS to identify the construction hours and the process by which works can be undertaken outside of these hours.	The proposed construction hours are described in Chapter 3 (Project description).
Alignment	Environmental impact	EIS to clarify if the alignment will impact on designated areas such as the Goulburn River National Park.	The transmission alignment and associated infrastructure would not impact on the Goulburn River National Park. A small section of the alignment runs through the Durridgere State Conservation Area (SCA). Impacts on land use and biodiversity are described in: • Chapter 7 (Land use and property) • Chapter 10 (Biodiversity) • Technical paper 4 – Biodiversity development assessment report.
		How will impacts on Groundwater Dependent Ecosystems (GDEs) be assessed and will it take account of groundwater levels in drought years.	Groundwater assessment methodology an impacts are detailed in: • Section 19.3 (Groundwater) • Technical paper 17 – Groundwater • Technical paper 4 – Biodiversity development assessment report.

Category	Topic	Key issues raised	Where addressed in the EIS
	Biosecurity	How will biosecurity risks be managed along the alignment.	Biosecurity risks and the associate mitigation measures are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture • Technical paper 4 – Biodiversity development assessment report.
		How will stockpiles of cleared vegetation be managed to reduce biosecurity risks.	Biosecurity risks and the associate mitigation measures are detailed in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
Waste	Infrastructure capacity	EIS to clarify the approach to waste management including waste infrastructure proposed to be used by the project, noting that some waste facilities in the region do not accept commercial waste and other facilities are at or close to capacity.	Approach to waste management is described in Chapter 18 (Waste management).
Water	Construction water demand	EIS to provide details of where water will be sourced from for construction activities including water needs of the temporary workforce accommodation camp.	Proposed water supply is described in Chapter 3 (Project description). Assessment of the proposed water supply is provided in • Section 19.1 (Hydrology, flooding and water quality) • Technical paper 14 – Hydrology and water quality • Section 19.3 (Groundwater) • Technical paper 17 – Groundwater.
Resources	Demand and availability	Council expressed concern about the demand for material resources (e.g. sand, stone) as a result of multiple projects in the REZ which may leave Council facing a shortfall for its projects in future years.	Proposed resource requirements are described in Chapter 3 (Project description).
Acquisition	Compensation	EIS to provide details of how landowners who host transmission line infrastructure will be compensated.	Property acquisition for the project is described in Chapter 3 (Project description).
Cumulative impacts	Cumulative impacts	Concerns about cumulative impacts to local communities particularly during the construction phase.	Cumulative impacts and the associated mitigation measures are detailed in: • Chapter 20 (Cumulative impacts) • Appendix E (Cumulative impact assessment).
		Concerns about the cumulative impact of demand on local services such as health and policing as a result of the large influx of temporary workers into the region.	Impacts to social services and the associated mitigation measures are detailed in: • Chapter 13 (Social) • Technical paper 7 – Social.

D1.1.2 Agency feedback

A summary of the issues raised by agencies and where this has been addressed in this EIS is provided in Table D-3.

Table D-3 Agency feedback

Category	Topic	Key issues raised	Where addressed in the EIS
Civil Aviation Safety Authority (CASA)			
Aviation risk	Impacted on restricted airspace	CASA confirmed that the project does not intersect the Obstacle Limitation Surface (OLS) for a certified aerodrome or Procedures for Air Navigation Services Aircraft Operations (PANS-OPS).	Noted. Impacts to aviation operations and the associated mitigation measures are detailed in: • Chapter 7 (Land use and property) • Chapter 16 (Hazard and risk) • Technical paper 1 – Aviation.
Aviation risk	Impact on small airstrips	Recommended that EnergyCo consult with each airstrip operator with regard to potential impact on these strips.	Impacted stakeholders as identified in the aviation assessment will be consulted as described in: • Chapter 7 (Land use and property) • Chapter 16 (Hazard and risk) • Technical paper 1 – Aviation.
Department of Climate Change, Energy, the Environment and Water (DCCEEW) (Cwth)			
MNES	Alternatives	EIS to make clear how the alignment development has sought to avoid impacts on Matters of National Environmental Significance.	Approach to transmission line alignment development and selection is provided in Chapter 2 (Strategic context).
Department of Planning and Environment (DPE) (NSW)			
Social impact assessment	Assessment method	Recommendation to refine the boundaries for the Local Social Localities on the western edge of the study area to identify all potential impacts.	The SIA adopted this recommendation. The localities are described in the Technical paper 7 – Social.
		Recommended that the change in character in the area as a result of energy infrastructure should be assessed as loss to sense of place.	The SIA considered the change in local character as a result of new energy infrastructure as provided in: • Chapter 13 (Social) • Technical paper 7 – Social.
		Recommendation to increase the number of SIA interviews proposed to reflect the scale of the study area.	The number of SIA interviews was increased in response to this recommendation. Consultation undertake for the SIA is described in: • Chapter 13 (Social) • Technical paper 7 – Social.
Visual impact assessment	Assessment method	Recommendation that the visual impact assessment method consider the VIA method included in the DPE Large Scale Solar Energy Guidelines (DPE, August 2022).	The visual impact assessment considered the Large Scale Solar Energy Guidelines (DPE, August 2022) as described in: • Chapter 9 (Landscape character and visual amenity) • Technical paper 3 – Visual and landscape character.

Category	Topic	Key issues raised	Where addressed in the EIS
		Recommendation that the visual impact assessment method provide more detailed analysis of how certain viewpoints have been ruled out for more detailed analysis based on low impact.	Visibility analysis was undertaken for the visual impact assessment as described in: • Chapter 9 (Landscape character and visual amenity) • Technical paper 3 – Visual and landscape character.
		Recommendation that the number of viewpoints from private dwellings be increased to be representative of the range of views that would be experienced from private dwellings.	The number of properties assessed were increased in response to DPE comments. The viewpoints are described in: • Chapter 9 (Landscape character and visual amenity) • Technical paper 3 – Visual and landscape character.
		Recommendation that for private viewpoints where visual impacts are assessed as high or the transmission line is in close proximity to the view point, EnergyCo should enter into an agreement with the property owner to reduce the impacts to an acceptable level.	For private dwellings on non-host properties where the project is predicted to have a moderate or high visual impact, opportunities for the provision of screening vegetation will be investigated. Mitigations for visual impacts are provided in: • Chapter 9 (Landscape character and visual amenity) • Technical paper 3 – Visual and landscape character.
DPE – Crown Lands			
Crown roads	Alignment	EIS to confirm Crown Roads that would be affected by the alignment and form part of the easement.	Crown land is discussed in Chapter 7 (Land use and property).
DPE – Biodiversity Conservation Services (BCS)			
Alignment	Avoidance	EnergyCo updated BCS on aspects of the alignment of particular relevance to BCS including: • the alignment through the Durridgere State Conservation Area (SCA) • the alignment through mining biodiversity offset areas. BCS emphasised that the BDAR would need to justify the alignment through these areas including how the development of the alignment had sought to avoid these areas.	Development and justification of the alignment (and avoidance outcomes achieved) is detailed in Technical paper 4 – Biodiversity development assessment report.
Assessment method	Land categorisation	BDAR to state clearly the process for land categorisation including the extent of field survey vs desktop analysis.	Description of the assessment methodology including the extent of field surveys is provided in Technical paper 4 – Biodiversity development assessment report.
	Disturbance area	BDAR to clearly describe the disturbance area within the easement that formed the basis of the biodiversity assessment.	Description of the disturbance area within the easement is provided in Technical paper 4 – Biodiversity development assessment report.
	Spring survey	BDAR to confirm the number of botanists that participated in Spring surveys.	Description of the ecologists involved is provided in Technical paper 4 – Biodiversity development assessment report.

Category	Topic	Key issues raised	Where addressed in the EIS
	Access	BCS confirmed that where access to property was not available at the time of field surveys, the BDAR should assume presence which could subsequently be refined when access had been obtained.	This assessment methodology has been adopted as described in Technical paper 4 – Biodiversity development assessment report.
	Partial impact	EnergyCo proposing to adopt a partial impact approach for Box Gum Woodland noting that this approach has been used and accepted on Project Energy Connect.	This assessment methodology has been adopted as described in Technical paper 4 – Biodiversity development assessment report.
		Field data was presented on vegetation Integrity for transmission lines 10–20 years post construction to support the partial impact approach. BCS supportive In principle to this approach but would need to review in the context of the BDAR.	This assessment methodology has been adopted as described in Technical paper 4 – Biodiversity development assessment report.
Offsets	Staging	EnergyCo noted that it is planning to stage the offsets in a manner that aligns with some of the generator connections. This is to safeguard an unlikely scenario where one of the generators does not proceed. BCS confirmed it supported this approach.	This assessment methodology has been adopted as described in Technical paper 4 – Biodiversity development assessment report.
DPE – Water			
Water resources	Mine water	Request to consider the feasibility of using treated water from mines as source of water supply to the project.	Investigation of use of treated mine water will be completed as described in: • Section 19.1 (Hydrology, flooding and water quality) • Technical paper 13 – Hydrology and water quality.
	Surface water	Water should be sourced from irrigators or other sources rather than seeking new entitlements for surface water.	Proposed water supply is described in Chapter 3 (Project description).
	Groundwater	The availability of groundwater as a water source for the project would be dependent on yields which should be assessed in the EIS.	Assessment of potential groundwater extraction for construction water supply is provided in: • Section 19.3 (Groundwater) • Technical paper 17 – Groundwater.
		If groundwater is to be sourced from a new bore, the EIS should undertake an assessment against the requirements of the Aquifer Interference Policy (AIP) in addition to an assessment for the installation of the bore.	Assessment of potential groundwater extraction for construction water supply is in accordance with the AIP as described in: • Section 19.3 (Groundwater) • Technical paper 17 – Groundwater.
	Wastewater	EIS to confirm how wastewater generated at temporary workforce accommodation camps will be managed.	Wastewater management is described in Chapter 3 (Project description).
	Licensing	If a Water Access Licence (WAL) is required, the EIS should include the information required to facilitate the WAL approval.	Assessment of potential groundwater extraction for construction water supply is provided in: • Section 19.3 (Groundwater) • Technical paper 17 – Groundwater.

Category	Topic	Key issues raised	Where addressed in the EIS
Water impact	Groundwater	EIS to confirm whether dewatering will be required for excavation/piling at transmission tower locations.	Assessment of potential groundwater impacts during construction is provided in: • Section 19.3 (Groundwater) • Technical paper 17 – Groundwater.
Department of Primary Industries (DPI) – Agriculture			
Agriculture	Assessment method	Recommended the assessment be undertaken at a detailed level rather than relying on ABS data at a LGA level.	The methodology for agricultural impact assessment is provided in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
	Land survey	Recommended undertaking a land survey for the corridor to identify the different agricultural land uses.	A land and soil survey was proposed at the energy hub sites. However, this investigation was unable to be completed due to a lack of land access. The investigation is unlikely to change the outcome of the assessment due to the relatively small operation area involved. The methodology for agricultural impact assessment is provided in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
	Soil survey	Recommended undertaking a soil survey to support the soil and land capability assessment.	As above. The methodology for agricultural impact assessment is provided in: • Chapter 8 (Agriculture) • Technical paper 2 – Agriculture.
Department of Regional NSW – Mineral Exploration Group (MEG)			
Mine exploration licences	Consultation	EnergyCo should consult with mine exploration licence holders in the project study area to understand the potential impact on the exploration licence.	EnergyCo would consult with the holders of exploration licences which cover the construction area, and project study area to understand current exploration activities. The exploration licences impacts are identified in Chapter 7 (Land use and property).
Environment Protection Authority (EPA)			
Noise	Concrete batching plants	EIS to confirm if concrete batching plants are part of the scope of the project. If yes, the noise assessment should assess the impacts of concrete batching plants including their operation out of hours.	Use of concrete batching plants are confirmed in Chapter 3 (Project description). The construction noise assessment is provided in: • Chapter 15 (Noise and vibration) • Technical paper 9 – Noise and vibration.
		EIS should clearly state the processing capacity of the concrete batching plant so the Appropriate Regulatory Authority under the *Protection of the Environment Operations Act 1997* can be identified.	Use of concrete batching plants is described in Chapter 3 (Project description).
	Out-of-hours	EIS to identify the types of activities which may need to be undertaken outside of normal hours (e.g. concrete pours) and an assessment of out-of-hours noise impacts.	Construction hours are described in Chapter 3 (Project description).

Category	Topic	Key issues raised	Where addressed in the EIS
Water	Mine water	Recommended investigating the possibility of using treated mine water as a source of water for the project.	Investigation of use of treated mine water will be completed as described in: • Section 19.1 (Hydrology, flooding and water quality) • Technical paper 14 – Hydrology and water quality.
	Water discharge	Recommended the project adopt a strategy for zero discharge of water from the project site to the environment. Where zero discharge cannot be achieved, a detailed assessment of the impact of discharged water on the receiving environment should be provided.	Assessment of discharge of water is provided in: • Section 19.1 (Hydrology, flooding and water quality) • Technical paper 14 – Hydrology and water quality.
	Water balance	The EIS should include a water balance for the project.	A water balance is provided in: • Section 19.1 (Hydrology, flooding and water quality) • Technical paper 14 – Hydrology and water quality.
	Erosion and sedimentation	The EIS should demonstrate the approach to ERSED to minimise impacts to the surrounding environment.	Mitigation of erosion impacts is provided in: • Chapter 19.2 (Soils and contamination) • Section 19.1 (Hydrology, flooding and water quality) • Technical paper 14 – Hydrology and water quality.
Heritage NSW			
Historic heritage	Significance	Recommended further research is undertaken for certain sites to confirm their heritage significance which would be used to confirm the need for test excavations.	The methodology and significance assessment of Non-Aboriginal heritage is detailed in: • Chapter 12 (Non-Aboriginal heritage) • Technical paper 6 – Non-Aboriginal heritage.
	Avoidance	EIS should demonstrate how colonial homestead sites have been avoided, including roads, bridges and culverts that are from early 19th century through to 1870's.	The alignment has been modified to avoid direct impacts to the Dapper Homestead and Dapper Hut and Shed. Specific environmental constraints that have been avoided or minimised through the project development process are described in Chapter 2 (Strategic context). The methodology and significance assessment of Non-Aboriginal heritage is detailed in: • Chapter 2 (Strategic context) • Technical paper 6 – Non-Aboriginal heritage.

Category	Topic	Key issues raised	Where addressed in the EIS
Aboriginal heritage	Test excavations	Heritage NSW confirmed an approach to test excavations based on a predictive risk model validated by a high level of pedestrian survey of the corridor with aboriginal heritage knowledge holders. Heritage NSW also confirm that some test excavations could be documented in the Submissions Report given the difficulties in accessing properties for test excavations due to the prevailing wet weather conditions at the end of 2022 and early 2023.	This approach to the Aboriginal cultural heritage assessment has been undertaken as detailed in: • Chapter 11 (Aboriginal heritage) • Technical paper 5 – Aboriginal cultural heritage assessment report.
Local Land Services (Central Tablelands)			
Biosecurity	Property access	Local Land Services (Central Tablelands) referred to biosecurity policies to be considered by EnergyCo when planning for site access including the NSW Biosecurity and Food Strategy 2022–2030, Central Tablelands Regional Strategic Pest Animal Management Plan and Central Tablelands Regional Strategic Weed Management Plan.	EnergyCo's approach to planning for site access includes biosecurity arrangements which take into account various government policies and guidelines.
Travelling stock reserves	Location	Local Land Services (Central Tablelands) confirmed the location of the Travelling Stock Routes (TSRs) identified by EnergyCo and their status as Category 3. Category 3 TSRs are described as those which are rarely, if ever used for travelling stock or emergency management, but are important, valued and used for other reasons such as biodiversity conservation and First Nations Peoples' heritage or recreation (NSW Government, 2021).	TSRs that are located close to the project are identified in Chapter 7 (Land use and property). The assessment included in Chapter 7 concludes that one TSR would intersect with the construction area and may be subject to temporary impacts during construction. Local Land Services (Central Tablelands) would continue to be consulted during detailed design to confirm how impacts on TSRs would be managed during construction and operation. Alternative access arrangements would be made as required.
National Parks and Wildlife Services (NPWS)			
Durridgere State Conservation Area	Alignment and alternatives	EIS to make clear that the transmission line alignment through the Durridgere State Conservation Area would be either the proposed EnergyCo alignment or the approved Liverpool Range Wind Farm alignment will proceed, but not both. EIS to identifying the mechanism for ensuring only one but not both alignments can proceed.	The EIS makes clear that only alignment will proceed – refer to Chapter 2 (Strategic context).
	Biodiversity values	NPWS expressed concern about impacts on biodiversity values in the SCA and the need for the EIS to demonstrate efforts made to avoid the SCA.	Approach to transmission line alignment development and selection is provided in Chapter 2 (Strategic context). Development and justification of the alignment (and avoidance outcomes achieved) is detailed in Technical paper 4 – Biodiversity development assessment report.

Category	Topic	Key issues raised	Where addressed in the EIS
NSW Telco Authority			
Radio communication	Microwave link	Potential impacts to point to point microwave links as a result of transmission towers interfering with line of sight communications. NSW Telco provided spatial data of the current and proposed microwave links. As part of the transmission tower design development, the interface with microwave links was considered. Where practical, the transmission towers have been placed outside of 100 m of the link path to avoid impacts. However, in some locations due to local constraints some towers have been placed within 100 m of the link path. These will be reviewed during detailed design to determine the effect on the microwave link.	Interaction with telecommunications and microwave links are discussed in Chapter 16 (Hazard and risk).
Subsidence Advisory NSW (SANSW)			
Determination process	Subsidence	SANSW confirmed the process through which EnergyCo should seek a determination (in the form of design and performance parameters) to be met by the project.	Detailed design and construction planning will be undertaken in accordance with approvals issued by Subsidence Advisory NSW. Consideration of mine subsidence risk and is provided in: • Chapter 3 (Project description) • Chapter 16 (Hazard and risk).

Appendix E

Cumulative impact assessment

E1 Introduction

This appendix describes the methodology for the cumulative impact assessment carried out for the project. This appendix supports the information provided in Chapter 20 (Cumulative impacts).

The appendix is consistent with the requirements of the *Cumulative Impact Assessment Guidelines for State Significant Projects* (Cumulative Impact Assessment Guidelines) (NSW Department of Planning, Industry and Environment (DPIE), 2022a). The Secretary's Environmental Assessment Requirements (SEARs) as they relate to cumulative impacts, and where in the Environmental Impact Statement (EIS) these have been addressed, are detailed in Appendix A (SEARs checklist).

As Infrastructure Planner for the Central-West Orana Renewable Energy Zone (REZ), EnergyCo will coordinate transmission, generation, firming and storage projects to deliver efficient, timely and coordinated investment. In this capacity, EnergyCo is taking a leading role in the coordination of impacts and benefits to communities who will be hosting renewable generation and transmission infrastructure.

Within the Central-West Orana region, a significant number of new developments are proposed, approved or under construction, including more than 30 major renewable energy generation and storage projects within the REZ (of which 11 would connect to this project, subject to securing access rights and obtaining respective planning approval), as well as other infrastructure and mining projects. These developments are expected to result in substantial investment, economic benefits and job opportunities in the region. However, the scale of new development would also result in potential impacts on the communities and the environment during construction and operation, including amenity, traffic and biodiversity impacts and pressure on community services such as accommodation, health services, retail, hospitality and emergency services.

The assessment of cumulative impacts takes place in the context of incomplete information, as detailed impact information may not be available for other relevant future projects at the time of preparation of the cumulative assessment (for example, if the EIS for other relevant future projects has not been published). Cumulative impacts presented in this chapter should be read in the context of this uncertainty.

The mitigation of cumulative impacts is based on a three-tiered approach:

1. Each project mitigates its own impacts to the fullest extent possible.
2. Where residual impacts occur that have a cumulative impact in respect of other projects, EnergyCo will collaborate with the proponents of the other relevant projects to explore opportunities for collectively managing any cumulative impacts.
3. Further investigation of the cumulative impacts of the project and associated renewable energy generation projects within the Central-West Orana REZ to inform future decision making and resource use. These investigations would identify opportunities to coordinate community impacts and benefits within the Central-West Orana REZ.

It is important to note that the strategic studies being undertaken by EnergyCo are specific to the project and renewable energy generation projects within the Central-West Orana REZ, and do not address the implications of other projects (such as local mining projects) that are considered in this assessment.

E2 Methodology

The *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE, 2022a) (the Guidelines) recognises the cumulative impact assessment can be undertaken at a strategic level and a project level.

The Guidelines notes that strategic-level cumulative impact assessment includes a range of government legislation, strategies, plans, policies and guidelines that have been developed over time to anticipate and respond to environmental, social and economic changes.

Project-level cumulative impact assessment builds on the findings of project assessments to consider impacts from a proposed project in combination with other relevant future projects that are anticipated or reasonably foreseeable. Project-level cumulative impact assessment is therefore the assessment of environmental, social, economic and other impacts which result from a project when added to other relevant future projects.

This assessment is a project-level cumulative impact assessment based on the approach described in the Guidelines. The Guidelines defines cumulative impacts as those arising as a result of incremental, sustained and combined effects of human action and natural variations over time that can be both positive and negative. These impacts can be caused by the compounding effects of a single project or multiple projects in an area, and by the accumulation of effects from past, current and future activities as they arise.

The Guidelines identify important principles that should be considered in the approach to cumulative assessment, including:

- proportionate: the assessment is to focus on the key matters that could be materially affected by the cumulative impacts of the project and other relevant future projects – not on every conceivable cumulative impact on every matter
- collaboration: managing cumulative impacts is a shared responsibility and requires collaboration between government, industry and the community.

The approach to the assessment has been informed by these principles by:

- focussing on assessment matters that could be materially affected as described in Section E3.1.2.
- recognising that not all REZ related cumulative impacts can be addressed through a project-level approach alone, requiring a more strategic and collaborative approach between EnergyCo, renewable energy developers, councils and government agencies (refer to Section E4 for further details).

The assessment methodology for the cumulative impact assessment for the project involved:

- identifying relevant future projects (with publicly available information) and issues for each project that could be considered for cumulative impacts, by applying the screening criteria outlined in section 3.4 of the Guidelines (refer to Section E2.1)
- identifying the level of assessment (detailed/standard/not applicable (N/A)) required for each of the identified issues, in accordance with the Guidelines (refer to Section E2.2)
- identifying the proposed approach and key uncertainties for assessing the cumulative impacts for each issue
- assessing and evaluating cumulative impacts and recommending in some instances mitigation and management measures to minimise the project's contribution to relevant cumulative impacts (however specific cumulative impact mitigation measures are only proposed where the project-specific mitigation measures detailed elsewhere in the EIS are insufficient to manage the project's contribution to cumulative impact).

The Guidelines set out two types of cumulative impact assessments:

- issue-specific cumulative impact assessment. This involves an assessment of the project together with the impacts of other relevant future projects on specific issues (e.g. traffic) within an identified area, including the additional impacts that may occur over time as a result of changes to existing projects (e.g. closures and expansions, increases or decreases to the intensity of operations) or the commencement of new projects
- combined cumulative impact assessment. This involves an assessment of the combined effect of the different cumulative impacts of the project (e.g. noise, dust and traffic) with other relevant future projects on key matters in an identified area.

Issue-specific cumulative impact assessment for the project and the relevant future projects is provided in Sections E3.1 to E3.12. Combined cumulative impact assessment for the project and the relevant future projects is effectively addressed through the cumulative social impact assessment (which considers a range of assessment matters), provided in Section E3.5.

E2.1 Screening criteria

An initial list of relevant projects was developed using publicly available information and the application of five criteria to identify whether a project should be assessed for cumulative impacts (refer to Table A-1).

Several triggers were developed for each screening criteria in accordance with the Guidelines, to objectively determine whether a project could potentially cause a material cumulative impact with the project (referred to as 'this project' in this assessment) and should be considered in the cumulative impact assessment. To be considered as having a material cumulative impact, the spatial extent and the significance of the impact have been considered. For example, while a project may be of a geographically large scale, the significance of the impact of the project may be minor, and/or the spatial extent of the impact may self-contained within a discrete part of the project area such that there is no material cumulative impact.

Projects that satisfied at least one of the triggers in each of the five criteria were considered further in the cumulative impact assessment.

The schedule of projects considered for screening is based on known projects and associated public information that was current in early 2023. EnergyCo will review this cumulative impact assessment prior to project approval, and will update the findings in the event of any significant changes to the planning status of planned projects. Should the project be approved, there are likely to be additional renewable energy generation projects that would be developed to connect to the Central-West Orana REZ in the future, that have not been considered in this assessment. The cumulative impact assessments of these developments would have to consider their additional cumulative impacts within the Central-West Orana region.

Table A-1 Screening criteria for the cumulative impact assessment

Criteria	Triggers
Scale of project	A project was considered relevant where it is a large-scale major development or infrastructure project that could cause cumulative impacts with the project, including: • other State Significant Development (SSD) and State Significant Infrastructure (SSI) projects • projects that are classified as designated development and require an EIS • projects that require assessment under Division 5.1 of the EP&A Act that are likely to significantly affect the environment and require an EIS • projects that have been declared to be controlled actions under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) • any major greenfield and urban renewal developments that are scheduled for the area (e.g. new areas zoned for urban development).
Planning status	• Proposed projects (currently under statutory environmental impact assessment which includes where an application has been lodged), where there is enough publicly available information at the time of preparing this EIS to allow for analysis of potential cumulative impact issues. • Approved projects (statutory approvals received), including approved projects that have not started construction and projects currently under construction where construction periods overlap. • Changes to existing projects, including projects where: — an approval that is due to run out and operations are likely to cease — an announcement has been made that operations will cease — the intensity of the project's operations may change over time (e.g. the project is currently operating below its approved capacity, the project is currently under construction and will only start operating in two years) — approval is being sought for a major expansion of the project. As part of the relevant future projects that were selected based on the above criteria, a specific category of 'related development' has been identified, these being development that responds to the opportunities created by the project or which is required as a result of the project (refer to Section 1.4 of Chapter 1 (Introduction)).
Scale of impact	• Local – impacts of the future project would overlap with impacts of this project at a local scale. • Regional – impacts of the future project would overlap with impacts of this project at a regional scale.
Timeframe	• Concurrent construction program with this project. • Consecutive construction program with this project.
Issue	A future project was considered relevant where it would have a potential impact on an environmental issue identified as potentially impacted by this project.

E2.2 Level of assessment

The level of assessment required for the cumulative impact assessment of each issue considered in the assessment, was identified based on the scale and nature of the potential cumulative impacts, and available information and uncertainties associated with each relevant future project, as outlined in Appendix B of the Guidelines. The provisions of these guidelines are presented below in Table A-2.

Table A-2 Level of assessment

Level of assessment	Definition
Detailed	The project may result in significant impacts on an issue identified for this project, including cumulative impacts. Detailed assessment is characterised by: • potential overlap in impacts between the project and this project • potential for significant cumulative impacts as a result of the overlap, requiring detailed technical studies to assess the impacts • sufficient data is available on the project to allow a detailed assessment of cumulative impacts with this project for the relevant matter • uncertainties exist with respect to data, mitigation, assessment methods and criteria.
Standard	The project is unlikely to result in significant impact on an issue identified for this project, including cumulative impacts. Standard assessments are characterised by: • impacts are well understood • impacts are relatively easy to predict using standard methods • impacts are capable of being mitigated to comply with relevant standards or performance measures • the assessment is unlikely to involve any significant uncertainties or require any detailed cumulative impact assessment.
N/A	No potential overlap in impacts between the project and this project that would warrant any consideration in the cumulative impact assessment.

A number of projects characterised were not progressed beyond the scoping phase of environmental assessment at the time of this assessment, and detailed technical studies have not yet been undertaken to assess potential impacts. Consideration of these projects was limited to information that was publicly available at the time of this assessment. Uncertainties and assumptions made in the assessment have been documented where relevant.

E2.3 Identification of projects and issues

The projects and issues for each project that met the screening criteria for consideration in the cumulative impact assessment are outlined in Table A-3. These projects are shown in Figure A-1 and Figure A-2.

The proposed Narragamba solar farm that would connect to this project (subject to the outcomes of the Consumer Trustees competitive tender process for rights to access the new transmission infrastructure and obtaining planning approval) has been announced and a Scoping Report was published for the project in July 2023 (ACEN Australia, 2023). Due to the late availability of that document, the project has not been included in this assessment, but would be considered further as part of the Submissions Report.

The potential overlap in construction schedules of this project with the identified projects is shown in Table A-4. The overlap would be dependent on the project approval timeframes of the relevant future projects. Projects that have not indicated the expected start or completion date of construction in publicly available environmental assessment documentation have not been included in Table A-4, due to the difficulty in determining potential overlap of construction impacts, when cumulative impacts are more likely to be material.

Issues that did not require further cumulative impact assessment are identified in Section E2.3.1. The level of assessment carried out for assessed issues are identified in Section E2.3.2.

Table A-3 Relevant future projects considered in the cumulative impact assessment

Project details				Potential cumulative impacts											
ID, name and location	**Planning status and environmental assessment documentation reviewed**	**Construction/ operation period**	**Distance from project**	**Land use, property and agriculture**	**Landscape and visual**	**Biodiversity**	**Aboriginal**	**Social**	**Economic**	**Noise and vibration**	**Bushfire and general hazards**	**Air quality**	**Traffic and transport**	**Waste management**	**Surface water and groundwater supply**
Related development															
1 – Public road works (in the event these works are not determined under Division 5.1 of the EP&A Act – refer to Section 1.4 of Chapter 1 (Introduction)) Various locations, including Spring Ridge Road, Merotherie Road, Golden Highway and Barigan Road Adjustments and upgrades to public roads to facilitate access to energy hubs and switching stations, including road widening, intersection upgrades and upgrades or replacement of existing bridges, culverts and/or causeways.	Pre-REF (Review of Environmental Factors) EnergyCo information (not in public domain)	Construction period: 2023–2024	Various distances from project, at closest point directly adjacent to project.				✓	✓	✓	✓	✓	✓	✓	✓	✓
2 – Liverpool Range wind farm Coolah, Cassilis, Turill and Ulan, Warrumbungle, Upper Hunter and Liverpool Plains LGAs The construction, operation and decommissioning of a 3,630 gigawatt hours (GWh) wind farm with up to 220 wind turbines (with a maximum tip height of about 250 metres (m)), with supporting infrastructure and temporary construction facilities, including concrete batching plants, laydown facilities and construction compounds, and minor local road upgrades.	Approved, modification under assessment EIS, Response to Submissions Report, Modification Report and Assessment Report	Construction period: 2024–2027 (24–36 months)	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Project details				Potential cumulative impacts											
ID, name and location	**Planning status and environmental assessment documentation reviewed**	**Construction/ operation period**	**Distance from project**	**Land use, property and agriculture**	**Landscape and visual**	**Biodiversity**	**Aboriginal**	**Social**	**Economic**	**Noise and vibration**	**Bushfire and general hazards**	**Air quality**	**Traffic and transport**	**Waste management**	**Surface water and groundwater supply**
3 – Valley of the Winds wind farm Coolah, Uarbry and Leadville, Warrumbungle LGA The construction, operation and decommissioning of an 800 megawatts (MW) wind farm with up to 148 wind turbines (with a maximum tip height of 250 m) with Battery Energy Storage System (BESS) (indicative capacity of 320 MW/ 640 megawatt hours (MWh)), supporting infrastructure and temporary construction facilities, including workforce accommodation, construction compounds, laydown areas, concrete batching plants and quarry sites, and minor local road upgrades.	Under assessment EIS	Construction period: 2023–2026 (24–48 months)	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4 – Barneys Reef wind farm Tallawang, Barneys Reef and Merotherie, Mid-Western Regional LGA The construction, operation and decommissioning of a 441 MW wind farm with about 63 wind turbines (with a maximum tip height of about 280 m) with BESS (indicative capacity of 441 MW/1,764 MWh), supporting infrastructure and temporary construction facilities, including concrete batching plant and borrow pit, and public road upgrade works.	Scoping/pre-EIS Scoping Report	Construction period: 28 months	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Project details				Potential cumulative impacts											
ID, name and location	**Planning status and environmental assessment documentation reviewed**	**Construction/ operation period**	**Distance from project**	**Land use, property and agriculture**	**Landscape and visual**	**Biodiversity**	**Aboriginal**	**Social**	**Economic**	**Noise and vibration**	**Bushfire and general hazards**	**Air quality**	**Traffic and transport**	**Waste management**	**Surface water and groundwater supply**
5 – Birriwa solar farm Birriwa and Merotherie, Mid-Western Regional and Warrumbungle LGAs The construction, operation and decommissioning of a 600 MW solar farm with about 1.2–1.4 million photovoltaic (PV) solar panels with BESS (indicative capacity of 600 MW/1,200 MWh), supporting infrastructure and temporary construction facilities including construction compound and laydown area, and public road upgrade works.	Under assessment EIS	Construction period: Early 2024 – Mid 2026 (28 months)	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6 – Tallawang solar farm Tallawang and Beryl, Mid-Western Regional LGA The construction, operation and decommissioning of a 500 MW solar farm with about 1,136,400 PV solar panels with BESS, supporting infrastructure and temporary construction facilities, including a construction compound and laydown areas, and public road upgrade works.	Under assessment EIS	Construction period: June 2023 – April 2026 (34 months)	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
7 – Orana wind farm Warrumbungle and Mid-Western Regional LGAs The construction, operation and decommissioning of a 524 MW wind farm with about 92 wind turbines (with a maximum tip height of about 272 m) with BESS (indicative capacity of 100 MW/200 MWh), supporting infrastructure and temporary construction facilities, including construction compounds, concrete batching plants, borrow pits, workforce accommodation and public road upgrade works.	Scoping/pre-EIS Scoping Report	Construction period: 2025–2027	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Project details				Potential cumulative impacts											
ID, name and location	**Planning status and environmental assessment documentation reviewed**	**Construction/ operation period**	**Distance from project**	**Land use, property and agriculture**	**Landscape and visual**	**Biodiversity**	**Aboriginal**	**Social**	**Economic**	**Noise and vibration**	**Bushfire and general hazards**	**Air quality**	**Traffic and transport**	**Waste management**	**Surface water and groundwater supply**
8 – Cobbora solar farm Cobbora and Elong Elong, Dubbo Regional and Warrumbungle LGAs The construction, operation and decommissioning of a 700 MW solar farm with BESS (indicative capacity of 200 MW/200 MWh), supporting infrastructure and temporary construction facilities, including construction compound and laydown areas, and minor upgrades to the local road network.	Scoping/pre-EIS Scoping Report	Construction period: Late 2023–2026 (36 months)	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
9 – Sandy Creek solar farm Goolma, Warrumbungle and Dubbo Regional LGAs The construction, operation and decommissioning of a 750 MW solar farm with about 1.3–1.5 million PV solar panels with BESS (indicative capacity of 750 MW/3,000 MWh), supporting infrastructure and temporary construction facilities, including construction compounds, and public road upgrade works.	Scoping/pre-EIS Scoping Report	Construction period: May 2024–2027 (22–28 months)	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
10 – Dapper solar farm Dunedoo, Cobbora and Goolma, Warrumbungle and Dubbo Regional LGAs The construction, operation and decommissioning of a 300 MW solar farm with BESS, supporting infrastructure and temporary construction facilities, including construction compound, laydown areas and concrete batching plant.	Scoping/pre-EIS Scoping Report	Construction period: 2025–2027 (18–24 months)	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Project details				Potential cumulative impacts											
ID, name and location	**Planning status and environmental assessment documentation reviewed**	**Construction/ operation period**	**Distance from project**	**Land use, property and agriculture**	**Landscape and visual**	**Biodiversity**	**Aboriginal**	**Social**	**Economic**	**Noise and vibration**	**Bushfire and general hazards**	**Air quality**	**Traffic and transport**	**Waste management**	**Surface water and groundwater supply**
11 – Spicers Creek wind farm Dunedoo, Goolma, Gollan and Elong Elong, Dubbo Regional and Warrumbungle LGAs The construction, operation and decommissioning of a 730 MW wind farm with about 122 wind turbines (with a maximum tip height of about 300 m) with BESS (indicative capacity of 400 MW/400 MWh), supporting infrastructure and temporary construction facilities, including construction compounds, rock crushing facilities, concrete batching plants and laydown areas, and public road upgrade works.	Scoping/pre-EIS Scoping Report	Construction period: 24–30 months	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Proposed projects															
12 – Wellington South battery energy storage system (BESS) Wuuluman, Dubbo Regional LGA The construction, operation and decommissioning of a major grid-scale battery project (with peak maximum generation capacity of 500 MW/1000 MWh) next to the Wellington Substation, supporting infrastructure and temporary construction facilities, including construction compound/laydown area, and upgrade of the TransGrid Wellington Substation.	Under assessment EIS	Construction period: Stage 1: May 2023 – May 2024; Stage 2: Nov 2024 – Nov 2025 (12–18 months)	36 kilometres (km) southwest of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
13 – Apsley BESS Apsley, Dubbo Regional LGA The construction, operation and decommissioning of a battery project and temporary construction facilities.	Under assessment EIS, Submissions Report, Amendment Report and Assessment Report	Construction period: 2023–2023 (5 months)	47 km southwest of western section of project	✓		✓	✓	✓	✓		✓			✓	✓

Project details				Potential cumulative impacts											
ID, name and location	**Planning status and environmental assessment documentation reviewed**	**Construction/ operation period**	**Distance from project**	**Land use, property and agriculture**	**Landscape and visual**	**Biodiversity**	**Aboriginal**	**Social**	**Economic**	**Noise and vibration**	**Bushfire and general hazards**	**Air quality**	**Traffic and transport**	**Waste management**	**Surface water and groundwater supply**
14 – Forest Glen solar farm Minore, Dubbo Regional LGA The construction, operation and decommissioning of a 110 MW solar farm with 150,000–200,000 PV solar panels with BESS (indicative capacity of 25 MW/25 MWh), supporting infrastructure and temporary construction facilities, and public road upgrade works.	Under assessment EIS, Submissions Report, Amendment Report and Assessment Report	Construction period: 2023–2024 (12–18 months)	61 km west of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
15 – Dubbo firming power station Dubbo, Dubbo Regional LGA The construction, operation and decommissioning of a 64 MW firming power station with 17.5 MW hydrogen generation plant, associated infrastructure and temporary construction facilities, and public road upgrade works.	Scoping/pre-EIS Scoping Report	Construction period: To be completed in 2024/2025	50 km west of western section of project			✓		✓	✓		✓			✓	✓
Approved projects															
16 – Stubbo solar farm Stubbo, Mid-Western Regional LGA The construction, operation and decommissioning of a 400 MW solar farm with about 800,000 photovoltaic (PV) solar panels with BESS, supporting infrastructure and temporary construction facilities, including construction compounds, laydown areas and access tracks, and public road upgrades.	Approved EIS, Submissions Report, Amendment Report and Assessment Report	Construction period: Late 2022–2025 (24–36 months)	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Project details				Potential cumulative impacts											
ID, name and location	**Planning status and environmental assessment documentation reviewed**	**Construction/ operation period**	**Distance from project**	**Land use, property and agriculture**	**Landscape and visual**	**Biodiversity**	**Aboriginal**	**Social**	**Economic**	**Noise and vibration**	**Bushfire and general hazards**	**Air quality**	**Traffic and transport**	**Waste management**	**Surface water and groundwater supply**
17 – Bowdens silver mine Lue, Mid-Western Regional LGA The construction, operation and decommissioning of an open cut silver, lead and zinc mine to extract and process around 30 million tonnes (Mt) of ore, and up to 2 million tonnes per annum (Mtpa), supporting infrastructure, ancillary works and temporary construction facilities, including construction compound, materials management facilities and laydown areas. The mine would comprise a main open cut pit, two satellite pits and mine site infrastructure including a processing plant, waste rock emplacement, ore stockpiles, a tailings storage facility and ancillary infrastructure. Also involves the realignment of a section of a local road which runs through the middle of the proposed mine site.	Approved EIS, Submissions Report, Amendment Reports and Assessment Report	Construction period: 2024–2025 (12–18 months)	23 km southwest of New Wollar Switching Station	✓		✓	✓	✓	✓		✓			✓	✓
18 – Inland Rail (Narromine to Narrabri) Various suburbs between Narromine and Narrabri The construction and operation of about 306 km of single-track standard-gauge railway between the towns of Narromine and Narrabri, to link the Parkes to Narromine section of Inland Rail in central western NSW with the Narrabri to North Star section of Inland Rail in north western NSW. The project includes the construction and operation of supporting infrastructure, ancillary works (including road realignments at various locations and road closures) and temporary construction facilities, including workforce accommodation, construction compounds, borrow pits, concrete batching plants, laydown areas, welding yards and groundwater bores for construction water supply.	Approved EIS, Submissions Report, Amendment Report and Assessment Report	Construction period: 2023–2027 (48 months)	81 km west of western section of the project			✓	✓	✓	✓		✓			✓	✓

Project details				Potential cumulative impacts											
ID, name and location	Planning status and environmental assessment documentation reviewed	Construction/ operation period	Distance from project	Land use, property and agriculture	Landscape and visual	Biodiversity	Aboriginal	Social	Economic	Noise and vibration	Bushfire and general hazards	Air quality	Traffic and transport	Waste management	Surface water and groundwater supply
19 – Dunedoo solar farm Dunedoo, Warrumbungle LGA The construction, operation and decommissioning of a 55 MW solar farm with about 173,000 PV solar panels with BESS (indicative capacity of 60.48 MW/ 85.88 MWh), supporting infrastructure and temporary construction facilities, including construction compounds, and local road upgrades and augmentation works at the Dunedoo Substation.	Approved EIS, Submissions Report, Amendment Reports and Assessment Report	Construction period: 2024–2025 (10–12 months)	20 km north of central section of the project	✓		✓	✓	✓	✓		✓			✓	✓
20 – Uungula wind farm Wuuluman, Yarragal and Twelve Mine, Dubbo Regional LGA The construction, operation and decommissioning of a 400 MW wind farm with up to 97 wind turbines (with a maximum tip height of about 250 m) with BESS (indicative capacity of 150 MW/150 MWh), supporting infrastructure and temporary construction facilities, including site compounds, rock crushing and concrete/asphalt batching plants and laydown areas, and local and regional road upgrades.	Approved EIS, Submissions Report, Amendment Report and Assessment Report	Construction period: 2022–2024 (24–30 months)	25 km south of western section of the project	✓		✓	✓	✓	✓		✓			✓	✓
21 – Maryvale solar farm Maryvale, Dubbo Regional LGA The construction, operation and decommissioning of a 125 MW solar farm with up to 450,000 PV solar panels with BESS (indicative capacity of 230 MW/375 MWh), supporting infrastructure and temporary construction facilities, including construction compounds and laydown areas, and local road upgrades.	Approved EIS, Submissions Report and Assessment Report	Construction period: Late 2023–2025 (14 months)	30 km southwest of western section of the project	✓		✓	✓	✓	✓		✓			✓	✓

Project details				Potential cumulative impacts											
ID, name and location	**Planning status and environmental assessment documentation reviewed**	**Construction/ operation period**	**Distance from project**	**Land use, property and agriculture**	**Landscape and visual**	**Biodiversity**	**Aboriginal**	**Social**	**Economic**	**Noise and vibration**	**Bushfire and general hazards**	**Air quality**	**Traffic and transport**	**Waste management**	**Surface water and groundwater supply**
22 – Geurie solar farm Geurie, Dubbo Regional LGA The construction, operation and decommissioning of a 5 MW solar farm with up to 11,700 PV solar panels with BESS, supporting infrastructure and temporary construction facilities.	Approved Council Assessment Report	Construction period: Mid to late 2023–2024 (3 months)	35 km southwest of western section of the project	✓		✓	✓	✓	✓		✓			✓	✓
23 – Dubbo solar farm Dubbo, Dubbo Regional LGA The construction, operation and decommissioning of a 5 MW solar farm with up to 12,609 PV solar panels with supporting infrastructure and temporary construction facilities.	Approved Council Assessment Report	Construction period: Mid to late 2023–2024 (6 months)	48 km west of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
24 – Gilgandra solar farm Gilgandra, Gilgandra LGA The construction, operation and decommissioning of a 5 MW solar farm with up to 12,000 PV solar panels with BESS, supporting infrastructure and temporary construction facilities.	Approved Council Assessment Report	Construction period: 3 months	77 km northwest of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
25 – Wahroonga solar farm Narromine, Narromine LGA The construction, operation and decommissioning of a 5 MW solar farm with up to 15,708 PV solar panels with BESS, supporting infrastructure and temporary construction facilities.	Approved Council Assessment Report	Construction period: 3 months	81 km west of western section of project	✓		✓	✓	✓	✓		✓			✓	✓

Project details				Potential cumulative impacts											
ID, name and location	**Planning status and environmental assessment documentation reviewed**	**Construction/ operation period**	**Distance from project**	**Land use, property and agriculture**	**Landscape and visual**	**Biodiversity**	**Aboriginal**	**Social**	**Economic**	**Noise and vibration**	**Bushfire and general hazards**	**Air quality**	**Traffic and transport**	**Waste management**	**Surface water and groundwater supply**
Changes to existing projects															
26 – Moolarben coal mine OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2 Moolarben, Mid-Western Regional LGA Moolarben coal mine OC3 Extension: The extension of existing approved open cut mining operations immediately south of the approved OC3 open cut pit, as well as development of four new open cut pits to the east and southeast of the approved OC3 mining area, within existing mining tenements. The project would extract up to 9 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal, with a total of around 40 million tonnes (Mt) over the life of the project. Moolarben coal mine Stage 2 – Modification 4 – UG2 modification: The modification to the Stage 2 project approval (08_0135) to incorporate adjustments to the mine layout for the approved underground mine UG2, including the extension of two approved longwall panels, increased UG2 extraction height and revised UG2 mining sequence. Includes the development of an additional gate road along the southern boundary of the UG1 mining area to assist with ventilation in UG2.	Under assessment OC3 Extension: EIS Stage 2 – Modification 4 – UG2: Modification Report and Submissions Report	Operational period: 2025–2034	Direct overlap	✓		✓	✓	✓	✓	✓	✓	✓			✓

Project details				Potential cumulative impacts											
ID, name and location	**Planning status and environmental assessment documentation reviewed**	**Construction/ operation period**	**Distance from project**	**Land use, property and agriculture**	**Landscape and visual**	**Biodiversity**	**Aboriginal**	**Social**	**Economic**	**Noise and vibration**	**Bushfire and general hazards**	**Air quality**	**Traffic and transport**	**Waste management**	**Surface water and groundwater supply**
27 – Ulan coal mine Modification 6 Ulan, Mid-Western Regional LGA The extension of currently approved longwall panels in existing mining lease and exploration licence areas to enable the extraction of an additional around 25 Mt of product coal, and the provision of associated infrastructure, including ventilation shafts and an access track.	Under assessment Modification Report	Operational period: present – 2035	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓

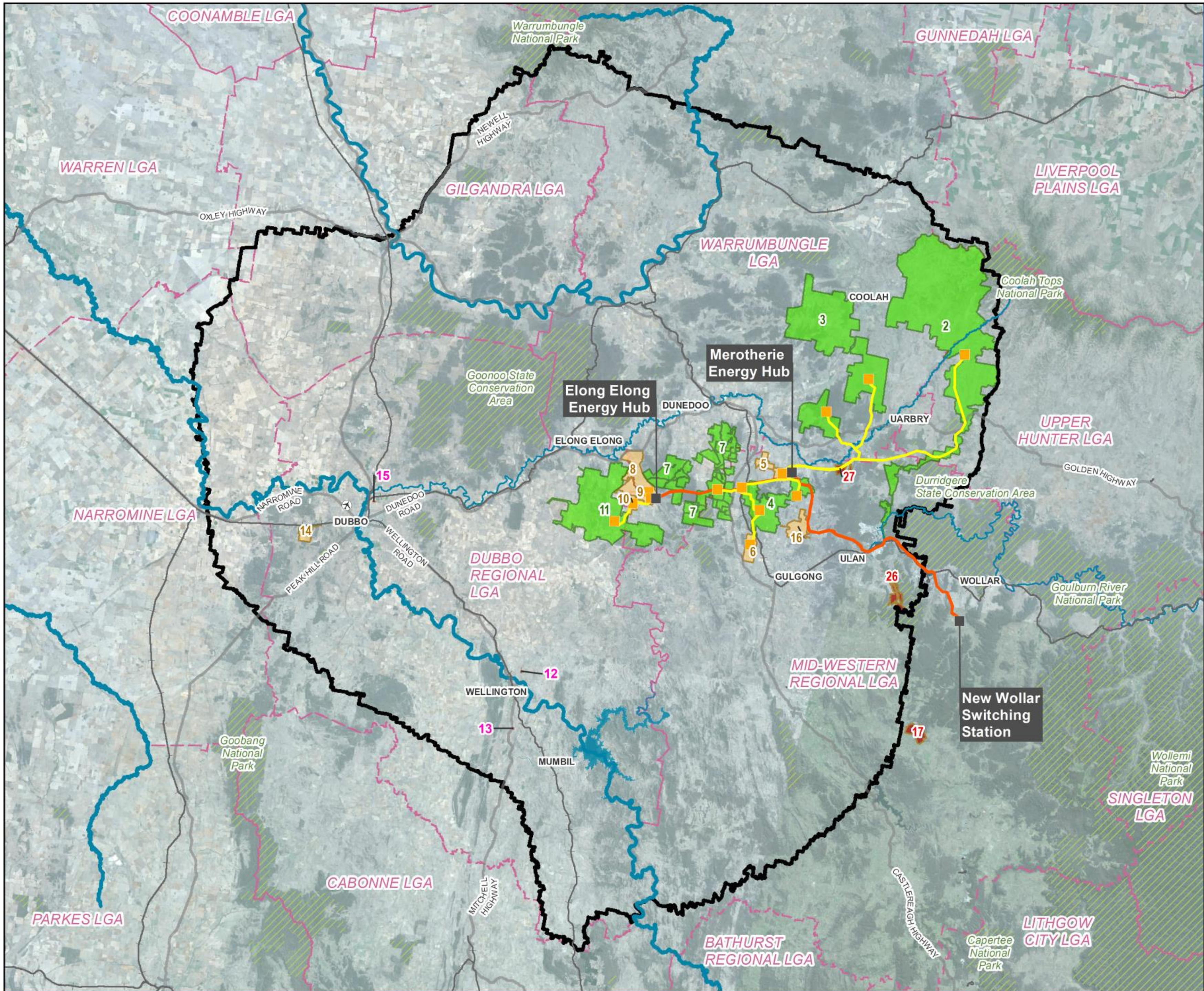
Table A-4 Anticipated schedule overlap with relevant future projects during construction

Project[1]	2023				2024				2025				2026				2027				2028			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Central-West Orana REZ Transmission																								
Public road works																								
Liverpool Range wind farm																								
Valley of the Winds wind farm																								
Birriwa solar farm																								
Tallawang solar farm																								
Orana wind farm																								
Cobbora solar farm																								
Sandy Creek solar farm																								
Dapper solar farm																								
Wellington south BESS																								
Apsley BESS																								
Forest Glen solar farm																								
Stubbo solar farm																								
Bowdens silver mine																								
Inland Rail (Narromine to Narrabri)																								
Dunedoo solar farm																								
Uungula wind farm																								
Maryvale solar farm																								
Geurie solar farm																								
Dubbo solar farm																								

2. Includes only projects that have provided indicative construction periods in publicly available environmental assessment documentation.

Central-West Orana REZ Transmission

Figure E-1
Cumulative impact assessment projects (regional)



Legend

- Energy hub / 500 kV switching station
- 330 kV switching station
- 500 kV transmission line
- 330 kV transmission line
- Central-West Orana REZ
- Dubbo regional airport
- Railway
- Road
- Major watercourse
- Minor watercourse
- Water body
- Local government area
- NPWS estate
- Wind farms
  - 2, Liverpool Range wind farm
  - 3, Valley of the Winds wind farm
  - 4, Barneys Reef wind farm
  - 7, Orana wind farm
  - 11, Spicers Creek wind farm
- Solar farms
  - 5, Birriwa solar farm
  - 6, Tallawang solar farm
  - 8, Cobbora solar farm
  - 9, Sandy Creek solar farm
  - 10, Dapper solar farm
  - 14, Forest Glen solar farm
  - 16, Stubbo solar farm
- Mines
  - 17, Bowdens silver mine
  - 26, Moolarben coal mine – OC3 Extension & Stage 2 Mod 4 (UG2)
  - 27, Ulan coal mine – Mod 6
- Other
  - 12, Wellington south battery energy storage system
  - 13, Apsley BESS
  - 15, Dubbo firming power station

COOLAH
DUNEDOO
MERRIWA
DUBBO
GULGONG
MUDGEE
NEWCASTLE

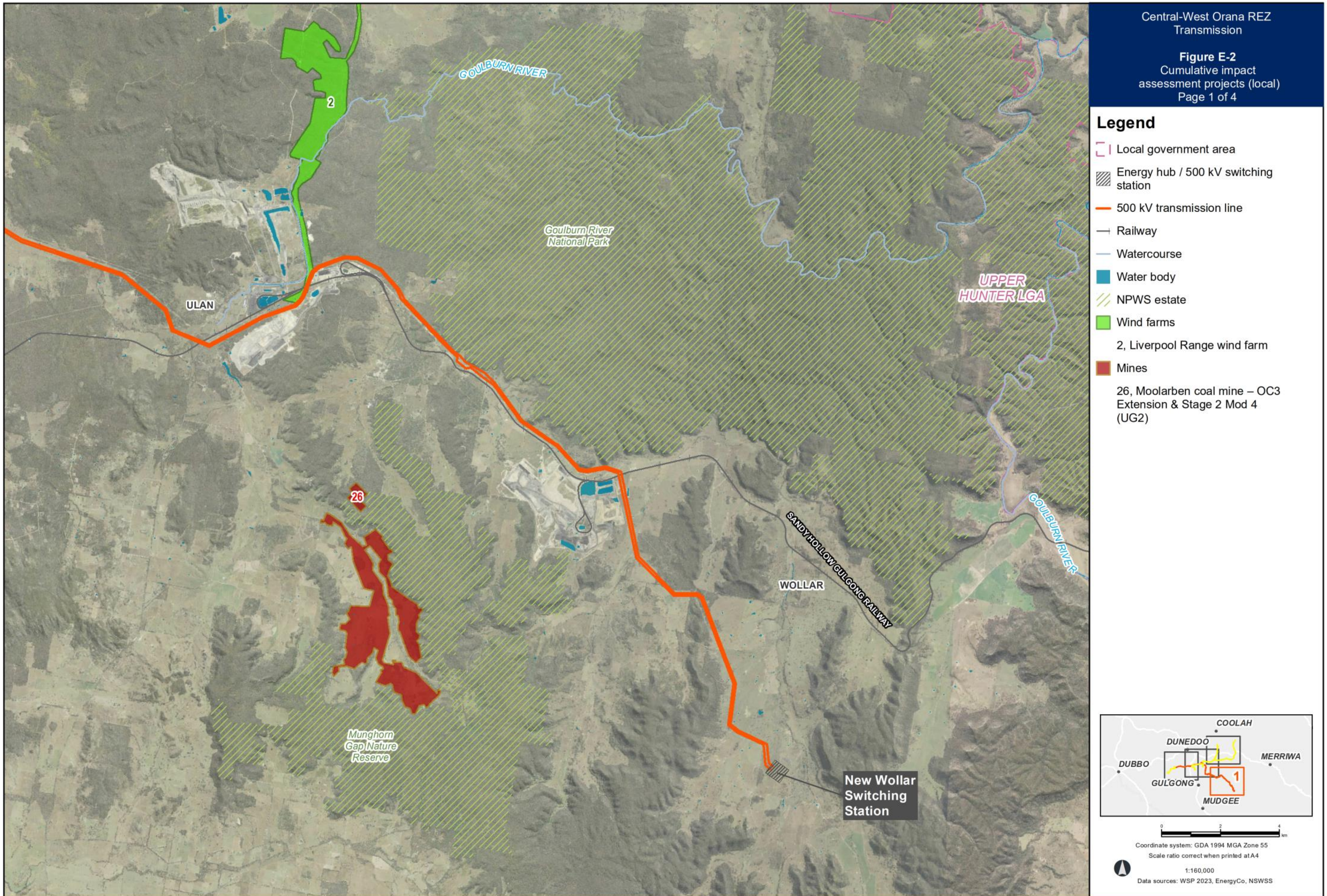
0 20 40 km

Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:1,100,000
Data sources: WSP, 2023, EnergyCo, NSWSS

C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\11_EIS\Appendix_E\PS130593_EIS_E-1_CumulativeImpactAssessmentProjectsRegional_r1v12.mxd

Central-West Orana REZ Transmission

Figure E-2
Cumulative impact assessment projects (local)
Page 1 of 4



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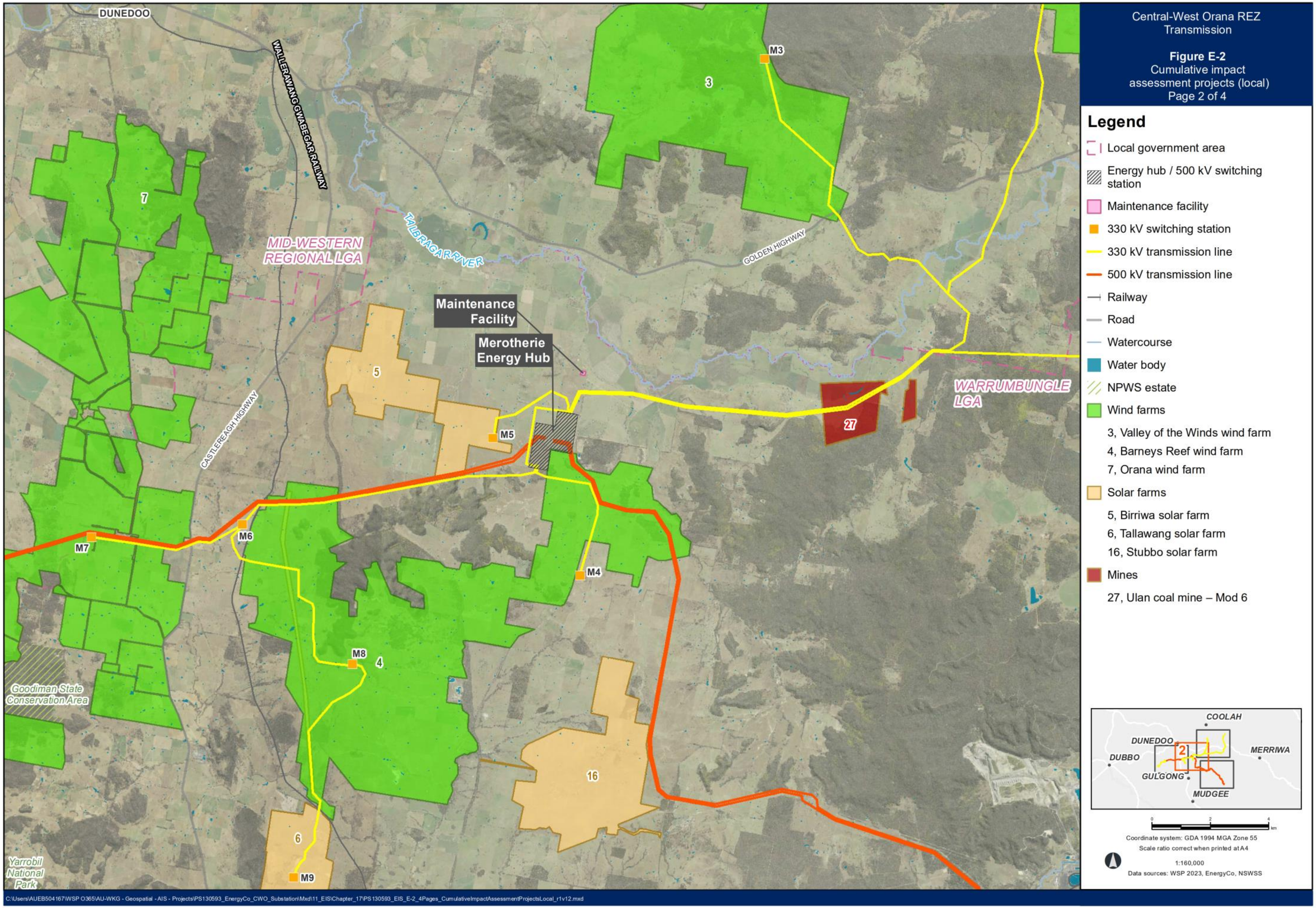
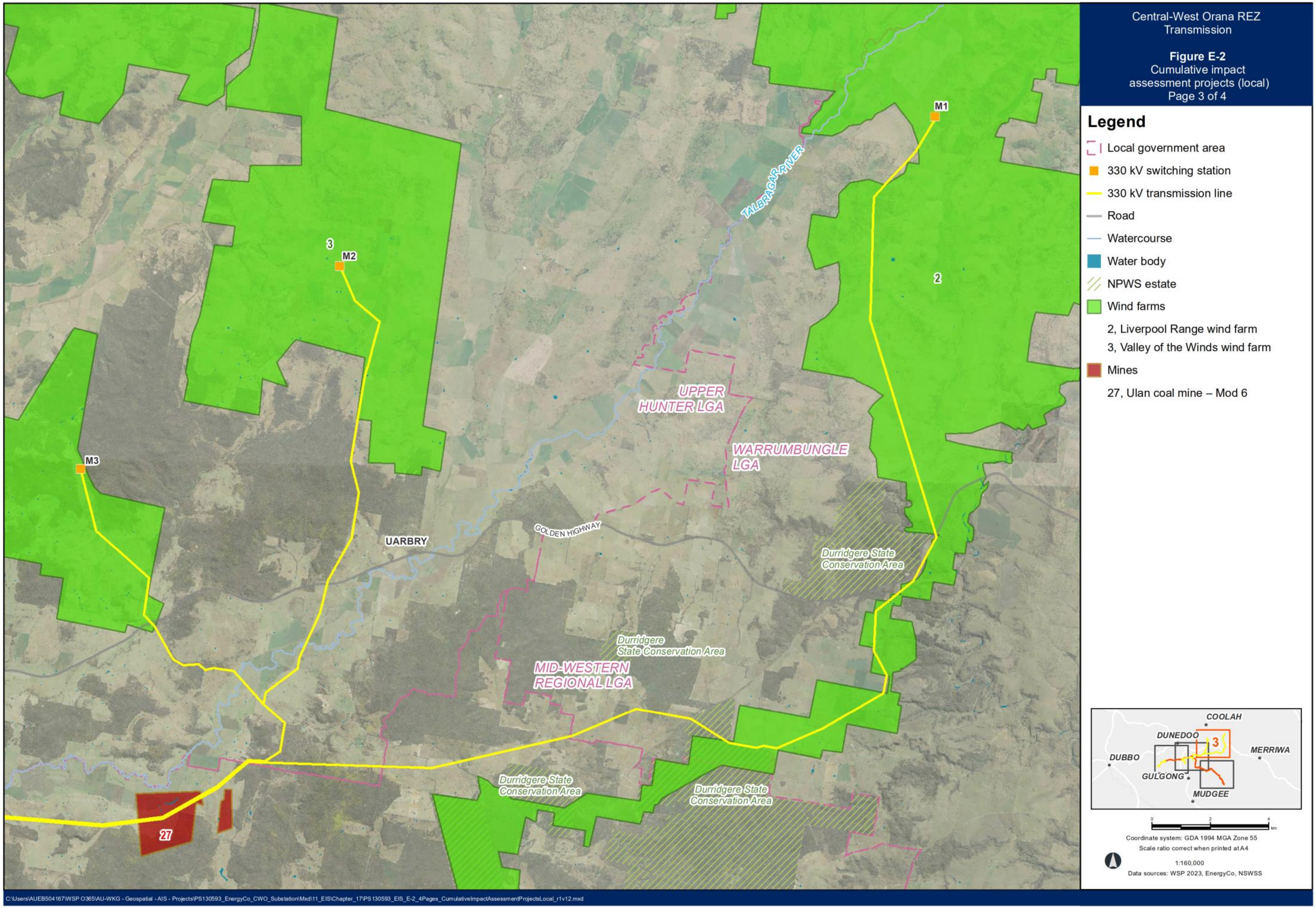
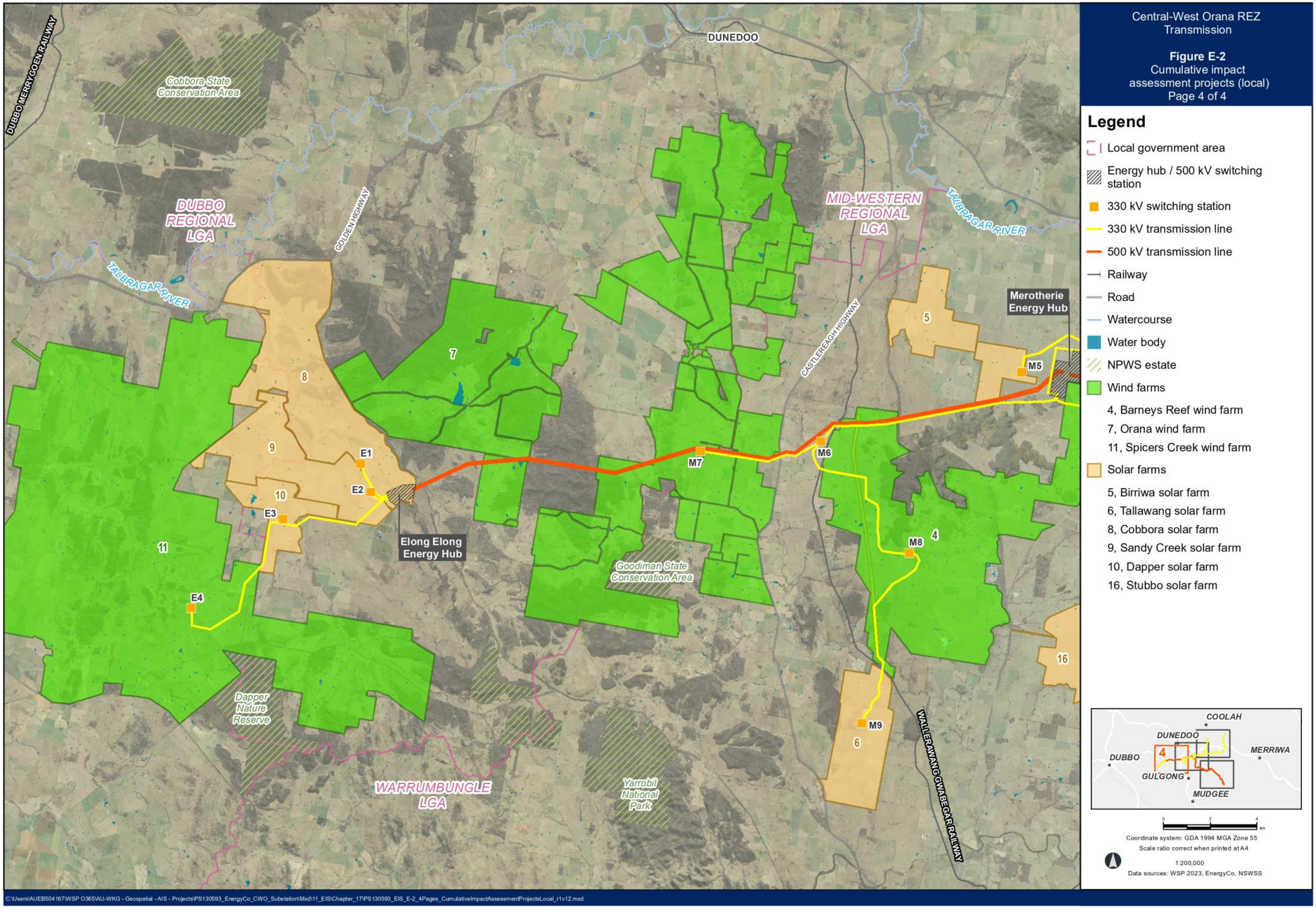


Central-West Orana REZ Transmission

Figure E-2
Cumulative impact assessment projects (local)
Page 2 of 4



Central-West Orana REZ
Transmission
Figure E-2
Cumulative impact
assessment projects (local)
Page 3 of 4
Legend
Local government area
330 kV switching station
330 kV transmission line
Road
Watercourse
Water body
NPWS estate
Wind farms
2, Liverpool Range wind farm
3, Valley of the Winds wind farm
Mines
27, Ulan coal mine – Mod 6
M1
M2
M3
2
3
27
TALBRAGAR RIVER
UPPER HUNTER LGA
WARRUMBUNGLE LGA
MID-WESTERN REGIONAL LGA
UARBRY
GOLDEN HIGHWAY
Durridgere State Conservation Area
Durridgere State Conservation Area
Durridgere State Conservation Area
Durridgere State Conservation Area
COOLAH
DUNEDOO
MERRIWA
DUBBO
GULGONG
MUDGEE
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:160,000
Data sources: WSP 2023, EnergyCo, NSWSS
C:\Users\AUEB504167\WSP O365\AU-WKG - Geospatial - AIS - Projects\PS130593_EnergyCo_CWO_Substation\Mxd\11_EIS\Chapter_17\PS130593_EIS_E-2_4Pages_CumulativeImpactAssessmentProjectsLocal_r1v12.mxd



Central-West Orana REZ Transmission

Figure E-2
Cumulative impact assessment projects (local)
Page 4 of 4

E2.3.1 Issues not included in the assessment

Potential impacts of the relevant future projects that met the screening criteria (refer to Table A-3) were considered, to identify any issues that do not require further cumulative impact assessment (N/A in Table A-2). Specifically, where potential cumulative impacts are expected to be relatively minor, or where there is no potential overlap in the potential impacts of this project and the relevant future projects' impacts, issues were not considered further in the assessment. As a result, a number of issues were identified that did not require further consideration in the assessment, as summarised in Table A-5.

Table A-5 Issues not further considered in the assessment

Issue	Assessment
Aviation	The construction of this project is not expected to result in any adverse impacts on aerial operations (refer to Chapter 16 (Hazard and risk)). During operation, this project would have only minimal impacts on aerial operations at aircraft landing areas near the project, when the recommended risk management process is carried out by the pilot and landowner. No other adverse impacts on aerial operations are expected during operation. Some of the relevant future projects, such as wind farms, would result in impacts on aerial operations during operation in areas that would overlap with the impacts of this project. With the implementation of the mitigation and management measures for each project, this project in combination with the relevant future projects, are not expected to result in any material cumulative aviation impacts during construction or operation.
Soils and contamination	Potential soil and contamination impacts of this project during construction are likely to be minor and localised to the construction area, outside of the active mining areas (refer to Section 19.2 (Soils and contamination)). While the relevant future projects may have contamination impacts and require management, none of the projects would have any contamination impacts within areas impacted by this project. In active mining areas, there would be a low to high risk of contamination during construction of this project. Potential contamination impacts would be adequately managed with the mitigation measures outlined in Section 19.2 (Soils and contamination). Similarly, the identified mining projects would be implementing a range of measures to manage potential contamination impacts. Potential soil and contamination impacts of this project during operation are expected to be minimal, and would be managed within an operational environmental management plan area. With the implementation of the mitigation and management measures for each project, this project in combination with the relevant future projects, are not expected to result in any material cumulative soil and contamination impacts during construction or operation.
Groundwater levels, flow, recharge and quality	Any potential impacts on groundwater levels, recharge or quality at sensitive receivers during the construction of this project is likely to be minor and localised (refer to Section 19.3 (Groundwater)). During operation, this project is not expected to result in any impacts on groundwater levels. Any impacts on groundwater recharge, flow and quality would be minimal with the implementation of mitigation measures. As the groundwater impacts are minor and localised, no cumulative impacts are anticipated with relevant future projects. With the implementation of the mitigation and management measures for each project, this project in combination with the relevant future projects, are not expected to result in any material cumulative impacts on groundwater levels, flow, recharge and quality during construction or operation.
Non-Aboriginal heritage	During construction and operation, this project would result in neutral/slight impacts on two listed local non-Aboriginal heritage items, and neutral to slight/moderate impacts on 24 unlisted local non-Aboriginal heritage items (refer to Chapter 12 (Non-Aboriginal heritage)). No impacts are expected on heritage items listed on the World Heritage List, National Heritage List, Commonwealth Heritage List, State Heritage Register, State Heritage Inventory or Section 170 registers. The relevant future projects identify minimal impacts to non-Aboriginal heritage and no cumulative impacts. Due to the minor nature of the potential impacts to non-Aboriginal heritage from this project, this project in combination with the relevant future projects are not expected to have material cumulative impacts on non-Aboriginal heritage during construction or operation.

Issue	Assessment
Geomorphology, flooding and water quality	Potential impacts of this project, and each of the relevant future projects, on geomorphology, flooding and water quality during construction and operation is expected to be minor and localised (refer to Section 19.1 (Hydrology, flooding and water quality)). With the implementation of the mitigation and management measures for each project, this project in combination with the relevant future projects, are not expected to result in any material cumulative impacts on geomorphology, flooding and water quality during construction or operation.
Greenhouse gas	During construction, the project and the relevant future projects would result in Scope 1, Scope 2 and Scope 3 greenhouse gas emissions. However, these emissions would be minimal in comparison with total greenhouse gas emissions in Australia. Each project would implement strategies and technologies during detailed design and construction planning to reduce greenhouse gas emissions during construction. During operation, the project would result in greenhouse gas emissions due to electricity consumption to power the energy hubs and switching stations, energy losses during transmission, the operation of switchgear and the maintenance of project infrastructure. However, overall, the project would reduce greenhouse gas emissions in the wider economy by enabling an increase in the generation of renewable energy in the grid, to replace carbon intensive fossil fuel generation. The majority of the relevant future projects are renewable energy generation projects and would contribute to cumulative reduction of greenhouse gas emissions. With the implementation of the mitigation and management measures for each project, this project in combination with the relevant future projects, are not expected to result in any material cumulative impacts on greenhouse gas emissions during construction or operation.

E2.3.2 Level of assessment carried out for assessed issues

For issues not screened out altogether (as detailed in Table A-3), Table A-6 summarises the level of assessment carried out in the assessment. A detailed assessment was undertaken where the cumulative impacts of the project and relevant future projects are likely to be significant. A standard assessment was undertaken where the cumulative impacts of the project and relevant future projects are not likely to be significant. Quantitative methods were used to assess the relevant cumulative impacts where the relevant data was available in publicly available planning documents. Qualitative assessment or suitably sensitivity testing was carried out where the cumulative impacts of relevant future projects were in the scoping phase at the time of EIS preparation and detailed technical studies have not yet been undertaken to assess potential impacts.

Table A-6 Level of assessment carried out for assessed issues

Issue	Consideration	Level of assessment
Land use, property, and agriculture	Construction of this project would require the temporary use of land for construction and the permanent use of land for operation. Impacts to land use during operation, while long term, would commence during construction. At the commencement of construction, the current land use within the construction area would cease, either permanently at locations where permanent infrastructure would be required (energy hubs and the New Wollar Switching Station, 330 kV switching stations, transmission line towers, and access roads and access tracks), or temporarily while construction activities are being carried out (brake and winch sites, construction compounds, workforce accommodation camps and transmission line easements). The primary land use impacted by this project is agriculture, while other land uses impacted include small extents of protected areas and mining operations (refer to Chapter 7 (Land use and property)). Land impacted by the relevant future projects is also mostly used for agricultural purposes.	Standard

Issue	Consideration	Level of assessment
	The relevant future projects would also result in a change in the existing land use, either permanently (where permanent infrastructure is required) or temporarily, until construction activities are completed. However, construction activities for this project and the relevant future projects would not occur for the full construction period in one location, and a relatively small proportion of the total existing agricultural land in the four local government areas (LGAs) would be impacted. Operation of this project and the relevant future projects would result in a permanent change in land use, which would predominantly result in a change from agricultural land use to electricity transmission and energy generation infrastructure (refer to Chapter 7 (Land use and property) and Chapter 8 (Agriculture)). Given the type and scale of most of the relevant future projects, (that is wind and solar energy generation projects), the area directly impacted by permanent infrastructure is relatively small when considering the total existing agricultural lands within the four impacted LGAs. In areas which are not directly impacted (e.g. transmission line easements or areas between wind turbines and solar arrays), agricultural activities would be able to continue across their respective project areas, with some restrictions on certain agricultural activities.	
Landscape and visual	Construction and operation of this project may result in potential impacts on landscape character ranging from negligible to moderate, and potential visual impacts ranging from negligible to high ((refer to Chapter 9 (Landscape character and visual amenity)). The majority of the relevant future projects, particularly renewable energy projects such as solar and wind farms, may also result in potential landscape character and visual impacts during construction and operation, as they would be introducing construction activities and energy and electricity infrastructure into a largely rural landscape. There is the potential for this project, in combination with the relevant future projects, to result in material cumulative landscape character and visual impacts during construction and operation where construction and operational periods overlap.	Detailed
Biodiversity	This project would result in potentially significant impacts on Threatened Ecological Communities (TECs) and threatened species listed under the *Biodiversity Conservation Act 2016* (BC Act) and EPBC Act, including TECs and species at risk of serious and irreversible impacts (SAII), as well as impacts on habitat connectivity (refer to Chapter 10 (Biodiversity)). The majority of the relevant future projects would also include removal of native vegetation and potential impacts on TECs, threatened species and habitat fragmentation. This project in combination with the relevant future projects, are expected to result in material cumulative impacts on biodiversity values during construction.	Detailed
Aboriginal heritage	Construction and operation of this project and the relevant future projects may have potential direct and indirect impacts on Aboriginal sites, places and/or deposits of high and moderate significance, due to ground disturbance and vegetation removal (refer to Chapter 11 (Aboriginal heritage)). Each project would include archival recording of identified Aboriginal objects, sites and places and recovery or relocation, documentation and analysis of any Aboriginal sites directly impacted. Mitigation measures would also be implemented to minimise any inadvertent impacts on known and undiscovered Aboriginal heritage. With the implementation of mitigation and management measures for each project, this project in combination with the relevant future projects are unlikely to result in material cumulative impacts on Aboriginal heritage during construction and operation.	Standard
Social	During construction, this project has the potential to result in substantial negative social impacts, mainly due to potential impacts on amenity and an influx of a largely non-resident workforce. Potential substantial negative social impacts during operation of this project are associated with perceptions of an unequal distribution of impacts and benefits of the project, perceived health and safety and bushfire risk, uncertainty about property value impacts, changes in the landscape and a perceived loss of biodiversity (refer to Chapter 13 (Social)). The majority of the relevant future projects would have similar social impacts during construction and operation. Where construction and operational periods overlap, there is the potential for this project, in combination with the relevant future projects, to result in material cumulative social impacts during construction and operation.	Detailed

Issue	Consideration	Level of assessment
Economic	Where construction periods overlap, this project, in combination with the relevant future projects, is expected to generate a large demand for a suitably qualified construction workforce (refer to Chapter 14 (Economic)). This may have associated impacts on construction sector wages, the available labour force, accommodation supply, housing and rental prices and inflation in the region. With the implementation of mitigation measures for each project, this project in combination with the relevant future projects, are not expected to result in material cumulative impacts. Overall, this project in combination with the relevant future projects, are likely to boost economic activity within the Central-West Orana region during construction and operation, due to increased expenditure and flow-on effects from construction, and would result in positive cumulative economic impacts.	Standard
Noise and vibration	During construction, this project and the relevant future projects may result in potential cumulative noise and vibration impacts as a result of construction activities and traffic, where construction activities and construction routes impact on the same sensitive receivers (refer to Chapter 15 (Noise and vibration)). These impacts would be managed with the implementation of mitigation measures for each project, in accordance with the relevant guidelines. Potential cumulative noise and vibration impacts during operation as a result of this project, in combination with the relevant future projects, are expected to be minimal.	Standard
Bushfire risk and other general hazards	This project, in combination with the relevant future projects, may result in potential cumulative hazards and risks associated with bushfire risks and the use, storage and transportation of dangerous goods and hazardous materials, where construction periods would overlap (refer to Chapter 16 (Hazard and risk)). These impacts would be managed with the implementation of mitigation measures for each project. Potential cumulative impacts related to bushfire risk during operation would occur where projects near each other would increase the risk of bushfire ignition and spread. Bushfire risks would be managed for each project by implementing asset protection zones around infrastructure and other maintenance and emergency mitigation measures. With the implementation of the mitigation and management measures for each project, this project in combination with the relevant future projects are unlikely to result in material cumulative bushfire risks and other general hazards.	Standard
Traffic and transport	Construction traffic generated by this project would have a potential minor impact on the efficiency and capacity of the road network, with most roads predicted to continue to operate with a similar level of service (refer to Chapter 17 (Traffic and transport)). This project, with the implementation of the mitigation measures (including upgrading of a number of local roads and road intersections), is also expected to have negligible to minor impacts on active and public transport networks, road condition, road safety and property access. Cumulative traffic and transport impacts during operation as a result of this project, in combination with the relevant future projects, are expected to be minimal. Where the construction periods and construction routes of this project and the relevant future projects overlap, there is the potential for material cumulative traffic and transport impacts due to an increase of construction vehicles on the road network.	Detailed
Waste management	This project and the relevant future projects would generate waste during construction and operation (refer to Chapter 18 (Waste management)). Waste mitigation and management measures would be implemented for each project, which would include minimising waste generation through project design and waste targets and implementing waste segregation, reuse and recycling during construction. However, local waste management facilities may have limited or no capacity to accept waste from multiple projects, and may also have restrictions on throughput. Therefore, this project, in combination with the relevant future projects, have the potential to result in material cumulative waste impacts. However, as limited waste volume data is available for the relevant future projects, a standard assessment of the cumulative waste impacts was carried out.	Standard

Issue	Consideration	Level of assessment
Surface water and groundwater supply	Water for construction of this project and the relevant future projects would be sourced from a range of sources, which may include surface water and groundwater sources (refer to Section 19.1 (Hydrology, flooding and water quality) and Section 19.3 (Groundwater)). However, water for this project would be sourced according to a hierarchy that prefers the use of non-potable water over potable water, and the use of rainwater and recycled/treated construction water, wastewater and groundwater inflows over extraction from surface water and groundwater sources. In addition, water extraction from regulated surface water sources and groundwater sources are controlled at a State level by the NSW Government. Where construction periods of this project and the relevant future projects overlap, there is the potential for material cumulative impacts on surface water and groundwater sources. Operational water demand for this project would be minor. However, water availability for operational water use would potentially be affected during dry periods when water availability and rainwater tanks could be low, and competition for water resources from existing irrigation suppliers in the region accessing the same water resources could be increased. As limited water supply volumes and source data are available for the relevant future projects, a standard assessment of the cumulative water supply impacts of this project in combination of the relevant future projects was carried out.	Standard
Air quality	Construction of this project and the relevant future projects may generate dust emissions as a result of earthworks, civil construction activities and the movement of construction vehicles (refer to Section 19.4 (Air quality)). Where dust-generating activities of projects overlap, there is the potential for cumulative amenity (dust soiling) impacts and human health risks at nearby sensitive receivers. However, no material cumulative air quality impacts are expected with the implementation of mitigation measures for each project.	Standard

E3 Cumulative impact assessment

The methodology and assessment of cumulative impacts that have been considered in the cumulative impact assessment are described in the following sections.

Cumulative impacts on aviation, soils and contamination, non-Aboriginal cultural heritage, groundwater (except groundwater supply), surface water (except surface water supply) and greenhouse gas emissions are not anticipated for this project in combination with other relevant future projects in the immediate study area (refer to Section E2.3.1).

E3.1 Land use, property and agriculture

The study area for the land use, property and agriculture cumulative impact assessment consists of the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs. Agriculture is the dominant land use in these LGAs.

E3.1.1 Methodology

While the EIS separately assesses agricultural impacts and land use/property impacts, for the cumulative assessment these have been combined due to the close correlation between agricultural impact and broader land use and property impacts in a cumulative impact context.

A standard assessment was carried out that involved:

- identifying relevant future projects (listed in Table A-3) with the potential for cumulative land use, property and agricultural impacts
- reviewing the nature and scale of potential land use, property and agricultural impacts of the relevant future projects as described in the publicly available planning documents for the projects
- qualitatively assessing the potential local cumulative land use and property impacts of the relevant future projects in combination with this project, including acquisition and/or leasing of land and changes to land uses
- qualitatively assessing the potential cumulative impact on the loss of agricultural land and productivity during the construction and operation phases of the relevant future projects
- qualitatively assessing the potential cumulative impacts on agriculture (other than the loss of agricultural land use and productivity), including biosecurity risks, livestock disturbance and impacts on aerial agricultural operations
- recommending mitigation measures as required.

E3.1.2 Impact assessment

As discussed in Chapter 7 (Land use and property), this project would require the use of land (mostly used for agricultural purposes) both temporarily for construction, and then permanently for operation in areas where permanent infrastructure is proposed. This requirement for land, and the subsequent impacts to agricultural land use and productivity, is generally consistent with the majority of relevant future projects in relation to:

- temporary removal of agricultural land and agricultural productivity during construction, for construction compounds, temporary access roads/tracks and construction work areas outside areas where project infrastructure is installed
- permanent removal of agricultural land and agricultural productivity at locations where project infrastructure (energy hubs, switching stations, transmission line towers, wind turbines etc) is proposed
- establishment of 'dual use' areas, where the presence of electrical infrastructure allows for the continuation of some agricultural activities, such as within transmission line easements, or continued grazing of sheep beneath solar generation infrastructure.

Construction

For the purpose of calculating the loss of agricultural value (production) from the use of land for construction, a conservative ('worst case') scenario was used that assumed the entire construction area for this project would be unavailable for agricultural use during the construction period, the estimated loss of agricultural production would be around $1.35 million per year. This is equivalent to around 0.21 per cent of the total gross value of annual agricultural production across the four impacted LGAs. This is considered a 'worst case' impact as it is expected that agricultural land uses such as grazing would continue within parts of the construction area, subject to the timing and location of construction activities, and the ability to implement safe access arrangements.

Relevant future projects that have the potential to contribute to cumulative land use, property and agriculture impacts consist of the related development projects. A summary of the potential cumulative land use, property and agriculture impacts of each of these relevant future projects is provided in Table A-7.

The temporary removal of agricultural land during construction of these projects would generally be limited to small areas of each impacted landholding (typically less than five percent of each landholding), with existing agricultural activities continuing on the largest part of the landholding. For solar farm projects the removal of agricultural activities during construction would extend across the construction area of each project. Disturbed areas (not required for operation) would be rehabilitated to ensure minimal impacts on agricultural operations. Agricultural operations may also be temporarily impacted due to increased construction traffic, vegetation removal, the generation of noise, vibration and dust, damages/changes to farm infrastructure and increased biosecurity risks. These impacts would be minimised with the implementation of mitigation measures for each project, and would be managed via property management plans and in consultation with landowners.

With the implementation of the mitigation measures outlined in Chapter 7 (Land use and property) and Chapter 8 (Agriculture) and the management approach outlined in Section E4, cumulative impacts on agriculture, as a result of the overlap in construction activities for the project and the relevant future projects, are not expected to be significant.

Operation

Operation of this project would result in a permanent change in land use, from the existing agricultural land use to electrical infrastructure, where permanent infrastructure would be established (e.g. transmission line towers, energy hubs, maintenance facility, switching stations, access tracks and access roads). The permanent loss of agricultural land for this project is equivalent to 0.13 per cent of the total area of agricultural land use in the four impacted LGAs, and an estimated productivity loss of around $317,550 per year. This represents around 0.05 per cent of the total annual gross value of agricultural production across the four impacted LGAs. Land within the transmission line easements for this project, and immediately next to the easements, would remain available for agricultural activities such as grazing and cropping, however, would be subject to certain restrictions for safety and operational reasons.

Most of the relevant future projects would have a relatively minor impact on agricultural production, generally allowing agricultural activities to continue across the respective project areas during operation, depending on the type of project and the type of agriculture. For example, wind farms would allow cropping to continue within the project footprint, whereas solar farms would remove existing arable land within their project footprints from future crop production. However, grazing could most likely continue within the project footprint of both solar and wind farms.

Mining projects, such as Bowdens silver mine and Moolarben coal mine (OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2), would collectively remove around 2,500 hectares of land currently used for agricultural production throughout the life of the projects and rehabilitation periods. This is likely to impact local agricultural productivity, however is unlikely to result in a significant impact on regional agricultural production. Considering the impacts of this project on regional agricultural productivity, this project in combination with these mining projects are unlikely to result in significant cumulative impacts on regional agricultural productivity.

The remainder of the relevant future projects would have limited impacts on agriculture due to their small footprint (such as the BESS projects and small solar farms), or distance from this project (such as Inland Rail and some solar farms).

This project, in combination with wind farms located near this project may have a cumulative impact on aerial agriculture operations (e.g. aerial spraying), as these projects would introduce new obstacles (and turbulence, in the case of wind turbines) into the airspace and reduce the area available for aerial application, as aircraft would not be able to operate under the transmission lines or wind turbines. Cumulative impacts on aerial agriculture operations in the vicinity of the wind farms are expected to be minor when the recommended risk management process is carried out by the pilot and landowner.

Cumulative biosecurity risks are expected to be low once standard mitigation measures are implemented by each project.

Summary of each project

Table A-7 provides a summary of the potential cumulative impacts of the relevant future projects identified in Table A-3.

Table A-7 Potential cumulative impacts on agriculture during construction and operation

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Related development				
Liverpool Range wind farm	12,601 ha	Construction: 1,599 ha Operation: 1,192 ha	Not specified	During construction: Construction of the Liverpool Range wind farm is expected to directly overlap with the construction of this project, however the cumulative impacts due to the loss of agricultural lands are not expected to be significant. While there would be some restriction on agricultural land use, and productivity, it is expected that this would be limited to construction compounds, access roads, and areas required for the construction of wind turbines only. As such, agricultural activities would continue on large parts of the land holdings impacted by the wind farm project. Typically, around 2–3 % of a property holding would be impacted, which is not expected to result in material economic loss. It is expected that leasing agreements for the wind farm project would take into consideration the existing use of agricultural land, and any lost revenue from agricultural production. With reference to disruptions to agricultural operations, if construction activities were to occur in the same area, farming operation may be temporary impacted, mainly due to increased construction traffic and construction activities at key locations. These impacts would be managed via property management plans and in consultation with landowners to minimise operational impacts. During operation: Once operational, it is expected that all disturbed areas would be rehabilitated for agricultural use, with permanent infrastructure (including substations, access roads, wind turbines and operational and maintenance facilities) the only areas removed permanently from agricultural use. These areas are expected to occupy only a few percent of the overall land holdings.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Valley of the Winds wind farm	Construction: 1,318 ha Operation: 549 ha	Construction: 1,318 ha Operation: 549 ha	$235,500 per year	During construction: Construction of the Valley of the Winds wind farm is expected to directly overlap with the construction of this project and result in around 1,318 ha of agricultural lands (including around 65 ha of mapped Biophysical Strategic Agricultural Land (BSAL) being temporarily removed from agricultural production (Ramboll, 2022). With reference to disruptions to agricultural operations, if construction activities were to occur in the same area, farming operation may be temporary impacted, mainly due to increased construction traffic and construction activities at key locations. These impacts would be managed via property management plans and in consultation with landowners to minimise operational impacts. During operation: Once operational, it is expected that all disturbed areas would be rehabilitated for agricultural use, with permanent infrastructure (including substations, access roads, wind turbines and operational and maintenance facilities) the only areas removed permanently from agricultural use. These areas are expected to occupy only a few percent of the overall land holdings. Permanent infrastructure would permanently remove around 549 ha of agricultural land, including around 60 ha of mapped BSAL.
Barneys Reef wind farm	7,548 ha	Not specified. Agricultural land use is the main existing land use.	Not specified	During construction The construction timeframe for the Barneys Reef wind farm is unknown, however should the construction period overlap with this project's construction, it is expected the cumulative impacts due to the loss of agricultural lands would not be significant. While there would be some removal of agricultural land use, and thus productivity, it is expected that this loss would be limited to construction compounds, access roads, and areas required for the construction of wind turbines only, and agricultural activities would continue on large parts of the land holdings impacted by the wind farm project. Typically, around 2–3 % of a property holding would be impacted, which is not expected to result in material economic loss. In addition, it is expected leasing agreements for the wind farm project would take into consideration the existing use of agricultural land, and any lost revenue from agricultural production. If construction activities were to occur in the same area, agricultural operations may be temporary impacted, mainly due to increased construction traffic and construction activities at key locations. These impacts would be managed via property management plans and in consultation with landowners to minimise operational impacts. During operation: Once operational, it is expected that all disturbed areas would be rehabilitated for agricultural use, with permanent infrastructure (including substations, access roads, wind turbines and operational and maintenance facilities) the only areas removed permanently from agricultural use. These areas are expected to occupy only a few percent of the overall land holdings.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Birriwa solar farm	1,330 ha	Not specified. Agricultural land use is the main existing land use.	Not specified	<u>During construction</u> Construction of the Birriwa solar farm is expected to overlap with the first half of construction of this project, which would concurrently result in the loss of access to agricultural land. Based on the study area identified by the Birriwa solar farm l EIS (EMM, 2022a) and included details on land use, it is assumed the use of up to 1,330 ha of agricultural lands would have its use temporarily restricted during construction. It is expected leasing agreements for the solar farm project would take into consideration the existing use of agricultural land and any lost revenue from agricultural production. The solar farm project would not impact any areas of mapped BSAL. <u>During operation:</u> Once operational, the Birriwa solar farm EIS identifies the potential for grazing on some portions of the development footprint. This approach would be similar to that proposed for other solar farms considered by this assessment. If this dual use of the solar farm is implemented during operation, the impacts on productivity would be minimised.
Tallawang solar farm	Construction: 866 ha Operation: 866 ha	Construction: 866 ha Operation: 866 ha	Not specified	<u>During construction</u> The construction periods of this project and the Tallawang solar farm are expected to overlap, with temporary restrictions on agricultural land use and productivity up until the completion of construction. The Tallawang solar farm EIS (Umwelt, 2022a) indicates the property holding has been used for grazing in its entirety since at least 2011, and there are no impacts to areas of BSAL. The solar farm project is expecting to lease 1,370 ha of land, with a project area of around 866 ha. Agricultural activities would be temporarily restricted within the lease area during construction. It is expected leasing agreements for the solar farm project would take into consideration the existing use of agricultural land, and any lost revenue from agricultural activities. <u>During operation:</u> Once operational, it proposed that Tallawang solar farm would become dual purpose, with sheep grazing continuing beneath the solar panels, minimising the impacts of the proposal on agricultural productivity.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Orana wind farm	744 ha	Not specified. Agricultural land use is the main existing land use.	Not specified	During construction The preliminary construction timeframes of the Orana wind farm project are expected to overlap of construction periods with this project. While minimal details are available, it is expected the impacts would be comparable to the Liverpool Range wind farm and the Valley of the Winds wind farm. The project area of the wind farm consist of cropping and grazing activities, with large portions mapped as BSAL, and while not specifically identified, the Scoping Report indicates an indicative development footprint of 744 ha (Ramboll, 2023). During operation: Once operational, it is expected that all disturbed areas would be rehabilitated for agricultural use, with permanent infrastructure (including substations, access roads, wind turbines and operational and maintenance facilities) the only areas removed permanently from agricultural use, occupying only a few percent of the overall land holdings.
Cobbora solar farm	2,700 ha	Not specified. Agricultural land use is the main existing land use.	Not specified	During construction The construction periods of this project and the Cobbora solar farm project are expected to overlap, with temporary restrictions on the use of agricultural land likely, impacting agricultural use and productivity, up until the completion of construction. The development footprint of the solar farm is around 2,700 ha, with agricultural land use the dominant land use in the area. The Cobbora solar farm Scoping Report (EMM, 2021) does not identify specific impacts to land use or agricultural productivity. It is expected that leasing agreements for the solar farm project would take into consideration the existing use of agricultural land, and any loss of revenue from agricultural production. It should be noted that the 2,700 ha development footprint identified in the Scoping Report, includes areas identified as ‘exclusion zones’ where development would not occur. During operation: Once operational, while not identified in the project Scoping Report the grazing of livestock (sheep) may be considered (based on other nearby solar farm projects). If this dual use of the solar farm, once operational, is implemented, impacts on productivity are expected to me minimal.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Sandy Creek solar farm	1,600 ha	Not specified. Agricultural land use is the main existing land use.	Not specified	The construction periods of this project and the Sandy Creek solar farm project are expected to overlap, with temporary restrictions on agricultural land use and productivity likely up until the completion of construction. Given the land use identified in the Sandy Creek solar farm Scoping Report (EMM, 2022b) and minimal additional information, specific impacts on agricultural land use are not known. The development area of the solar farm is identified in the Scoping Report to be around 1,600 ha, with agricultural land use the dominant land use in the area. Additionally, around 56 ha of the solar farm project area is mapped as BSAL. It is expected that leasing agreements for the solar farm project would take into consideration any existing use of agricultural land, and any loss of revenue from agricultural production. During operation: Once operational, the Sandy Creek solar farm Scoping Report identifies the preference that the site would become dual purpose, with sheep grazing continuing on agricultural lands beneath the solar panels, minimising the impacts of the solar farm project on agricultural productivity.
Dapper solar farm	730 ha (including an indicative solar array footprint of 554 ha)	Not specified. Agricultural land use is the main existing land use.	Not specified	During construction The construction periods of this project and the Dapper solar farm project are expected to overlap, with temporary restrictions on agricultural land use and productivity up until the completion of construction. While the total area of impact to agricultural lands is not specified in the Dapper solar farm Scoping Report (Jacobs, 2022), given the identification of mostly agricultural lands used for grazing, it is expected that up to 730 ha of agricultural lands may have its use temporarily restricted during construction. It is expected leasing agreements for the solar farm project would take into consideration the existing use of agricultural land, and any lost revenue from agricultural production. During operation: Once operational, the Dapper solar farm Scoping Report identifies the preference for the site to become dual purpose, with sheep grazing continuing on agricultural lands beneath the solar panels. This dual use would minimise the impacts of the solar farm project on agricultural productivity. The Dapper solar farm Scoping Report also identifies investigations into soil carbon farming opportunities.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Spicers Creek wind farm	18,085 ha	Not specified. Agricultural land use is the main existing land use.	Not specified	During construction No details are currently available with regards to the timing of the construction of the Spicers Creek wind farm, however once commencing, construction is expected to take between 24 and 30 months to complete. Due to the level of detail available for the wind farm, the degree of impacts during both construction and operations are unknown, however given the size and scale of the wind farm, construction impacts comparable with other wind farm projects assessed (Liverpool Range wind farm, Valley of the Winds wind farm, Barneys Reef wind farm) would be expected. During operation: Once operational, it is expected that all disturbed areas would be rehabilitated for agricultural use, with permanent infrastructure (including substations, access roads, wind turbines and operational and maintenance facilities) the only areas removed permanently from agricultural use, occupying only a few percent of the overall land holdings.
Proposed projects				
Wellington South BESS	Construction: 15 ha Operation: 9 ha	Not specified Agricultural land use is the main existing land use.	Construction: $1,895 per year over 18 months Operation: $1,006 per year	During construction and operation: Given the size, scale of construction and location of the Wellington South BESS project, it is not expected to have a significant contribution to cumulative impacts associated with land use and agricultural productivity during both construction and operation.
Apsley BESS	6 ha	Not specified Agricultural land use is the main existing land use.	Not specified	During construction and operation: Given the size, scale and location of the Apsley BESS project, in addition to the construction timing, it is not expected to have a significant contribution to cumulative impacts associated with both construction and operation on land use and agriculture.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Forest Glen solar farm	444 ha	Not specified Agricultural land use is the main existing land use.	Not specified	During construction Given the size, scale and location of the Forest Glen solar farm, in addition to the construction timing, it is not expected to have a significant contribution to cumulative impacts associated with construction. Around 444 ha of agricultural lands would have its use temporarily restricted during construction (NGH Environmental, 2021). The project EIS notes that 36.9 ha of the project area has been identified as 'exclusion areas' which would be protected from impacts. It is expected that leasing agreements for the solar farm project would take into consideration the existing use of agricultural land, and any lost revenue from agricultural production. No areas of BSAL would be impacted by the solar farm project. During operation: Once operational, if the project becomes dual purpose, with a continuation of agricultural activities (grazing) on site, it would minimise the impacts associated with the loss of agricultural productivity.
Approved projects				
Stubbo solar farm	Construction: 1,243 ha Operation: 715 ha	Construction: 1,243 ha Operation: 715 ha	Not specified	During construction Construction of the Stubbo solar farm is expected to commence in 2023 and extend until late 2025. As such, the construction periods of this project and the Stubbo solar farm are expected to overlap during the early stages of this project, which would concurrently result in temporary restrictions on agricultural land use and productivity throughout the duration of construction. Around 1,243 ha of agricultural lands would be impacted during construction. It is expected that leasing agreements for the solar farm would take into consideration the existing use of agricultural land, and any lost revenue from agricultural production. During operation: Once operational, if the Stubbo solar farm may become dual purpose, with investigations into sheep grazing continuing on agricultural lands beneath the solar panels, it would minimise impacts on productivity.
Bowdens silver mine	1,498 ha	Construction: 1,498 ha Operation: 1,498 ha	Construction: $160,000 per year Operation: $160,000 per year After closure: $88,000 per year	During construction and operation: The construction of the Bowdens silver mine and this project would likely overlap, with the removal of agricultural land occurring during the construction phase of this project and continuing throughout operation. The construction and operation of the mine would marginally reduce the availability of land used for agriculture throughout the region. The proposed progressive rehabilitation schedule would ensure that this project, in combination with the Bowdens silver mine project, would only have minor impacts on land used for agriculture.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Dunedoo solar farm	112 ha	Not specified	Not specified	During construction: Given the size, scale and location of the Dunedoo solar farm, construction is not expected to have a significant contribution to cumulative impacts associated with construction. During operation: Once operational, if the solar farm project becomes dual purpose, with a continuation of agricultural activities (grazing) on site being explored (as outlined in the project EIS (NGH Environmental, 2020)), it would minimise the impacts associated with the loss of agricultural productivity.
Uungula wind farm	2,770 ha	659 ha (based on project BDAR estimates)	Not specified	During construction Construction of the Uungula wind farm is expected to have some overlap with the construction of the early stages of this project. However, due to the distance between the wind farm project and this project, and the linkages with the nearest large town (Wellington) rather than those closely associated with this project, local cumulative impacts during construction will be limited. During construction, given the size and scale of the Uungula wind farm, construction impacts comparable with other wind farm projects assessed (Liverpool Range wind farm, Valley of the Winds wind farm, Barneys Reef wind farm) would be expected. During operation: Once operational, it is expected that all disturbed areas would be rehabilitated for agricultural use, with permanent infrastructure (including substations, access roads, wind turbines and operational and maintenance facilities) the only areas removed permanently from agricultural use, occupying only a few percent of the overall land holdings.
Maryvale solar farm	375 ha	Not specified. Agricultural land use is the main existing land use.	Not specified	During construction: Construction of the Maryvale solar farm is expected to have some overlap with the construction of the early stages of this project. However, due to the distance between the wind farm project and this project, and the linkages with the nearest large town (Wellington) rather than those closely associated with this project, local cumulative impacts during construction will be limited. The solar farm project area has been mapped as BSAL, and the Maryvale solar farm EIS (Pitt & Sherry, 2018) identified current cropping and grazing uses. Use of around 375 ha of agricultural land would be restricted with impacts to productivity. It is expected that leasing agreements for the solar farm would take into consideration the existing use of agricultural land, and any lost revenue from agricultural production. During operation: Once operational, if the solar farm project becomes dual purpose with a continuation of agricultural activities (sheep grazing) on site (as outlined in the project EIS), it would minimise the impacts associated with the loss of agricultural productivity.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Geurie solar farm	13 ha	Not specified Agricultural land use is the main existing land use.	Not specified	Due to the small size and distance of this solar farm from this project, the cumulative impacts during both construction and operational would be minimal.
Dubbo solar farm	64 ha	Not specified. Agricultural land use is the main existing land use.	Not specified	Due to the small size and distance of this solar farm from this project, the cumulative impacts during both construction and operational are negligible.
Gilgandra solar farm	188 ha	Not specified. Agricultural land use is the main existing land use.	Construction: $66,417 per year	Due to the small size and distance of this solar farm from this project, the cumulative impacts during both construction and operational are negligible. Once operational, if the solar farm project becomes dual purpose, with a continuation of agricultural activities (sheep grazing) on site (as outlined in the project EIS (GHD, 2017)), it would minimise the impacts associated with the loss of agricultural productivity.
Wahroonga solar farm	Construction: 15.6 ha Operation: 15.6 ha	Construction: 15.6 ha Operation: 15.6 ha	Not specified	Due to the small size and distance of this solar farm from this project, the cumulative impacts to land use, property, and agriculture are negligible.
Changes to existing projects				
Moolarben coal mine OC3 Extension	Construction: 975 ha Operation: 975 ha	Construction: 975 ha Operation: 975 ha	Construction: $467,000 per year Operation: $467,000 per year	The Moolarben coal mine OC3 extension project would result in around 975 ha of agricultural land removed from production during the mine life and rehabilitation period. The Moolarben coal mine OC3 extension project EIS identifies a loss of agricultural productivity of around $467,000 per year, however the EIS also notes that agricultural land use has already ceased in the area due to the existing Moolarben coal mining operations. The Moolarben coal mine OC3 extension project would not impact any areas of BSAL. On completion of mining activities around 500 ha of land would be reinstated. While the timing of the extension project is not specified, it is unlikely to result in any cumulative impacts on land use, property and agriculture.
Moolarben coal mine Stage 2 – Modification 4 – UG2	Not specified	None	None	The Moolarben coal mine Stage 2 – Modification 4 – UG2 project (located within the existing mine lease area) consists of underground impacts and would not result in a change in land use, which currently consists of native vegetation and areas of biodiversity offset. While the timing of the extension project is not specified, no cumulative impacts on land use, property and agriculture would be expected.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Ulan coal mine Modification 6	27 ha	Not specified	Not specified	The Ulan coal mine Modification 6 project would result in the disturbance of around 27 ha of land within the existing mining lease area (owned by the operator). A small portion of this is suitable and currently used for grazing, and land above the proposed underground mining area would continue to be used for grazing. No area of BSAL would be impacted. This project is not anticipated to materially impact on the agricultural value of the land and is unlikely to contribute to cumulative impacts on land use, property, and agriculture.

E3.2 Landscape and visual

E3.2.1 Methodology

Potential landscape character and visual impacts of the relevant future projects are likely to overlap with the potential landscape character and visual impacts of this project at a local scale. Therefore, the study area for the landscape and visual cumulative impact assessment consists of a two kilometre radius of this project.

A detailed assessment was carried out that involved:

- identifying relevant future projects (listed in Table A-3) within the study area with the potential for cumulative landscape character and visual impacts
- reviewing the nature and scale of potential landscape character and visual impacts within the project timeframes, as described in publicly available planning documents for the relevant future projects.
- qualitatively assessing potential local cumulative landscape and visual impacts of the relevant future projects in combination with this project, including impacts on landscape character (changes to landform, vegetation cover, built form and land use), private and public views and visual amenity, including night time visual impacts
- recommending mitigation measures as required.

For landscape character type/zone, the assessment considered character zones which would also be occupied by relevant future projects.

For visual impact, this assessment considered:

- views from public vantage points where there would be multiple relevant future projects visible, such as views from a lookout, area of open space or location along roads (including local roads and highways)
- views from roads and rail lines where relevant future projects and this project are viewed sequentially
- views from private dwellings (within two kilometres of this project) where this project would be seen together with the relevant future projects.

The assessment:

- made general comments about the location and extent of relevant future projects where it was not known and subject to detailed design
- applied the assessment methodology and terminology of the landscape character and visual impact assessment in this EIS to ensure a consistent approach that is tailored to the scale and specific visual characteristics of the infrastructure considered.
- considered the relevant future projects identified in the Table A-3.

E3.2.2 Impact assessment

The cumulative impacts have been assessed for five geographical areas, due to the close proximity of relevant future projects to this project in these areas, the cumulative impact of these projects on landscape character and the potential overlap in visibility between the projects during construction and operation:

- southeast (Ulan and Bungaba)
- northeast (Cassilis and Turill)
- north (Leadville, Coolah and Uarbry)
- central (Merotherie, Birriwa, Barneys Reef, Stubbo and Tallawang)
- west (Elong Elong, Cobbora, Gollan, Goolma and Dunedoo).

Landscape character impacts during the day

This project in combination with the relevant future projects are expected to result in cumulative impacts to the regions' landscape character and visual amenity. Table A-8 outlines the potential cumulative impacts on landscape character.

Table A-8 Summary of potential cumulative landscape character impacts during the day

Location	Identified project	Cumulative landscape character impacts
Southeast Ulan and Bungaba	• Ulan coal mine Modification 6	During construction: The construction program for Ulan coal mine Modification 6 may overlap with construction of this project. If approved, this would occur in the vicinity of the Coolah connection, to the south of Blue Springs Road, Bungaba, in the Talbragar River rural valley landscape character zone (LCZ) (RV-3). Some areas of bushland vegetation would be removed for the Ulan coal mine Modification 6, as well as the use of large-scale machinery and vehicles, landform changes and proposed surface infrastructure. During this period where construction may overlap, the landscape character of this area would change to include construction activity, resulting in cumulative landscape character impact. This character change would be mostly due to the construction of this project, with a relatively small contribution by Ulan coal mine Modification 6. During operation: The mining activity would be underground, and the extent of vegetation removed, and additional infrastructure would not, together with this transmission project, result in a cumulative landscape character impact.

Location	Identified project	Cumulative landscape character impacts
Northeast Cassilis and Turill	• Liverpool Range wind farm	During construction: The construction program for the Liverpool Range wind farm would overlap with construction of this project for several years. This would occur in the vicinity of the Cassilis connection and switching station M1, in the Cassilis to Coolah undulating rural hills LCZ (URH-5). The changes to character during construction would in some ways be similar in nature to that of the approved Liverpool Range wind farm, including the use of large-scale machinery and vehicles, landform changes to accommodate towers and turbines, the removal of vegetation to accommodate these structures. However, the wind farm would require construction activity and equipment of a much larger scale and extending over a broader area. There would also be widespread road upgrades and access tracks as a result of this project and the wind farm project. The vehicles and equipment required to transport and install the turbine components would also be greater, and more visually dominant within this character zone. During this period where construction overlaps the landscape character of this area would change to include construction activity dispersed widely across the rural landscape, resulting in cumulative landscape character impact. This character change would be mostly due to the construction of the wind farm, with a relatively small contribution by this project. During operation: These projects would introduce energy generation and transmission structures, switching and substation infrastructure, maintenance access tracks and upgraded roads into a landscape where there is currently limited built development and a prevailing undulating rural landscape character. The wind farm proposes multiple turbines reaching around four times the height of this project's transmission line towers which would be prominent features of the landscape. Together there would be large areas of the Cassilis to Coolah undulating rural hills LCZ (URH-5) that would accommodate wind turbines. Together with this project, this infrastructure would change the landscape character to one where the presence of energy and electricity infrastructure is more frequently encountered, resulting in cumulative landscape character impact. The contribution of this project to this change in character would be greater in the vicinity of the Cassilis connection and switching station M1 where these projects would be grouped together.

Location	Identified project	Cumulative landscape character impacts
North Leadville, Coolah and Uarbry	• Valley of the Winds wind farm	During construction: If approved, the construction programs would overlap for several years with works in the vicinity of the Coolah and Leadville connections, associated with switching stations M2 and M3, in the Uarbry and Tongy undulating rural hills LCZs (URH-3 and URH-4) potentially being undertaken together. The changes to landscape character during construction would in some ways be similar in nature to that of the approved Valley of the Winds wind farm, including the use of large-scale machinery and vehicles, landform changes to accommodate towers and turbines, and the removal of vegetation to accommodate these structures. However, the wind farm would require construction activity of a much larger scale, and over a much broader area. There would also be widespread road upgrades and access tracks as a result of this project and the wind farm project. The vehicles and equipment required to transport and install the turbine components would also be greater, and more visually dominant within this character zone. During this period where construction overlaps the landscape character of this area would change to include construction activity dispersed widely across the rural landscape, resulting in cumulative landscape character impact. This character change would be mostly due to the construction of the wind farm, with a relatively small contribution by this project. During operation: There would be large areas of the Tongy and Uarbry undulating rural hills LCZs (URH-3 and URH-4) that would accommodate wind turbines and this project's transmission infrastructure. This would include many wind turbines (up to 148) that would be four times the height of the proposed project transmission line towers and would be prominent features of the landscape. These projects would introduce energy generation and transmission structures, switching and substation infrastructure, maintenance access tracks and upgraded roads into a landscape where there is currently limited built development and a prevailing undulating rural landscape character. Together with this project, this infrastructure would change the landscape character to one where the presence of energy and electricity infrastructure is more frequently encountered, and more prominent feature. The contribution of this project to this change in character would be greater in the vicinity of the Coolah connection and switching station M2, where the projects would be located together.

Location	Identified project	Cumulative landscape character impacts
Central Merotherie, Birriwa, Barneys Reef, Stubbo and Tallawang	• Birriwa solar farm • Barneys Reef wind farm • Stubbo solar farm • Tallawang solar farm	<u>During construction</u>: In the landscapes between Gulgong and Dunedoo, multiple renewable energy projects are proposed, including the approved Stubbo solar farm. This transmission project would extend through or be located adjacent to each of these projects. The Stubbo solar farm may be under construction for several years while this project is under construction, particularly works at the Merotherie to New Wollar Connection, near Blue Springs Road. If approved, there is also likely to be construction works associated with the remaining solar farm projects occurring for several years together with this project. These projects would share some common construction activities and equipment to undertake minor earthworks, vegetation clearing, and construction of the energy infrastructure. The construction of these solar farms would be of smaller scale than this project but would occupy a greater geographic area. This work would gradually introduce energy generation and electrical infrastructure into the landscape, transforming the landscape character of these LCZs from predominantly rural to a character where the construction and installation of electricity infrastructure characterises large areas of the landscape. Overall, there is the potential for a cumulative landscape character impact on the Narragamba to Blue Springs (URH-1) and Birriwa to Tallawang undulating rural hills LCZs (URH-2) due to the extent and characteristics of this activity. This project would pass through a small area of the Barneys Reef forested hills LCZ (FH-4), which would also be the site of the Barneys Reef wind farm. This project would contribute in a small way to the changes to character that would be experienced during construction as a part of the Barneys Reef wind farm. That would include earthworks, vegetation clearance and the introduction of large scale construction equipment and activities, heavy vehicles and transport of materials and components through this landscape. Overall, there would be a cumulative landscape character effect on the Barneys Reef forested hills LCZ (FH-4) due to these projects in combination. The construction of this transmission project would contribute a small amount of the combined impacts as the wind farm would require construction over a much wider area of the hilly terrain and of a scale that is much greater than this transmission project. <u>During operation</u>: There would be large areas of the Narragamba to Blue Springs (URH-1) and Birriwa to Tallawang undulating rural hills LCZs (URH-2) that would accommodate solar farm infrastructure. These projects would introduce solar panel arrays and associated infrastructure such as switching and substations, BESS, workshops, maintenance and operations buildings, maintenance access tracks and upgraded roads into a landscape where there is currently limited built development and a prevailing undulating rural landscape character. The presence of these projects, in conjunction with this project, which would include large-scale transmission lines and an energy hub at Merotherie, would transform the character of these LCZs from predominantly rural to having a prevailing character of renewable energy infrastructure. The presence of energy and electricity infrastructure would be more extensive and a more visually prominent feature, occupying views of both the land and extending into the sky. The contribution of this project to this change in character would be greater in the vicinity of the Merotherie Energy Hub and in areas to the west of the energy hub where there are several transmission lines in parallel. This project would also alter the character of a small area of the Barneys Reef forested hills LCZ (FH-4) and contribute in a small way to the changes to character that would be experienced due to the introduction of the Barneys Reef wind farm as this transmission would be of a smaller vertical scale and only affect a small area of the forested hills landscape character type. Overall, there would be a cumulative landscape character effect on the Barneys Reef forested hills LCZ (FH-4) due to these projects in combination.

Location	Identified project	Cumulative landscape character impacts
West Elong Elong, Cobbora, Gollan, Goolma and Dunedoo	• Orana wind farm • Sandy Creek solar farm • Cobbora solar farm • Dapper solar farm • Spicers Creek wind farm	During construction: In the landscapes between Tallawang and Spicers Creek, multiple renewable energy projects are proposed. This transmission project is located in the centre of these renewable energy projects, with the transmission line easements extending through or adjacent to each project. This area forms part of the Dapper and Elong undulating rural hills LCZs (URH-6) and Spring Ridge and Tuckland forested hills LCZ (FH-5). If approved, this transmission project may overlap with the construction of these renewable energy projects for several years. These projects would share some common construction activities and equipment to undertaken minor earthworks, vegetation clearing, and construction of the energy infrastructure. The construction of these solar farms would be of smaller scale than this project but would occupy a greater geographic area. This work would gradually introduce energy generation and electrical infrastructure into the landscape, transforming the landscape character of these LCZs from predominantly rural to a character where the construction and installation of electricity infrastructure characterises large areas of the landscape. Overall, there would be a cumulative landscape impact associated with this project in combination with these projects, during construction. During operation: Large areas of the Dapper and Elong undulating rural hills LCZs (URH-6) and Spring Ridge and Tuckland forested hills LCZ (FH-5) would be transformed by the introduction of energy generating infrastructure that would include large-scale wind turbines, solar panel arrays, switching stations and substations, BESS facilities, workshops, maintenance and operations buildings, maintenance access tracks and upgraded roads. These features would occupy views of both the land and extending into the sky. This infrastructure would be introduced into a landscape where there is currently limited built development and a prevailing undulating rural landscape character. The presence of these projects, in conjunction with this project, would transform the character of these LCZs to an area where energy and electricity infrastructure prevail, resulting in cumulative landscape character impacts.

Visual impacts during the day

Table A-9 outlines the potential cumulative visual impacts during construction and operation.

Table A-9 Summary of potential cumulative visual impacts during the day

Location	Identified project	Cumulative visual impacts
Southeast Ulan and Bungaba (Refer to Viewpoints 10 and 11, Technical paper 3 – Visual and landscape character (Technical paper 3))	• Ulan coal mine Modification 6	During construction: If approved, construction of the Ulan coal mine Modification 6 may be seen sequentially and together with this project in the area south of Blue Springs Road, Bungaba. The works at multiple transmission line towers sites and the surface work areas of the proposed mine may be visible, including vegetation removal, leveling works, foundation construction and presence of vehicles and machinery travelling along access tracks and construction routes. The projects would be seen from sections of local roads such Blue Springs Road, and from nearby rural properties. The construction activity would be viewed from the rural valley and detract from the rural amenity and scenic quality of this landscape, resulting in potential cumulative visual impacts. During operation: If approved, Ulan coal mine Modification 6 may be seen sequentially and together with this project in the Talbragar River rural valley LCZ (RV-3). Although much of the proposed mine would be located underground, there may be some surface infrastructure such as haulage roads seen in addition to the double row of transmission line towers from sections of local roads such Blue Springs Road, and from nearby rural properties. Although the proposed mine would be less prominent due to intervening vegetation around the proposal, together the projects would contrast with the rural amenity and scenic quality of this area, resulting in cumulative visual impacts. There is the potential for views of this project with the Ulan coal mine together with this transmission project from about two dwellings and the potential for a cumulative effect on views.
Northeast Cassilis and Turill (Refer to Viewpoint 17 and 18, Technical paper 3)	• Liverpool Range wind farm	During construction: The construction of the approved Liverpool Range wind farm would be seen sequentially and together with this project in undulating rural hills north of Cassilis, for several years. The works at multiple transmission line pole tower and wind turbine sites would be visible, including leveling works, foundation construction and presence of vehicles and machinery travelling along access tracks and construction routes. These projects would be seen from sections of local roads such Rotherwood Road and Coolah Road, and from nearby rural properties between Cassilis and Coolah. The construction activity would be viewed against the undulating hills and detract from the rural amenity and scenic quality of this landscape, resulting in potential cumulative visual impacts. During operation: The operational wind farm would be seen sequentially and together with this project in undulating rural hills north of Cassilis. The projects would be seen from sections of local roads such Rotherwood Road and Coolah Road, and from nearby rural properties between Cassilis and Coolah. The wind farm proposes multiple turbines reaching around four times the height of this project's transmission line towers. The turbines would also be viewed in close proximity to switching station M1. The projects would be prominent and contrast with the rural amenity and scenic quality of this landscape, resulting in potential cumulative visual impacts. There is the potential for views of this project with the Liverpool Range wind farm from one private dwelling, which is associated with the proposed wind farm development and a cumulative visual impact.

Location	Identified project	Cumulative visual impacts
North Leadville, Coolah and Uarbry (Refer to Viewpoint 13 and 14, Technical paper 3)	• Valley of the Winds wind farm	<u>During construction</u>: If approved, construction of the Valley of the Winds wind farm would be seen sequentially and together with this project in this area north of Uarbry, for several years. The works at multiple transmission line tower and wind turbine sites would be visible, including leveling works, foundation construction and presence of vehicles and machinery travelling along access tracks and construction routes. The projects would be seen from sections of local roads such Moorefield Road, and from nearby rural properties. The construction activity would be viewed against the undulating hills and detract from the rural amenity and scenic quality of this landscape, resulting in potential cumulative visual impacts. <u>During operation</u>: The operational wind farm would be seen sequentially and together with this project in undulating rural and forested hills north of Uarbry. The wind farm proposes multiple turbines (up to 148) reaching around four times the height of this project's transmission line towers. The turbines would also be viewed in close proximity to switching stations M2 and M3. The projects would be seen from sections of Moorefield Road and from nearby rural properties south of Coolah and around Leadville. The projects would be prominent and contrast with the rural amenity and scenic quality of this area, resulting in cumulative visual impacts. There is the potential for views of this project with the Valley of the Winds wind farm from one dwelling, however this dwelling would host both the wind farm project and the transmission line.
Central Merotherie, Birriwa, Barneys Reef, Stubbo and Tallawang (Refer to Viewpoints 6-9, and 17-19, Technical paper 3)	• Birriwa solar farm • Barneys Reef solar farm • Stubbo solar farm • Tallawang solar farm	<u>During construction</u>: The construction of the approved Stubbo solar farm could potentially overlap with this project for several years, in the area north east of Gulgong, in the vicinity of Blue Springs Road. Construction of the remaining projects could be seen sequentially and together with this project in areas between Gulgong and Dunedoo, including view to leveling works, clearing of vegetation, and vehicles, machinery travelling along access tracks and construction routes, particularly the installation of wind turbines and transmission lie towers in close proximity. The construction activity would be spread across a large area and viewed against the hills at Barneys Reef, detracting from the rural amenity and scenic quality of views in this area, resulting in cumulative visual impacts. In particular this would affect views from the Castlereagh Highway, where large scale construction would be seen for an extended duration on both sides of the highway. <u>During operation</u>: In this area north and northeast of Gulgong, the projects would extend across a large area of undulating rural landscape and often viewed against a backdrop of hills at Barneys Reef. The projects would be viewed sequentially and together, from nearby roads such as the Castlereagh Highway and from rural properties, including dwellings. Due to the scale, proximity and extent of the projects seen from this area, and the contrast to the rural amenity and scenic quality of views which do not currently contain large-scale built features or infrastructure, there would be cumulative visual impacts. There is the potential for views from this project together with the Birriwa solar farm in the vicinity of the Merotherie Energy Hub from two dwellings. There would also be views of this project together with the Barneys Reef wind farm from dwellings about six dwellings in the west in the vicinity of the Castlereagh Highway, some of which are not associated with either of these projects.

Location	Identified project	Cumulative visual impacts
West Elong Elong, Cobbora, Gollan, Goolma and Dunedoo (Refer to Viewpoints 20-26, Technical paper 3)	• Orana wind farm • Sandy Creek solar farm • Cobbora solar farm • Dapper solar farm • Spicers Creek wind farm	<u>During construction</u>: Multiple renewable energy projects are proposed in the rural area west of the Castlereagh Highway, between Tallawang and Spicers Creek. If approved, construction of these projects would be seen sequentially and together with this project in this area, for around 2–3 years. The works at multiple construction sites would be visible, including leveling works, foundation construction and presence of vehicles and machinery travelling along access tracks and construction routes. As this area is fairly remote, the projects would be seen from sections of local roads such Spring Ridge Road and Dapper Road, and from nearby rural properties. The construction activity would extend across a large part of this rural area and detract from the rural amenity and scenic quality, resulting in cumulative visual impacts. <u>During operation</u>: In this area between Tallawang and Spicers Creek, the projects would extend across a large area of undulating rural landscape. The projects would be viewed sequentially and together, from nearby roads such as the Spring Ridge Road and Dapper Road and from rural properties, including dwellings. Due to the scale, proximity and extent of the projects seen from this area, and the contrast to the rural amenity and scenic quality of these views which do not currently contain large scale built features or infrastructure, there would be cumulative visual impacts. There is the potential for views from this transmission project together with the Orana wind farm from about five dwellings , several of these would host this transmission line project and/or this wind farm project. There would also be views of this project together with the Spicers Creek wind farm, Sandy Creek, Cobbora and Dapper solar farms from dwellings in the vicinity of the Elong Elong Energy Hub. Including about 10 dwellings, most of which would also host one of these projects.

Landscape character impacts at night

Table A-10 provides a summary of the potential cumulative landscape character impacts at night, during construction and operation.

Table A-10 Summary of potential cumulative landscape character impacts at night

Location	Identified project	Cumulative visual impacts
Southeast Ulan and Bungaba (For existing conditions at night, refer to Rural valleys and forested hills landscape character types, Section 5.2, Technical paper 3)	• Ulan coal mine Modification 6	<u>During construction:</u> The construction program for the Ulan coal mine Modification 6 may overlap with the construction of this project, however, the majority of the lighting for the proposed mine modification would be located underground, within mine exploration areas. While much of the lighting proposed for this project would be directed towards work areas and compliant with AS4282 (Umwelt, 2022b), there would be some external lighting at surface construction areas (e.g. portals, laydowns, access roads for example), where this lighting may be experienced together with lighting from this transmission project and would result in a cumulative landscape character impact on the Talbragar River rural valley LCZ (RV-3) at night. There would also be potential for the landscape character appreciated in views from private dwellings to be affected. This may include views to construction lighting at this project from nearby private dwellings, including a couple of dwellings to the north of the Ulan coal mine. Overall, there may be a cumulative landscape character impact during construction in the Durridgere, Goulburn River and Munghorn Gap forested hills LCZ (FH-2) at night due to the combined lighting of these projects. <u>During operation:</u> While the majority of the mining activity at Ulan coal mine and associated lighting would be underground, so any lighting would not affect the character of the surrounding landscape, there would be some external lighting provided for the surface infrastructure (e.g. at tunnel portals, and along access roads), that may cause a cumulative landscape character impact during construction on the Talbragar River rural valley LCZ (RV-3) at night. There is the potential for views to operational lighting from a couple of private dwellings to the north of the Ulan coal mine. Overall, this project would, together with the Ulan coal mine Modification 6 project, would increase lighting levels with the surrounding low district brightness landscape of the Narragamba to Blue Springs Undulating rural hills LCZ (URH-1).

Location	Identified project	Cumulative visual impacts
Northeast Cassilis and Turill (For existing conditions at night, refer to undulating rural hills landscape character type, Section 5.2, Technical paper 3)	• Liverpool Range wind farm	<u>During construction:</u> The Liverpool Range wind farm construction program would overlap with the construction of this project for several years, occurring in the vicinity of the Cassilis connection and switching station M1, in the Cassilis to Coolah undulating rural hills LCZ (URH-5). Night lighting is likely to be located at key construction sites such as the construction compounds, laydown and storage areas, compound buildings and facilities, and large equipment such as cranes (Green Bean Design, 2017). There would also be potential for views to construction lighting at these projects from one private dwelling which is associated with the proposed wind farm development, and would also host this transmission line. Overall, there would be the potential for a cumulative landscape character impact on the LCZ (R-5) landscape character zone due to the lighting for construction of these projects. <u>During operation:</u> The Liverpool Range wind farm will include hundreds of turbines, which according to the wind farm EIS is unlikely to require Aviation Hazard Lighting (AHL) mounted on the turbine nacelles (Epuron, 2017). However, there would also be low intensity night lighting at the substations, control and auxiliary buildings associated with this project. In addition to this, there would be some minor lighting as a part of this project at the Cassilis connection and switching station M1 where these projects would be grouped together. There would also be potential for views to the operational lighting of these projects from one private dwelling that is associated with the proposed wind farm development and would host this transmission project. Together these projects would slightly increase the lighting levels within parts of the Cassilis to Coolah undulating rural hills LCZ (URH-5) at night and result in a cumulative landscape character impact.
North Leadville, Coolah and Uarbry (For existing conditions at night, refer to undulating rural hills landscape character type, Section 5.2, Technical paper 3)	• Valley of the Winds wind farm	<u>During construction:</u> If approved, the construction program of the Valley of the Winds wind farm and this project would be likely to overlap for several years in the vicinity of the Coolah and Leadville connections, including at switching stations M2 and M3. Night lighting is likely to be located at construction sites including at the switching stations, collector substations, construction compounds, operation and maintenance buildings and on large equipment such as cranes for the wind farm (Moir Landscape Architecture, 2022). The resulting landscape character change would be mostly due to the construction of the wind farm, with a relatively small contribution by this project. There would also be the potential for construction lighting from these projects to be seen from nearby private dwellings including one which is associated with the proposed wind farm development and would also host this transmission project. Overall, there is the potential for a cumulative landscape character impact in the Uarbry and Tongy undulating rural hills LCZs (URH-3 and URH-4), where the projects overlap during construction. <u>During operation:</u> There would be large areas of the Tongy and Uarbry undulating rural hills LCZs (URH-3 and URH-4) that would accommodate wind turbines and this project's transmission infrastructure. This would include over a hundred wind turbines that would be four times the height of the proposed project transmission line towers, which may require AHL on the nacelle of each wind turbine. There would also be low-level lighting for safety and security on ancillary structures such as the switching stations, collector substations and permanent operations and maintenance buildings for night time maintenance and emergency access. This lighting would be seen in the context of the proposed low-level lighting at switching stations M2 and M3 for this project. There would also be potential for views to operational lighting at these projects from nearby private dwellings including one which is associated with the proposed wind farm development and would also host this project, resulting in a cumulative impact at night. Together there would be additional lighting across the Uarbry and Tongy undulating rural hills LCZs (URH-3 and URH-4) and the potential for a cumulative landscape character impact.

Location	Identified project	Cumulative visual impacts
Central Merotherie, Birriwa, Barneys Reef, Stubbo and Tallawang (For existing conditions at night, refer to undulating rural hills landscape character type, Section 5.2, Technical paper 3)	• Birriwa solar farm • Barneys Reef solar farm • Stubbo solar farm • Tallawang solar farm	<u>During construction</u>: Multiple renewable energy projects are proposed in the area between Gulgong and Dunedoo. This project would extend through or be located adjacent to each of these projects. It is expected that these projects would be mainly constructed during daylight hours if approved. However, there would be some after-hours deliveries and low-level lighting for safety, security and maintenance access at construction compounds and laydown areas, site office and amenities, road works (e.g. Blue Springs Road/Cope Road intersection upgrade at Stubbo solar farm) and turbine sites (for lighting of large equipment such as cranes). There would also be the potential for construction workers accommodation camps, due to the large workforce requirements of these projects. There is the potential for views to construction lighting at this transmission project together with the Birriwa solar farm in the vicinity of the Merotherie Energy Hub from several dwellings, and several dwellings in the vicinity of the Castlereagh Highway that would see this project together with the Barneys Reef wind farm. Overall, there is the potential for a cumulative impact at night on the Narragamba to Blue Springs (URH-1) and Birriwa to Tallawang undulating rural hills LCZs (URH-2) and the Barneys Reef forested hills LCZ (FH-4), due to the temporary increase in lighting for the construction of these projects in combination with this transmission project. <u>During operation</u>: If approved, there would be large areas of the Narragamba to Blue Springs (URH-1) and Birriwa to Tallawang undulating rural hills LCZs (URH-2) that would accommodate solar farm infrastructure. At night this is likely to include low-level lighting for safety and security at ancillary structures such as the switching stations, battery storages and permanent operations and maintenance buildings. The proposed Barneys Reef wind farm may also include night lighting (e.g. at the operation and maintenance buildings, battery storage facilities, substations and AHL on the nacelle of each wind turbine) (Moir Landscape Architecture, 2021). There is the potential for these projects to be located together with the nearby Merotherie Energy Hub and switching stations M6 and M8, within the Barneys Reef forested hills LCZ (FH-4). There is the potential for views from several private dwellings to operational lighting at this transmission project together with the Birriwa solar farm in the vicinity of the Merotherie Energy Hub. Some of these would be associated with the solar farm project or host this transmission project. There would also be views to operational lighting at this project together with the Barneys Reef wind farm from around dwellings six to eight dwellings in the west, in the vicinity of the Castlereagh Highway. Overall, there is the potential for a cumulative impact at night during construction within the Narragamba to Blue Springs (URH-1) and Birriwa to Tallawang undulating rural hills LCZs (URH-2) and the Barneys Reef forested hills LCZ (FH-4), due to these projects in combination with this project.

Location	Identified project	Cumulative visual impacts
West Elong Elong, Cobbora, Gollan, Goolma and Dunedoo (For existing conditions at night, refer to undulating rural hills landscape character type, Section 5.2, Technical paper 3)	• Orana wind farm • Sandy Creek solar farm • Cobbora solar farm • Dapper solar farm • Spicers Creek wind farm	<u>During construction</u>: In the landscapes between Tallawang and Spicers Creek, multiple renewable energy projects are proposed. This transmission project is located in the centre of these renewable energy projects, with the transmission line, switching stations (E1, E2, E3, E4) and Elong Elong Energy Hub extending through or adjacent to each project. These projects would be mainly constructed during daylight hours, if approved. However, there would be low-level lighting for safety, security and maintenance access at key construction sites such as the construction compounds and laydown areas, site office and amenities. There may be after hours deliveries and there would also be the potential for night works associated with the proposed road upgrade works (e.g. at Tuckland Road, Corishs Lane, Brooklyn Road, and Upper Laheys Creek Road for the proposed Orana wind farm) and turbine sites (for lighting of large equipment such as cranes). There would be potential for views to construction lighting at this transmission project together with the Orana wind farm, in the vicinity of switching stations M6 and M7, from about five nearby private dwellings, several of which are associated with the wind farm project and some may host this transmission line project. There would also be views of this transmission project together with the Spicers Creek wind farm, Sandy Creek, Cobbora and Dapper solar farms from dwellings in the vicinity of the Elong Elong Energy Hub, including about ten dwellings, most of which are associated with these proposals and would host the transmission line infrastructure. Overall, there is the potential for a cumulative impact at night during construction within the Dapper and Elong undulating rural hills LCZ (URH-6) and Spring Ridge and Tuckland forested hills LCZ (FH-5), due to these projects in combination with this transmission project. <u>During operation</u>: If approved, large areas of the Dapper and Elong undulating rural hills LCZ (URH-6) and Spring Ridge and Tuckland forested hills LCZ (FH-5) would accommodate energy generating infrastructure that would include lighting at key operational infrastructure such as the operation and maintenance buildings, battery storage facilities, substations, as well as potential for AHL on the nacelle of each some wind turbine. This would include lighting located near the switching stations (E1, E2, E3, E4) and energy hub at Elong Elong, which would also include lighting at night. There would be potential for views from about five nearby private dwellings to both the operational lighting of this transmission project and Orana wind farm in the vicinity of switching stations M6 and M7. Most of these dwellings are associated with the wind farm project or would host this transmission line project. There would also be views of this transmission project together with the Spicers Creek wind farm, Sandy Creek, Cobbora and Dapper solar farms from dwellings in the vicinity of the Elong Elong Energy Hub, from about ten private dwellings. Many of these are associated with these projects or would host this transmission line project. Overall, there is the potential for a cumulative impact at night during operation within the Dapper and Elong undulating rural hills LCZ (URH-6) and Spring Ridge and Tuckland forested hills LCZ (FH-5), due to these projects in combination with this project.

E3.3 Biodiversity

E3.3.1 Methodology

The study area for the biodiversity cumulative impact assessment consists of the combined footprint of the relevant future projects (listed in Table A-3) with the potential for cumulative biodiversity impacts. Public road works have not been included in the assessment as environmental assessment for these works has not yet commenced and sufficient information is not available to assess the potential cumulative biodiversity impacts with this project. .

A detailed, local assessment was carried out that involved:

- reviewing the nature and scale of potential biodiversity impacts, as described in supplied or publicly available planning and biodiversity documents for the relevant future projects within the study area
- quantitatively assessing potential regional cumulative impacts on native vegetation, threatened and migratory species and threatened ecological communities of the relevant future projects in combination with this project, in a tabulated form showing known or estimated impacts for each project and the total cumulative impact
- qualitatively assessing potential regional cumulative impacts on groundwater dependent ecosystems, wildlife connectivity and habitat corridors and protected and sensitive lands by reviewing regional habitat impacts for areas directly impacted by the project.
- recommending mitigation measures as required.

The assessment is limited in the variability of biodiversity assessments for other projects, and assumes the accuracy and reliability of biodiversity provided by these other assessments. It also assumes that cumulative impacts can be predicted for projects that are of a different impact nature.

E3.3.2 Impact assessment

This assessment considers the impacts of this project together with other nearby development projects of a similar nature and scale. Projects considered in this cumulative assessment are identified in Table A-11. All projects have been assessed quantitatively, except for Barneys Reef wind farm, Dapper solar farm, Spicer's Creek wind farm, Orana wind farm and Dubbo firming power station, which were assessed on a qualitative basis, as these projects were still in the scoping phase at the time of EIS preparation.

Table A-11 Relevant future projects considered in the cumulative biodiversity impact assessment

Project	Type of assessment
Related development	
Liverpool Range wind farm	Quantitative
Valley of the Winds wind farm	Quantitative
Barneys Reef wind farm	Qualitative
Birriwa solar farm	Quantitative
Tallawang solar farm	Quantitative
Cobbora solar farm	Quantitative
Sandy Creek solar farm	Quantitative
Dapper solar farm	Qualitative

Project	Type of assessment
Spicers Creek wind farm	Qualitative
Orana wind farm	Qualitative
Proposed projects	
Wellington South BESS	Quantitative
Apsley BESS	Quantitative
Forest Glen solar farm	Quantitative
Dubbo firming power station	Qualitative
Approved projects	
Stubbo solar farm	Quantitative
Bowdens silver mine	Quantitative
Inland Rail (Narromine to Narrabri)	Quantitative
Dunedoo solar farm	Quantitative
Uungula wind farm	Quantitative
Maryvale solar farm	Quantitative
Geurie solar farm	Quantitative
Dubbo solar farm	Quantitative
Gilgandra solar farm	Quantitative
Changes to existing projects	
Moolarben coal mine OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2	Quantitative
Ulan coal mine Modification 6	Quantitative

Cumulative impacts on native vegetation, threatened and migratory species and threatened ecological communities

This section provides an assessment of those projects with potential cumulative native vegetation and threatened species impacts.

Where available, the total impact to native vegetation from each project is provided along with a list of the TECs and threatened species that would be impacted. The total ecosystem credit and species credit requirement for each project is also provided to provide an overview of cumulative offset requirements. A broad approach has been taken due to the variance in impacts between projects and the total native vegetation impact is considered the simplest way to represent impact to threatened species habitats. The species credit requirement provides a surrogate for the level of impact to threatened species.

The results from the review of available information indicate the following:

- the known or estimated cumulative native vegetation impacts equate to 9,859.21 hectares
- the cumulative ecosystem credit requirement equates to 147,215.25 credits
- the cumulative species credit requirement equates to 305,854 credits.

Table A-12 Quantitative cumulative biodiversity assessment

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Related development						
Liverpool Range wind farm	1,790	• White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• White Box - Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland.	• Ausfeld's wattle • *Silky swainson-pea* • Glossy black-cockatoo • Large-eared pied-bat • Square-tailed kite • Squirrel glider • Eastern cave bat	30,101	20,405
Valley of the Winds wind farm	1,340.78	• Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	• Large-eared Pied Bat • Large Bent-winged Bat • Barking Owl • Squirrel Glider • *Acacia ausfeldii* • Bush Stone-curlew • Gang-gang Cockatoo • Glossy Black-Cockatoo • Eastern Pygmy-possum • *Commersonia procumbens* • *Cynanchum elegans*	8,966	19,688

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
				• Pale-headed Snake • Stephens' Banded Snake • Square-tailed Kite • *Monotaxis macrophylla* • Greater Glider • Brush-tailed Rock-wallaby • Koala • *Prasophyllum petilum* • *Prasophyllum sp. Wybong* • Grey-headed Flying-fox • *Tylophora linearis* • Masked Owl • Eastern Cave Bat		
Barneys Reef wind farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	• Not identified in Scoping Report	• Not identified in Scoping Report	• Unknown	Unknown	Unknown

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Birriwa solar farm	368.71	• Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	• Large-eared Pied Bat • Barking Owl • Powerful Owl • Koala • Masked Owl • *Acacia ausfeldii* • Bush-stone Curlew • Glossy Black Cockatoo • Eastern Pygmy Possum • *Dichanthium setosum* • *Diuris tricolor* • *Euphrasia arguta* • White-bellied Sea Eagle • Little Eagle • Major Mitchells Cockatoo • Square-tailed Kite • Squirrel Glider • Brush-tailed Phascogale • Superb Parrot • *Prasophyllum petilum* • *Prasophyllum sp. Wybong* • *Swainsona sericea*	281	350

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Tallawang solar farm	41.89	• White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions • Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions.	• White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands • Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia.	No Species Credit Species recorded	1,124	0
Cobbora solar farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	• Possible: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • Possible: White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions • Possible: Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions	• Possible: Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • Possible: White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	Unknown	Unknown	Unknown

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Sandy Creek solar farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	• Possible: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • Possible: Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions • Possible: White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Possible: Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • Possible: White Box - Yellow Box - Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	Unknown	Unknown	Unknown
Dapper solar farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	• Possible-likely: White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions • Likely: Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions.	• Possible-likely: White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	Unknown	Unknown	Unknown

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Spicers Creek wind farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	• Possible: Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • Possible: White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Possible: Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • Possible: White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	Unknown	Unknown	Unknown
Orana wind farm	Unknown This project is in the 'Prepare EIS' stage; Limited information available	• White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions • Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions.	• White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands • Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia.	Unknown	Unknown	Unknown

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Proposed projects						
Wellington South BESS	Wellington South BESS	• Wellington South BESS	• Wellington South BESS	Wellington South BESS	Wellington South BESS	Wellington South BESS
Apsley BESS	Apsley BESS	• Apsley BESS	• Apsley BESS	Apsley BESS	Apsley BESS	Apsley BESS
Forest Glen solar farm	Forest Glen solar farm	• Forest Glen solar farm	• Forest Glen solar farm	Forest Glen solar farm	Forest Glen solar farm	Forest Glen solar farm
Dubbo firming power station	Dubbo firming power station	• Dubbo firming power station	• Dubbo firming power station	Dubbo firming power station	Dubbo firming power station	Dubbo firming power station
Approved projects						
Stubbo solar farm	Stubbo solar farm	• Stubbo solar farm	• Stubbo solar farm	Stubbo solar farm	Stubbo solar farm	Stubbo solar farm
Bowdens silver mine	Bowdens silver mine	• Bowdens silver mine	• Bowdens silver mine	Bowdens silver mine	Bowdens silver mine	Bowdens silver mine
Inland Rail (Narromine to Narrabri)	Inland Rail (Narromine to Narrabri)	• Inland Rail (Narromine to Narrabri)	• Inland Rail (Narromine to Narrabri)	Inland Rail (Narromine to Narrabri)	Inland Rail (Narromine to Narrabri)	Inland Rail (Narromine to Narrabri)
Dunedoo solar farm	Dunedoo solar farm	• Dunedoo solar farm	• Dunedoo solar farm	Dunedoo solar farm	Dunedoo solar farm	Dunedoo solar farm
Uungula wind farm	Uungula wind farm	• Uungula wind farm	• Uungula wind farm	Uungula wind farm	Uungula wind farm	Uungula wind farm
Maryvale solar farm	Maryvale solar farm	• Maryvale solar farm	• Maryvale solar farm	Maryvale solar farm	Maryvale solar farm	Maryvale solar farm
Geurie solar farm	Geurie solar farm	• Geurie solar farm	• Geurie solar farm	Geurie solar farm	Geurie solar farm	Geurie solar farm
Dubbo solar farm	Dubbo solar farm	• Dubbo solar farm	• Dubbo solar farm	Dubbo solar farm	Dubbo solar farm	Dubbo solar farm
Gilgandra solar farm	Gilgandra solar farm	• Gilgandra solar farm	• Gilgandra solar farm	Gilgandra solar farm	Gilgandra solar farm	Gilgandra solar farm
Wahroonga solar farm	Wahroonga solar farm	• Wahroonga solar farm	• Wahroonga solar farm	Wahroonga solar farm	Wahroonga solar farm	Wahroonga solar farm

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Changes to existing projects						
Moolarben coal mine OC3 Extension and Moolarben Stage 2 - Modification 4 - UG2	624.18	• White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions • Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion Vulnerable Ecological Community.	• White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands • Central Hunter Valley eucalypt forest and woodland.	None	0	0
Ulan coal mine Modification 6	Unknown Environmental Impact Assessment yet to be completed	• Possibly: White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, and Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Possibly: White Box - Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands.	None	0	0
Sub-totals						
Related development, proposed and approved projects	8,805.87	N/A	N/A	N/A	125,651.25	253,689

Project	Known or estimated native vegetation impacts (ha)	TECs impacted		Species Credit Species impacted	Native vegetation offsets (Ecosystem credits) total	Threatened species offsets (Species credits) total
		BC Act	EPBC Act			
Central-West Orana Renewable Energy Zone Transmission project (this project)						
This project	1,053.34	• Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion • Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions • Fuzzy Box Woodland on alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Bioregions • White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions.	• Central Hunter Valley eucalypt forest and woodland • Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia • White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland.	• *Acacia ausfeldii* • *Eucalyptus camaldulensis* - endangered population • *Eucalyptus cannonii* • *Dichanthium setosum* • *Leucochrysum albicans* subsp. *Tricolor* • *Swainsona sericea* (potentially) • Glossy Black-Cockatoo • Little Eagle • Masked Owl • Barking Owl • Squirrel Glider • Large-eared Pied Bat • Large Bent-winged Bat • Eastern Cave Bat.	21,564	52,165
Cumulative biodiversity impacts						
Cumulative totals	9,859.21	N/A	N/A	N/A	147,215.25	305,854

Cumulative impacts on groundwater dependent ecosystems

Table A-13 outlines the potential cumulative impacts to groundwater dependent ecosystems (GDEs). The results from the review of available information indicate the following:

- The Atlas of GDEs (Bureau of Meteorology, 2022a) and relevant water sharing plans for the relevant future projects identifies many potential GDEs in and around these projects.
- Moolarben coal mine OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2, Ulan coal mine Modification 6, Dubbo firming power station, Inland Rail (Narromine to Narrabri), Dunedoo solar farm and Uungula wind farm are the projects that would impact, or potentially impact, GDEs.
- The remaining projects, including this project, are not anticipated to impact groundwater during construction, operation or decommissioning due to the limited amount of subsurface disturbance activities required during the installation and decommissioning of project infrastructure.

This project would not contribute to the cumulative impacts on GDEs.

Table A-13 Potential cumulative impacts of relevant future projects on GDEs

Project	Impacts on groundwater dependent ecosystems
Related development	
Liverpool Range wind farm	No impact on current groundwater levels or groundwater users is expected from the project primarily due to significant elevation differences between existing groundwater and proposed turbines regardless of whether a gravity type or rock anchor type foundation is used.
Valley of the Winds wind farm	Minimal subsurface activities are proposed and will not affect any geological features of significance, groundwater-dependent plant communities and their supporting aquifers.
Barneys Reef wind farm	Impacts on GDEs not yet assessed.
Birriwa solar farm	Due to the nature of the project, the project is not expected to intersect groundwater or impact on GDEs. Therefore, impacts on threatened species and ecological communities because of changes in water quality, water bodies and hydrological processes are not expected during construction or operation.
Tallawang solar farm	The Lachlan Belt Murray-Darling Basin (MDB) aquifer supports a number of identified high priority GDEs and springs. High potential GDEs were identified around 400 m north of the project area (at the Tallawang Creek watercourse) and moderate-low potential GDEs were identified within the project area. Impacts to groundwater resources, including GDEs and bore users, are not expected given the groundwater table is unlikely to be intercepted during project construction. Additionally, given the depth to groundwater within the project area hydrocarbon/chemical spills are unlikely to infiltrate to the groundwater table.
Cobbora solar farm	The project is located in areas identified as 'groundwater vulnerable' on the Warrumbungle and Wellington local environmental plans' (LEPs) Groundwater vulnerability maps. Clause 6.4 of each of the LEPs requires the consent authority to consider the likelihood of groundwater contamination from a development and potential impacts on GDEs prior to determining a development application. Potential impacts to water resources from the project are expected to include demand for water during the construction of the project, as well as for land management during operations. The project is not likely to impact groundwater during construction, operation and decommissioning due to the limited amount of subsurface disturbance activities required during the installation and decommissioning of project infrastructure.
Sandy Creek solar farm	The project is located in areas mapped as 'groundwater vulnerable' on the Warrumbungle and Wellington LEPs. Groundwater vulnerability maps and generally follow Sandy Creek and Lahey's Creek to the east of the project. The project is not likely to impact groundwater during construction or operation due to the limited amount of subsurface disturbance activities and associated shallow depths of construction.

Project	Impacts on groundwater dependent ecosystems
Dapper solar farm	The level of groundwater dependence and potential for interaction for terrestrial Plant Community Types (PCTs) in the project area is high for PCT 202, 281 and 78 and low for PCT 267 and 511. The project is not anticipated to impact groundwater during construction, operation and decommissioning due to the limited amount of subsurface disturbance activities required during the installation and decommissioning of project infrastructure.
Spicers Creek wind farm	The project is not predicted to impact on groundwater resources within the project area and is not expected to have any impacts on GDEs.
Orana wind farm	High, moderate and low potential terrestrial GDEs occur within the wind farm site, with the majority being low potential. Impacts on GDEs have not been assessed yet.
Proposed projects	
Wellington South BESS	Two groundwater systems are present near the project area, a shallow system residing in the shallow colluvium and unconsolidated sediments; and a deeper system associated with the underlying fractured rock. No impacts to groundwater resources are anticipated for the project due to limited ground disturbance and minor licenced groundwater take during construction.
Apsley BESS	The project is located within the “Groundwater vulnerability” area under clause 7.5 of the DLEP 2022. The entirety of the site is mapped as being moderately high groundwater vulnerability. The project is well separated from sensitive environments and would not lead to unacceptable impacts to groundwater.
Forest Glen solar farm	Low to moderate terrestrial GDE’s occur within and surrounding the project area. No aquatic GDE’s have been mapped onsite or surrounding the project area. No groundwater is anticipated to be intercepted, and no groundwater would be extracted. The maximum depth of infrastructure would be pile driven or screwed mounting structures up to a depth of 2 – 3 m. Impacts to groundwater are considered unlikely to occur. Groundwater supplies would not be affected, as such, impacts to terrestrial and aquatic GDE’s that are known to occur within the project area would not occur as a result of impact to groundwater supplies. No groundwater is anticipated to be intercepted and no groundwater would be extracted.
Dubbo firming power station	The confluence point of the Macquarie River and Talbragar River is around 3 km northwest from site. These rivers are known to contain water dependent riparian vegetation and GDEs. Potential impacts include: • potential for localised dewatering during construction • impacts on groundwater quality due to inadequate storage or handling of hazardous fuels, chemicals, wastes or other contaminants • localised surface water interference, displacement caused by new buildings, altered drainage water flows and compaction • altered groundwater flow regime to the Macquarie River and Talbragar River riparian corridors.
Approved projects	
Stubbo solar farm	The project is not anticipated to have material groundwater interaction and no changes to groundwater infiltration or extraction are proposed. The deepest infrastructure to be installed would be the steel piles, to a depth of between 1.5 m to 2.4 m below ground level.
Bowdens silver mine	No impacts predicted on high priority GDEs. The terrestrial vegetation present in the vicinity of the expected drawdown is not likely to be groundwater dependent. Where the vegetation does draw on groundwater it is most likely rainfall infiltration that has seeped into the capillary zone, has reached the soil-rock interface or is stored in perched aquifers. It is considered unlikely that terrestrial vegetation would be impacted by predicted drawdown within the regional groundwater table.

Project	Impacts on groundwater dependent ecosystems
Inland Rail (Narromine to Narrabri)	The water sharing plans that apply to the project map areas of high-priority GDEs. These are located at the Macquarie River, Castlereagh River, Gulargambone Creek, Baradine Creek, Etoo Creek, Rocky Creek, Goona Creek, Bohena Creek and its tributary, Namoi River, and Narrabri Creek. The project traverses these areas. There are 10 mapped high-priority GDE springs within the study area. There would be limited impacts on GDEs given the comparatively small area of GDE vegetation impacted. Additionally, the small footprint of piers required to construct bridges, and the retention of riparian vegetation under the bridges, would further reduce the potential for impacts.
Dunedoo solar farm	There are no listed aquatic or terrestrial GDEs within the project area. Water during construction would require around 41,760 kilolitres (kl) to potentially be sourced, depending on availability, from a new bore within the project area, purchased from Warrumbungle Shire Council locally to the site or transported from another township. Considering the relatively shallow depth of local groundwater, local groundwater resources could be impacted by excavation at depth. Minimal excavation is proposed for slab footings (up to 2.4 metres) and would avoid physical impacts to the groundwater resource. Similarity, contamination of groundwater would be highly unlikely given that chemicals and fuels would be appropriately stored, and spills procedures would be implemented. As the project's construction demand for groundwater resources is limited in duration (10 months) and the proportion of water-use relative to agriculture and farming water demand is minimal (<2 %), the risks of impacts on GDEs are considered very low. Additionally, it is noted that there are currently no high-priority GDEs as listed on Schedule 6 of the Water Sharing Plan for the Macquarie Bogan Unregulated and Alluvial Water.
Uungula wind farm	The Wellington LEP identifies parts of the project area to contain vulnerable groundwater resources that are at risk from depletion and contamination as a result of development. Base-flow dependent aquatic GDEs may be present in these areas. Areas across the region where groundwaters are fresh and shallow, deep-rooted terrestrial vegetation GDEs may be supported. The relatively high salinities in local groundwaters, however, and generally deeper (greater than 10 m) water tables in the fractured rock aquifers, suggests it is unlikely that terrestrial vegetation is being supported by groundwater. Shallow water tables in the alluvial aquifers suggest that vegetation along river courses may at least have an opportunistic dependence on groundwater.
Maryvale solar farm	The project is located in an area identified as containing GDEs, however no remnant woodland or GDEs are located within the project area. The project is not expected to have any impacts on GDEs.
Geurie solar farm	The project is not expected to have any impacts on GDEs.
Dubbo solar farm	The project is not expected to have any impacts on GDEs.
Gilgandra solar farm	Native vegetation along the Newell Highway is mapped as vegetation that has high potential for being reliant on subsurface groundwater. No creeks in the immediate area are mapped as being reliant on the surface expression of groundwater. Construction of the project is unlikely to impact adjoining GDEs. No substantial earthworks would be conducted. As noted above, minor drainage lines and associated damp soaks would likely remain on site, allowing drainage of water from the site into adjacent areas. As such, there is unlikely to be any impact on GDEs in adjacent areas.
Wahroonga solar farm	The project is not expected to have any impacts on GDEs.

Project	Impacts on groundwater dependent ecosystems
Changes to existing projects	
Moolarben coal mine OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2	The Drip and other similar seepage zones along Goulburn River will not be affected by either subsidence or mine dewatering associated with the Moolarben coal mine project. It is possible that surface cracking could impact on any seepages that may be present above the longwalls, within the area of potential subsidence impact, i.e. within the area defined by the appropriate angle of draw. Only one seepage derived from the Triassic aquifer system is expected to be possibly affected by the proposal. For Moolarben coal mine OC3 Extension, the project is unlikely to impact on water-dependent assets in the Munghorn Gap Nature Reserve (including vegetation mapped as high-priority GDEs) as these are not connected to the regional groundwater system. The Groundwater Assessment for the project concludes there would be no deterioration in groundwater quality as a result of mining, including in the long term.
Ulan coal mine Modification 6	The Drip is recognised as an important natural feature located east of Underground 3 which sustains groundwater dependent ecosystems. Depressurisation of the Triassic strata in the area of the Drip has already occurred as a result of historical mining operations at Ulan and no impact on the perched groundwater system have been observed to date. No further impacts were expected to be likely as a result of future Ulan coal mine operations as they were moving north, away from the Drip. There was the potential for impacts to unidentified local spring systems where present within the subsidence footprint if subsurface cracking was to occur in proximity to these features.
Central-West Orana REZ Transmission project	
Central-West Orana REZ Transmission project (this project)	Impacts to groundwater associated with the project include the construction of concrete pilings, energy hubs and switching stations and blasting. These potential impacts on groundwater and subsequent GDEs is considered very low and restricted to direct impact areas. In terms of impacts, concrete pilings may intercept the local water table where the water table is close to surface. During construction concrete would be poured into the excavated pile, and water removed from the pile as it is displaced by the concrete. There is no permanent take of water, and therefore, there is no permanent change to groundwater levels and associated sensitive receivers, during the project construction or operation. Energy hubs and switching station construction are considered unlikely to lead to groundwater level decline at surrounding sensitive receivers because of any hillside excavation. If shallow groundwater is encountered, it is likely to be perched, non-permanent and localised (that is, not connected regionally). Therefore, there would be very limited to no groundwater inflow to the hillslope cuttings and no change in groundwater levels at nearby receivers. Blasting may be required for construction of some transmission line towers and for the establishment of energy hubs and switching stations in areas of shallow hard rock. The associated blasting halo is expected to be minor and not extend more than 10 metres from the origin of the blast(s), and not result in any take of groundwater, it is unlikely to result in an impact to the groundwater environment within the proposed development or adjacent sensitive receivers. None of the structures or construction activities would result in any permanent groundwater take that would alter the groundwater flow outside of the direct impact areas. Given this, native vegetation assessment under the Biodiversity Assessment Method (BAM) (refer to Technical Paper 4) is considered adequate to address the direct impacts on terrestrial GDE native vegetation and the proposed development is considered unlikely to result in any indirect additional impact on GDEs.

Cumulative impacts on wildlife connectivity and habitat corridors

Table A-14 outlines the potential cumulative impacts to wildlife connectivity and habitat corridors. The results from the review of available information indicate the following:

- many of the projects occur on land where the connectivity of native vegetation and habitat corridors has been previously compromised by clearing for agricultural land uses. This is particularly evident for the solar farms which are built in, or proposed to be built in, paddocks
- the wind farm projects would result in some interruption of aerial habitat through the introduction of potential turbine strike and barotrauma
- the projects are likely to result in short term impacts resulting in species relocating outside of the development footprints. Once construction is completed, species are expected to move back into habitats adjacent to the relevant project. Long term impacts could include permanent breaks in connectivity due to installation of fence lines and access roads across large intact blocks of habitat
- the projects are likely to reduce the integrity of current corridors and connectivity.

This project would contribute to the cumulative impacts to wildlife connectivity and habitat corridors and would potentially have one of the largest impacts to connectivity. This is due to this project bisecting large areas of native vegetation associated with Durridgere State Conservation Area (SCA) east of Ulan Road and vegetation to the north of Tuckland State Forest. It should however be noted that the project traverses a relatively disturbed landscape that contains cleared paddocks, three working coal mines and existing power lines that cut through areas of vegetation. Functional connectivity for bird and bat species remains despite these developments having occurred and it is likely that a similar level of functional habitat connectivity would remain after the project is built.

This project would result in a highly permeable structure for biodiversity and connectivity is expected to remain largely unaffected for all species. The impacts to connectivity area expected to be permanent, though minor. They are likely to reduce over time as biodiversity acclimatises to the presence of the towers and powerlines. The consequence of the impacts would be minor and non-significant as a result of the design development process.

Table A-14 Potential impacts of key relevant future projects on wildlife connectivity and habitat corridors

Project	Impacts on wildlife connectivity and habitat corridors
Liverpool Range wind farm	The project area is located in a region of NSW that has been extensively modified and disturbed as a result of a long history of agricultural land uses. Specifically, the project area is comprised of agricultural landscapes on the valley floors and low slopes, with substantial areas of intact vegetation associated with the network of public reserves, upper slopes and ridgetops. Much of the project area occur where the connectivity of native vegetation and habitat corridors has been previously compromised by historical agricultural land uses. However, there are specific locations within the project area where substantial areas of intact native vegetation and associated fauna habitat is recognised to occur. This occurs primarily to the north (private land) and east (Coolah Tops National Park) of the project area; and north, east (Durridgere SCA, State Forest land, National Park Land – The Drip, Goulburn River National Park) and west of the external transmission line site. It is considered likely that the project could potentially interrupt the connectivity of threated species, but not threatened ecological communities. Of the interruptions to habitat connectivity listed above, those associated with the external transmission line, south of the Golden Highway, are considered to be most substantial. It is in this location of the project area where the project impacts on large intact patches of high quality vegetation. This includes publicly owned reserves as well as land in private ownership. This vegetation provides important habitat connection across the landscape for a range of fauna species and also the passive movement of flora species. The 220 wind turbines proposed as part of the project will introduce an interruption of aerial habitat through the introduction of potential turbine strike and barotrauma (rapid or excessive air-pressure change near moving turbine blades that result in haemorrhaging of the lungs).

Project	Impacts on wildlife connectivity and habitat corridors
Valley of the Winds wind farm	Areas of connectivity were identified throughout the project biodiversity study area. Threatened species likely to use these areas of habitat connectivity include Barking Owl, Masked Owl, Squirrel Glider, Dusky Woodswallow, Speckled Warbler and Grey-crowned Babbler (Eastern subspecies). All of these species are highly mobile and will be unaffected by the project. The only species that will be subject to measurable disruption of connectivity will be Squirrel Glider along the southern portion of the transmission line route, where there will be a loss of connectivity between two large patches of burned forest. The remaining two portions of this forest however are both of sufficient size to allow the species to persist.
Barneys Reef wind farm	Impacts to habitat connectivity not yet assessed. Project is in the 'Prepare EIS' stage so there is limited information available.
Birriwa solar farm	The locality of the project is considered highly fragmented with native vegetation often occurring in isolated patches surrounded by a matrix of agricultural land. A vegetated road corridor provides connectivity along the western extent of the subject land to the ridgeline to the south. Ecosystem and species credit species predicted to occur in the subject land predominantly comprise highly mobile birds and mammals, and therefore most species will not be impacted by fragmentation. The road corridor is known to provide habitat for Koalas, however, fragmentation is unlikely to occur due to the nature of the project.
Tallawang solar farm	The project area is not an important link for any fauna movement and has not been identified in connectivity mapping. The project area is also not identified within a Priority Investment Area (areas of high environmental value, including core areas of remnant vegetation) and is not identified as an important flyway for migratory species.
Cobbora solar farm	Impacts to habitat connectivity not yet assessed. Project is in the 'Prepare EIS' stage so there is limited information available.
Sandy Creek solar farm	Impacts to habitat connectivity not yet assessed. Project is in the 'Prepare EIS' stage so there is limited information available.
Dapper solar farm	There are no formal biodiversity corridors within the project area. Vegetative connectivity to reserves and larger areas of habitat is fragmented, with about 500–800 m distances across cleared agricultural lands. Patches of woodland vegetation in the project area can provide habitat and refuge (stepping stones between larger patches of woodland) for several native fauna species (birds, microbats, and large macropods). The creek lines and riparian vegetation also provide important linkages for wildlife movement, aquatic species and a water resource.
Spicers Creek wind farm	The project area consists of an agricultural landscape, predominantly comprised of grazed grasslands with remnant trees and forested patches and bordered in the southeast by Dapper Nature Reserve. Patches of retained forest and woodland vegetation is present, typically in areas surrounding watercourses and on steeper or rocky less fertile habitats. While the project area occurs in a disturbed agricultural landscape a number of habitat corridors occur across the landscape, varying in quality and width. These corridors provide a linkage of habitat from the project area north to Goonoo SCA and Goonoo National Park, Yarrobil National Park to the east, as well as various other conserved land.
Orana wind farm	Impacts to habitat connectivity not yet assessed in detail. Project is in the 'Prepare EIS' stage so there is limited information available in the Preliminary Biodiversity Assessment Report for the project.
Proposed projects	
Wellington South BESS	Native vegetation and fauna habitats are highly fragmented in the project area. Ecosystem and species credit species predicted to occur in the project area predominantly comprise highly mobile birds and mammals, and therefore most species will not be impacted by fragmentation. For the less mobile Key's Matchstick Grasshopper, abundant suitable habitat is available within the locality. The design of the subject land results in minimal fragmentation and no isolation as surrounding suitable habitat remains connected.
Apsley BESS	No impacts on wildlife connectivity and habitat corridors.

Project	Impacts on wildlife connectivity and habitat corridors
Forest Glen solar farm	No state or regionally significant biodiversity links occur within the project area or within the 1,500 m assessment area. Roadside vegetation in the northern section of the project area provides some connectivity through continuous canopy cover. The majority of the project area is situated within unregulated Category 1 Land (255 ha). However, the installation of fencing, road construction and infrastructural development will have some impacts on connectivity. The species most likely impacted by changes to connectivity are those reliant on moving large distances such as Koala, should this species be present within the greater area surrounding the project area. Short term impacts will result in species requiring relocating outside of the project area, while long term impacts could include permanent breaks in connectivity due to installation of fence lines and access roads. The loss of these areas is unlikely to have an impact that could cause a decline in a threatened species, with a modification of their behaviour over time to move within the existing and retained bushland more likely.
Dubbo firming power station	Impacts to habitat connectivity not yet assessed. Project is in the 'Prepare EIS' stage so there is limited information available.
Approved projects	
Stubbo solar farm	Woodlands within the project area generally have poor connectivity as they are present as isolated paddock trees or small patches. Habitat corridors are present at the periphery of the project area along public road reserves.
Bowdens silver mine	The project would result in some loss of connectivity and habitat fragmentation. However, the project is located at the southern extent of a large expanse of native vegetation to the north, which then opens onto an existing fragmented landscape with irregular patches of vegetation. While some level of connectivity would be lost and levels of habitat fragmentation would increase, the landscape would still retain features suitable for landscape connectivity.
Inland Rail (Narromine to Narrabri)	The project would be located in a highly fragmented, rural landscape for much of the alignment. Fragmentation of native vegetation and associated fauna habitats in the locality has previously occurred through clearing for agriculture, residences and farm buildings, and construction of linear infrastructure (such as transmission lines and roads). These land uses have created barriers to movement for some fauna species, particularly those that are limited by dispersal abilities and habitat preferences. More mobile species, such as birds and bats, can readily traverse this landscape. The project would exacerbate fragmentation in these areas. There is the potential for impacts on fauna connectivity, particularly in the Pilliga forests.
Dunedoo solar farm	The landscape within the project area has been heavily cleared and lacks significant connectivity. However, remnant vegetation does occur in small isolated patches within the farmed landscape. The main source of connectivity throughout the broader region surrounding the project occurs along the watercourse to the south of the project area, Talbragar River, which supplies permanent to semi-permanent water, contains a predominately native understorey and is lined with sparsely distributed *Eucalyptus* and *Casuarina* species.
Uungula wind farm	The project area generally follows ridgelines and will not impact connectivity between the more vegetated valleys. Riparian vegetation is lacking or degraded within the project area and will not be subject to any further disconnection. Establishment of vegetated riparian zones will enhance connectivity in the project area.
Maryvale solar farm	No vegetation corridors exist within the project area or immediate surrounds.
Geurie solar farm	No impacts on wildlife connectivity and habitat corridors.
Dubbo solar farm	No impacts on wildlife connectivity and habitat corridors.
Gilgandra solar farm	The project would not affect any State or regional biodiversity links. A corridor of native vegetation is present along the Newell Highway east of the project, which is up to 300 m wide. The project would not affect this link.
Wahroonga solar farm	No impacts on wildlife connectivity and habitat corridors.

Project	Impacts on wildlife connectivity and habitat corridors
Changes to existing projects	
Moolarben coal mine OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2	Habitats are mostly fragmented by past clearing events for agriculture. In the short to medium term further fragmentation is expected. Habitats would be fragmented by clearing for mining. The project area is partially surrounded by the Munghorn Gap Nature Reserve to the east and south which provides habitat connectivity for species to the broader region. Species habitat within the project indicative surface disturbance extent has been previously cleared and is highly fragmented, with only small patches of woodland remaining. The remaining fragmented riparian vegetation along Moolarben Creek and Murdering Creek provides for partial connectivity throughout the project area. Forest and woodland on the steep slopes, rises and ridges surrounding the project indicative surface disturbance extent are well-connected with surrounding habitats, including the adjacent Munghorn Gap Nature Reserve. All threatened species and communities known to occur in the area are likely to benefit from this habitat connectivity outside of the project area. Sufficient habitat connectivity would remain around and through the project indicative surface disturbance extent (e.g. due to the distance from Moolarben Creek and Murdering Creek and other habitat avoidance measures) such that no threatened species are likely to become isolated as a result of the project. The project is not likely to impact well-defined movement patterns for any particular threatened species.
Ulan coal mine Modification 6	The vegetation of the project area has strong connectivity to nearby conservation areas including Goulburn River SCA, Goulburn River National Park, Durridgere SCA and Cope State Forest. The extent of vegetation removal from within the project area is not considered likely to reduce the integrity of current corridors and connectivity.
Central-West Orana REZ Transmission project	
Central-West Orana REZ Transmission project	The project is likely to have impacts on habitat connectivity where the alignment bisects vegetation associated with Durridgere SCA east of Ulan Road. Fragmentation impacts to Squirrel Glider habitat may occur where the alignment bisects this vegetation. The project is likely to have impacts on habitat connectivity where the alignment bisects vegetation to the north of Tuckland State Forest. Habitat fragmentation impacts may also be associated with any vegetation removal associated with the Spring Ridge Road corridor and nearby riparian corridor. A number of threatened species were recorded and have habitat along these corridors including threatened woodland birds and Squirrel Glider. The project is also likely to have impacts on habitat connectivity where the project runs between vegetation in Goulburn River National Park and Cope State Forest. The alignment also runs between larger patches of woodland in the locality including Goulburn River National Park and Munghorn Gap Nature Reserve. Threatened bat species and threatened woodland birds that occur within this area have potential to be impacted by further habitat fragmentation. It should however be noted that the project traverses a relatively disturbed landscape that contains three working coal mines and existing powerlines that cut through areas of vegetation. Functional connectivity for bird and bat species remains despite these development having occurred and it is likely that a similar level of functional habitat connectivity would remain after the project is built. The project would result in a highly permeable structure for biodiversity and connectivity is expected to remain largely unaffected for all species. The impacts to connectivity area expected to be permanent, though minor. They are likely to reduce over time as biodiversity acclimatises to the presence of the towers and powerlines. The consequence of the impacts would be minor and non-significant as a result of the design development process.

Cumulative impacts on protected lands

Protected areas are set aside for conservation and managed by the NSW National Parks and Wildlife Service, and include areas such as national parks, nature reserves, regional parks and SCAs. Table A-15 outlines the cumulative impacts to protected and sensitive lands. The results from the review of available information indicate the following:

- most of the projects do not occur within or adjacent to protected lands
- project designs have been altered to avoid impacts on protected lands where possible (e.g. Liverpool Range wind farm being designed to locate wind turbines away from Coolah Tops National Park but the associated external transmission line would impact Durridgere SCA).
- projects are located next to protected lands, including Liverpool Range wind farm (located next to and within the Durridgere SCA), Spicers Creek wind farm (located next to the Dapper Nature Reserve), Orana wind farm (located next to Goodiman SCA and Tuckland State Forest) and Moolarben coal mine OC3 Extension and Stage 2 – Modification 4 – UG2 (located next to Munghorn Gap Nature Reserve).

This project would directly impact the Durridgere SCA, and would contribute to cumulative impacts to protected lands (however, the transmission alignment through the SCA, if Tilt Renewables is successful in the Consumer Trustee's access right tender process, would negate the need for a longer section of alignment through the SCA associated with the approved Liverpool Range wind farm, with an overall net reduction in impacts to biodiversity values and area of disturbance in the SCA).

Table A-15 Potential impacts of relevant future projects on protected lands

Project	Impacts on protected lands
Liverpool Range wind farm	The proponent altered the proposed location of several wind turbines to increase their distance from Coolah Tops National Park as well as other large patches of woodland and forests outside of the National Park. This recommendation and design change was a direct measure to avoid impacting habitat connectivity and proximity to high conservation value areas. The external transmission line would however impact Durridgere SCA (note that this transmission line would be shared with this project and only one transmission line would be constructed through Durridgere SCA. This is discussed further in Section 2.9 of the EIS).
Valley of the Winds wind farm	No impacts on protected lands.
Barneys Reef wind farm	No impacts on protected lands.
Birriwa solar farm	No impacts on protected lands.
Tallawang solar farm	No impacts on protected lands.
Cobbora solar farm	The nearest national parks to the project site area are the Goulburn River National Park, around 50 km to the east, and the Yarrobil National Park, around 15 km to the southeast. Other areas of environmental conservation in the vicinity of the project area include the Dapper Nature Reserve, Goodiman and Goonoo SCA areas. No impacts on protected lands.
Sandy Creek solar farm	The nearest national parks to the project area are the Goulburn River National Park, around 115 km to the southeast, and the Yarrobil National Park, around 17 km to the southwest. The Goonoo SCA is located around 27 km to the west of the project; Goodiman SCA is located around 10 km east; Yarrobil National Park is around 13 km southeast; and Dapper Nature Reserve is around 7 km to the south. No impacts on protected lands.
Dapper solar farm	There are several reserves and woodland areas within 10 km of the project area, including Dapper Nature Reserve about 3 km to the south, Yarrobil National Park about 9 km to the southeast, and Tuckland State Forest about 8 km to the northeast. No impacts on protected lands.

Project	Impacts on protected lands
Spicers Creek wind farm	The project would have direct impacts on protected lands. Due to the project being located adjacent to the Dapper Nature Reserve, an assessment considering the guidelines for Development adjacent to National Parks and Wildlife Service land (NPWS, 2020) and how they relate to the project has been undertaken covering a wide range of potential impacts.
Orana wind farm	Within the locality, the following conservation areas have been identified: Goodiman SCA, Yarrobil National Park and Tuckland State Forest. No direct impacts on protected lands. The project is directly adjacent to Goodiman SCA and Tuckland State Forest.
Proposed projects	
Wellington South BESS	No impacts on protected lands.
Apsley BESS	No impacts on protected lands.
Forest Glen solar farm	The project is located around 3 km northwest of the Sappa Bulga National Park. No impacts on protected lands.
Dubbo firming power station	No impacts on protected lands.
Approved projects	
Stubbo solar farm	No impacts on protected lands.
Bowdens silver mine	No impacts on protected lands.
Inland Rail (Narromine to Narrabri)	The project would not impact any SCAs, reserves or national parks. The project would impact a number of forestry management zones set aside for the protection of specific flora and fauna habitats. These include: • Forestry management zone (FMZ) 1 — flora reserve broomplain. Management of this zone is aimed at preserving the flora and fauna in a natural and undisturbed condition. • FMZ 3A — special value fauna broom/bloodwood. This zone is managed to protect habitat for the Pilliga mouse. • FMZ 3A — special value fauna wattle. This zone is managed to provide areas of structural diversity (mid storey). • FMZ 3B — grassy box woodland. This zone is managed to encourage the same species that are often associated with Inland Grey Box and Box Gum Woodland threatened ecological communities. • FMZ 3B — general habitat mosaic. This zone is managed to protect large-crowned trees which provide areas of structural diversity (overstorey).
Dunedoo solar farm	No impacts on protected lands.
Uungula wind farm	There are 3 State Forests, 2 Nature Reserves, 2 National Parks and 1 Water Supply Reserve within a 30 km radius of the project. An additional three unnamed reserves have been mapped by Geoscience Australia to the north of the project. No impacts on protected lands.
Maryvale solar farm	No impacts on protected lands.
Geurie solar farm	No impacts on protected lands.
Dubbo solar farm	No impacts on protected lands.
Gilgandra solar farm	No impacts on protected lands.
Wahroonga solar farm	No impacts on protected lands.

Project	Impacts on protected lands
Changes to existing projects	
Moolarben coal mine OC3 Extension and Stage 2 – Modification 4 – UG2	The Goulburn River National Park, located around 5 km northeast of the project. The Goulburn River National Park would not be impacted by the project. Portions of the Munghorn Gap Nature Reserve are located directly adjacent to the project area to the east, south and southwest. No impacts on protected lands.
Ulan coal mine Modification 6	There are three large conservation areas within relatively close proximity to the project area: • Durridgere SCA, around 8 km to the east • Goulburn River National Park, around 14 km to the southeast. • Munghorn Gap Nature Reserve, approximately 21 km to the southeast. • Wollemi National Park, around 50 km to the southeast. No impacts on protected lands.
Central-West Orana REZ Transmission project (this project)	
Central-West Orana REZ Transmission project (this project)	The project directly impacts the Durridgere SCA. The Goulburn River National Park, Tuckland State Forest and Cope State Forest are located directly adjacent to the project, but there would be no direct impacts to these areas.

Summary

The assessment of cumulative impacts, the incremental effect of multiple sources of impact (past, present and future), provides an opportunity to consider this project within a strategic context. The accumulating impacts of multiple projects (including the mining and renewable energy projects considered in this assessment), continuing agricultural activities, and development and maintenance of infrastructure will likely result in continued loss of biodiversity.

Taking into account the cumulative vegetation removal impacts of the relevant future projects considered in this cumulative assessment, an estimated 8,805.87 hectares of remnant vegetation would be removed. Six of these projects are in the early planning stages and the likely impacts of these projects are currently unknown, but biodiversity impacts from all of these projects can be expected. Taking into consideration the impacts from this project, together with the impacts from the relevant future projects considered in this cumulative assessment, the direct impacts to native vegetation are estimated at 9,859.21 hectares.

Table A-16 Summary of the cumulative biodiversity impact assessment

Project	Known or estimated native vegetation impacts (ha)	Native vegetation offsets (Ecosystem credits)	Threatened species offsets (Species credits)
Related development, proposed and approved projects and changes to existing projects	8,805.87	125,651.25	253,689
Central-West Orana Renewable Energy Zone Transmission project	1,053.34	21,564	52,165
Cumulative totals	**9,859.21**	**147,215.25**	**305,854**

This project would not contribute to the cumulative impacts on GDEs.

This project would contribute to the cumulative impacts to wildlife connectivity and habitat corridors and would potentially have one of the largest impacts to connectivity of the projects considered. This is due to this project bisecting large areas of native vegetation associated with Durridgere SCA east of Ulan Road and vegetation to the north of Tuckland State Forest. The project would however result in a highly permeable structure for biodiversity and functional connectivity is expected to remain largely unaffected for all species despite physical connectivity being affected.

This project would contribute to the cumulative impacts to protected lands, as it would directly impact the Durridgere SCA.

E3.4 Aboriginal heritage

E3.4.1 Methodology

The study area for the Aboriginal heritage cumulative impact assessment consists of the combined footprint of the relevant future projects (listed in Table A-3) with the potential for cumulative Aboriginal heritage impacts.

A detailed assessment was carried out that involved:

- reviewing the potential and actual Aboriginal heritage impacts as described in publicly available planning documents for the relevant future projects. Public road works have not been included in the assessment as environmental assessment for these works has not yet commenced. Given the presence of cultural materials in all environments, the focus would be to identify moderate and high significant sites and places, especially those that may be rare in the region, that may be adversely affected by these projects, and which may contribute to cumulative loss. To date, these would likely include grinding grooves, rockshelters, and culturally modified trees, which are all typically referenced as rare and/or important
- a comparison of the regional information would be undertaken against the cultural materials identified within the construction area to identify those that may be of regional importance and contribute to cumulative loss if adversely affected
- using the comparative information, determine whether the potential impacts to cultural materials would result in a cumulative loss to the Aboriginal record of the region. The focus would be on significant and/or rare sites, rather than the broader (typically stone artefactual) cultural materials that are found across the construction area and surrounds
- recommending mitigation measures as required.

No regional models or cumulative impact frameworks exist for the study area, or broader region, which limits the ability to frame the broader context for this assessment and quantitatively assess the cumulative loss in registered Aboriginal heritage sites.

E3.4.2 Impact assessment

A wide range of site types are found in the study area and broader region. These are typically dominated by small low density stone artefact scatters often distributed along major waterways. These are indicative of a lengthy and repeated use of these environments by Aboriginal people in the past. There is frequent reference to sites typically considered of high significance, including rockshelters, grinding grooves and culturally modified trees. Increasingly rare within the cultural assemblage are ritual and/or spiritual sites, such as bora grounds and Dreaming tracks.

It is expected that the greatest impacts to Aboriginal heritage in the region are associated with mining projects (refer to Table A-17). Impacts from mining are substantial in nature and have included impacts to all recorded site types with several highly significant sites also being impacted. These have included rock shelters, ochre quarries, and high-density stone artefact scatters, all of which are typically identified of moderate or high significance based on criteria identified in relevant assessment guidance. In contrast, renewable energy projects have had lesser impacts, and generally avoid areas of greatest sensitivity to generally impact on sites of lower significance such as isolated finds or low/moderate density stone artefact scatters. In many instances, these projects are yet to be implemented or constructed, and as such cumulative impact from these projects is limited to date.

The Aboriginal cultural heritage assessment (ACHA) completed for this project (Technical paper 5) identified 183 Aboriginal sites, places and/or deposits within the construction area. As a result of these findings, and re-designs to this project, some 55 per cent of these sites have been excluded from the construction area and potential impacts. This includes two of the most significant sites identified in the ACHA, namely significant grinding groove complexes at Prospect Creek and Talbragar River, and several areas of cultural importance as provided by the Aboriginal participants.

Of the 46 discrete Aboriginal sites, places and/or deposits remaining within the construction area, 37 would be potentially subject to direct impacts resulting in their complete loss. These are dominated by subsurface moderate and high density artefact sites in close proximity to some creek corridors (including Laheys Creek, Sandy Creek, Tallawang Creek and Wilpinjong Creek), rockshelters, grinding grooves and culturally modified trees – all only tentatively classified. The project would also directly impact about 100 hectares of creek banks identified as having sub surface potential. A low-density stone artefact background scatter is considered present across the entire construction area and would also be adversely affected where disturbed.

Nine Aboriginal sites can be avoided, and includes several high value grinding groove sites at the Merotherie Energy Hub, and a significant artefact site with associated grinding groves at the Neeleys Lane workforce accommodation camp. These sites may be indirectly impacted by visual impacts, potentially resulting in partial loss of value, due to their proximity to the project infrastructure. In addition, EnergyCo is continuing to explore the potential avoidance of other sites of high and moderate significance within the construction area, especially within the energy hub and switching station sites, construction compounds and workforce accommodation camps.

It is expected that all eight rockshelters, the remaining two grinding groove sites, a culturally modified tree and two high density artefact scatters of the directly impacted sites would be either avoided or minimally affected by this project during continued development of the project design.

This project, in combination with the relevant future projects, would result in cumulative impacts to cultural materials of the study area and broader region, with direct impacts to between five and 16 per cent of the Aboriginal site types identified within the construction area for this project, including rockshelters, grinding grooves, culturally modified trees and moderate or high significant stone artefact deposits. EnergyCo is continuing to explore the potential avoidance of sites of high and moderate significance within the construction area. This project, in combination with the relevant future projects would also result in the protection of numerous cultural heritage sites avoided through design and construction refinement.

No cumulative impacts are expected on Aboriginal heritage as a result of the operation of this project in combination with the relevant future projects.

While this project and the relevant future projects would result in some loss of cultural materials, it is acknowledged that increasingly, engagement on cultural heritage is seeking to move beyond the material to a more holistic consideration of heritage. The investigations for this project and relevant future projects have significantly improved our archaeological and scientific understanding of a previously poorly understood areas. The information obtained through each project's ACHA will be provided to proponents of other renewable energy generation projects and thereby assist in identifying key sites of local and regional value for a more holistic approach to the conservation of cultural materials across the REZ. Further potential cumulative Aboriginal heritage benefits include opportunities for Aboriginal heritage interpretation and engagement with Aboriginal communities during project assessment and development.

Table A-17 Potential cumulative Aboriginal heritage impacts of relevant future projects during construction

Project	Type of assessment	Distance from project	Aboriginal heritage identified	Significance	Aboriginal heritage to be impacted and/or protected
Related development					
Liverpool Range wind farm	Qualitative: ACHA – archaeological survey	Direct overlap	19 Aboriginal sites comprising isolated or low density stone artefacts (<3 artefacts), moderate density stone artefact scatters (10 — 30 artefacts), a small rock shelter with Potential Archaeological Deposit (PAD), grinding grooves and PADs.	2 sites of moderate significance (grinding grooves and stone artefacts adjacent to creek) all other sites are of low significance.	Potential impact to 16 sites (isolated artefacts to moderate density artefact scatters). Protection of grinding groove sites and rock shelter.
Valley of the Winds wind farm	Qualitative: ACHA – archaeological survey	Direct overlap	7 Aboriginal sites comprising: isolated artefacts, stone artefact scatters, stone artefact scatters with PAD, stone quarry, grinding grooves/waterhole/stone arrangement.	Low significance was allocated to stone artefact scatters and isolated finds. Low-moderate significance was allocated to stone artefact scatters with PAD. High significance was allocated to rare sites in good to very good condition.	2 sites were identified as being subject to direct partial or total harm (AHIMS #36-3-3806 Cainbil Creek OS-1 and The Rock IF-1) this sites were of low-moderate and low significance.
Barneys Reef solar farm	Assumed qualitative	Direct overlap	Desktop information indicates 68 sites within the project boundary, dominated by stone artefacts of varying densities.	Yet to be assessed.	Yet to be assessed.
Birriwa solar farm	Qualitative: ACHA – archaeological survey	Direct overlap	8 Aboriginal sites comprising: 1 stone artefact scatter with PAD, 4 stone artefact scatters, 2 isolated finds and a scarred tree.	All sites assessed as having low significance except the 1 stone artefact scatter with PAD which was low-moderate.	1 site identified as being subject to impact AHIMS #36-2-0518 (Mangarlowe IF-2). This site is an isolated find of low significance.

Project	Type of assessment	Distance from project	Aboriginal heritage identified	Significance	Aboriginal heritage to be impacted and/or protected
Tallawang solar farm	Qualitative: ACHA – archaeological survey	Direct overlap	31 Aboriginal sites were identified. These comprised: nine PADs (PAD 1 AS to PAD 3 AS; PAD 4 to PAD 6; PAD 7 IF; PAD 8 AS to PAD 9 AS), 12 stone artefact scatters (AS1-12), and 10 isolated stone artefacts or isolated finds (IF1-10).	Isolated finds and low density scatters were assessed as having low significance. Artefact scatters with moderate to high densities were assessed as having low-moderate significance.	The proposed development changed design to avoid areas of PAD, riparian corridors and minimising (where possible) impacts to surface sites. This allowed areas of moderate to high significance to be avoided. Areas of development to occur in areas of low significance.
Orana wind farm	Assumed qualitative	Direct overlap	Desktop information indicates 39 sites within the project boundary, dominated by stone artefacts of varying densities.	Yet to be assessed.	Yet to be assessed.
Cobbora solar farm	Assumed qualitative	Direct overlap	Desktop information indicates 103 sites within the project boundary, dominated by stone artefacts of varying densities.	Yet to be assessed.	Yet to be assessed.
Sandy Creek solar farm	Qualitative: ACHA – archaeological survey and subsurface testing	Direct overlap	7 previously recorded sites comprising a hearth, surface stone artefact concentrations with associated PADs, and isolated surface stone artefacts. A further 33 sites was found during survey and comprised: stone artefact scatters, isolated finds and1 culturally scarred tree.	Yet to be assessed.	Yet to be assessed.
Dapper solar farm	Assumed qualitative	Adjacent to project along Goolma connection	Desktop information indicates no sites within the project boundary.	Yet to be assessed.	Yet to be assessed.
Spicers Creek wind farm	Assumed qualitative	Overlaps project along Goolma connection	Desktop information indicates 3 sites within the project boundary, dominated by stone artefacts of varying densities.	Yet to be assessed.	Yet to be assessed.
Proposed projects					
Wellington south BESS	Qualitative: ACHA – archaeological survey	38 km south west of this project at its closest point	No Aboriginal sites identified and not expected to occur within the area.	N/A	No impacts to Aboriginal heritage.
Apsley BESS	Qualitative: ACHA – archaeological survey	48 km south west of this project at its closest point	2 isolated finds identified within project area but outside of impact area.	Low significance.	No impacts to Aboriginal heritage.

Project	Type of assessment	Distance from project	Aboriginal heritage identified	Significance	Aboriginal heritage to be impacted and/or protected
Forest Glen solar farm	Qualitative: ACHA – archaeological survey	61 km west of this project	No Aboriginal sites identified.	N/A	No impacts to Aboriginal heritage.
Dubbo firming power station	Assumed qualitative	50 km west of the western section of the project	No information provided.	Yet to be assessed.	Yet to be assessed.
Approved projects					
Stubbo solar farm	Qualitative: ACHA – archaeological survey	Adjacent to project along New Wollar Switching Station — Merotherie Energy Hub connection	25 Aboriginal sites comprising less than 9 isolated or low density stone artefacts, 8 moderate and high density stone artefact scatters (10–100 artefacts), various PADs associated with these sites, and a culturally modified tree.	Low-moderate significance was allocated to the isolated and low density stone artefact scatters. Moderate-high significance to moderate and high density stone artefact scatters and PADs.	Potential impact to one low significance isolated stone artefact. Remaining identified sites should be avoided.
Bowdens silver mine	Qualitative: ACHA – archaeological survey	60 km south of this project	45 previously recorded sites comprising: rock shelter with art, stone artefact scatters and isolated finds. Additional 31 sites found during survey and comprise: 19 stone artefact scatters, 9 isolated finds, 2 scarred trees and a rock shelter with PAD.	Majority of sites allocated low significance. 4 sites are of low-moderate significance (stone artefact scatters) and 1 site is of moderate significance (rock shelter).	26 sites situated within disturbance area, includes direct impact to site of moderate significance (rock shelter).
Inland Rail (Narromine to Narrabri)	Qualitative: ACHA – archaeological survey and test excavation	81 km west of the western section of the project	152 sites and 13 areas of PADs identified. Sites comprised: 93 culturally modified trees, 13 PADs, 8 stone artefact scatters/PAD, 24 stone artefact scatters, 17 isolated artefacts, 3 ceremony and dreaming sites, 2 grinding grooves, a reburial site, a shelter tree, an ochre quarry, a historic burial site and a cultural crossing.	All sites assessed as having high social significance.	48 sites to potentially impacted – including: 29 culturally modified trees, 8 stone artefact scatters, 4 stone artefact scatters/ PAD, 2 grinding groove sites, 2 PADs, 1 archaeological deposit, 2 isolated finds.
Dunedoo solar farm	Qualitative: ACHA – archaeological survey and subsurface testing	18 km north of this project at its closest point	26 sites comprising – 1 previously recorded site, 9 isolated finds and 16 stone artefact scatters.	Low, low to moderate and moderate significance.	Impact to a total of 6 isolated finds, 10 artefact scatters and 1 previously recorded site. Harm avoided to 8 sites. No impacts to sites with low to moderate or moderate significance.

Project	Type of assessment	Distance from project	Aboriginal heritage identified	Significance	Aboriginal heritage to be impacted and/or protected
Uungula wind farm	Qualitative: ACHA – archaeological survey	25 km south of the western section of the project	76 sites comprising isolated finds or stone artefact scatters.	Majority of sites assessed as being of low significance. 1 site is of moderate significance.	45 sites subject to harm, no harm to site of moderate significance.
Maryvale solar farm	Qualitative: ACHA – archaeological survey	30 km southwest of the western section of the project	7 sites within study area comprising: 4 stone artefact scatters, 2 isolated artefacts and one culturally modified tree.	4 sites were assessed as being of low significance and 3 sites were of moderate significance.	No impacts to Aboriginal heritage.
Geurie solar farm	Qualitative – Aboriginal heritage due diligence	35 km southwest of the western section of the project	No cultural materials identified, site considered disturbed.	N/A	N/A
Dubbo solar farm	Qualitative: ACHA – archaeological survey	48 km west of western section of project	2 sites consisting of varying densities of stone artefacts identified.	Both sites assigned low significance classification.	Not provided.
Gilgandra solar farm	Qualitative: Due diligence assessment	77 km northwest of western section of project	Site inspection identified an isolated find (Oakvale IF1) and an extension to AHIMS #28-4-0056.	N/A	No impacts to Aboriginal heritage.
Wahroonga solar farm	Qualitative – Aboriginal heritage due diligence	81 km west of western section of project	No cultural materials identified, site considered disturbed.	N/A	N/A
Changes to existing projects					
Moolarben coal mine OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2	Qualitative: ACHA – archaeological survey	Overlaps New Wollar Switching Station — Merotherie Energy Hub connection	At least 871 sites have been identified within the mine area. These comprise: PADs, stone artefact scatters, grinding grooves, isolated finds, rock shelters with art. A further 9 sites were identified for extension and comprised: stone artefact scatter, isolated finds and a rock shelter with PAD.	Newly identified sites assessed as being of low significance except for a stone artefact scatter which was moderate.	Around 40% of the 871 Aboriginal sites have been impacted by the mining activities over the years. 2 sites to be impacted by extension.
Ulan coal mine Modification 6	Qualitative: ACHA – archaeological survey	Overlaps New Wollar Switching Station — Merotherie Energy Hub connection	22 new sites identified during survey for modification comprising: 13 stone artefact scatters, 7 isolated finds, 2 rock shelters, 5 rock shelters/PAD. The site database for the entire project area includes 1,274 known sites within the mine area.	Varied (low to high significance).	315 Aboriginal sites/PADs occur within the area or zones of potential subsidence impact. Increased impacts were also noted for the following sites assessed as being of high significance: an Ochre Quarry (ID#807), rock shelter with artefacts (ID#284), rock shelter with art and artefacts (ID#161, 162).

E3.5 Social

E3.5.1 Methodology

The study area for the social cumulative impact assessment consists of the local and regional social localities as described in Chapter 13 (Social).

A detailed assessment was carried out that:

- identified projects seeking approval or already approved within the social locality; a total of 27 projects within the local social locality are identified to have potential cumulative impacts (refer to Table A-3)
- identified social impacts of projects within the social locality through a review of available Social Impact Assessment (SIA) reports and determined cumulative social impacts as well as the project contribution to these impacts
- considered Technical paper 7 – Social consultation findings relevant to cumulative impacts
- recommended mitigation measures as required.

A limitation to this assessment is that out of the 27 relevant future projects identified for cumulative impact assessment, five projects are currently in the pre-EIS stage, being the Sandy Creek solar farm and BESS, Cobbora solar farm, Barneys Reef wind farm, Spicers Creek wind farm, and the Dapper solar farm. As such, only preliminary information on social impacts of these projects is available. However, the scoping reports for each of these projects have been reviewed to provide insight into potential social impacts that have been preliminarily identified. Public road works have not been included in the assessment as environmental assessment for these works has not yet commenced.

All projects, excluding the Apsley BESS, are anticipated to have some periods of their construction program that overlap with this project (as indicated in Table A-4). However, only two projects have a full overlap (Liverpool Range wind farm and Inland Rail). Other relevant future projects will have a partial overlap during various phases of the project's construction phase, most of which will be during 2024 and 2025.

E3.5.2 Impact assessment

Construction

Detrimental effects to community cohesion

This project is likely to impact community cohesion, largely due to differing views that exist towards this project amongst community members. During consultation, multiple stakeholders including landholders, councils and community organisations, raised concerns that there have already been changes to community cohesion as a result of some of listed in Table A-5 the proposed projects within the local social locality.

A key issue identified during SIA consultation was the conflicting views between those who support and oppose this project and other proposed developments within the REZ. This has caused significant division within communities, and between neighbours, families and friends. Residents also reported receiving backlash from other members of the community for negotiating with development companies, agreeing to host infrastructure and potentially receive economic benefits.

Consultation also found that some stakeholders were not majorly opposed to the this project alone, however the cumulative impacts associated with the interaction between the 21 renewable energy projects within the local social locality was 'too much' and evoked opposition.

This project has been located near renewable energy projects and within previously disturbed land, such as mining areas and existing transmission line easements, where practicable. EnergyCo has had ongoing engagement with key stakeholders, landowners and community representatives to provide information and receive feedback.

It is almost certain that there would be detrimental effects to community cohesion from the interaction of the 26 relevant future projects in the local social locality. Given that this project would enable the development of some of the relevant future projects identified in the local social locality, it has been determined that this project would have a moderate contribution to cumulative impact on community cohesion in the local social locality.

No cumulative impact would be anticipated in the regional social locality in relation to this project.

Diminished short term accommodation and housing availability and affordability

The 26 relevant future projects would result in the influx of a non-resident workforce (i.e. fly-in fly-out (FIFO) and/or drive-in drive-out (DIDO) workers that do not reside in the region) which may lead to diminished short-term accommodation availability and affordability, if workforce accommodation is not provided by each project.

It is anticipated that the construction workforce would exceed 6,995 at the peak during times of concurrent construction of the projects considered for cumulative assessment. This construction workforce would be made up of:

- the construction workforce between this project and the 11 related development projects projected workforce numbers are anticipated to exceed 4,000 people between mid-2025 and mid-2026, peaking in late 2025 at 5,000 (EnergyCo, 2023b)
- the Wellington South BESS, Bowdens silver mine, Inland Rail Narromine to Narrabri, Apsley BESS, Forest Glen solar farm, Dubbo Firming power station, Dunedoo solar farm, Uungula wind farm, Maryvale solar farm, Geurie solar farm, Gilgandra solar farm, Wahroonga solar farm, and the Moorlaben coal mine extension projects would require an additional peak construction workforce of 1,955 employees
- workforce information was not available for Ulan coal mine and Dubbo solar farm, however it is assumed these projects would also require additional construction workforce.

While all of the project's construction workforce would be able to be accommodated within the two workforce accommodation camps at Merotherie and Cassilis, some project workers may choose to reside outside of the camps in short-stay accommodation.

Some of the other projects would also construct temporary workforce accommodation camps or would use their existing facilities to house construction workers (including the Valley of the Winds wind farm and Inland Rail Narromine to Narrabri projects). However, the extent to which this would occur within the social locality is not known based on the documentation available. Moreover, it is possible that there would be some instances where there would be camp overflow during peak periods, and some projects may choose to accommodate some, or all, of their workforce in local temporary and/or rental accommodation within the community.

As outlined in the SIA baseline and consultation findings, existing housing and short-stay accommodation is highly constrained. Consequently, it is possible that there would be major cumulative impacts to diminished short term accommodation availability and affordability within the local social locality, however as the project's workforce accommodation camps would cater for the workforce, this project's contribution to this impact is minimal.

No cumulative impact would be anticipated in the regional social locality in relation to this project.

Impacts to sense of safety due to an influx of non-resident workforce

The influx of a large non-resident construction workforce may impact community cohesion and sense of safety. Between all the relevant future projects within the regional social locality there could be a temporary construction workforce exceeding 6,995 at peak times during the project's construction period (including this project).

During SIA engagement, some stakeholders and community members raised concerns that the project's construction workforce could impact sense of safety within local towns. For elderly residents and women sense of safety may be impacted to a greater degree due in part to workforce 'gender imbalances' which have been shown to heighten the vulnerability of women, children and youth, and erode perceptions of community safety (Carrington et al., 2012).

Despite these concerns, other local stakeholders raised potential benefits and opportunities associated with the anticipated influx of workforce, including increased economic activity, population growth and potential for increased funding and resourcing of services to an overall increase in local users.

Given these considerations, it is possible that there would be cumulative impacts to sense of safety (not to the actual level of safety) due to an influx of non-resident workforce. Given that the workforce required for the project represents around 26 per cent of the total cumulative workforce it is anticipated that it would have a moderate contribution to the cumulative impact on sense of safety.

No cumulative impact would be anticipated in the regional social locality in relation to this project.

Diminished sense of place due to cumulative amenity impacts

Technical paper 7 – Social identified that during construction, hosting landholders and landholders neighbouring project infrastructure would experience medium impacts to sense of place associated with changes to amenity. Amenity impacts refer to air quality, noise and vibration disturbance and changes to landscape and visual amenity.

Most of the 26 relevant future projects would result in further amenity impacts across the local and regional social locality due to their overlapping construction periods (excluding the Apsley BESS).

Section E3.7 identified medium and high risks to cumulative noise impacts resulting from the interaction between this project and the relevant future projects.

Section E3.12 identified the potential for cumulative air quality impacts within five kilometres of this project when construction activities are undertaken concurrently with this project.

As such, it is likely that there would be potential impacts to diminished sense of place due to cumulative amenity impacts for landowners located within three kilometres of this project. However, the contribution of this project to the cumulative impact is anticipated to be minor.

Changes to the way people move and work due to perceived road delays and reduced sense of safety

Technical paper 7 identified a medium impact to the way people move and work caused by their perception to traffic delays and road safety. The 26 relevant future projects would further increase vehicle movements in the local and regional social locality.

SIA consultation with project stakeholders, councils, community members and residents, in addition to site visits, identified that several road networks within the local and regional social locality are of a poor quality and require repair and maintenance, due in part to weather conditions and recent flooding within the region. Concerns regarding cumulative road damage and safety risks associated with increase in vehicles (including heavy vehicles) throughout the regional social locality, using local roads to access project construction sites and workforce accommodation was raised across different stakeholders.

Residents and community members raised concerns that increased traffic could lead to delays, reduced mobility, and traffic incidents, reducing the overall sense of safety within the community. For some residents, accessing essential goods and services may only be available via driving to the nearest service centre (which may be up to an hour away for some local residents).

In Section E3.9, the Transport and Traffic cumulative impact assessment identifies each of the potential overlapping land and road development projects, stating that each project would have either a minor or negligible cumulative impact, given that construction routes generally do not overlap with this project's construction routes.

Consequently, it is possible that some people across the local social locality would change the way they move and work due to their perception to road delays and sense of safety. However, the contribution of the project to this cumulative impact is minimal given that minor traffic and transport impacts were identified only at specific locations.

Local business opportunities and economic stimulus due to project procurement opportunities and population growth

Medium benefits to the local and regional social locality were identified in Technical paper 7. This benefit will be enhanced by the procurement opportunities arising from the 26 relevant future projects, which are likely to either source or hire percentage of their supply and procurement requirements from within the regional social locality.

As described in Section E3.6, the Economic cumulative impact assessment anticipates that population growth deriving from workers relocating to regional areas would increase the demand for goods and services and thus result in more jobs, increasing local multiplier effects, scale economies and an increase in the rate of innovation and capital availability.

However, it can be assumed that for some projects, a large proportion of project procurement requirements will be sourced from outside the region, due to the specialised nature of supply needs and competitive pricing.

As such, it is likely that local and regional businesses will experience cumulative business opportunities and economic stimulus. The contribution of this project to this positive cumulative impact is moderate.

Improved livelihoods due to increased local employment opportunities

Technical paper 7 identified low to medium benefits arising from employment opportunities across the local and regional social localities. The cumulative benefit arising from employment was raised as a potential benefit associated with the 21 relevant future renewable energy projects in the local social locality.

In Section E3.6, the Economic cumulative impact assessment identified that regional jobs growth from the cumulative project demand would contribute to reduce outmigration of the regional workforce to look for employment in cities and increase regional labour force participation.

EnergyCo has published a summary of a study that identified skill shortages in a range of key occupations, such as construction managers, electrical and civil engineers, and transmission line workers, which is consistent with consultation findings (EnergyCo, 2023b). Additionally, the study identified that ‘training facilities and access to training is inadequate, and there are variations in access to training.

As such, it is likely that increased employment opportunities generated by the 26 relevant future projects would lead to cumulative livelihood improvements due to increased local employment opportunities for the local and regional social localities. The contribution of this project to this positive cumulative impact is moderate.

Diminished workforce availability for businesses due to increased competition with the project

SIA engagement revealed that labour force availability within the local and regional social locality was limited, with many agricultural and trade businesses unable to find additional workers locally. This was partially due to the presence of existing projects within the area such as Ulan coal mine, Wilpinjong coal mine and Moolarben coal mine, which local residents felt offered more attractive economic opportunities for local employees, which other businesses were not able to compete with. Interviewees raised concerns that challenges in sourcing and retaining local workers would be further intensified by the development of the 26 relevant future projects within the Central-West Orana REZ region.

The project anticipates that around 10 per cent of the construction workforce would be local, and as such the project would engage only a comparatively low number of local employees (up to 180). However, if the 26 relevant future projects in the region have a total combined construction workforce exceeding 6,995 at peak times (including this project), it would be likely that each of these projects would also aim to engage a proportion of local workers during their construction period. Using the assumption that around 10 per cent of these workers would be local residents, there could be a combined local workforce exceeding 699 employees.

Given the already small, limited availability of local skilled workforce within the region, it is possible that these positions would take workers away from local industry and businesses due to the likely competitive wages and experience offered by the projects. However, given this lack of skilled workforce in the region who would be suited to work within the renewable energy sector (EnergyCo, 2023b), it is possible that projects would not be able to source this number of local employees, leading to a lower proportion of local residents engaged during these projects' construction phases.

As such, it is possible that there would be cumulative diminished workforce availability due to increased competition. However, given that this project would contribute around 26 per cent of the total cumulative workforce it is anticipated that it would have a moderate contribution to this cumulative impact.

Impacts on Aboriginal cultural values

This project may impact Aboriginal cultural values due to changes in the landscape, access to sites of cultural significance and disrupt cultural and historical artefacts and places.

In Section E3.4, the Aboriginal Cultural Heritage cumulative impact assessment identified that this project would result in some cumulative impacts to cultural materials of the study area and broader region, with direct impacts to between five and 15 per cent for each of the identified site types documented, including rock shelters, grinding grooves, culturally modified trees and moderate or high significant stone artefact deposits.

As such, it is possible that this project would contribute to cumulative impacts on Aboriginal cultural values. However, the contribution of this project to the cumulative impact would be moderate.

Impacted capacity of health, food, and social services

It is likely that pressure on health, food and social services would be exacerbated by the large influx of non-resident construction workers that will be required to construct the 26 relevant future projects within the regional social locality. The combined temporary construction workforce of the 26 relevant future projects may exceed 6,995 at peak times during the project’s construction period.

As identified during consultation and research of the existing social locality, there is limited social infrastructure, goods and services within the local social locality, and most options are limited to service hubs such as Gulgong and Mudgee. During SIA consultation, stakeholders (including local councils, health services and social services) identified the current lack of social infrastructure throughout the region, and the severe lack of capacity, funding, and personnel that existing services currently have. Numerous interviewees raised concerns that this project and the relevant future projects would place a major strain on local services that could result in diminished health and wellbeing amongst community members, which may be experienced to a greater degree by vulnerable members of the community (including children, elderly people, those with pre-existing health conditions, and those experiencing socio-economic disparity).

As such, it is likely that there would be cumulative impact to the capacity of health, food and social services to respond to an increased demand for services in the local social locality, and possibly at the regional social locality. It is anticipated that the contribution from this project to this cumulative impact would be moderate.

Changes to the way people enjoy and connect with the environment

This project would require vegetation clearing to some extent within the construction area, which would result in reduced biodiversity values and changes to the landscape for hosting and neighbouring landholders. As detailed in Section E3.3, each of the 26 relevant future projects would require some form of vegetation clearing within their respective construction areas and would result in cumulative changes to the surrounding landscape and environment. However, vegetation clearing required for this project and the wind farm projects would likely be limited due to the nature of project design and site layouts. Additionally, agricultural practices such as sheep and cattle grazing would potentially be able to continue under and around solar and wind projects in some cases (Clean Energy Council, 2023; NSW Climate and Energy Action, 2023).

During SIA consultation, many local residents and stakeholders expressed a significant attachment to the natural landscape and biodiversity within the local area. Additionally, some stakeholders expressed concerns that changes to local land use would diminish opportunities to enjoy and connect with the surrounding environment during construction and continuing into the operational phase of each project.

Section E3.2 identified the potential for cumulative landscape character and visual impacts during construction across multiple project locations.

Section E3.3 identified that this project would contribute to cumulative impacts to wildlife connectivity and habitat corridors and would potentially have one of the largest impacts to connectivity.

As such, it is possible that people within the local social locality would experience cumulative changes to the way they enjoy and connect with the environment. This project's contribution to this cumulative impact is moderate considering the geographical extent of this project.

People’s capacity to influence decisions regarding changes that may affect their lives

Engagement with communities and stakeholders relating to the proposed new transmission network infrastructure in the Central-West Orana REZ has been ongoing since 2020. EnergyCo has since refined this project based on feedback from the community and key stakeholders.

During SIA consultation, engagement fatigue, miscommunication and misinformation resulting from the multiple projects within the local study area was raised as a concern by a number of key stakeholders, including concerns regarding their capacity to participate in preparing submissions during the EIS public exhibition phase due to the large number of EIS and reports that needed to be reviewed.

Consequently, it can be anticipated that residents within the local social locality would experience limited capacity to influence decisions regarding changes that may affect their lives. The contribution of this project to this cumulative impact is moderate considering that it would enable the development of the other 12 renewable energy projects.

Summary

During construction, this project in combination with the relevant future projects are expected to result in the cumulative impacts outlined in Table A-18. However it is anticipated that the project contribution to these would range from minimal to moderate.

Table A-18 Potential cumulative social impacts during construction

Potential impact	Social locality	Project contribution to cumulative impact
Detrimental effects to community cohesion	Local	Moderate
Diminished short term accommodation and housing affordability and availability	Local	Minimal
Impacts to sense of safety due to an influx of non-resident workforce	Local	Moderate
Diminished sense of place due to cumulative amenity impacts	Local and regional	Minor
Changes to the way people move and work due to perceived road delays and reduced sense of safety	Local	Minimal
Local business opportunities and economic stimulus due to project procurement opportunities	Local and regional	Moderate
Improved livelihoods due to increased local employment opportunities	Local and regional	Moderate
Diminished workforce availability due to increased competition with the project for local employees	Local	Moderate
Impacts on Aboriginal cultural values	Local	Moderate
Impacted capacity of health, food, and social services	Local and regional	Moderate
Changes to the way people enjoy and connect with the environment	Local	Moderate
People's capacity to influence decisions regarding changes that may affect their lives	Local and regional	Moderate

Operation

Potential disruption to telecommunications in the vicinity of transmission infrastructure, including radio, internet, and television

Telecommunication coverage is a pre-existing issue in the Central-West Orana region that could be exacerbated by the presence of renewable projects and transmission lines. This project would potentially contribute to minimal telecommunications disruptions during utility works within the local social locality surrounding transmission infrastructure. While there is limited evidence that suggests operational solar farms contribute to telecommunications disruptions, there has been research linking wind farms to disrupted telecommunications. The five proposed wind farms adjacent to the project include:

- Spicers Creek wind farm
- Orana wind farm
- Barneys Reef wind farm
- Valley of the Winds wind farm
- Liverpool Range wind farm.

Angulo et al. (2014) indicates that "wind farms near telecommunication transmitters or receivers may introduce distortions on the transmitted signals, which can cause different effects on the radiocommunications services depending on the frequency band, the modulation scheme and the discrimination of the radiation pattern of transmitter and receiver aerials".

EnergyCo (2023b) found that mobile coverage in the region is less than what is indicated by coverage maps, and that due to the lack of coverage, mobile boosters are commonly used to improve indoor coverage. Moreover, operations and productivity can be negatively impacted due to the poor mobile coverage and can also impact worker safety. As coverage in the region is already low, it would be anticipated that any disturbance caused by the project would contribute to a cumulative impact.

As such, it is likely that the five wind farms surrounding this project would contribute to minimal telecommunications impacts, resulting in a low unmitigated impact within the local social locality. There would be no anticipated impact in the regional area associated with this project.

Increased renewable energy sources and choices

This project would contribute to unlock the potential for the development of solar and wind farm projects that would likely give consumers more energy choices.

During SIA consultation, stakeholders acknowledged the benefits of the project to the broader NSW community, especially to the coastal cities. SIA survey findings also reported that landowners expect that this project would contribute to lower carbon emissions and promote the delivery of renewable energy and cheaper electricity.

EnergyCo has committed to developing a regional energy strategy which would outline opportunities to benefit regional communities in the REZ, including community energy schemes, power purchasing agreements and other initiatives. In addition, the *First Nation Guidelines Increasing Central West Orana income and employment opportunities from electricity and infrastructure projects* (EnergyCo, 2022c), stated that the REZ would create potential opportunities to provide lower electricity costs for local Aboriginal community owned properties.

These strategic initiatives may contribute to increased renewable energy sources and choices for local residents within the Central-West Orana REZ, and consequently the project would have a major contribution to this cumulative benefit.

Stress due to perceived bushfire risk

It is possible that this project would cause stress to community members due to the potential bushfire risk associated with transmission infrastructure. Seven solar farms, five wind farms and one BESS project are proposed close to this project. The cumulative operation of these projects would likely enhance concerns regarding potential bushfire risks amongst the local social locality.

It is considered unlikely for wind farms to pose bushfire ignition risks, however 'it is possible that turbines can malfunction and start fires within the unit. This is generally considered a low risk given appropriate protection measures (Australasian Fire and Emergency Service Authorities Council, 2018). For solar farms, solar panels can carry some ignition risk, however this risk would be considered minor with a low intensity resulting fire (i.e. the solar panels are not highly combustible and do not contain toxic chemicals) (ACT Emergency Services Agency, 2018). The fire risk associated with BESS projects are notably higher, as they typically contain lithium-ion batteries and come with associated risks and hazards if not installed and maintained correctly (including fire and explosion, radiation, heat, chemical and electrical) (Fire and Rescue NSW, 2023).

Consultation identified significant concern amongst local community members and residents regarding cumulative bushfire risk associated with projects in the region, as well as potential difficulties that emergency services may have responding to fires near, or within, project infrastructure.

The local and regional social locality have experienced major bushfire events in recent history, which has contributed to heightened stress and anxiety regarding potential sources of ignition, and firefighting obstructions. Additionally, previous major bushfires have had devastating impacts on agricultural activities, including the destruction of livestock, properties and degradation of the landscape and soil.

Section E3.8, indicates that the project and renewable energy projects would implement asset protection zones (APZ) around energy infrastructure to reduce the risk of fire spreading from these locations as well as minimising the risk of bushfire impacting the facilities. Thus, the bushfire risk from each of these projects is unlikely to contribute to a cumulative increased risk of bushfire.

As such, it is possible that the local social locality would experience cumulative stress due to bush fire risks. The project's contribution to this impact is moderate given the geographical extent of this project.

Diminished sense of belonging due to loss of aesthetic values and perceived loss of biodiversity

This project will likely result in varying levels of impacts on aesthetic values and biodiversity. As discussed, there are 13 projects located in proximity to this project, including five wind farms and seven solar farms. These projects would be likely to contribute to amenity and environmental impacts, which would be experienced by hosting and neighbouring residents. Given the scale of wind turbines, and the proposed size and location of the five surrounding wind farms, these wind farm projects would be most likely to contribute to cumulative landscape character and visual impacts.

For the wind farm and solar farm projects, a large proportion of the land used would be existing private agricultural land, through negotiations and lease agreements with landholders. Additionally, for the Narromine to Narrabri Inland Rail transport project, both temporary and permanent acquisition of residential and agricultural land is proposed (WSP, 2022). All projects occurring on directly affected landholders' properties (either through lease agreements or acquisitions) would likely alter the way these landholders use and enjoy their properties due to changes to access, amenity and aesthetic impacts.

As identified during SIA consultation, many landholders placed high value on the aesthetic, environmental and agricultural qualities of their properties and the surrounding environment, and expressed concern that this project, and projects associated with the Central-West Orana REZ more generally, would take negatively impact these values and the overall way of life for many landholders.

Section E3.2 identified that there would be cumulative landscape and visual impacts associated with this project and the other 11 relevant future renewable energy projects, due to the proximity and associated potential for the projects to be seen together and change the character of the surrounding landscape.

Section E3.3 identified that this project would likely contribute to cumulative impacts to wildlife connectivity and habitat corridors and would potentially have one of the largest impacts to connectivity. In addition, this project is likely to contribute to cumulative impacts to protected and sensitive lands. This project also directly impacts the Durridgere SCA.

As such, it is possible that there would be cumulative diminished sense of belonging due to losses of aesthetic values and biodiversity in the local social locality. It is anticipated that this project's contribution to this impact is moderate given its geographical extent and contribution to visual and biodiversity cumulative impacts.

Diminished sense of safety due to flooding and drainage changes

This project would lead to low-minor impacts sense of safety impacts due to flooding amongst landholders hosting and neighbouring project infrastructure. The 13 relevant future projects located adjacent or near the transmission line would likely also contribute to community concerns and sense of safety impacts associated with flooding and drainage changes.

Technical paper 15 – Flooding has found that during operation, this project is expected to have only a minor and localised impact on peak flood levels and flow velocities during the one per cent AEP and Probable Maximum Flood (PMF) flood events, therefore this project's contribution to potential cumulative impact on flooding is considered minimal.

Consequently, it is possible that some people within the local social locality would experience cumulative diminished sense of safety due to minor changes to sediment runoff from permanent structures. The contribution of this project to this cumulative impact is minimal given that transmission infrastructure is unlikely to cause material changes to existing flooding conditions in most instances.

Impact to agricultural land and food production for future generations

Councils, community organisations and landowners raised concern about the direct and cumulative use of prime agricultural land by this project and the Central-West Orana REZ and its potential effects on food production and security for future generations.

While the operational area of this project consists of around 2,437 hectares of agricultural land, direct impacts as a result of the operation of this project would consist of around 829 hectares or 34 per cent of the total operational area.

The land within the transmission line easements, and immediately next to the easement would continue to be able to be used for some agricultural activities such as grazing. The direct impact to agricultural land is equivalent to 0.13 per cent of the total agricultural land in the four impacted LGAs, therefore insignificant at a regional scale.

The land use, property and agricultural cumulative impact assessment in Section E3.1 identified:

- cumulative impacts to aerial agricultural operations from this project interaction with the Liverpool Range wind farm, Valley of the Winds wind farm, Spicers Creek wind farm, Orana wind farm and Barneys Reef wind farm
- minor cumulative impact on sheep grazing activities given that most solar farm projects would allow for the continuity of this activity
- cumulative impact on crop land from the project's interaction with Tallawang solar farm, Cobbora solar farm, Sandy Creek solar farm and Dapper solar farm.

The agricultural cumulative impact assessment determined that impacts on agricultural production were considered minimal and no impact on the number of persons employed in the agricultural sector would be expected at a regional level.

Consequently, cumulative impacts to agricultural land and food production for future generations in the local social locality is possible. This project's contribution to this impact is anticipated to be minimal considering that the land within the transmission line easements, and immediately next to the easement would continue to be able to be used for some agricultural activities such as grazing and that the direct impact to agricultural land is equivalent to 0.13 per cent of the total agricultural land in the four impacted LGAs.

Summary

During the operational phase, this project in combination with the relevant future projects are expected to result in moderate and major cumulative social impacts in the social locality. Table A-19 outlines the potential cumulative social impacts during operation.

Table A-19 Potential cumulative social impacts during operation

Potential impact	Social locality	Project contribution to cumulative impact
Potential disruption to telecommunications in the vicinity of transmission infrastructure, including radio, internet, and television	Local	Minimal
Increased renewable energy sources and choices	Regional	Major
Stress due to perceived bushfire risk	Local	Moderate
Diminished sense of belonging due to loss of aesthetic values and perceived loss of biodiversity	Local	Moderate
Diminished sense of safety due to flooding and drainage changes	Local	Minimal
Impact to agricultural land and food production for future generations	Local	Minimal

E3.6 Economic

E3.6.1 Methodology

The study area for the economic cumulative impact assessment consists of the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs.

A standard assessment was carried out that involved:

- reviewing the nature and scale of potential economic impacts within the project timeframes, as described in publicly available planning documents for the relevant future projects (identified in Table A-3). Public road works have not been included in the assessment as environmental assessment for these works has not yet commenced. Potential impacts of the relevant future projects were found to overlap with the potential impacts of this project at a regional scale
- reviewing the economic literature on the theoretical impacts of large demand on regional economies
- qualitative assessment of the cumulative economic impacts that would potentially arise from the relevant future projects and this project in the regional economy, including impacts on gross agricultural production and labour supply and wages
- recommending mitigation measures as required.

E3.6.2 Impact assessment

Construction

Initial cumulative labour stimulus

As of March 2023, there are more than 30 renewable energy projects of varying capacity proposed, approved or under construction in the Central-West Orana REZ (EnergyCo, 2023b). The main cumulative economic impact of these projects is to generate a large demand for a suitably qualified construction workforce in regional areas. Workforce numbers are estimated to exceed 4,000 between mid-2025 and mid-2026 (EnergyCo, 2023b).

This labour demand would be met from:

- the Central-West Orana region:
  - the unemployment pool
  - increased labour force participation
  - workers from other industries
- the rest of NSW and Australia, with labour:
  - moving into the region to live during the employment period; or
  - commuting from outside the region e.g. FIFO and DIDO.

Population impact

To the extent that the cumulative job stimulus results in workers (and their families) relocating to regional areas, even temporarily, or workers from the region not emigrating from the region in search of work, this can provide population growth (or reduce or prevent population decline), including in areas experiencing population decline. Trends in regional economies of NSW (because of globalisation and associated structural adjustment) has resulted in many non-coastal rural areas in NSW experiencing population decline. There has also been a decline in the population of smaller towns even in regions where the population has been growing.

Population growth is an important driver of the health of regional economies. Places that can attract population immigration create increased demand for goods and services and thus more jobs. This growth leads to increasing local multiplier effects, scale economies and an increase in the rate of innovation and capital availability (Sorensen, 1990). Conversely, population losses can contribute to a 'vicious cycle' of decline whereby reduced populations results in closure of services, which in turn makes it difficult to attract new populations (Sorensen, 1990).

Accommodation impacts

Cumulative regional population changes driven by cumulative regional employment growth would increase demand for short term and long term accommodation. The impacts can be increases in housing prices and rents, and shortages of short term accommodation that might otherwise be used for tourism or other purposes.

From an economic perspective, increases in the cost of housing are predominantly a transfer between local owners and renters, or local owners and buyers. The existing homeowners and accommodation providers of the property benefit when this happens, and the renters/buyers lose (Deloitte Access Economics, 2012). However, price rises also impact lower income households who may get squeezed out of the market. In situations where there are no market distortions, and cumulative population changes are longer term, the local housing supply would normally adjust to demand and prices return to their previous levels (Deloitte Access Economics, 2012). However, given the more temporary nature of population change, normal longer term housing supply adjustments may be tempered and so there would be a need to encourage and facilitate the provision of additional accommodation, including temporary workforce camps, adaptive reuse or extension of existing buildings, use of existing granny flats and spare bedrooms and use of vacant housing.

The extent of residual housing price impacts for regional economies would depend on a number of variable factors, including the balance of labour supply from inside the region, outside the region and DIDO/FIFO, the level of provision of workforce accommodation facilities, and other accommodation options, as well as adjustment of the overall housing supply in response to increased demand. Early provision of additional accommodation can reduce price impacts on housing.

Regional job growth

Cumulative demand for labour in regional areas can help address the jobs growth imbalance between Australia's biggest cities which have grown by an average of 2.4 per cent per year since 2000 and the regions which have grown at 1.0 per cent per year (Sobyra, 2022). This imbalance has been attributed to the economy creating relatively more demand for high skilled jobs than previously with the vast majority of these located in big cities rather than regions (Sobyra, 2022).

Regional jobs growth from the cumulative project demand can partly offset this trend by providing opportunities for the existing and future regional workforces, attracting middle-and high-skilled workers and families to regional areas, reducing outmigration of the regional workforce to look for employment in cities, and increase regional labour force participation. Regional projects can therefore provide a boom to non-coastal regional economies that have experienced low growth or decline because of globalisation and associated structural adjustment.

Notwithstanding, EnergyCo (2023b) have identified potential skills shortages in a range of key occupations including construction managers, electrical engineers, civils engineers, transmission line workers and electricians.

Stimulus to regional economic activity

Cumulative projects in regional NSW would provide a substantial boost in direct economic activity in the region as well as flow-on economic activity to businesses that are able to supply the goods and services:

- required for project construction and operation
- demanded by workers, i.e. expenditure of wages.

Based on the Economic Assessment (Technical paper 8), cumulative project construction is most likely to directly impact the heavy and civil engineering construction, construction services and non-residential building construction sectors.

The sectors of regional economies most impacted by production induced flow-on effects, associated with firms buying goods and services from each other are likely to be as follows:

- professional, scientific and technical services
- wholesale and retail trade
- structural metal product manufacturing
- road transport
- employment, travel agency and other administrative services
- cement lime and ready-mixed concrete manufacturing.

Consumption-induced flow-on effects in the region, associated the expenditure of wages will be mainly experienced in the following sectors:

- retail and wholesale trade
- food and beverage services
- health care services
- primary and secondary education
- residential care and social assistance services
- road transport
- professional, scientific and technical services.

Any business that can provide the goods and services demanded for project construction and operation, and by workers, would benefit from the cumulative economic activity.

Impacts on other sectors of the economy

Notwithstanding the above, excess demand for construction workers can in the short run lead to increased construction sector (and other sector) wages and attraction of workers from other relevant sectors of the economy, leading to labour shortages in these other areas of the economy (and associated shortages of goods and services) and rising inflation as firms pass wage costs onto consumers.

In addition, in the short run excess demand for inputs to construction such as quarry materials and concrete can result in rising costs (prices) for these materials and potentially shortages for other uses. The extent of these short run impacts for regional economies would depend on the balance of labour supply from inside the region, outside the region and DIDO/FIFO, as well as adjustment of the overall labour market, and other markets, in response to increased demand. However, in the medium term markets will adjust to some extent (e.g. increased labour force participation, new quarry proposals to supply demand for aggregate) and enable wages and prices to return to previous levels.

Any price increases and crowding out of other economic activities in the region represents the operation of the market system where scarce resources are reallocated to where they are most highly valued and where society would benefit the most from them. This reallocation of resources is therefore a positive impact on the economy. and may be associated with social benefits.

Operation

No cumulative economic impacts are expected during operation.

E3.7 Noise and vibration

E3.7.1 Methodology

Developments located within two kilometres of this project have the potential to generate cumulative noise impacts during construction and operation. Sensitive receivers adjoining this area have been considered for potential cumulative noise impacts. Cumulative vibration impacts are considered highly unlikely to arise from adjoining projects (due to the large separation distances) and have not been considered in the assessment.

A standard assessment was carried out that involved reviewing the nature and scale of potential noise impacts within the project timeframes, as described in publicly available planning documents for the relevant future projects. Public road works have not been included in the assessment as environmental assessment for these works has not yet commenced. Where potential impacts of the relevant future projects were found to overlap with the predicted impacts of this project at a local scale, the following assessment was undertaken:

- calculating the nature of any overlapping impacts was considered and cumulative noise and vibration impacts in consideration of overlapping project schedules, noise predictions of this project's noise assessment (refer to Technical paper 9 – Noise and vibration) and publicly available noise assessments for the relevant future projects. This included the consideration of construction noise, operational noise and construction road traffic noise
- describing receivers or areas that would be potentially subject to cumulative noise impacts
- recommending mitigation measures as required.

The primary limitation in this assessment method has been the availability and format of quantitative predictions of noise impacts and project timing for relevant future projects. In addition, the large number of receivers and conflicting quality of data across projects has made correlations between properties difficult. For example, only one of the relevant future projects has undertaken an assessment of construction traffic noise. Where two noise events occur at similar noise levels, the resulting total noise level is three decibels higher than each individual source. In the absence of detailed, coordinated information on precise activities from each site at any one time, potential maximum impacts have been calculated using this assumption.

Conclusions have been based on high level review existing environmental studies and a detailed analysis of Technical Paper 9.

E3.7.2 Impact assessment

Table A-20 and Table A-21 provides a description of the potential cumulative noise impacts for sensitive receivers/projects within a two kilometre buffer zone of this project for construction and operation respectively. A qualitative indication of risk has also been provided for simultaneous activities.

Construction

Table A-20 Potential cumulative noise impacts during construction

Project	Potential cumulative noise impacts with this project	Risk of noise impacts
Related development		
Liverpool Range wind farm	Cumulative noise impacts have been predicted during construction activities at up to 5 receivers, mainly during the transmission line works, however substantial impacts have been predicted from the Liverpool range wind farm construction. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project, and these impacts will require careful management between the projects due to the extent of potential exceedances and number of receivers impacted.	Medium
Valley of the Winds wind farm	Cumulative noise impacts have been predicted during construction activities at up to 3 receivers, mainly during the transmission line works. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project. Exceedances are expected across multiple stages of the wind farm construction, with higher noise levels predicted in the earlier stages.	Medium
Barneys Reef solar farm	Cumulative noise impacts have been predicted during construction activities at up to 18 receivers, mainly during the transmission line works. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project.	High
Birriwa solar farm	Cumulative noise impacts have been predicted during construction activities at up to 4 receivers, mainly during the transmission line works, however impacts from the Birriwa solar farm are predicted to be minimal. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project.	Medium
Tallawang solar farm	It is predicted that Tallawang solar farm is likely to meet construction noise criteria, and thus cumulative impacts with this project are unlikely.	Nil
Orana wind farm	Cumulative noise impacts have been predicted during construction activities at up to 15 receivers, mainly during the transmission line works, however impacts from the Orana wind farm are predicted to be minimal. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project.	High
Cobbora solar farm	Cumulative noise impacts have been predicted during construction activities at up to 4 receivers, mainly during the transmission line works. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project.	Medium
Sandy Creek solar farm	Cumulative noise impacts have been predicted during construction activities at up to 4 receivers, mainly during the transmission line works, however substantial impacts have been predicted from the Sandy Creek solar farm construction. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project, and these impacts will require careful management between the projects due to the extent of potential exceedances and number of receivers impacted.	Medium

Project	Potential cumulative noise impacts with this project	Risk of noise impacts
Dapper solar farm	Cumulative noise impacts have been predicted during construction activities at up to 5 receivers, mainly during the transmission line works. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project.	Medium
Spicers Creek wind farm	Cumulative noise impacts have been predicted during construction activities at up to 5 receivers, mainly during the transmission line works. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project.	Medium
Approved projects		
Stubbo solar farm	Cumulative noise impacts have been predicted during construction activities at up to 5 receivers, mainly during the transmission line works. During worst case cumulative noise impacts, noise levels may be up to 3 dB louder than the maximum predicted level from either project.	Medium
Changes to existing projects		
Moolarben coal mine OC3 Extension and Moolarben Stage 2 - Modification 4 - UG2	While the construction areas for this project and the Moolarben coal mine intersect, the OC3 Extension and Stage 2 Modification 4 are indicated to be an adequate distance from this project's construction area to provide no cumulative impacts. It is predicted that construction noise of this project would be indistinguishable from the Moolarben coal mine operation.	Nil
Ulan coal mine	Cumulative construction noise impacts may be noted at up to 22 receivers primarily during the transmission line works. Under worst case cumulative noise levels may be up to 3 dB louder than the maximum predicted level from either project. Out of hours works at Ulan coal mine may impact two (potentially different) receivers under noise-enhancing meteorological conditions, however noise mitigation measures aim to avoid any work outside of standard hours.	High

Operation

Table A-21 Potential cumulative noise impacts during operation

Project	Potential cumulative impacts with this project	Risk of impacts
Related development		
Liverpool Range wind farm	Cumulative operational noise impacts may be noted at up to 5 receivers, primarily during adverse weather conditions generating coronal noise. Under worst case conditions, cumulative noise levels may be up to 3 dB louder than the maximum predicted impact under either project. Additional treatment may be required at some properties due to the extent of potential exceedances and should be confirmed once both projects are operational.	Medium
Valley of the Winds wind farm	Cumulative operational noise impacts may be noted at up to 2 receivers, primarily during adverse weather conditions generating coronal noise. Under worst case conditions, cumulative noise levels may be up to 3 dB louder than the maximum predicted impact under either project. Additional treatment may be required at some properties due to the extent of potential exceedances and should be confirmed once both projects are operational.	Low
Barneys Reef solar farm	Cumulative operational noise impacts may be noted at up to 4 receivers, primarily during adverse weather conditions generating coronal noise. Under worst case conditions, cumulative noise levels may be up to 3 dB louder than the maximum predicted impact under either project. Additional treatment may be required at some properties due to the extent of potential exceedances and should be confirmed once both projects are operational.	Medium
Tallawang solar farm	No receivers are predicted to be impacted by cumulative operational noise impacts from these two projects.	Nil

Project	Potential cumulative impacts with this project	Risk of impacts
Orana wind farm	Cumulative operational noise impacts may be noted at 2 receivers, primarily during adverse weather conditions generating coronal noise. Under worst case conditions, cumulative noise levels may be up to 3 dB louder than the maximum predicted impact under either project. Additional treatment may be required at some properties due to the extent of potential exceedances – this should be confirmed once both projects are operational.	Medium
Cobbora solar farm	Cumulative operational noise impacts may be noted at a single receiver, primarily during adverse weather conditions generating coronal noise. Under worst case conditions, cumulative noise levels may be up to 3 dB louder than the maximum predicted impact under either project. Additional treatment may be required at some properties due to the extent of potential exceedances and should be confirmed once both projects are operational.	Low
Sandy Creek solar farm	Cumulative operational noise impacts may be noted at up to 2 receivers, primarily during adverse weather conditions generating coronal noise. Under worst case conditions, cumulative noise levels may be up to 3 dB louder than the maximum predicted impact under either project. Additional treatment may be required at some properties due to the extent of potential exceedances and should be confirmed once both projects are operational.	Medium
Dapper solar farm	Cumulative operational noise impacts may be noted at up to 2 receivers, primarily during adverse weather conditions generating coronal noise. Under worst case conditions, cumulative noise levels may be up to 3 dB louder than the maximum predicted impact under either project. Additional treatment may be required at some properties due to the extent of potential exceedances and should be confirmed once both projects are operational.	Medium
Spicers Creek wind farm	No receivers are predicted to be impacted by cumulative operational noise impacts from these two projects.	Nil
Approved projects		
Stubbo solar farm	Cumulative operational noise impacts may be noted at a single receiver, primarily during adverse weather conditions generating coronal noise. Under worst case conditions, cumulative noise levels may be up to 3 dB louder than the maximum predicted impact under either project. Additional treatment may be required at some properties due to the extent of potential exceedances and should be confirmed once both projects are operational.	Low
Changes to existing projects		
Moolarben coal mine OC3 Extension and Moolarben Stage 2 - Modification 4 - UG2	While the operational areas for this project and the Moolarben coal mine intersect, the OC3 Extension and Stage 2 Modification 4 are indicated to be an adequate distance from this project's operation area to provide no cumulative impacts. The predicted operational noise levels for the Moolarben projects are predicted to comply with criteria.	Nil
Ulan coal mine Modification 6	For receivers potentially impacted by operational impacts from this project, up to 8 receivers may be impacted by cumulative noise from Ulan coal mine Modification 6 project. Noise impacts from the operation of Ulan coal mine Modification 6 are not yet known. Under worst case conditions, cumulative noise levels may be up to 3 dB louder than the maximum predicted level from either project. This may result in marginal exceedances requiring treatment at some properties and should be confirmed once both projects are operational.	High

Summary

This assessment has identified a range of potential noise impacts during the construction phase, however the extent and magnitude of these impacts are dependent on timing and overlap of individual construction activities or operations. Cumulative noise impacts during the operation stage would mostly be associated with transmission line infrastructure and primarily during adverse weather conditions generating coronal noise, which is expected to be unpredictable and likely only for short periods of time.

E3.8 Bushfire risk and general hazards

E3.8.1 Methodology

The study area for the bushfire risk and general hazards cumulative impact assessment consists of the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs.

A standard assessment was carried out that involved:

- qualitatively assessing potential local cumulative bushfire and general hazards impacts of the relevant future projects (identified in Table A-3) in combination with this project, including increased risk of bushfire or risk to projects from bushfire. Public road works have not been included in the assessment as environmental assessment for these works has not yet commenced
- recommending mitigation measures as required.

E3.8.2 Impact assessment

Construction

Cumulative impacts related to bushfire risk during construction would occur where multiple projects undertaking construction at the same time would increase the risk of bushfire ignition in the study area from construction activities. Potential sources of ignition are outlined in Sections 16.5.1 and 16.6.1 and include hot works (welding and grinding), electrical faults, the generation of sparks during the use of vehicles and equipment and lightning strikes. Fuel leaks and spills from plant and machinery, and the storage of flammable goods during construction, could also provide a fuel source for bushfires if ignited.

Construction and operation of this project and the relevant future projects would also involve the use, storage and transport of dangerous goods and hazardous materials, which would increase health and safety risks to people, property and the environment where project timeframes overlap.

Standard mitigation measures would be implemented for each project to minimise potential hazards and risks and provide emergency protocols, in accordance with a safety management system, policies and guidelines. Minor road upgrades and access track works are proposed for most projects, which would provide adequate emergency egress and evacuation routes.

Operation

Cumulative impacts related to bushfire risk during operation would occur where projects in close proximity would increase the risk of bushfire ignition and spread within the study area. The relevant future projects and this project would increase the risk of bushfire in the four impacted LGAs through the introduction of potential sources of ignition and fuel sources in bushfire prone land.

This project's permanent project infrastructure 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). Regular inspection and maintenance activities are expected to include:

- regular inspection (ground and aerial) and maintenance of electrical equipment and easements
- fault and emergency response (unplanned maintenance)
- general building, asset protection zone and landscaping maintenance
- fire detection system inspection and maintenance
- remote asset condition monitoring
- network infrastructure performance monitoring.

Transmission line easements for this project would typically be around 60 to 140 metres wide depending on the transmission line infrastructure present, and up to around 240 metres where the 500 kV and 330 kV networks are located in the same easement. Vegetation clearing would be required to some extent for the full width of the transmission line easement, depending on the vegetation types present.

This project and the other renewable energy projects would also implement asset protection zones (APZs) around energy infrastructure to reduce the risk of fire spreading from these locations as well as minimising the risk of bushfire impacting the facilities. The bushfire risk posed by each project would be managed with APZs, regular maintenance and emergency protocols including access for emergency services. The bushfire risk from each of these projects is unlikely to contribute to a cumulative increased risk of bushfire.

E3.9 Traffic and transport

E3.9.1 Methodology

The study area for the traffic and transport cumulative impact assessment consists of the construction routes utilised by this project and the relevant future projects (identified in Table A-3), where their construction periods overlap. The construction routes include roads that are used between the workforce accommodation camps, construction compounds and work areas, as well as oversize and overmass (OSOM) routes from the Port of Newcastle.

A detailed assessment was carried out that involved:

- a review of the nature and scale of potential traffic and transport impacts during construction within the project timeframes, as described in publicly available planning documents for the relevant future projects
- a sensitivity analysis to quantitatively review the road capacity during construction, of the impacted road network and the additional traffic generated by the relevant future projects, to understand the level of service likely to be experienced
- qualitatively assess potential regional cumulative traffic and transport management impacts during construction of the relevant future projects in combination with this project, including impacts on access and the performance of the local and regional road network
- qualitatively assessing the potential cumulative impact during operational stage, reviewing each projects' proposed requirement as detailed in the publicly available planning documents for the relevant future projects
- recommend mitigation measures as required.

The assessment assumes that other relevant projects would maintain accessibility of the road network as detailed in their planning documents and would cause no significant detours resulting from road closures. During construction however, changes in traffic management may occur, therefore the Network Operator will liaise with the relevant road authority to plan around any temporary short/long term road closures caused by these other projects.

E3.9.2 Impact assessment

Construction

Projects considered in the assessment

Developments with construction routes that overlap with this project has the potential to increase the number of construction vehicles on the road network.

Of the relevant future projects identified in Table A-3, only 10 related development projects would utilise construction routes proposed by this project. These include renewable energy generation projects such as wind farms and solar farms that would connect to this project, and include:

- Liverpool Range wind farm
- Valley of the Winds wind farm
- Barneys Reef solar farm
- Birriwa solar farm
- Tallawang solar farm
- Cobbora solar farm
- Sandy Creek solar farm
- Dapper solar farm
- Orana wind farm
- Stubbo solar farm.

Other projects are considered to have negligible cumulative traffic and transport impacts in combination with this project as they would utilise roads during construction that are not within the study area, or are already operational.

Construction of the public road works (related development project 1 in Table A-3) have not been included in the assessment as a potential cumulative impact, as environmental assessment for these works has not yet commenced and there is insufficient information in the public domain (however, once completed they will potentially mitigate cumulative traffic impacts as discussed below). The Moolarben coal mine OC3 Extension and Moolarben Stage 2 – Modification 4 – UG2, and Ulan coal mine Modification 6 projects are currently in operation and their impacts have been included as part of the baseline conditions in the traffic assessment for this project (Technical paper 13). These projects are therefore also not included in this assessment.

A summary of the potential traffic and transport impacts of each of the ten relevant future projects during the construction and operation of this project is provided in Table A-22. The table additionally identifies the roads that would be the subject of cumulative impacts (in relation to the project and the relevant future project).

A quantitative sensitivity assessment of the predicted mid-block road network performance of the impacted construction routes (i.e. routes impacted by the project and one or more of the relevant future projects), due to the anticipated increase in construction traffic, is provided in Table A-23. This table shows a quantitative sensitivity assessment of the cumulative impacts of this project with the related future projects identified above. Traffic demand generated by each relevant future project has been assigned to the relevant roads which would also be used by this project.

The assessment indicates that the additional traffic volumes generated by the 10 relevant future projects (in combination with this project) would have only a minor impact on the capacity and efficiency of the impacted roads, with the existing level of service (LoS) (LoS A for all routes) maintained on most roads.

A moderate impact on capacity (reduction of LoS from A to B) is expected on Cope Road and Ulan Road due to the high traffic generation estimate produced by the Stubbo solar farm. At LoS B however, traffic would still be considered as free-flowing.

The free-flowing conditions were mainly due to the current low traffic demand on these roads.

EnergyCo is proposing to upgrade certain roads that would be used to access the construction area as part of a separate works package to ensure they can support OSOM movements. These upgrades would potentially assist in mitigating some of the potential cumulative impacts.

EnergyCo has also recently finalised an agreement with Transport for NSW to facilitate the upgrade of the State's road network to support OSOM movements between the Port of Newcastle and the Central-West Orana REZ. The upgrades delivered by these works would provide REZ-wide traffic and transport benefits.

Table A-22 Potential traffic impacts of relevant future projects during construction and operation

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Liverpool Range wind farm	Quantitative (sensitivity analysis)	Project location is between Coolah (to the northwest) and Cassilis (to the southeast). The project had been approved, however is seeking modification to for larger, yet a smaller number of turbines to be installed. Wind turbine components are anticipated to be transported to the site from the Port of Newcastle (travelling on the Hunter Express and Golden Highway). Road upgrades to surrounding roads and intersections have been included in the condition of consent of approval to allow OSOM access. Sealing, widening and/or pavement strengthening to roads includes Coolah Road, Ulan Road and other access roads to the project sites have been included. Upgrades to key intersections such as along Coolah Road, Ulan Road and others have also been included as part of the conditions of consent. The modification seeks to upgrade these in stages, with Stage 1 encompassing upgrades to site entry intersections and Stage 4 completion of road upgrades for all public roads for use by the project based on the final pre-construction layout. The project would generate 401 vehicles per day. To quantitatively assess the cumulative impact of this project along with this project, a sensitivity assessment (refer to Table A-23) has been included to assess additional traffic potentially using the Golden Highway in Uarbry/Leadville. Assume the peak hour traffic makes up of 10 per cent of the daily traffic, which results in an increase of 40 vehicles/hour (inbound to the project site in the morning (AM) peak and outbound in the afternoon (PM) peak).	Coolah Road, Ulan Road and Golden Highway	Modern wind farms are designed to largely operate automatically and unmanned. Generally the operation would only require several technicians in attendance to carry out scheduled site inspections during work hours and maintenance on the wind turbines. Unscheduled maintenance will be carried out by technicians, as required, both during and outside normal working hours. The project anticipates that all scheduled and unscheduled maintenance will generate up to 30 movements per day on the surrounding road network, largely comprising light vehicles such as utility vehicles and/or vans. This is considered minor and manageable given ample capacity on the road network.

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Valley of the Winds wind farm	Quantitative (sensitivity analysis)	Valley of the Winds wind farm is located between Coolah town and the Golden Highway. Roads in the study area which overlap with this project include Golden Highway. Several local roads within this region would also be used for access to the wind farm project. Upgrades to some of these local roads are proposed to provide reliable access for construction and operation of the wind farm. Intersection upgrades on the state road network are also proposed particularly along the Golden Highway to provide access for OSOM vehicles. During the peak period of construction, in 2023, the project would generate 253 light vehicle and 8 heavy vehicle hourly movements if the workforce is to be distributed across nearby towns. This would result in an increase of around 135 vehicles per hour on both Golden Highway. However, should the project provide a centralised workforce accommodation camp, it would generate 64 light vehicle and 8 heavy vehicle hourly movements. The significant reduction in light vehicle volumes is due to the use of shuttle buses to transport workers between camp and compound. This would only result in an increase of around 8 vehicles per hour on the Golden Highway. To quantitatively assess the cumulative impact of this project along with this project, a sensitivity assessment has been included (refer to Table A-23) to assess additional traffic potentially using the Golden Highway in Uarbry/Leadville. The increase is assumed to be 8 vehicles/hour (inbound to the project site in the AM peak and outbound in the PM peak) consistent with the impact report of the project.	Golden Highway	The project estimates around 50 operational staff which would generate about 100 daily light vehicle movements (50 inbound and 50 outbound). Heavy vehicles would only be required for infrequent repairs and maintenance and are not expected to occur on a regular basis. The minimal movements generated during the operation of the project can be readily accommodated on the road network. The cumulative impact with the this project is minor.

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Stubbo solar farm	Quantitative (sensitivity analysis)	The Stubbo solar farm site is located immediately north of Gulgong township. Access to the site is proposed from Blue Springs Road to the east of the site. Construction access to the site would be via Golden Highway, Ulan Road, Cope Road and Blue Springs Road. Workers would travel through Gulgong and use Cope Road and Blue Springs Road to access the project area. According to the transport impact assessment, the construction phase would peak in 2023 with the site expected to generate 580 daily trips, or 242 peak hour trips (230 light vehicles and 12 heavy vehicles). The study has indicated no upgrades to the road network would be required. The trip distribution is estimated to be 90% from Mudgee and 10% from Gulgong. To quantitatively assess the cumulative impact of this project along with this project, a sensitivity assessment has been completed (refer to Table A-23) to assess additional traffic potentially using Ulan Road and Cope Road in Ulan. The increase of 242 peak hour trips would reduce the mid-block level of service from LoS A to LoS B. This is considered a medium impact as under LoS B, traffic would still be free-flowing with slight reduction in freedom to manoeuvre within the traffic stream.	Golden Highway, Ulan Road, Cope Road and Blue Springs Road	A total of 10 operational staff would be required during the operational stage. Assuming all staff drive to work, this equals to 20 daily light vehicle trips (10 in the AM peak and 10 in the PM peak). The cumulative impact with this project is minor.
Barneys Reef solar farm	Qualitative	Barneys Reef wind farm is located in Barneys Reef, north of Gulgong. According to the Scoping Report, the site would be accessible from Merotherie Road and Gingers Lane. The project would result in increased traffic movements by light, heavy and OSOM vehicles. OSOM vehicles are required to transport turbine towers, blades and other large/heavy equipment for construction. It is expected that upgrades to local roads and intersections to allow access to heavy vehicles would be required prior to deliveries of materials for construction. The Scoping Report has not detailed the increase in traffic demand on the road network as part of the project.	Merotherie Road and Gingers Lane	The Scoping Report has identified that traffic associated with the operational phase of the project would be minimal and generally only involve the movements of light vehicles for operational staff. The cumulative impact is therefore considered minor.

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Birriwa solar farm	Quantitative (sensitivity analysis)	Birriwa solar farm is located on Barneys Reef Road off the Castlereagh Highway. The construction program has been noted that it may coincide with Tallawang solar farm and Barneys Reef wind farm. During peak construction period, the project is proposed to generate on a daily basis 360 light vehicle, 13 shuttle bus and 120 heavy vehicle movements. The peak hour movement include 360 light vehicles, 13 shuttle bus and 28 heavy vehicles. 35% of movements would occur along the north (Dunedoo and Dubbo) and 65% of movements would occur in the south (Mudgee and Gulgong) on the Castlereagh Highway. The project also proposes to widen and resurface Birriwa Bus Route South to provide access for heavy vehicles. To quantitatively assess the cumulative impact of this project along with this project, a sensitivity assessment (refer to Table A-23) has been included to assess additional traffic potentially using Merotherie Road (10% of movements) and Castlereagh Highway north of Barneys Reef Road (25% of movements) as an estimate of movements to Dunedoo and Dubbo. Assuming the peak hour traffic makes up of 10 per cent of the daily traffic, Merotherie Road would be subject to an increase of 4 vehicles per hour in the peak period and Castlereagh Highway north of Barneys Reef Road would be subject to an increase of 10 vehicles per hour.	Castlereagh Highway	The project would operate 24 hours, 7 days a week. It is anticipated throughout its operations that up to 20 people would be required on-site to carry out maintenance. This would generate movements for up to 20 light vehicles per day. Heavy vehicles would only be required for larger component of the project. The cumulative impact is therefore considered minor.

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Tallawang solar farm	Quantitative (sensitivity analysis)	Tallawang Solar farm is located within the project's study area, near Laheys Creek Road/ Castlereagh Highway intersection. The project is anticipated to commence in June 2023 subject to approvals and construction would extend for around 34 months, and a peak period of up to 4 months. There would be 580 workers required during the peak period, generating 300 light vehicle movements daily (150 hourly movements) distributed across Golden Highway/Castlereagh Highway (north) and Castlereagh Highway (south) to the project area. For heavy vehicles, the study assumes 270 vehicles per day and 2 OSOM movements per day. This was assumed as 30 heavy vehicles per hour and 1 OSOM vehicle movement during the peak hour. To quantitatively assess the cumulative impact of this project along with this project, a sensitivity assessment (refer to Table A-23) has been included to assess additional traffic potentially using the Castlereagh Highway in Birriwa. The increase is assumed to be 150 vehicles/hour, split into 50:50 between north (Dunedoo) and south (Gulgong). The movements are assumed to travel inbound to the project area in the AM peak and outbound in the PM peak.	Laheys Creek Road and Castlereagh Highway	Traffic generation during operation would be relatively minor, with up to 7 operational/maintenance staff servicing the solar farm infrastructure. As such, the cumulative impact is considered minor.
Cobbora solar farm	Qualitative	According to the Scoping Report, Cobbora solar farm is accessible from the Golden Highway via Spring Ridge Road. The project currently considers 2 site access points at the northern access (5 km from the Golden Highway) and southern access (10 km from the Golden Highway). The Scoping Report has not detailed the increase in traffic demand on the road network as part of the project.	Golden Highway and Spring Ridge Road	The Scoping Report has identified for the solar farm to potentially require 15 full time equivalent staff. Minor traffic demand would be generated during the operation, as such, the cumulative impact is considered minor.
Sandy Creek solar farm	Qualitative	According to the Scoping Report, the Sandy Creek solar farm would be accessible from the Golden Highway via Spring Ridge Road. A number of access options are currently being investigated for the site, including Option 2 (eastern entry via Spring Ridge Road and Dapper Road). Light vehicles would access the site from the south via Spring Ridge Road. The Scoping Report has not detailed the increase in traffic demand on the road network as part of the project.	Golden Highway and Spring Ridge Road	The Scoping Report has identified no significant traffic impacts to report during operation. The cumulative impact is therefore considered minor.

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Dapper solar farm	Qualitative	The project area would be accessed via the Golden Highway via Spring Ridge Road or Dapper Road. Construction could be expected to begin in 2025 and extend up to 18-24 months. This project is located near Elong Elong Energy Hub and has the potential to overlap with this project in access (on Spring Ridge Road) and timing. The Scoping Report has not detailed the increase in traffic demand on the road network as part of the project.	Golden Highway, Spring Ridge Road, Sandy Creek Road and Dapper Road	The Scoping Report has not identified the number of workers likely to be required during the operational phase. However similar solar farms typically identify the need of only a small group of staff on a daily basis. Should this be the case, the project would be considered to have minor cumulative impact overall.
Orana wind farm	Qualitative	The wind farm would be accessed via Tucklan Road off the Golden Highway at the north of the wind farm site and via Tucklan Road off the Castlereagh Highway at the east of the wind farm site. The Tucklan Road/Castlereagh Highway intersection would be upgraded to accommodate OSOM vehicle movements. A third access point would be via Spring Ridge Road in the west. The project would likely require up to around 580 full time equivalent construction workers during peak periods, which are expected to be during Phase 3 (out of 4 phases) of the project when the main construction works would be undertaken. The timing of construction would be dependent on project approval, however, is expected to commence in 2025 and run for around 2 to 3 years. The Orana wind farm project would likely be under construction at the same time as this project. The Scoping Report has not detailed the increase in traffic demand on the road network as part of the project. The project however will be mainly accessed from Tucklan Road with a smaller portion of movements required to/from Spring Ridge Road. As such, the cumulative traffic impacts of the wind farm project and this project during construction is considered minor.	Tucklan Road, Spring Ridge Road, Golden Highway, Castlereagh Highway, Corishs Lane, Brooklyn Road, Upper Laheys Creek Road and Spir Road.	The wind farm is envisaged to operate 24/7 with up to around 12 full-time equivalent staff required to operate and maintain the wind farm on site. Overall the operation of the wind farm would result in insignificant impact to the operation of the road network.

Table A-23 Road performance analysis – during construction and with cumulative traffic from relevant future projects

ID	Location	Road classification	Lane capacity (vehicles per hour/lane)	Traffic volume (project construction) volume/capacity ratio (Level of Service)				Projects influencing Cumulative Impact Assessment	Cumulative Impact Assessment (CIA) - Additional peak hour movements generated by other projects				Traffic volume with project and CIA volume/capacity ratio (Level of Service)			
				AM peak hour		PM peak hour			AM peak hour		PM peak hour		AM peak hour		PM peak hour	
				NB/WB[1]	SB/EB[1]	NB/WB	SB/EB		NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB	NB/WB	SB/EB
H01	Golden Highway (near Spring Ridge Road, west of Dunedoo), Dunedoo	Highway	1,800	147 vehicles per hour (vph) 0.08 (LOS A)	62 vph 0.03 (LOS A)	61 vph 0.03 (LOS A)	151 vph 0.08 (LOS A)	• Birriwa solar farm	13	1	1	13	160 vph 0.09 (LOS A)	63 vph 0.04 (LOS A)	62 vph 0.03 (LOS A)	164 vph 0.09 (LOS A)
H02	Golden Highway (between Ulan Road and Merotherie Road), Uarbry)	Highway	1,800	122 vph 0.07 (LOS A)	42 vph 0.02 (LOS A)	46 vph 0.03 (LOS A)	110 vph 0.06 (LOS A)	• Valley of the Winds wind farm • Liverpool Range wind farm	5	43	43	5	127 vph 0.07 (LOS A)	85 vph 0.05 (LOS A)	89 vph 0.05 (LOS A)	115 vph 0.06 (LOS A)
H03	Castlereagh Highway (between Golden Highway and Tucklan Road), Birriwa	Highway	1,800	34 vph 0.02 (LoS A)	86 vph 0.05 (LoS A)	83 vph 0.05 (LoS A)	39 vph 0.02 (LoS A)	• Birriwa solar farm	9	80	80	9	43 vph 0.02 (LOS A)	166 vph 0.09 (LOS A)	163 vph 0.09 (LOS A)	48 vph 0.03 (LOS A)
H05	Castlereagh Highway (north of Laheys Creek Road), Beryl	Highway	1,800	36 vph 0.02 (LOS A)	91 vph 0.05 (LOS A)	89 vph 0.05 (LOS A)	50 vph 0.03 (LOS A)	• Tallawang solar farm	68	7	7	68	104 vph 0.06 (LOS A)	98 vph 0.05 (LOS A)	96 vph 0.05 (LOS A)	118 vph 0.07 (LOS A)
L07	Merotherie Road (south of Golden Highway)	Local	1,000	8 vph 0.01 (LOS A)	67 vph 0.07 (LOS A)	67 vph 0.07 (LOS A)	8 vph 0.01 (LOS A)	• Birriwa solar farm • Barneys Reef solar farm	3	26	26	3	11 vph 0.01 (LOS A)	93 vph 0.09 (LOS A)	93 vph 0.09 (LOS A)	11 vph 0.01 (LOS A)
M01	Cope Road (between Blue Springs Road and Springwood Park Road)	Main Road	1,400	61 vph 0.04 (LOS A)	111 vph 0.08 (LOS A)	51 vph 0.04 (LOS A)	96 vph 0.07 (LOS A)	• Stubbo solar farm	218	24	24	218	279 vph 0.20 (LOS A)	135 vph 0.10 (LOS A)	75 vph 0.05 (LOS A)	314 vph 0.22 (LOS A)
M03	Ulan Road near Ulan township	Main Road	1,400	455 vph 0.33 (LOS B)	197 vph 0.14 (LOS A)	241 vph 0.17 (LOS A)	199 vph 0.14 (LOS A)	• Stubbo solar farm	25	217	217	25	480 vph 0.34 (LOS B)	414 vph 0.30 (LOS B)	458 vph 0.33 (LOS B)	224 vph 0.16 (LOS A)

(2) NB = Northbound; WB = Westbound; SB = Southbound; EB = Eastbound

Operation

Operation and maintenance activities of the relevant future projects have the potential to increase the number of vehicle movements on the road network in combination with this project.

Of the relevant future projects, only 10 related development projects are located within the study area and would utilise roads used by this project during operation. Each of these projects would generate up to between 20 and 100 light vehicle movements per day. This is expected to result in an overall minor impact on traffic and transport, considering the existing capacity and efficiency of the local road network. Heavy vehicles would only be required for infrequent repairs and maintenance and are expected to have a negligible impact.

E3.10 Waste management

E3.10.1 Methodology

The study area for the waste management cumulative impact assessment consists of the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs.

A standard assessment was carried out that involved:

- reviewing the nature and scale of potential waste management impacts within the project timeframes, as described in publicly available planning documents for the relevant future projects (identified in Table A-3). Potential impacts of the relevant future projects were found to overlap with the potential impacts of this project at a regional scale. Public road works have not been included in the assessment as environmental assessment for these works has not yet commenced
- qualitatively assessing potential regional cumulative waste management impacts of the relevant future projects in combination with this project, including the capacity of existing waste management facilities to accept wastes from these projects
- recommending mitigation measures as required.

E3.10.2 Impact assessment

Construction

A number of waste management and waste transfer facilities operated by local councils are located near this project and would also potentially service the relevant future projects considered in this assessment. These facilities accept a wide range of wastes, including construction and demolition waste, domestic waste and recyclable materials. Table 18-1 of Chapter 18 (Waste management) identifies existing waste management facilities within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter LGAs, and the waste types able to be received by these facilities.

Engagement with the relevant councils have indicated the Mudgee Waste Facility is at capacity and would not be able to accept waste generated from the construction of the project, and commercial waste is not accepted at the Mid-Western Regional council-operated Gulgong Waste Facility. In addition, the Wellington Waste Transfer Station and Cassilis Waste Management Facility do not accept large volumes of waste.

While there is only very limited information available about the quantities and types of waste generated by the relevant future projects, or their intended waste management strategies, waste generation by these projects would potentially impact on waste management facilities considered for this project. Potential waste management impacts of this project may therefore be significantly exacerbated by the potential cumulative waste management impacts of the relevant future projects.

As detailed in Chapter 5 (Community and Stakeholder Engagement), EnergyCo has been engaging with local councils (including Mid-Western Regional Council, Dubbo Regional Council, Warrumbungle Shire Council and Upper Hunter Shire Council) to discuss this project and the development of the Central-West Orana REZ. The capacity of waste infrastructure to accept the anticipated waste volumes of this project has been raised as a key issue in discussions to date. In response, EnergyCo has undertaken a series of studies to guide how cumulative impacts in the Central-West Orana REZ will be managed, including a dedicated study on waste management. EnergyCo will continue to engage with local councils about the management of potential cumulative waste management impacts as the project progresses.

Operation

Cumulative waste management impacts are expected to be minor due to the significantly smaller waste volumes generated during standard operational and maintenance activities for this project and the relevant future projects.

E3.11 Surface water and groundwater supply

E3.11.1 Methodology

The study area relating to surface water supply consists of the Talbragar River catchment upstream of Lake Burrendong and the Goulburn River upstream of its junction with the Hunter River. The study area relating to groundwater supply consists of a five kilometre radius around the proposed groundwater bores at the Elong Elong and Merotherie energy hubs.

A standard assessment was carried out that involved:

- identifying relevant future projects listed in Table A-3 with proposed sourcing of water for construction and/or operation from the surface water and groundwater supply study areas. Public road works have not been included in the assessment as environmental assessment for these works has not yet commenced
- reviewing project timeframes and extent of impacts as identified in the available planning documents for the relevant future projects
- quantitatively estimate the cumulative water demands for all relevant future projects and qualitatively assess the impacts of water demands on the surface water and groundwater supply for the study areas
- recommending mitigation measures as required.

The assessment of cumulative impacts on surface water quality did not include a quantitative assessment of pollutant loads against the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC/ARMCANZ, 2018) and Murray–Darling Basin Plan 2012 water quality trigger values.

E3.11.2 Impact assessment

Construction

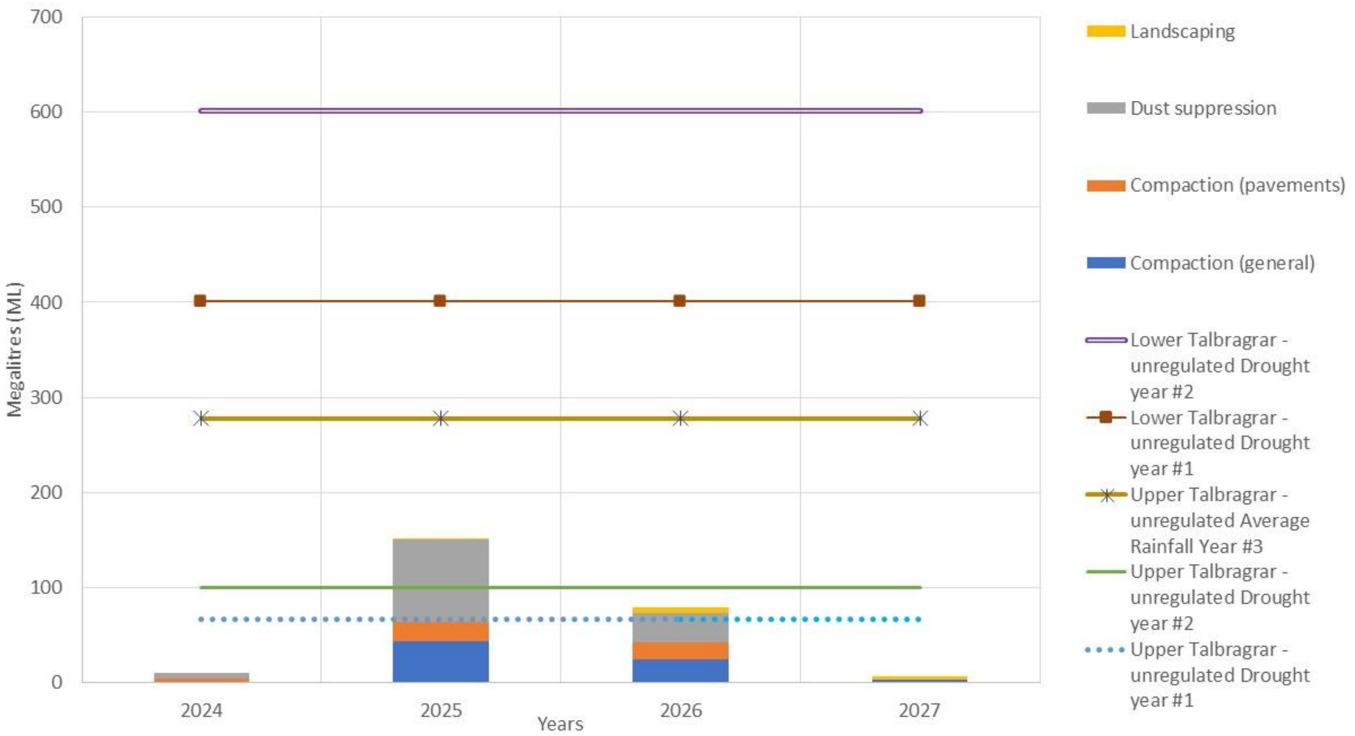
Surface water supply

During construction, the potential cumulative impacts on surface water supply is minimal. There are only two projects that have a substantial water demand overlap during the construction phase. The first is Liverpool Range wind farm, which is primarily located upstream of this project and overlaps this project along the Cassilis connection. This wind farm project is related development and has been approved with a proposed modification under assessment. The second project is the Tallawang solar farm which overlaps this project along the Tallawang south connection. The solar farm project is related development which has been proposed and is under assessment. Since neither of these projects have confirmed their proposed source of water supply, the assessment has assumed that the projects would extract water from the same surface water sources as this project. Surface water sources considered for the supply of non-potable water for this project include the Upper Talbragar River Water Source, Lower Talbragar River Water Source and Upper Goulburn River Water. All other relevant future projects would use either bore water or transport water from other water sources, or do not provide detail of the project water demands of the project or source of surface water supply.

Between 2024 and 2026, Liverpool Range wind farm and Tallawang solar farm would require 95 megalitres from the Upper Talbragar River Water Source and Lower Talbragar River Water Source, in addition to this project's water demand. There is currently sufficient water available in these surface water sources in an average rainfall year, to accommodate this additional demand, as shown in Figure A-3. However, during low rainfall or a drought period, there is likely to be an impact on the available water in the Upper Talbragar River Water Source and Lower Talbragar River Water Source. The trading of water access licences (WALs) for these water sources however is subject to open market forces and there is a limited volume and number of WALs available for each water source. WALs are granted subject to conditions which set out the licence holder's responsibilities and any restrictions. The volume of water licensed users can extract (known as an allocation or available water determination), is dependent on a range of factors including dam storage levels, river flows and catchment and climatic conditions, and is governed by the water sharing plan for the water source to ensure sustainable use of water sources. The allocation of available water through WALs thereby minimises cumulative impacts to water availability within the catchment.

Groundwater supply

No groundwater take has been identified for relevant future projects within five kilometres of the proposed construction water supply locations at the energy hubs, and therefore no cumulative impact would occur. Furthermore, groundwater extraction requires a water supply work approval, that takes into account existing extraction from any surrounding approvals, and therefore cumulative demand is considered for each new approval application.



#1 Drought year – based on Cudgegong River water source usage 2008–2009, 18% of total was available for regulated river (general security)

#2 Drought year – based on Cudgegong River water source usage 2019–2020, 27% of total was available for regulated river (general security)

#3 Average rainfall year – 600 millimetres – 2012–2013, 75% of total water was available for regulated fiver (general security)

Figure A-3 Cumulative construction water demand and water availability

Operation

Surface water supply

Surface water demand would reduce significantly for this project and the relevant future projects during operation, as water would be required for maintenance activities only.

The majority of the projects are renewable energy projects and would primarily source non-potable water from rainwater harvesting. Any additional water demand would be supplied from groundwater bores (excluding this project) and existing unregulated surface water sources. Surface water demand would be minimal for each project (less than an estimated five megalitres per year), which is well within the capacity of the Upper Talbragar River Water Source, Lower Talbragar River Water Source and Upper Goulburn River Water Source. Therefore, any potential cumulative impacts on available water in surface water sources during operation would be minor.

Groundwater supply

There is no permanent groundwater take as part of the operation of this project, and therefore there is no cumulative impact expected on the groundwater aquifers.

E3.12 Air quality

E3.12.1 Methodology

The study area for the air quality cumulative impact assessment consists of a five kilometre radius of this project. A standard assessment was carried out that involved:

- reviewing the nature and scale of potential air quality impacts within the project timeframes, as described in publicly available planning documents for the relevant future projects (identified in Table A-3). Public road works have not been included in the assessment as environmental assessment for these works has not yet commenced
- qualitatively assessing potential local cumulative air quality impacts of the relevant future projects in combination with this project, including dust generation and gaseous emissions during construction
- recommending mitigation measures as required

E3.12.2 Impact assessment

Construction

Cumulative air quality impacts would occur when projects within five kilometres undertake dust generating construction activities concurrently with the project, as described in Table A-24. With the implementation of standard mitigation measures for each project, any potential cumulative air quality impacts are expected to be minor.

Table A-24 Summary of cumulative air quality impacts during construction

Identified projects	Cumulative air quality impacts
Related development	
Liverpool Range wind farm	Potential for cumulative impacts at one receiver as the wind farm would be located next to this project's transmission line and switching station M1.
Barneys Reef wind farm	Potential for cumulative impacts given the potential for direct overlap during construction at switching stations M4, M5, M6 and M8 and the Merotherie Energy Hub. There are several sensitive receivers near the Barneys Reed wind farm construction area (around 4.3 km west) that have the potential to be affected by cumulative air quality impacts from this project and the wind farm project.
Birriwa solar farm	Potential for cumulative impacts given the potential for direct overlap during construction of switching station M5. There is the potential for 3 sensitive receivers to be affected by cumulative air quality impacts. There is also the potential for cumulative air quality impacts at one receiver depending on the timing and location of construction works at Barneys Reef wind farm (located around 4.2 km to the northwest boundary of Birriwa solar farm).
Tallawang solar farm	Potential for cumulative impacts given the potential for direct overlap during construction of switching station M9 and associated transmission line. There is the potential for 1 sensitive receiver to be affected by cumulative air quality impacts. There is also the potential for cumulative impacts from construction works at the Barneys Reef wind farm depending on construction overlap.
Orana wind farm	Potential for cumulative impacts given the potential for direct overlap during construction along the transmission line between the Elong Elong Energy Hub and Merotherie Energy Hub. There are several sensitive receivers near the Orana wind farm construction area that have the potential to be affected by cumulative air quality impacts from this project and the wind farm project.

Identified projects	Cumulative air quality impacts
Cobbora solar farm	Potential for cumulative impacts given the potential for direct overlap during construction of the Elong Elong Energy Hub, switching stations E1 and E2 and associated transmission line. There is the potential for 3 sensitive receivers to be affected by cumulative air quality impacts. Depending on construction overlap there is also the potential for cumulative impacts from construction works at the Sandy Creek solar farm, Dapper solar farm and the Spicers Creek wind farm.
Sandy Creek solar farm	Potential for cumulative impacts given the potential for direct overlap during construction of the Elong Elong Energy Hub, switching station E3 and associated transmission line. There is the potential for 3 sensitive receivers to be affected by cumulative air quality impacts. Depending on construction overlap there is also the potential for cumulative impacts from construction works at the Cobbora solar farm, Dapper solar farm and Spicers Creek wind farm.
Dapper solar farm	Potential for cumulative impacts given the potential for direct overlap during construction of switching station E2 and associated transmission line and the proximity to Elong Elong Energy Hub and switching station E1. There is the potential for 3 sensitive receivers to be affected by cumulative air quality impacts. Depending on construction overlap there is also the potential for cumulative impacts from construction works at the Cobbora solar farm, Sandy Creek solar farm and Spicers Creek wind farm.
Spicers Creek wind farm	Potential for cumulative impacts given the potential for direct overlap during construction of the switching station E4 and associated transmission line. There is the potential for 2 sensitive receivers to be affected by cumulative air quality impacts. Depending on construction overlap there is also the potential for cumulative impacts from construction works at the Cobbora solar farm, Dapper solar farm and the Sandy Creek solar farm.
Approved projects	
Stubbo solar farm	Potential for cumulative impacts given the potential for direct overlap during construction of the transmission line between the Merotherie Energy Hub and the New Wollar Switching Station. There is the potential for 2 sensitive receivers to be affected by cumulative air quality impacts. There is also the potential for cumulative air quality impacts at 1 of these receivers depending on the timing and location of construction works at Barneys Reef wind farm (located around 3.5 km to the northwest boundary of Stubbo wind farm).
Changes to existing projects	
Ulan coal mine Modification 6	Potential for cumulative impacts given the potential for direct overlap during construction of the transmission line extending northeast of the Merotherie Energy Hub. There is the potential for 9 sensitive receivers within 5 km of the proposed Ulan coal mine Modification 6 works to be affected by cumulative air quality impacts.

Operation

Air quality impacts from the project during operation would be minimal and are unlikely to contribute to cumulative impacts with the relevant future projects.

E4 Management of impacts

The approach taken to the assessment of cumulative impacts acknowledges that each project will be required to mitigate its own impacts to acceptable levels, minimising the overall contribution to cumulative impacts. However, it is also recognised that not all REZ related cumulative impacts can be addressed through a project-level approach alone, requiring a more strategic and collaborative approach between EnergyCo, renewable energy developers, councils and government agencies.

Over the last 12 months, EnergyCo has consulted with councils and other government agencies on studies to inform how cumulative impacts in the Central-West Orana REZ will be managed. The studies cover a range of issues that have been identified as priorities through consultation with communities and councils including:

- workforce accommodation
- road upgrades and traffic management
- training and skills
- waste management
- mobile connectivity
- social infrastructure.

Given the scale and complexity of the task, work undertaken to date has focussed on data gathering to:

- establish baseline information across a range of matters, for example, existing levels of service provision (e.g. medical services and waste infrastructure)
- identify key project parameters for this project and related development projects that could impact service provision (e.g. temporary workforce numbers and waste volumes).

Data gathering has been supplemented by engagement with government agencies with expertise or regulatory responsibility in an area relevant to the studies, to verify baselines and understand plans for future investment or expansion of service provision. This has provided an important evidence base to identify potential measures to manage cumulative impacts and to ensure they are targeted, coordinated and complement existing commitments and policy directions.

The next stage involves the establishment of working groups involving representatives from councils, agencies and EnergyCo to assess and prioritise recommendations, including the identification of funding sources and lead agency responsibilities and implementation timeframes. The outcomes of this next stage will be documented in an Implementation Plan by the end of 2023.

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