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Date: Tuesday, 29 April 2025 at 2:39 pm

[redacted]

Subject: VoW WF Proposal - Strategic Cumulative Impact Assessment

Dear Stephen,
As you are aware, I act for Warrumbungle Shire Council on CWO REZ-related matters.

For the information of the IPC Panel, which is currently examining the Valley of the Winds Wind Farm proposal, please see the document attached. It is *Appendix L: Cumulative Impact Assessment to the Amendment Report for the CWO REZ Transmission Project*.

Council refers it to the IPC because, as stated therein, EnergyCo is the Infrastructure Planner for the CWO REZ and thus is responsible for co-ordinating the transmission, generation, firming and storage projects planned for the REZ. In the document EnergyCo points out it is taking a leading role in the coordination of impacts and benefits to communities who will be hosting renewable generation and transmission infrastructure.
In particular, Council draws your attention to page 140 'L4 Management of Impacts'.
The last paragraph indicates that the measures to manage cumulative impacts were expected to be documented in an Implementation Plan 'by the end of 2023'.

Kind regards,
Warwick

Warwick Giblin
Principal, ESE Justice
Adjunct Professor, Faculty of Science, Agriculture, Business & Law, University of New England
Fellow, Royal Society of NSW
Fellow, Environment Institute of Australia & New Zealand
[redacted]

EnergyCo

Central West Orana Renewable Energy Zone Transmission project

Amendment Report

Appendix L: Cumulative impact assessment

March 2024

www.energyco.nsw.gov.au

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L1 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.

L2 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 L3.1.2.
- 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 L4 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 L2.1)
- 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 L2.2)
- 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 L3.1 to L3.12. 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 L3.5.

L2.1 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 L-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 be 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 L-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.

L2.2 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 L-2.

Table L-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.

L2.3 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 L-3. These projects are shown in Figure L-1 and Figure L-2.

The potential overlap in construction schedules of this project with the identified projects is shown in Table L-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 L-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 L2.3.1. The level of assessment carried out for assessed issues are identified in Section L2.3.2.

Table L-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 – 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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2 – 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, Response to Submissions Report and Amendment Report	Construction period: 2024–2028 (24–42 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 – Narragamba solar farm Merotherie, Mid-Western Regional LGA The construction, operation and decommissioning of a 320 MW solar farm with about 832,000 photovoltaic (PV) solar panels with BESS, supporting infrastructure and temporary construction facilities including construction compounds and laydown areas, concrete batching plant, workforce accommodation camp and public road upgrade works.	Scoping/pre-EIS Scoping Report	Construction period: Late 2025–2027 (20–24 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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
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 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, Submissions Report and Amendment Report	Construction period: Late 2025–2028 (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
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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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
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	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
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.	Under assessment EIS	Construction period: 48 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
Proposed projects															
12 – Bellambi Heights battery energy storage system (BESS) Beryl, Mid-Western Regional LGA The construction, operation and decommissioning of a grid-scale battery project (with peak maximum generation capacity of 408 MW/816 MWh), supporting infrastructure and temporary construction facilities, including construction compound and laydown areas.	Under assessment EIS	Construction period: Early 2025 (One stage (13–20 months) or two stages: Stage 1 (13–20 months) and Stage 2 (12–15 months))	4 kilometres (km) south of central section of project	✓		✓		✓	✓			✓	✓	✓	✓
13 – Goulburn River solar farm Merriwa, Upper Hunter LGA The construction, operation and decommissioning of a 550 MW solar farm with BESS (indicative capacity of 280 MW/570 MWh), supporting infrastructure and temporary construction facilities, including construction compounds and laydown areas plants and public road upgrade works.	Under assessment EIS	Construction period: 2024–2027 (27 months)	16 km northeast of southeastern section of project	✓		✓	✓	✓	✓				✓	✓	✓
14 – Burrendong wind farm Yarragal, Yarrabin, Hargraves, Mumbil, and Dripstone, Dubbo Regional and Mid-Western Regional LGAs The construction, operation and decommissioning of a 500 MW wind farm with about 70 wind turbines (with a maximum tip height of about 250 m), supporting infrastructure and temporary construction facilities, including construction compounds, concrete batching plants and public road upgrade works.	Under assessment EIS	Construction period: 2024–2029 (18–24 months)	18 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
15 – Wellington South battery energy storage system 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, Response to Submissions Report and Amendment Report	Construction period: 2024–2025 (12–18 months; two stages with Stage 2 commencing 6–12 months after Stage 1)	36 kilometres (km) southwest of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
16 – Orana BESS Montefiores, Dubbo Regional LGA The construction, operation and decommissioning of a grid-scale battery project (with peak maximum generation capacity of 400 MW/1600 MWh), substation and switchyard, supporting infrastructure and temporary construction facilities, including construction compound/laydown areas.	Under assessment EIS and Response to Submissions Report	Construction period: Stage 1: Early to Mid 2024, Stage 2: Late 2024 (12–18 months)	37 km southwest of western section of project			✓		✓	✓				✓	✓	✓
17 – 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.	Under assessment EIS and Submissions Report	Construction period: To be completed in 2024/2025	50 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
Approved projects															
18 – Wollar solar farm Wollar, Mid-Western Regional LGA The construction, operation and decommissioning of a 290 MW solar farm with about 922,000 PV solar panels with BESS (indicative capacity of 30 MW/ 30 MWh), supporting infrastructure and temporary construction facilities, including construction compounds, and public road upgrade works.	Approved, under construction EIS, Submissions Report, Amendment Report and Assessment Report	Construction period: Late 2022–Mid 2024 (12–18 months)	Adjacent to project at New Wollar Switching Station	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
19 – 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, under construction 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
20 – 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	✓		✓	✓	✓	✓		✓			✓	✓
21 – 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
22 – 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	✓		✓	✓	✓	✓		✓			✓	✓
23 – Apsley BESS Apsley, Dubbo Regional LGA The construction, operation and decommissioning of a battery project and temporary construction facilities.	Approved EIS, Submissions Report, Amendment Report and Assessment Report	Construction period: Mid 2024 (5 months)	47 km southwest of western section of project	✓		✓	✓	✓	✓		✓			✓	✓
24 – 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.	Approved EIS, Submissions Report, Amendment Report and Assessment Report	Construction period: 2023–2024 (12–18 months)	61 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
25 – 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: 2024–2027 (24–30 months)	25 km south of western section of the project	✓		✓	✓	✓	✓		✓			✓	✓
26 – 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: Early 2024–Late 2025(14 months)	30 km southwest of western section of the project	✓		✓	✓	✓	✓		✓			✓	✓
27– Blain Road solar farm Caerleon, Mid-Western Regional LGA The construction, operation and decommissioning of a 5 MW solar farm with up to 9,408 PV solar panels with BESS, supporting infrastructure and temporary construction facilities.	Approved Council Assessment Report and Supplementary Council Assessment Report	Not specified	33 km southeast of central 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
28 – 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: 2024 (3 months)	35 km southwest of western section of the project	✓		✓	✓	✓	✓		✓			✓	✓
29 – 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	✓		✓	✓	✓	✓		✓			✓	✓
30 – 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	✓		✓	✓	✓	✓		✓			✓	✓
31 – 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	✓		✓	✓	✓	✓		✓			✓	✓

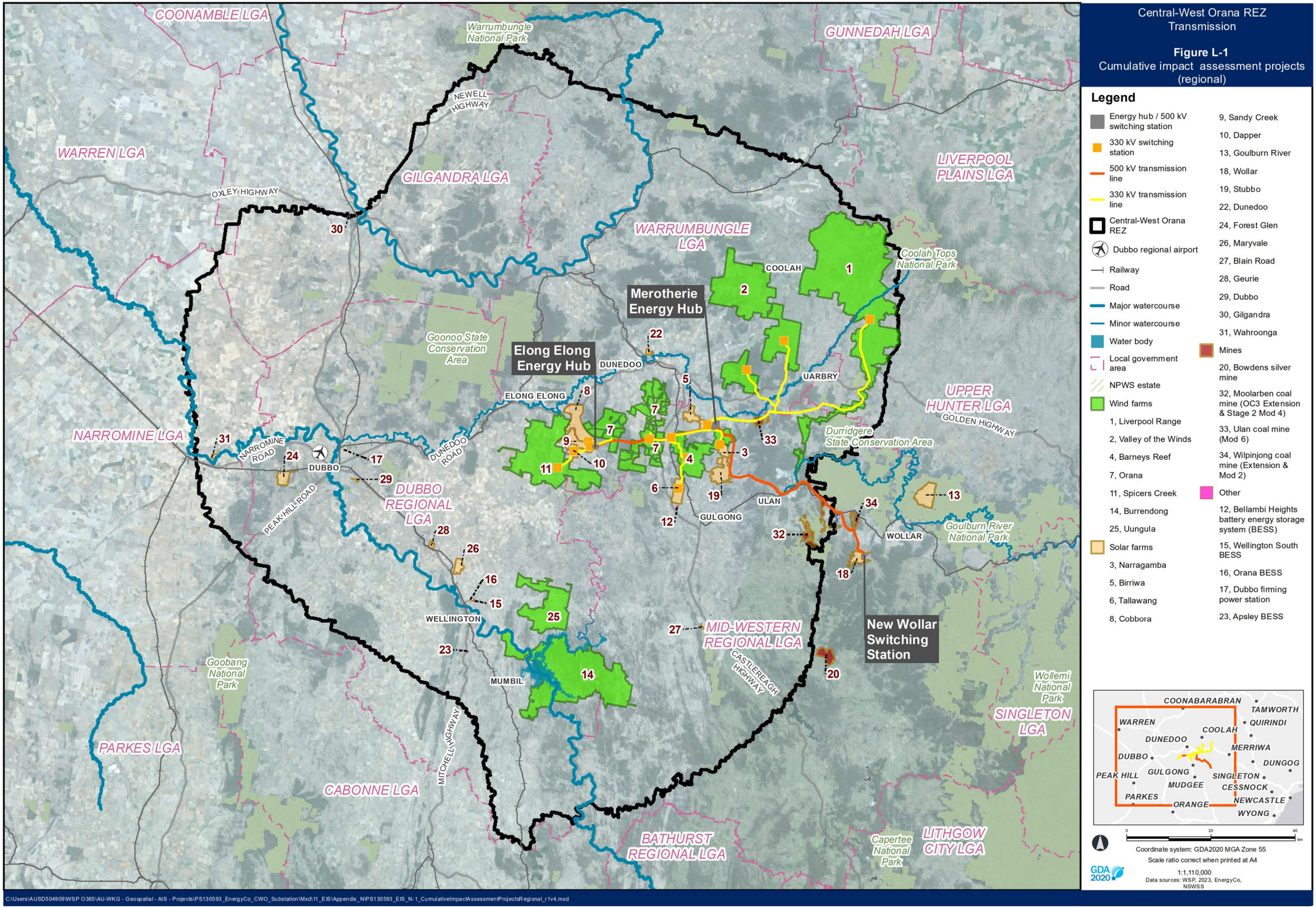
Project details				Potential cumulative impacts											
ID, name and location	Planning status and environmental assessment documentation reviewed	Construction/ operation period	Distance from project	Land use, property and agriculture	Landscape and visual	Biodiversity	Aboriginal	Social	Economic	Noise and vibration	Bushfire and general hazards	Air quality	Traffic and transport	Waste management	Surface water and groundwater supply
Changes to existing projects															
32 – 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
33 – 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 and Submissions Report	Operational period: present – 2035	Direct overlap	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓
34 – Wilpinjong coal mine Extension and Modification 2 Wilpinjong, Mid-Western Regional LGA The extension of the existing Wilpinjong open cut mine to enable the extraction of an additional around 95 Mt of coal, and the provision of associated infrastructure, including road upgrades and relocation of a 330 kV transmission line. Modification 2 involves the construction and use of a temporary on-site accommodation facility and supporting infrastructure within the existing approved open cut mining area.	Under assessment Extension: EIS, Submissions Report, Amendment Report and Assessment Report Modification 2: Modification Report	Operational period: present – 2033	1 km northeast of southeastern section of project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Table L-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																								
Liverpool Range wind farm																								
Valley of the Winds wind farm																								
Narragamba solar farm																								
Birriwa solar farm																								
Tallawang solar farm																								
Orana wind farm																								
Cobbora solar farm																								
Sandy Creek solar farm																								
Dapper solar farm																								
Bellambi Heights BESS																								
Goulburn River solar farm																								
Burrendong wind farm																								
Wellington south BESS																								
Orana 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																								

1. Includes only projects that have provided an indicative construction period and commencement date in publicly available environmental assessment documentation.



Central-West Orana REZ Transmission

Figure L-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
  - 1, Liverpool Range
  - 2, Valley of the Winds
  - 4, Barneys Reef
  - 7, Orana
  - 11, Spicers Creek
  - 14, Burrendong
  - 25, Uungula
- Solar farms
  - 3, Narragamba
  - 5, Birriwa
  - 6, Tallawang
  - 8, Cobbora
  - 9, Sandy Creek
  - 10, Dapper
  - 13, Goulburn River
  - 18, Wollar
  - 19, Stubbo
  - 22, Dunedoo
  - 24, Forest Glen
  - 26, Maryvale
  - 27, Blain Road
  - 28, Geurie
  - 29, Dubbo
  - 30, Gilgandra
  - 31, Wahroonga
- Mines
  - 20, Bowdens silver mine
  - 32, Moolarben coal mine (OC3 Extension & Stage 2 Mod 4)
  - 33, Ulan coal mine (Mod 6)
  - 34, Wilpinjong coal mine (Extension & Mod 2)
- Other
  - 12, Bellambi Heights battery energy storage system (BESS)
  - 15, Wellington South BESS
  - 16, Orana BESS
  - 17, Dubbo firming power station
  - 23, Apsley BESS

Coordinate system: GDA2020 MGA Zone 55
Scale ratio correct when printed at A4
1:1,110,000
Data sources: WSP, 2023, EnergyCo, NSWSS

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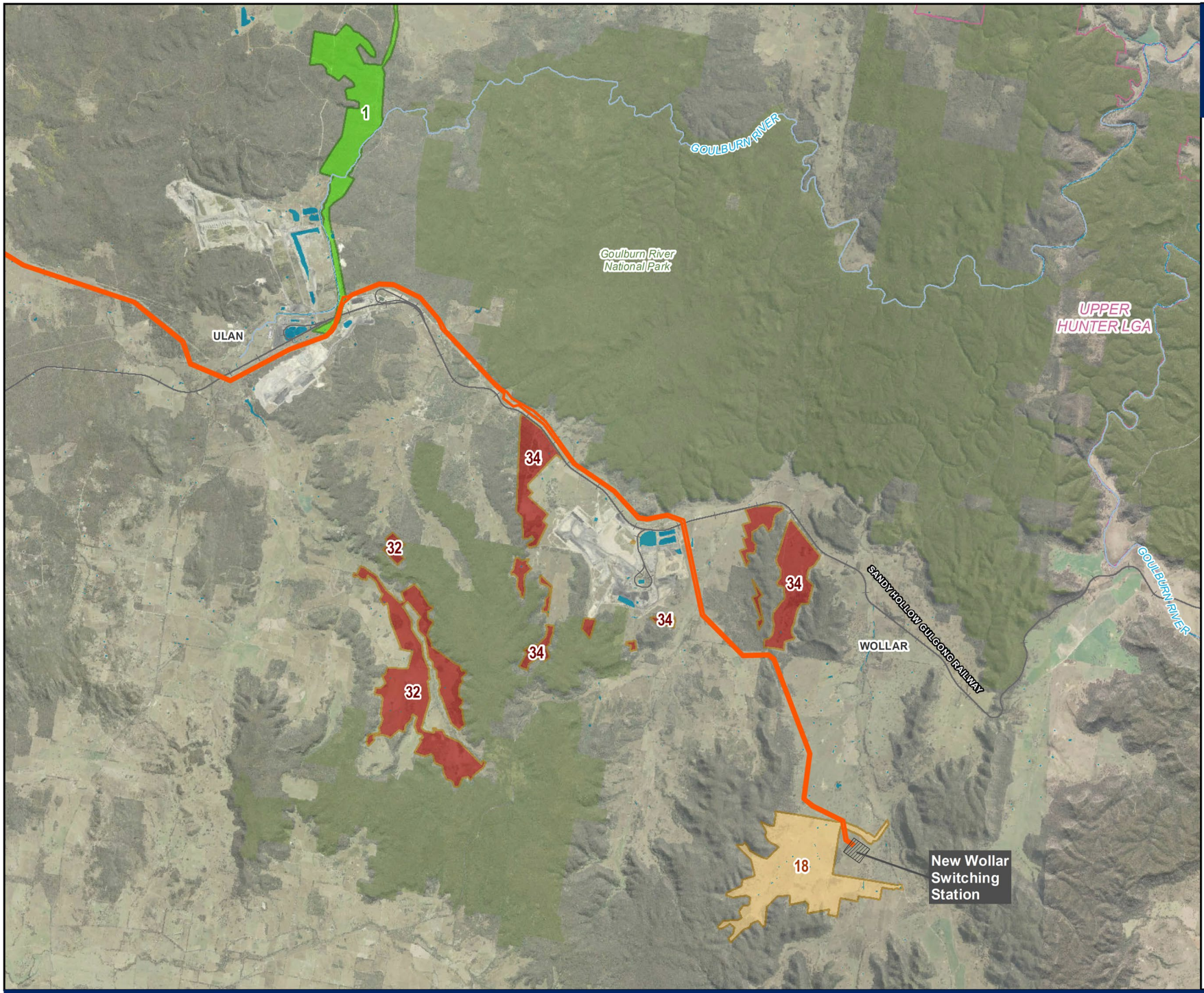
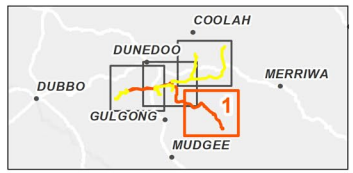


Central-West Orana REZ Transmission

Figure L-2
Cumulative impact assessment projects (local)
Map 1 of 4

Legend

- Local government area
- Energy hub / 500 kV switching station
- 500 kV transmission line
- Railway
- Watercourse
- Water body
- Wind farms
  - 1, Liverpool Range wind farm
- Solar farms
  - 18, Wollar solar farm
- Mines
  - 32, Moolarben coal mine (OC3 Extension & Stage 2 Mod 4)
  - 34, Wilpinjong coal mine (Extension & Mod 2)
- NPWS estate



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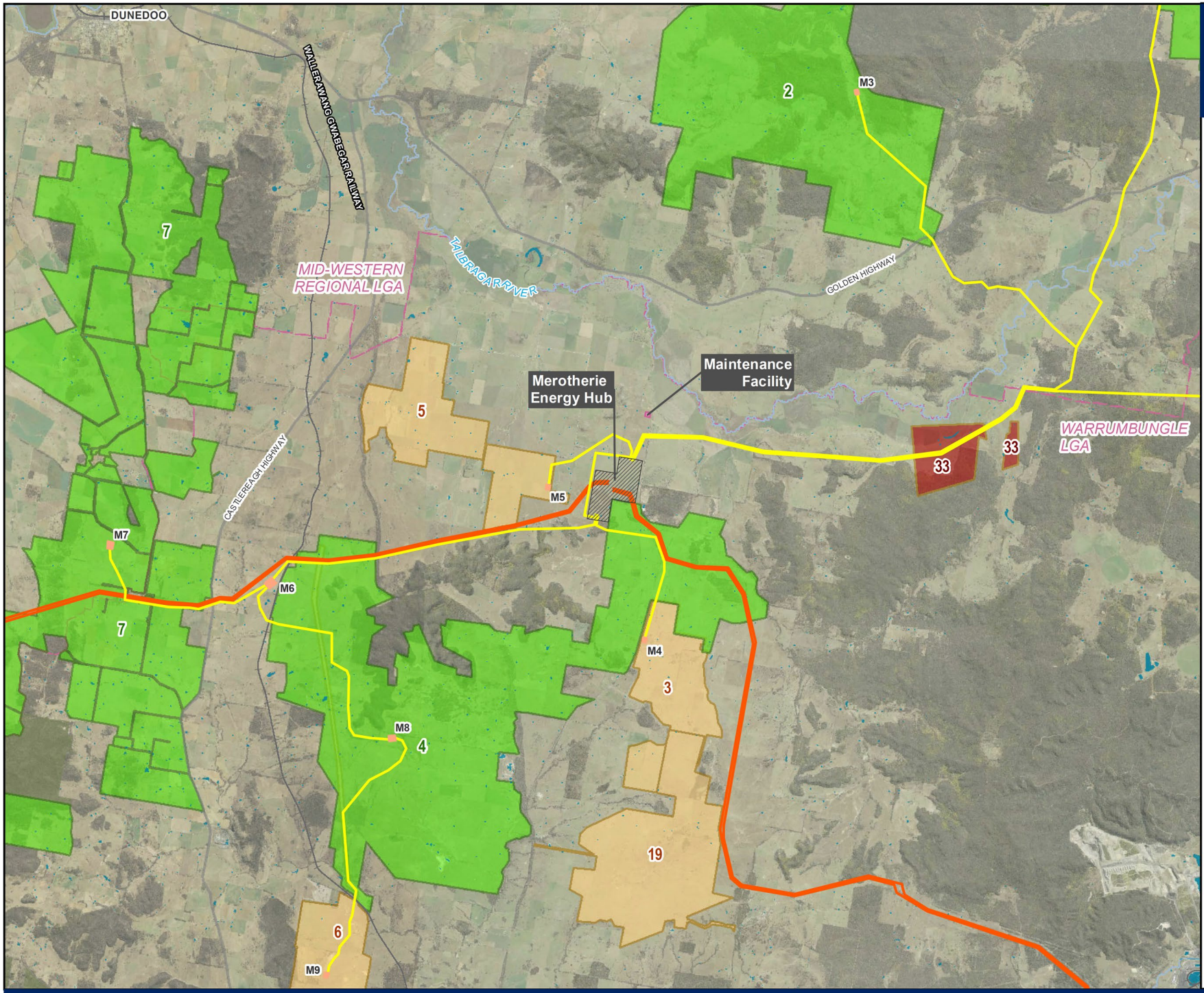
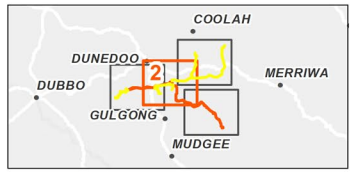


Central-West Orana REZ Transmission

Figure L-2
Cumulative impact assessment projects (local)
Map 2 of 4

Legend

- Local government area
- Energy hub / 500 kV switching station
- Maintenance facility
- 330 kV transmission line
- 500 kV transmission line
- 330 kV switching station
- Railway
- Road
- Watercourse
- Water body
- Wind farms
  - 2, Valley of the Winds wind farm
  - 4, Barneys Reef wind farm
  - 7, Orana wind farm
- Solar farms
  - 3, Narragamba solar farm
  - 5, Birriwa solar farm
  - 6, Tallawang solar farm
  - 19, Stubbo solar farm
- Mines
  - 33, Ulan coal mine (Mod 6)
- NPWS estate



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Data sources: WSP 2023, EnergyCo, NSWSS

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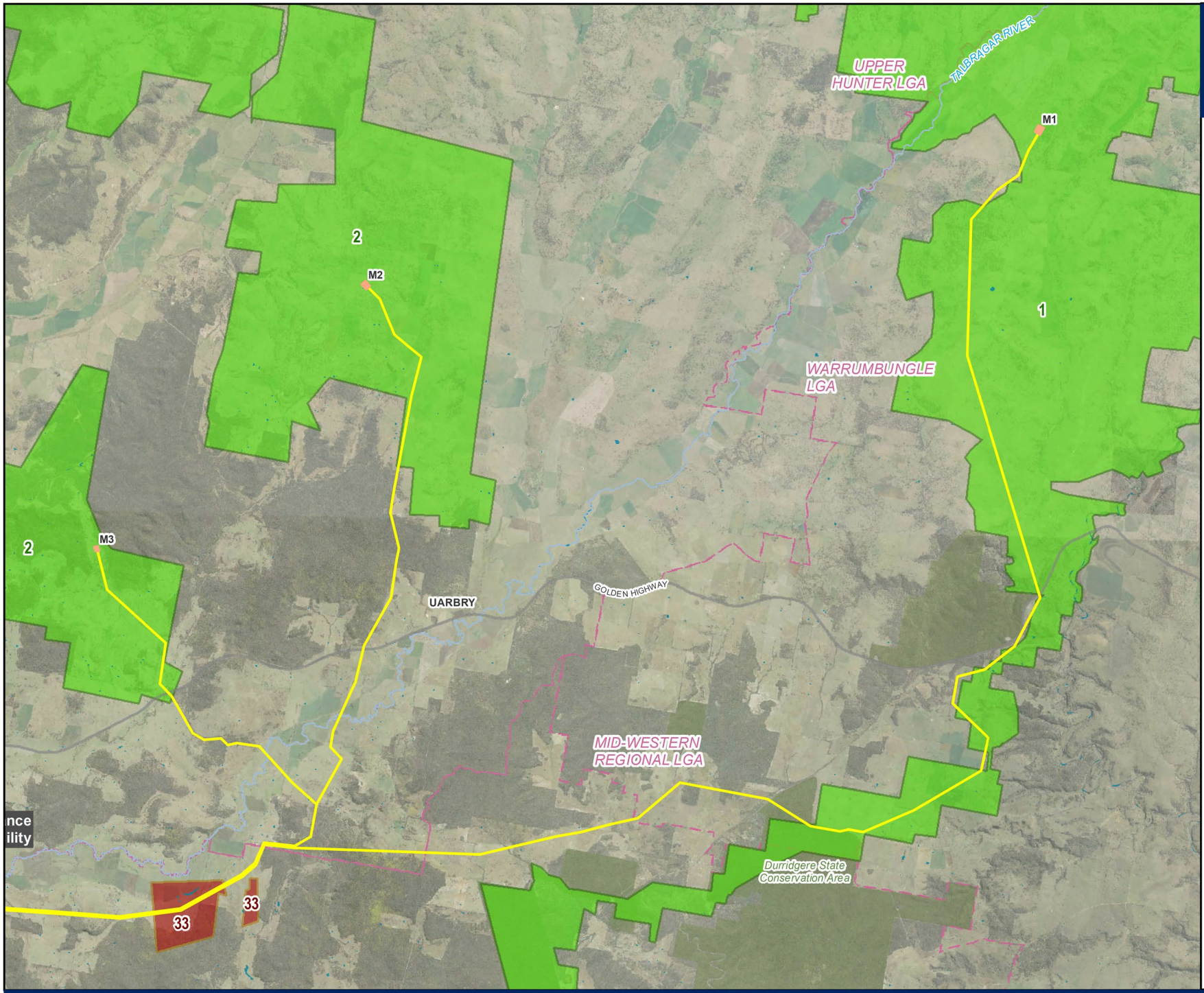
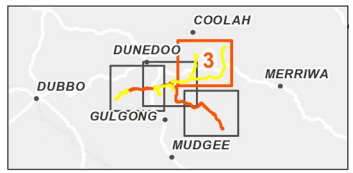


Central-West Orana REZ Transmission

Figure L-2
Cumulative impact assessment projects (local)
Map 3 of 4

Legend

- Local government area
- 330 kV transmission line
- 330 kV switching station
- Road
- Watercourse
- Water body
- Wind farms
  - 1, Liverpool Range wind farm
  - 2, Valley of the Winds wind farm
- Mines
  - 33, Ulan coal mine (Mod 6)
- NPWS estate



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Data sources: WSP 2023, EnergyCo, NSWSS

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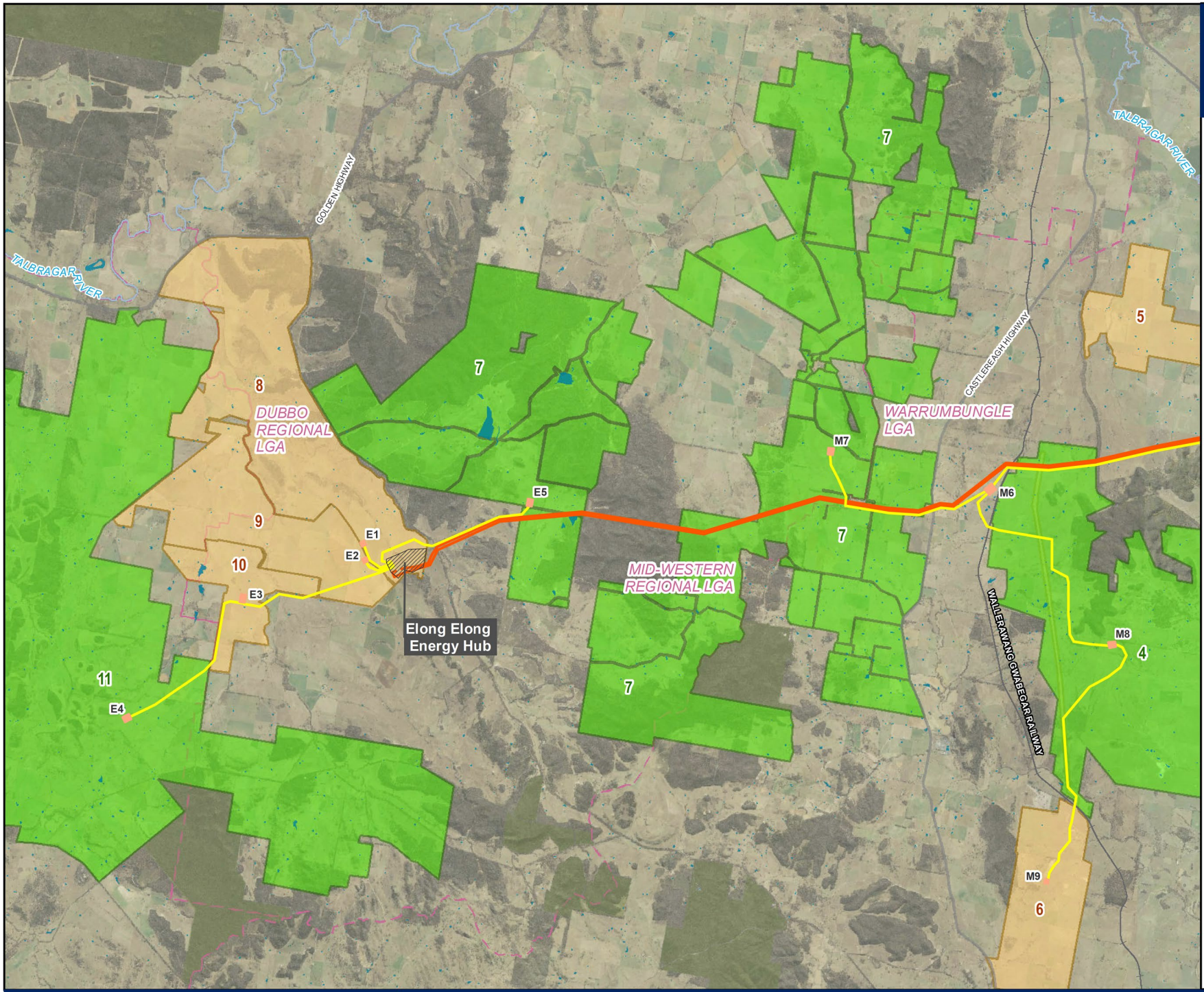
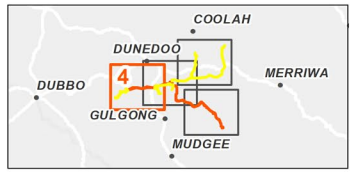


Central-West Orana REZ Transmission

Figure L-2
Cumulative impact assessment projects (local)
Map 4 of 4

Legend

- Local government area
- Energy hub / 500 kV switching station
- 330 kV transmission line
- 500 kV transmission line
- 330 kV switching station
- Railway
- Road
- Watercourse
- Water body
- Wind farms
  - 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
- NPWS estate



Coordinate system: GDA2020 MGA Zone 55
Scale ratio correct when printed at A4
GDA 2020
1:160,000
Data sources: WSP 2023, EnergyCo, NSWSS

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L2.3.1 Issues not included in the assessment

Potential impacts of the relevant future projects that met the screening criteria (refer to Table L-3) were considered, to identify any issues that do not require further cumulative impact assessment (N/A in Table L-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 L-5.

Table L-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.

L2.3.2 Level of assessment carried out for assessed issues

For issues not screened out altogether (as detailed in Table L-3), Table L-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 L-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

L3 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 L2.3.1).

L3.1 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.

L3.1.1 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 L-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.

L3.1.2 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 most relevant future renewable energy projects (wind farms and solar farms) 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 $1.32 million per year. This is equivalent to around 0.2 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 L-7.

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), 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 L4, 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 0.04 per cent of the total area of agricultural land use in the four impacted LGAs, and an estimated productivity loss of around $285,900 per year. This represents around 0.04 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.

L3.1.3 Summary of each project

Table L-7 provides a summary of the potential cumulative impacts of the relevant future projects identified in Table L-3.

Table L-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.
Narragamba solar farm	992 ha	Construction: 992 ha Operation: 992 ha	Not specified	During construction: Construction of the Narragamba solar farm is expected to overlap with the construction of this project, with temporary restrictions on agricultural land use and productivity up until the completion of construction. If construction activities occur over the same area, farming operation may be temporarily impacted, due to increased construction traffic and activities in this location. These impacts would be managed via traffic management measures and in consultation with landowners to minimise operational impacts. During operation: It is anticipated that landowners would continue to use the remaining part of their properties not impacted by the operation of the project for agricultural activities during operation of the project, as well as trialling the grazing of sheep within the project's operational area.

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). 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	During construction: 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 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. During operation: 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	During construction: 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. During operation: 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				
Bellambi Heights battery energy storage system (BESS)	25 ha	25 ha	$3,683 – $7,322 per year	During construction: Construction of the Bellambi Heights BESS is expected to overlap with the construction of this project, with temporary restrictions on agricultural land use and productivity up until the completion of construction. The project area will be removed from agricultural production during the life of the project. The project area is currently only used for livestock grazing as the soil profile is not conducive to cropping. Utilising data values for the Mid-Western Regional LGA and NSW Central Tablelands NRM region, respectively, development of the project area will result an estimated reduction value of between $3,682.92–$7,322.33 in annual productivity. This equates to a minor reduction of between 0.0037% and 0.0009% of the annual gross productivity of the Mid-Western Regional LGA and NSW Central Tablelands NRM region, respectively. During operation: Once operational, it is expected that disturbed areas would be rehabilitated for agricultural use, with permanent infrastructure (the BESS, maintenance facilities etc) the only areas removed from agricultural use during the life of the project. However, these are not expected to be significant given the small scale of this project compared to other developments in the area. The project area will be able to be reinstated following decommissioning and appropriate land management and rehabilitation.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Goulburn River solar farm	2,000 ha project area 800 ha (Development footprint)	2,000 ha, including 160 ha of marginal cropping land	Not specified	During construction: There is expected to be an overlap of the construction programs of the Goulburn River solar farm and this project. This would include some overlap in construction traffic and personnel in the area (if both undertaken in a similar area at the same time), which would temporarily impact agricultural operations in the area. During operation: Once operational, it is expected that disturbed areas would be rehabilitated, and only permanent infrastructure remain. Grazing would be able to continue within agricultural land once operational, . which would minimise the impacts of the solar farm project on agricultural productivity.
Burrendong wind farm	3,060 ha	855 ha	$139,020 per year	During construction: Construction of the Burrendong wind farm is expected to overlap with the construction of this project, with temporary restrictions on agricultural land use and productivity up until the completion of construction. More than 95% of the project area will be on land considered to have low to very low agricultural capability, which will limit the cumulative impacts to productive agricultural land within the Central-West Orana region. A small portion of BSAL occurs within the northern portion of the project site (3.4 ha),however. grazing would continue beneath the wind turbines following construction. 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. Grazing is expected to continue in some parts of the project area, including under transmission lines. No land within the project area is deemed viable long term cropping land. There are no cropping systems directly affected by the project. Therefore, no economic loss is expected to occur to cropping agricultural production directly from the development of the project infrastructure.
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.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
Orana BESS	15 ha	Construction: 15 ha Operation: 6.8 ha	Not specified	During construction: Construction of the Orana BESS is expected to overlap with the construction of this project, with temporary restrictions on agricultural land use and productivity up until the completion of construction. The project area includes two areas of BSAL (around 3.2 ha), with a small section of SSAL, however this is not currently used for agriculture. During operation: Once operational, it is expected that disturbed areas would be rehabilitated, and only permanent infrastructure remain. Grazing and agricultural activities, including agricultural production, would continue within the landowners property, outside the project operation area.
Approved projects				
Wollar solar farm	460 ha	878 ha	Not specified	During construction: Construction of the Wollar solar farm is expected to overlap with the construction of this project, with temporary restrictions on agricultural land use and productivity up until the completion of construction. During operation: Once operational, it is expected that disturbed areas would be rehabilitated, and only permanent infrastructure remain. Grazing may continue to be undertaken under the solar panels.
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.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
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.
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.
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 program, it is not expected to have a significant contribution to cumulative impacts associated with both construction and operation on land use and agriculture.
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.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
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.
Blain Road solar farm	17 ha	17 ha	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.
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.

Project	Total area affected (hectares (ha))	Agricultural land affected (ha)	Production impacts ($)	Cumulative impacts
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.
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.
Wilpinjong coal mine Extension and Modification 2	N/A	N/A	N/A	The Wilpinjong coal mine Extension and Modification 2 is not anticipated to result in any additional impacts on agricultural from the approved development.

L3.2 Landscape and visual

L3.2.1 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 L-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 L-3.

L3.2.2 Impact assessment

The cumulative impacts have been assessed for six 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:

- south (Gulgong and Mudgee)
- 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 L-8 outlines the potential cumulative impacts on landscape character.

Table L-8 Summary of potential cumulative landscape character impacts during the day

Location	Identified project	Cumulative landscape character impacts
South Gulgong and Mudgee	• Blain Road solar farm • Orana BESS • Burrendong wind farm	During construction: The Blain Road solar farm, near Mudgee, and Orana BESS, near Wellington, are located at a considerable distance (about 35 km) from this project's study area. The landscapes where these projects are located, are not experienced together with the landscapes through which this project passes. There would not be a cumulative effect on the landscape character of this project due to these projects. The Burrendong wind farm would be located about 40 km from the project, in the vicinity of Wellington. The changes to the landscape character in the vicinity of this project during construction would not have a cumulative effect on the landscape character of this project's study area due to this considerable distance. During operation: There would not be a cumulative effect on landscape character as a result of these projects, particularly due to their small scale and considerable distance from the landscape character and visual study area. The Burrendong wind farm would be located about 40 km from this project, in the vicinity of Wellington. The changes to the character of the landscapes in the vicinity of the wind farm project would not have a cumulative effect on the landscape character of this project's study area due to the considerable distance.

Location	Identified project	Cumulative landscape character impacts
Southeast Ulan and Bungaba	• Wilpinjong coal mine Extension and Modification 2 • Ulan coal mine Modification 6 • Wollar solar farm • Goulburn River solar farm	<u>During construction</u>: The construction program for Wilpinjong coal mine Extension and Modification 2, and Ulan coal mine Modification 6 may overlap with construction of this project. The approved Wilpinjong coal mine Extension and Modification 2 would occur along the New Wollar Switching Station — Merotherie Energy Hub connection in the Durridgere, Goulburn River and Munghorn Gap landscape character zone (LCZ) (FH-02) and Ulan mining LCZ (M-01). The Ulan coal mine Modification 6, if approved, 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-03). Some areas of bushland vegetation would be removed for these projects, 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 these areas would change to include construction activity, resulting in cumulative landscape character impact. The changes to the Talbragar River rural valley LCZ (RV-3) would be mostly due to the construction of this project, with a relatively small contribution by Ulan coal mine Modification 6. The Wilpinjong coal mine Extension and Modification 2 together with this project would expand the character of mining activity in the Durridgere, Goulburn River and Munghorn Gap landscape character zone (LCZ) (FH-02) and Ulan mining LCZ (M-01), and reduce the area of the forested hills landscape. These changes would be mostly attributed to the mining activity, with the project being consistent with the changes to the landscape expected in mining areas. The Wollar solar farm is located immediately adjacent to this project and is currently under construction. This solar farm together with this project would change the character of the Wollar rural valley LCZ (RV-01) to a character which combines solar infrastructure with the rural landscape. Together these projects would have a cumulative landscape character impact. The Goulburn River solar farm would be located in a landscape separated from the project study area by forested hills and would not have a cumulative landscape character impact together with the project during construction. <u>During operation</u>: The Wilpinjong coal mine Extension and Modification 2 together with this project would expand the character of mining activity in the Durridgere, Goulburn River and Munghorn Gap landscape character zone (LCZ) (FH-02) and Ulan mining LCZ (M-01), and reduce the area of the forested hills landscape. This change in character would be mostly attributed to the mining activity and this project's contribution to cumulative landscape character impact is expected to be minor. The mining activity proposed for the Ulan coal mine Modification 6 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. The changes to the Wollar rural valley LCZ (RV-01) would be permanent as the operational solar farm and new transmission lines transform the character of the landscape to one that combines energy infrastructure with the rural valley. The Goulburn River solar farm would be located in a landscape separated from the project study area by forested hills and would not have a cumulative landscape character impact together with this project during operation.

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.
Central Merotherie, Birriwa, Barneys Reef, Stubbo and Tallawang	• Birriwa solar farm • Barneys Reef wind farm • Stubbo solar farm • Tallawang solar farm • Narragamba solar farm • Bellambi Heights BESS	During 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), Barneys Reef forested hills LCZ (FH-04) 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. During operation: This project, in combination with the relevant future projects would transform the Narragamba to Blue Springs LCZ, Barneys Reef forested hills LCZ and Birriwa to Tallawang undulating rural hills LCZ 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.

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	<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 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. <u>During operation</u>: 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 L-9 outlines the potential cumulative visual impacts during construction and operation.

Table L-9 Summary of potential cumulative visual impacts during the day

Location	Identified project	Cumulative visual impacts
Southeast Ulan and Bungaba (Refer to Viewpoints 1, 4, 10 and 11, Technical paper 3 – Visual and landscape character (Technical paper 3))	• Wilpinjong coal mine Extension and Modification 2 • Ulan coal mine Modification 6 • Wollar solar farm • Goulburn River solar farm 6	During construction: Construction of the Wollar solar farm is likely to be completed when this project commences construction. However, this project would be viewed together with the Wollar solar farm and there would be a cumulative effect on views from Baragan Road during project 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. The Wilpinjong coal mine Extension and Modification 2 would be visible together with this project in views from Ulan-Wollar Road during construction. There would be a cumulative visual impact where these projects are seen together and sequentially. Due to the low sensitivity of these views, the visual impact is considered to be low. The Goulburn River solar farm would be located over 10 kilometres from the study area and would not be seen together or sequentially with the project while driving through the mining area. No cumulative visual impacts are expected as a result of the solar farm and this project during construction. During operation: This project would be viewed together with the Wollar solar farm and there would be a cumulative effect on views from Baragan Road during project construction. 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. The Wilpinjong coal mine Extension and Modification 2 would be visible together with this project in views from Ulan-Wollar Road during operation. There would be a cumulative visual impact where these projects are seen together and sequentially while driving through the mining area. However, due to the low sensitivity of these views, the visual impact is considered to be low. The Goulburn River solar farm would be located over 10 km from the study area and would not be seen together or sequentially with this project. No cumulative visual impacts are expected as a result of the solar farm and this project during operation.

Location	Identified project	Cumulative visual impacts
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.
North Leadville, Coolah and Uarbry (Refer to Viewpoint 13 and 14, Technical paper 3)	• Valley of the Winds wind farm	During 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. 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. During operation: 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.

Location	Identified project	Cumulative visual impacts
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 • Narragamba solar farm • Bellambi Heights BESS	<u>During construction</u>: The construction of the approved Stubbo solar farm, the proposed Birriwa solar farm and Narragamba 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. The Bellambi Heights BESS would not be visible from the Castlereagh Highway and would not have a cumulative visual impact in combination with this project during construction. <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. The Bellambi Heights BESS would not be visible from the Castlereagh Highway and would not have a cumulative visual impact in combination with this project during operation.

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	During 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 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. During operation: 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 L-10 provides a summary of the potential cumulative landscape character impacts at night, during construction and operation.

Table L-10 Summary of potential cumulative landscape character impacts at night

Location	Identified project	Cumulative landscape character impacts
South Gulgong and Mudgee	• Blain Road solar farm • Orana BESS • Burrendong wind farm	The Blain Road solar farm, Orana BESS and Burrendong wind farm are located a considerable distance from the landscape character study area of this project and would not be seen sequentially or together with this project. There may be some minor lighting during construction and some scattered, low-level lighting required for these projects' operation at night. Overall, there would not be a cumulative visual impact from these projects.
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)	• Wilpinjong coal mine Extension and Modification 2 • Ulan coal mine Modification 6 • Wollar solar farm • Goulburn River solar farm 6	During construction: Night lighting at the Wilpinjong coal mine may be experienced together with lighting from this project and would result in a cumulative landscape character impact on the Ulan mining LCZ (M-1) and the Durridgere, Goulburn River and Munghorn Gap forested hills LCZ (FH-2). However, the Ulan mining LCZ has very low sensitivity (refer to Table 9-3 of the EIS) and any cumulative impacts would be minimal in this landscape. 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, 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.

Location	Identified project	Cumulative landscape character impacts
		There would be limited lighting associated with the Wollar solar farm. This lighting together with lighting for this project during construction would have a minor cumulative effect on the Wollar rural valley LCZ (RV-1) at night. Due to the distance between the Goulburn River solar farm and this project, there would not be a cumulative effect on the character of the study area at night during construction. 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. During operation: 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 would be limited operational lighting associated with the Wollar solar farm. This lighting together with the limited lighting for this project at the New Wollar Switching Station would have a negligible cumulative effect on the Wollar rural valley LCZ (RV-1) at night. Due to the distance between the Goulburn River solar farm and this project, there would not be a cumulative effect on the landscape character of the study area at night during construction. There is the potential for views to operational lighting from a couple of private dwellings to the north of the Ulan coal mine.
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	During construction: 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. During operation: 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.

Location	Identified project	Cumulative landscape character impacts
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	During construction: 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. 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 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.
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 • Narragamba solar farm • Bellambi Heights BESS	During construction: At night, there is the potential for cumulative landscape character impacts on the Narragamba to Blue Springs LCZ, Birriwa to Tallawang undulating rural hills LCZ and Barneys Reef forested hills LCZ, due to construction lighting required for this 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. During operation: At night the relevant future projects are 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. 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. 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	Identified project	Cumulative landscape character 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.

L3.3 Biodiversity

L3.3.1 Methodology

The study area for the biodiversity cumulative impact assessment consists of the combined footprint of the relevant future projects (listed in Table L-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.

L3.3.2 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 L-11. All projects have been assessed quantitatively, except for Narragamba solar farm, Barneys Reef wind farm, Dapper solar farm, and Orana wind farm, which were assessed on a qualitative basis, as these projects were still in the scoping phase at the time of EIS preparation.

Table L-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
Narragamba solar farm	Qualitative
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
Spicers Creek wind farm	Quantitative
Orana wind farm	Qualitative

Project	Type of assessment
Proposed projects	
Bellambi Heights BESS	Quantitative
Goulburn River solar farm	Quantitative
Burrendong wind farm	Quantitative
Wellington South BESS	Quantitative
Orana BESS	Quantitative
Dubbo firming power station	Quantitative
Approved projects	
Wollar solar farm	Quantitative
Stubbo solar farm	Quantitative
Bowdens silver mine	Quantitative
Inland Rail (Narromine to Narrabri)	Quantitative
Dunedoo solar farm	Quantitative
Apsley BESS	Quantitative
Forest Glen solar farm	Quantitative
Uungula wind farm	Quantitative
Maryvale solar farm	Quantitative
Blain Road solar farm	Quantitative
Geurie solar farm	Quantitative
Dubbo solar farm	Quantitative
Gilgandra solar farm	Quantitative
Wahroonga 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
Wilpinjong coal mine Extension and Modification 2	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 24,251 hectares
- the cumulative ecosystem credit requirement equates to 198,868 credits
- the cumulative species credit requirement equates to 376,216 credits.

Table L-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* 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	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			
Narragamba solar 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.	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.	Unknown	Unknown	Unknown
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	269.2	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.	Superb parrot Glossy black-cockatoo Barking Owl	7,927	2,282
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 Fuzzy Box Woodland on Alluvial Soils of the South Western Slopes, Darling Riverine Plains and Brigalow Belt South Inland Grey Box Woodland in the Riverina, NSW South Western Slopes, Cobar Peneplain, Nandewar and Brigalow Belt South Bioregions 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						
Bellambi Heights BESS	1.12	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.	None recorded	No Species Credit Species recorded	2	0
Goulburn River solar farm	795.69	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.	Regent Honeyeater Barking Owl	4,778	1,553
Burrendong wind farm	855	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.	Pink-tailed Legless Lizard Spear-grass Bush Stone-curlew Eastern Pygmy possum Sloane's Froglet Pine Donkey Orchid Pale-headed Snake Key's Matchstick Grasshopper Barking Owl Powerful Owl Squirrel Glider Brush-tailed Phascogale Koala Small Purple-pea Silky Swainson-pea Masked Owl	17,771	27,662

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			
Wellington South BESS	9.47	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.	None recorded	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
Orana BESS	10.62	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.	None recorded	Pink-tailed Legless Lizard Masked Owl	0	38
Dubbo firming power station	1.2	White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland, Box Gum Woodland (Critically Endangered Ecological Community) and Pine Donkey Orchids (diuris tricolor), listed as vulnerable.	None recorded	None impacted	5	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			
Approved projects						
Wollar solar farm	367.5	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.	Austfeld's Wattle Large-leafed Monotaxis *Commersonia procumbens* Bush Stone-curlew Gang-gang Cockatoo Barking Owl Powerful Owl Masked Owl Squirrel Glider Large-eared Pied Bat Brush-tailed Phascogale Koala	713	544
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	34,820	160,421
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
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

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			
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
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

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			
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
Blain Road solar farm	3	None recorded	None recorded	No Species Credit Species recorded	0	0
Geurie solar farm	<1	N/A	N/A	N/A	0	0
Dubbo solar farm	Unlikely to impact. No expected impacts to TECs or native species predicted.	N/A	N/A	None	0	0
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. No expected impact to TECs or native species is predicted.	N/A	N/A	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			
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
Wilpinjong coal mine Extension and Modification 2	354	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.	Ozothamnus tesselatus Regent Honeyeater Koala	15,314	48,871

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			
Sub-totals						
Related development, proposed and approved projects	23,024	N/A	N/A	N/A	172,161	334,639
Central-West Orana Renewable Energy Zone Transmission project (this project)						
This project	1,227	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.	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* (Ausfeld's Wattle) *Anthochaera phrygia (Regent Honeyeater)* *Aprasia parapulchella (Pink-tailed Legless Lizard)* *Calyptorhynchus lathami (Glossy Black Cockatoo)* *Cercartetus nanus (Eastern Pygmy Possum)* *Chalinolobus dwyeri (Large-eared Pied Bat)* *Delma impar (Striped Legless Lizard)* *Dichanthium setosum (Bluegrass)* *Diuris tricolor (Pine Donkey Orchid)* *Eucalyptus camaldulensis* - endangered population *Euphrasia arguta Hieraaetus morphnoides (Little Eagle)* *Homoranthus darwinioides (Fairy Bells)* *Hoplocephalus bitorquatus (Pale-headed Snake)* *Indigofera efoliata (Leafless Indigo)*	26,707	41,577

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			
				Keyacris scurra (Key's Matchstick Grasshopper) *Leucochrysum albicans subsp. tricolor (Hoary Sunray)* *Myotis macropus (Southern Myotis)* *Petaurus norfolcensis (Squirrel Glider)* *Petrogale penicillata (Brush-tailed Rock-wallaby)* *Phascolarctos cinereus (Koala)* *Polytelis swainsonii (Superb Parrot)* *Pomaderris cotoneaster* *Pomaderris queenslandica (Scant Pomaderris)* *Prasophyllum petilum (Tarengo Leek Orchid)* *Swainsona recta (Small Purple-pea)* *Swainsona sericea (Silky Swainson-pea)* *Thesium australe (Austral Toadflax)* *Tylophora linearis* *Tyto novaehollandiae (Masked Owl)* *Vespadelus troughtoni (Eastern Cave Bat)* *Zieria ingramii (Keith's Zieria)..*		
Cumulative biodiversity impacts						
Cumulative totals	24,251	N/A	N/A	N/A	198,868	376,216

Cumulative impacts on groundwater dependent ecosystems

Table L-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 L-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.
Narragamba solar 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. The Atlas of GDEs (Bureau of Meteorology, 2022a) identifies that there is low potential for GDEs to occur within and surrounding the majority of the study area, with a portion of land within and adjacent to the southern boundary of the study area having a high and moderate probability of occurring within the riparian corridor of Pine Creek.
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.

Project	Impacts on groundwater dependent ecosystems
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.
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	
Bellambi Heights BESS	The project area does not contain waterbodies and will not intersect groundwater. The project is not expected to have any impacts on GDEs.
Goulburn River solar farm	No aquatic GDEs occur within the project area however a portion of the project area has been defined as a low potential terrestrial GDE. The project area has been situated largely outside of mapped hydrolines and exclusion zones were modified in the design phase to exclude much of Redlynch Creek and associated riparian vegetation. Consequently, no native riparian vegetation (associated with GDEs) is likely to be impacted by the project.
Burrendong wind farm	One high priority aquatic GDE (Pine Spring) has been mapped within 4 km of the project area and high potential aquatic and high potential terrestrial GDEs have been identified within a 2 km buffer zone of the project area. Impacts to these GDEs are possible, however it is unlikely, based on known groundwater data, that there will be any aquifer interference during construction. Groundwater-related impacts on GDEs are not anticipated.
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.
Orana BESS	Impacts on GDEs not yet assessed.
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	
Wollar solar farm	Impacts on GDEs not yet assessed. Generally, the project is not expected to affect groundwater resources due to the shallow nature of any excavation on site.
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.

Project	Impacts on groundwater dependent ecosystems
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.
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.
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.
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.
Blain Road solar farm	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.

Project	Impacts on groundwater dependent ecosystems
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.
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.
Wilpinjong coal mine Extension and Modification 2	No potential GDEs were identified in the project area or surrounds. The only areas with potential surface expression of groundwater were the main creeks which receive base flow from surrounding catchments, i.e. Cumbo Creek and Wilpinjong Creek. Wilpinjong coal mine were approved to relocate the lower sections of Cumbo Creek as a component of the approved mining operations.
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 of the EIS) 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 L-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 L-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.
Narragamba solar farm	Impacts to habitat connectivity not yet assessed. Project is in the 'Prepare EIS' stage so there is limited information available.
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	
Bellambi Heights BESS	Native vegetation and fauna habitats are highly fragmented in the project area. The largest most intact, patch of vegetation occurs to the east of the project area and will not be directly or indirectly impacted by the proposal. Ecosystem and species credit fauna 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. For the less mobile Key's Matchstick Grasshopper, abundant suitable habitat is available within the locality. The design of the development results in minimal fragmentation and isolation as surrounding suitable habitat remains connected.

Project	Impacts on wildlife connectivity and habitat corridors
Goulburn River solar farm	The project would result in some loss of connectivity and habitat fragmentation however all areas likely to be important for habitat connectivity for woodland species have been maintained. The project includes corridors between the development footprint areas which will not be fenced, to enable the persistence of habitat connectivity. Areas of clearing primarily consist of native vegetation composed of scattered canopy trees and areas of derived native grassland composed of highly disturbed agricultural land – consequently species utilising these areas for connectivity are already highly mobile and disturbance tolerant. There will be no overall changes to landscape connectivity for wildlife movement.
Burrendong wind farm	The loss of paddock trees and smaller patches within the project area would result in a minor loss of connectivity for more transient species. However, wind turbine generators are to be located on cleared ridges with few scattered trees - these trees are already isolated and would only provide habitat for highly mobile species such as birds. Connectivity will be retained in surrounding areas.
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.
Orana BESS	The project is likely to impact connectivity for the Pink-tailed Legless-lizard (recorded in the project area) by reducing suitable habitat given the species cryptic nature and living underground. The project is not anticipated to separate the population into two populations and the northern extent of the project area has avoided as much of the surveyed habitat as possible. More mobile threatened species that may occur include birds that are able to move further distances so the project is unlikely to substantially decrease connectivity of foraging habitat for these species.
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	
Wollar solar farm	Habitat connectivity values within the project area are considered minimal – small patches of Box Gum Woodland directly south of the development site provide some minor connectivity for highly mobile species such as birds, however, canopy connectivity is broken by open paddocks used for grazing and cultivation. The proposed solar farm is also not expected to disrupt connectivity of native grasslands when consideration is given to the large area of native grasslands surrounding the development site that exist within Wollar Valley (~8000 ha). Connectivity impacts to threatened fauna species are considered negligible.
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.

Project	Impacts on wildlife connectivity and habitat corridors
Apsley BESS	No 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.
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.
Blain Road solar farm	The development site lies within grasslands modified for agriculture and adjacent to large areas of continuous woody vegetation including Avisford Nature Reserve and Mudgee Common. The remnant woody vegetation serves as the main connectivity component in the landscape – the riparian vegetation of the Cudgegong River is a connectivity corridor but is outside the Assessment Area and is over 1.8 km distant from the nearest connecting woody vegetation. Overall, connectivity across the landscape is limited due to past clearing for agriculture and urban expansion. Due to the nature of the previously cleared grazing land, habitat connectivity is limited with only isolated paddock trees.
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.
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.

Project	Impacts on wildlife connectivity and habitat corridors
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.
Wilpinjong coal mine Extension and Modification 2	As outlined in the biodiversity report a portion of the native vegetation within the project area is currently fragmented due to early land clearing for historical agricultural practices. The Goulburn River National Park and Munghorn Gap Nature Reserve are located adjacent to the project, but the project was anticipated to result in minimal further fragmentation within the locality. Revegetation aimed to increase the continuity of woodland vegetation by establishing links between woodland vegetation in the rehabilitation areas, regeneration areas and existing remnant vegetation in the Munghorn Gap Nature Reserve, Goulburn River National Park and the related Enhancement and Conservation Areas.
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 L-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 L-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.
Narragamba solar 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.
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	
Bellambi Heights BESS	No impacts on protected lands.
Goulburn River solar farm	No direct impacts are on protected lands. Goulburn River National Park surrounds the project area and indirect impacts would be managed through mitigation measures for the project.
Burrendong wind farm	No impacts on protected lands.
Wellington South BESS	No impacts on protected lands.

Project	Impacts on protected lands
Orana BESS	No impacts on protected lands.
Dubbo firming power station	No impacts on protected lands.
Approved projects	
Wollar solar farm	No impacts on protected lands.
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.
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.
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.
Blain Road 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.
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.

Project	Impacts on protected lands
Wilpinjong coal mine Extension and Modification 2	The project does not have direct impacts on protected lands. There is a potential for indirect impacts (i.e., air quality, fire, weeds and pests, edge effects) to occur on the flora and/or fauna in Munghorn Gap Nature Reserve (because it is adjacent to the project). These effects were anticipated to be temporal in nature and managed through mitigation measures. The potential for indirect impacts on the Goulburn River National Park are generally comparable to the approved Wilpinjong Coal Mine because the project would not extend significantly closer to the Goulburn River National Park and no consequential impacts on biodiversity are likely downstream of the project.
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 23,024 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 24,251 hectares.

Table L-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	23,024	172,161	334,639
Central-West Orana Renewable Energy Zone Transmission project	1,227	26,707	41,577
Cumulative totals	24,251	198,868	376,216

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.

L3.4 Aboriginal heritage

L3.4.1 Methodology

The study area for the Aboriginal heritage cumulative impact assessment consists of the combined footprint of the relevant future projects (listed in Table L-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.

L3.4.2 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 L-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) and addendum report completed for this project (Technical paper 5) identified 246 Aboriginal sites, places and/or deposits as part of investigations. 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 one of the most significant sites identified in the ACHA, namely a significant grinding groove complex at Prospect Creek and Talbragar River, and several areas of cultural importance as provided by the Aboriginal participants.

Of the 50 discrete Aboriginal sites, places and/or deposits remaining within the construction area, all 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 – some only tentatively classified. Of note would be the potential impacts to #36-3-0111, a regionally significant grinding groove site on the banks of the Talbragar River. The project would also directly impact about 224 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.

It is considered that 23 Aboriginal sites of moderate to high significance would be avoided through this process, including Aboriginal sites previously identified in the EIS and newly identified sites. This would result in a 46 per cent reduction in potential impacts on Aboriginal sites for the amended project, including two sites of high significance and 21 sites of moderate significance. Potential direct impacts on 27 of the identified Aboriginal sites (54 per cent) are unlikely to be avoided, including five culturally modified trees, nine high density artefact scatters, 11 moderate density artefact scatters and a background artefact scatter.

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 four and 23 per cent of the Aboriginal site types identified within the amended 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.

Should avoidance or impact minimisation of the23 Aboriginal sites, places and/or deposits be achieved, 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 offsets include opportunities for Aboriginal heritage interpretation and engagement with Aboriginal communities during project assessment and development.

Table L-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.
Narragamba solar project	Assumed qualitative	Overlaps project east of Merotherie Road	Desktop information indicates that no previously recorded sites are in the project boundary with the closest site comprising an isolated stone artefact 850 m to the east.	Yet to be assessed.	Yet to be assessed.

Project	Type of assessment	Distance from project	Aboriginal heritage identified	Significance	Aboriginal heritage to be impacted and/or protected
Wollar solar farm	Qualitative: ACHA – archaeological survey	Adjacent to project at New Wollar Switching Station	A total of 43 Aboriginal sites identified: 25 isolated finds, 12 artefact scatters, 1 grinding groove site, 1 modified tree, 1 cultural site and 2 previously recorded AHIMS sites	Low to moderate.	The following sites were subject to impact: 15 isolated finds (60% of site type) and 11 artefact scatters (92% of site type). No impacts to grinding grooves, modified tree or previously recorded AHIMS sites.
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.
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.
Bellambi Heights Battery Energy Storage Project	Qualitative: ACHA – archaeological survey and test excavations	4 km south of the middle portion of the project	Isolated stone artefact and two low density artefact scatters.	Low and moderate significance.	No impacts to Aboriginal heritage.
Goulburn River Solar Farm	Qualitative: ACHA – archaeological survey	16 km east of the most eastern section of the project	11 sites – one grinding groove site, four stone artefact scatters, and six isolated artefacts.	Grinding grooves are of moderate significance. Three artefact scatters and five isolated finds are of low significance. Two sites (artefact scatter and isolated find) of moderate significance.	Eight sites to be impacted. The grinding grooves site, 1 artefact scatter (low significance) and an isolated artefact (low significance) will not be harmed.

Project	Type of assessment	Distance from project	Aboriginal heritage identified	Significance	Aboriginal heritage to be impacted and/or protected
Burrendong Wind Farm	Qualitative: ACHA – archaeological survey	40 km south of the most western section of the project	102 sites identified comprising: stone artefact scatters, isolated finds, quarry/outcrop sites,	Six sites assessed as having moderate or high significance, remaining sites low significance	Thirty-five sites to be impacted: two of high significance (an isolated find and artefact scatter); two of moderate significance (artefact scatters) and 31 of low significance (isolated finds and artefact scatters).
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
Orana BESS	Qualitative: ACHA – archaeological survey	37 km west of western section of project	No cultural materials identified; site considered to have low potential for Aboriginal sites.	N/A	N/A
Blain Road solar farm	Unknown	33 km southeast of central section of project	No Aboriginal heritage assessment available.	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.

Project	Type of assessment	Distance from project	Aboriginal heritage identified	Significance	Aboriginal heritage to be impacted and/or protected
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).
Wilpinjong Coal Mine Extension	Qualitative: ACHA – archaeological survey		296 sites or Potential Archaeological Deposits (PADs) identified and comprise: open artefact sites, rock shelters, scarred trees, waterhole/well.	Three sites were identified as having high significance (large site complexes and rock shelters). Three sites assessed as having moderate significance (rock shelter/s open artefact scatter). The majority of the remaining Aboriginal sites identified as having low significance in local context.	Impacts to sites will vary between three 'development zones'. In Zone 1 impact will be total and substantial across 800 hectares. In Zone 2 impacts are estimated over 50% of the 480 hectare area. There is potential for avoidance of impacts to heritage sites within this zone. For Zone 3 the extent of impacts is unknown at this stage as will be subject to future detailed design.

L3.5 Social

L3.5.1 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 34 projects within the local social locality are identified to have potential cumulative impacts (refer to Table L-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 34 relevant future projects identified for cumulative impact assessment, five projects are currently in the pre-EIS stage, being the Narragamba solar farm, Orana wind farm, Sandy Creek solar farm, Cobbora solar farm, Barneys Reef 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 L-3). 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.

L3.5.2 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 landowners, councils and community organisations, raised concerns that there have already been changes to community cohesion as a result of some of listed in Table L-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 this project alone, however the cumulative impacts associated with the interaction between the 34 relevant future 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 34 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

During construction, there is the potential for the construction periods of 22 relevant future projects to overlap, which 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). The workforce influx 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 9,000 at the peak during times of concurrent construction of the projects considered for cumulative assessment. This construction workforce would be made up of the following projects with a construction period that overlap with this project between 2024 and 2028:

- the required construction workforce of this project is anticipated to peak at 1,800 full time equivalent employees
- the Liverpool Range wind farm, Valley of the Winds wind farm, Narragamba solar farm, Birriwa solar farm, Tallawang solar farm, Orana wind farm, Cobbora solar farm, Sandy Creek solar farm, Dapper solar farm, Bellambi Heights BESS, Goulbourn River solar farm, Burrendong wind farm, Wellington South BESS, Orana BESS, Apsley BESS, Forest Glen solar farm, Stubbo solar farm, Bowdens silver mine, Inland Rail (Narromine to Narrabri), Dunedoo solar farm, Uungula wind farm, and Maryvale solar farm projects would require an additional peak construction workforce of 7,259 employees

While all of this project's construction workforce would be able to be accommodated within the two workforce accommodation camps at Merotherie and Neeleys Lane, some project workers may choose to reside outside of the camps in short-stay accommodation.

Construction of the workforce accommodation camps is planned to occur between November 2024 and April 2025 as part of the enabling works, subject to obtaining planning approval. It is anticipated that at the commencement of construction, prior to the operation of the workforce accommodation camps, a small number of construction personnel would utilise existing local hotel, motel, and rental accommodation.

This small number of personnel would primarily comprise the workforce required to construct the workforce accommodation camps, along with a number of project management personnel.

During the construction of this project's workforce accommodation camp, 18 relevant future projects would be undertaking construction activities, which equates to about 5,140 personnel.

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, Narragamba solar farm, Orana 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, and the short term requirements of accommodation during construction of the project and the workforce accommodation camps, 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 9,059 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 20 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 landowners and landowners 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.

Twenty-two out of the 34 relevant future projects would result in amenity impacts across the local and regional social locality during construction(excluding the Apsley BESS).

Section L3.7 identified medium and high risks to cumulative noise impacts resulting from the interaction between this project and the relevant future projects.

Section L3.12 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 22 relevant future projects would further increase vehicle movements in the local and regional social locality during construction.

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 L3.9, the Transport and Traffic cumulative impact assessment identifies each of the potential overlapping 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 34 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 L3.6, 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 34 relevant future projects in the social locality.

In Section L3.6, 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 34 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 34 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 22 relevant future projects in the region with an overlapping construction phase have a total combined construction workforce exceeding 9,059 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 905 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 20 per cent of the total cumulative workforce it is anticipated that it would have a moderate contribution to this cumulative impact.

Tourism impacts due to reduced accommodation availability and changes to the landscape and character

As previously outlined, it is possible that there would be major cumulative impacts to diminished short term accommodation availability and affordability within the local social locality, however availability at caravan parks, pubs and camping sites would not be affected by the relevant future projects as it is deemed not suitable to host workforce under health and safety standards.

During construction, it is anticipated that hosting landowners and landowners neighbouring project infrastructure (within three kilometres) would experience medium impacts to sense of place associated with changes to amenity (air quality, noise and vibration).

More broadly, Section L3.2 identified the potential for cumulative landscape character and visual impacts during construction across multiple project locations and Section L3.2 identified that this project would contribute to cumulative impacts to wildlife connectivity and habitat corridors.

As such, it is possible that some tourists could experience some minor changes to the way they enjoy and connect with the environment and could experience potential constraints to finding accommodation, but it is unlikely that would result in a major cumulative impact within the local and regional social locality. This project's contribution to this cumulative impact would be minor considering the project’s provision of workforce accommodation and the geographical extent of landscape changes.

Impacts on landowner’s livelihoods due to biosecurity threats

Construction of the relevant future projects has the potential to increase biosecurity risks to local agricultural businesses and farmers. The construction periods of three wind farms (Orana, Valley of the Winds and Liverpool Range), six solar farms (Dapper, Sandy Creek, Cobbera, Tallawang, Birriwa and Narragamba) and one BESS (Bellambi Heights) are likely to overlap with the construction period of this project and would be located near the project.

Technical paper 7 identified that landowners who are hosting project infrastructure would likely experience the most significant risks to biodiversity. While landowners neighbouring project infrastructure would be less likely to experience direct biosecurity risks, there is still the possibility of biosecurity risks from neighbouring construction sites and passing project traffic.

Given that 15 relevant future projects would be located near this project, biosecurity risk to local agricultural business and farmers would increase. This project's contribution to this cumulative impact is moderate considering the geographical extent of this project.

Impacts on Aboriginal cultural values

There is the potential for the construction periods of 22 relevant future projects to overlap with the construction period of this project.

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 L3.4, 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 22 relevant future projects within the regional social locality where construction periods overlap. The combined temporary construction workforce of the 22 relevant future projects may exceed 9,059 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).

The workforce accommodation camps would provide sufficient accommodation for all construction workers, including during the peak construction period. Food, sporting and recreation facilities, first aid facilities, two full time paramedics, and one full time nurse would be provided at the camps to minimise impacts of the construction workforce on local and regional health services. Internet connection would also be provided at the workforce accommodation camps.

The availability of accommodation has been identified as a constraint to mobilising additional medical resources to regional areas. EnergyCo is working with Health NSW to provide funding for the delivery of key health worker accommodation in four locations, including Coolah, Mudgee, Dubbo and Wellington.

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.

Potential disruption to essential services (communications, gas and electricity)

Technical paper 7 identified potential disruptions to essential services during construction would take place for a short duration and thus would possibly be experienced as a minimal change resulting in a low unmitigated impact.

As mentioned previously, the construction periods of 10 of the relevant future projects are likely to overlap with the construction period for this project and would be located near the project. These include three wind farms (Orana, Valley of the winds and Liverpool Range), six solar farms (Dapper, Sandy Creek, Cobbera, Tallawang, Birriwa and Narrangamba) and one BESS (Bellambi Heights). It is possible that some of these projects might require short term disruption to essential services. While it is not clear if all 10 projects would cause service disruptions, the Orana wind farm, Valley of the Winds wind farm, and the Narrangamba solar farm would all require utility adjustments. However, it is anticipated that disruptions will be notified in advanced to impacted communities.

Consequently, it is possible that cumulative disruptions are experienced in the local social locality. This project's contribution to this cumulative impact is minor considering the limited adjustments required to existing utilities for this project.

Diminished mental health amongst landowners

Technical paper 7 identified medium unmitigated mental health impacts for landowners hosting infrastructure and high impacts for landowners neighbouring project infrastructure.

Out of the 34 relevant future projects, 15 would be located near the project. These include: five wind farms (Spicers Creek, Orana, Barneys Reef, Valley of the Winds and Liverpool Range), eight solar farms (Dapper, Sandy Creek, Cobbera, Tallawang, Birriwa, Narrangamba, Ulan and Wollar solar farms), one BESS (Bellambi Heights) and one mining project (Wilpinjong coal mine Extension and Modification 2).

This means that it is possible that neighbouring landowners to the project and the relevant future projects would experience uncertainty, fear and concerns over changes to their lifestyle, the landscape, project land requirements and the value of their properties.

While the 15 relevant future projects have conducted some level of engagement activities to inform and communicate with landowners, and some of them might also consider providing strategic benefits to landowners hosting and neighbouring project infrastructure (such as the Valley of the Winds wind farm, the Liverpool Range wind farm, and the Sandy Creek solar farm), it is still possible there would be some landowners within the local social locality who might experience cumulative changes to their mental health.

This project's contribution to this cumulative impact is moderate considering the geographical extent of this project.

Diminished health and wellbeing for landowners due to amenity impacts, such as construction noise and vibration

As outlined in Technical paper 7 it is anticipated that hosting landowners and landowners neighbouring project infrastructure (within three kilometres) would experience medium impacts to sense of place associated with changes to amenity (air quality, noise and vibration).

The construction periods of 10 of the relevant future projects are likely to overlap with the construction period of this project and would be located near the project.

Section L3.7 identified medium and high risks to cumulative noise impacts resulting from the interaction between this project and the relevant future projects.

Section L3.12 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 possible that there would be potential impacts to health and wellbeing to landowners located within three kilometres of this project due to cumulative amenity impacts. However, the contribution of this project to the cumulative impact is anticipated to be minor.

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 landowners. As detailed in Section L3.2, each of the 34 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 L3.2 identified the potential for cumulative landscape character and visual impacts during construction across multiple project locations.

Section L3.2 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 L-18. However, it is anticipated that the project contribution to these would range from minimal to moderate.

Table L-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
Tourism impacts due to reduced accommodation and changes to landscape and character	Local	Minor

Potential impact	Social locality	Project contribution to cumulative impact
Impacts on landowners livelihoods due to biosecurity risks	Local	Moderate
Impacts on Aboriginal cultural values	Local	Moderate
Impacted capacity of health, food, and social services	Local and regional	Moderate
Potential disruption to essential services	Local	Minor
Diminished mental health amongst landowners	Local	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

Unequal distribution of impacts and benefits for neighbouring landowners

Technical paper 7 anticipated that landowners neighbouring project infrastructure would experience unequal distribution of impacts and benefits, due to potential heightened impacts to health and wellbeing as well as sense of belonging.

Landowners hosting infrastructure are expected to experience enhanced social and economic livelihoods associated with the Strategic Benefit Payments (SBP) Scheme. Neighbouring landowners are, however, ineligible for the SBP Scheme.

Out of the 34 relevant future projects, 15 have been identified in proximity to the project. This means that it is possible that neighbouring landowners to the project and the relevant future projects would experience uncertainty, fear, and concerns over changes to their lifestyle, the landscape, project land needs and the value of their properties.

While the 15 relevant future projects have conducted some level of engagement activities to inform and communicate with landowners, and some of them might also consider providing strategic benefits to landowners hosting and neighbouring project infrastructure, it is still possible there would be some landowners within the local social locality who might not receive direct benefits from any of the relevant future projects.

Consequently, it is possible that some landowners experience cumulative unequal distribution of impacts and benefits. This project's contribution to this cumulative impact is moderate considering the geographical extent of this project.

There would be no anticipated impact in the regional area associated with this project.

Changes to the way landowners enjoy their properties

Technical paper 7 found that landowners hosting infrastructure and neighbouring landowners may experience changes to the way they use and enjoy their properties.

Out of the 34 relevant future projects, 15 have been identified near the project. This means that it is possible that neighbouring landowners to the relevant future project and landowners hosting project infrastructure may experience cumulative changes to the way they enjoy their properties if any of these relevant future projects are visible from their properties. This project's contribution to this cumulative impact is moderate considering the geographical extent of this project.

There would be no anticipated impact in the regional area associated with this project.

Enhanced landowner social and economic livelihoods associated with the SBP Scheme

Technical paper 7 identified that landowners hosting infrastructure would almost certainly experience a moderate change to their social and economic livelihoods associated with SBP Scheme, resulting in a high benefit.

Out of the 34 relevant future projects, 15 would be located near the project. Furthermore, all projects within near the project have areas where the transmission line would intersect their project area (except for the Wilpinjong coal mine Extension and Modification 2). As such, there will likely be some landowners hosting multiple projects within their property boundaries. This means that it is possible that landowners hosting project infrastructure and neighbouring any of the relevant future project may receive additional benefits as result of those projects.

This project's contribution to this cumulative impact is moderate considering the geographical extent of this project.

Livelihood impacts due to property management restrictions or alterations

Technical paper 7 identified that it is unlikely that landowners would experience diminished livelihoods due to easement restrictions, and no impacts are anticipated for other farming properties within the local and regional social localities.

As discussed, 15 of the relevant future projects would be located near the project. It is understood that the property restrictions of those projects would be confined to the limits of their project areas, not affecting neighbouring landowners.

During consultation, it was noted that only a couple of landowners have decided to host both project infrastructure and other renewable energy project. Those landowners will receive easement payments and will be subject to specific agreements for the use and restrictions to their properties, resulting on no detrimental cumulative impacts to their livelihoods.

Changes to community cohesion due to community members leaving the region.

Technical paper 7 identified potential health and wellbeing impacts associated with stress, uncertainty and opposition linked to the construction and operation of the project. Consultation also revealed that concerns and related health and wellbeing impacts were enhanced by the proposed development of other cumulative projects in the region, and the REZ more broadly. Some community members and landowners also expressed the perception that there could be a loss of community members and residents away from the region associated with the approval and construction of the REZ, with some residents stating that they would potentially choose to move away if the project was to progress. A loss of community members due to reduced wellbeing associated with objections and stress linked to the REZ could lead to permanent changes on community cohesion in the local and regional area. As such, the project's contribution to this cumulative impact would likely be minor, given the number of cumulative projects in the region that may contribute to stress and wellbeing impacts.

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 six 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
- Burrendong 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 amongst landowners due to perceived health and safety risks associated with electromagnetic fields (EMFs)

Consultation with landowners hosting the project identified concern regarding the potential for transmission infrastructure to emit EMFs. Perceived health concerns related to potential EMFs associated with the project could be heightened by the cumulative effect of the four additional proposed wind farm projects within proximity of the project.

Public concerns and negative perceptions of adverse health effects associated with wind farms and EMFs have increased alongside the uptake of renewable energy projects globally. It has been argued that ‘these fears have not been based on any actual measurement of EMF exposure surrounding existing projects but appear to follow from worries from internet sources and misunderstanding of the science’ (McCallum et al., 2014). While wind turbines do emit low levels of EMFs, the National Health and Medical Research Council's (NHMRC) rapid review of wind turbine health impacts states that the “electromagnetic fields produced by the generation and export of electricity from a wind farm do not pose a threat to public health” (NHMRC, 2010). Despite these findings, the association between wind turbines and health, including impacts associated with the emission of EMFs, is highly debated (Knopper, Ollson, McCallum & Aslund, 2014).

It is unlikely that cumulative projects such as solar farms, BESS, transport, and mining extension projects would result in additional concerns of harmful EMF radiation.

However, the operation of the four wind farm projects in proximity may have the potential to heighten concerns regarding health and wellbeing impacts associated with EMFs for those landowners who are neighbouring the relevant windfarms and the project. Given the scale of the project and associated concerns related to transmission infrastructure EMFs, the project is likely to have a moderate contribution to this cumulative impact.

It is unlikely that landowners subject to acquisition of easements through mutual agreement would materialise mental health effects, however this may not be the case for neighbouring landowners, and landowners whose may have sections of their property acquired under a compulsory acquisition process who expressed heightened concerns over this topic.

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, eight wind farms, one BESS project and one mine expansion are proposed near this project[1]. 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 L3.8, 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.

Stress amongst neighbouring landowner due to perceived uncertainty in the local property market

Technical paper 7 identified that it is likely that the project neighbouring landowners may experience stress due to perceived changes to property values, resulting in a high unmitigated impact.

[1] Adjacent solar, wind and BESS projects close to the project are: Spicers Creek wind farm, Orana wind farm, Barneys Reef wind farm, Valley of the Winds wind farm, Liverpool Range wind farm, Orana wind farm, Dapper solar farm, Sandy Creek solar farm, Cobbera solar farm, Tallawang solar farm, Birriwa solar farm and BESS, Narrangamba solar farm, Ulan Solar farm, Wollar solar farm, Narragamba solar farm, Wipinjong Coal Mine Extension and Modification, and Bellambi Heights BESS

As previously outlined, out of the 34 relevant future projects, 15 of the projects would be located near the project. This means that it is possible that neighbouring landowners to the project and the relevant future projects would experience uncertainty, fear, and concerns over changes to their lifestyle, the landscape, project land needs and the value of their properties.

The project's contribution to this impact is moderate given the geographical extent of this project. There would be no anticipated impact in the regional area associated with 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 15 projects located in proximity to this project, including eight wind farms, seven solar farms, one BESS and one mine extension. 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 landowners. 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 landowners' properties (either through lease agreements or acquisitions) would likely alter the way these landowners use and enjoy their properties due to changes to access, amenity and aesthetic impacts.

As identified during SIA consultation, many landowners 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 landowners.

Section L3.2 identified that there would be cumulative landscape and visual impacts associated with this project and the other 17 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 L3.2 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 landowners 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 2,440 hectares of agricultural land, permanent project impacts (resulting in a change in land use) consist of around 805 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 L3.1 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 L-19 outlines the potential cumulative social impacts during operation.

Table L-19 Potential cumulative social impacts during operation

Potential impact	Social locality	Project contribution to cumulative impact
Unequal distribution of impacts and benefits for landowners neighbouring project infrastructure	Local	Moderate
Changes to the way landowners enjoy their properties	Local	Moderate
Enhanced landowner social and economic livelihoods associated with the Strategic Benefit Payments Scheme	Local	Moderate
Livelihood impacts due to property management restrictions or alterations	n/A	No cumulative impact

Potential impact	Social locality	Project contribution to cumulative impact
Changes to community cohesion due to community members leaving the region	Local	Minor
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 amongst landowners due to perceived health and safety risks associated with electromagnetic fields	Local	Moderate
Stress due to perceived bushfire risk	Local	Moderate
Stress amongst neighbouring landowners due to perceived uncertainty in the local property market	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

L3.6 Economic

L3.6.1 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 L-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.

L3.6.2 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

This project in combination with the relevant future projects would have a minor cumulative economic impact as a result of the operational workforce requirements for each project. A peak operational workforce of up to 60 personnel would be required for this project, whereas about 10 personnel, on average, would be required for each of the relevant future projects (based on publicly available environmental assessment documentation). The cumulative operational workforce requirements for this project and the relevant future projects would therefore be around 360 personnel.

Operational jobs for this project and the relevant future projects are typically permanent roles and would likely be sourced from within the Central-West Orana region. Similarly to construction workforce requirements, it is likely to provide 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 in the region. This would result in greater job opportunities in the region, which 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. It would also help address the jobs growth imbalance between Australia's biggest cities. Since operational jobs are likely to filled by those already residing in the region, population increases and increased demand for housing and other social services is likely to be modest and well within normal ranges.

L3.7 Noise and vibration

L3.7.1 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
- sensitive receivers that were predicted to have an extent of exceedance of greater than -3 dBA, but less than 0 dBA were considered. This is to account for receivers that may exceed relevant criteria as a result of a worst-case scenario where noise levels may be up to 3 dB louder than the maximum predicted level from either project.
- 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.

L3.7.2 Impact assessment

Table L-20 and Table L-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 L-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 32 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.	High
Valley of the Winds wind farm	Cumulative noise impacts have been predicted during construction activities at up to 11 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.	High

Project	Potential cumulative noise impacts with this project	Risk of noise impacts
Narragamba 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, levels may be up to 3 dB louder than the maximum predicted level from either project.	Medium
Barneys Reef solar farm	Cumulative noise impacts have been predicted during construction activities at up to 24 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 6 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.	High
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 30 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 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
Sandy Creek solar farm	Cumulative noise impacts have been predicted during construction activities at up to 8 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.	High
Dapper solar farm	Cumulative noise impacts have been predicted during construction activities at up to 9 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
Spicers Creek wind farm	Cumulative noise impacts have been predicted during construction activities at up to 6 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
Approved projects		
Bellambi Heights battery energy storage system (BESS)	Cumulative noise impacts have been predicted during construction activities at up to 2 receivers, mainly during the Transmission Line works. During worst case cumulative noise impacts, levels may be up to 3 dB louder than the maximum predicted level from either project.	Medium
Stubbo solar farm	Cumulative noise impacts have been predicted during construction activities at up to 7 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
Wollar solar farm	Cumulative noise impacts have been predicted during construction activities at up to 2 receivers, mainly during the Transmission Line works. During worst case cumulative noise impacts, 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

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 5 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.	Medium
Wilpinjong coal mine Extension and Modification 2	Cumulative noise impacts have been predicted during construction activities at up to 3 receivers, mainly during the Transmission Line works, however noise impacts from Wilpinjong Coal Mine Extension are not yet known. Under worst case cumulative noise levels may be up to 3 dB louder than the maximum predicted level from either project.	Medium

Operation

Table L-21 Potential cumulative noise impacts during operation

Project	Potential cumulative impacts with this project	Risk of impacts
Related development		
Liverpool Range wind farm	No receivers are predicted to be impacted by cumulative operational noise impacts from this project.	Nil
Valley of the Winds wind farm	No receivers are predicted to be impacted by cumulative operational noise impacts from this project.	Nil
Narragamba solar farm	No receivers are predicted to be impacted by cumulative operational noise impacts from this project.	Nil
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.	Medium
Tallawang solar farm	Cumulative operational noise impacts may be noted at a single property, 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, and additional treatment may be required at some properties. It is recommended that this be confirmed once both projects are operational.	Low
Orana wind farm	No receivers are predicted to be impacted by cumulative operational noise impacts from this project.	Nil
Cobbora solar farm	No receivers are predicted to be impacted by cumulative operational noise impacts from this project.	Nil
Sandy Creek solar farm	No receivers are predicted to be impacted by cumulative operational noise impacts from this project.	Nil
Dapper solar farm	No receivers are predicted to be impacted by cumulative operational noise impacts from this project.	Nil
Spicers Creek wind farm	No receivers are predicted to be impacted by cumulative operational noise impacts from these two projects.	Nil
Approved projects		
Bellambi Heights battery energy storage system (BESS)	No receivers are predicted to be impacted by cumulative operational noise impacts from this project.	Nil
Stubbo solar farm	No receivers are predicted to be impacted by cumulative operational noise impacts from this project.	Nil
Wollar 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
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.	High
Wilpinjong coal mine Extension and Modification 2	Cumulative operational noise impacts may be noted at a single property, primarily during adverse weather conditions generating coronal noise. Under worse case conditions, cumulative noise levels may be up to 3 dB louder than the maximum predicted impact under either project.	Low

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.

L3.8 Bushfire risk and general hazards

L3.8.1 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 L-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.

L3.8.2 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.

L3.9 Traffic and transport

L3.9.1 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 L-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
- analysis of predicted cumulative traffic impacts on the performance of key intersections along this project's construction routes, using the SIDRA intersection modelling program. Cumulative traffic data from the relevant future projects were applied using the available information in publicly available environmental assessment documentation. The assessment considered the predicted cumulative construction traffic volumes for the relevant future projects in combination with this project with increased background traffic volumes (using a growth value of 1.6%) applied. The assessment was based on the assumption that the peak hour of the peak construction period of all of the future projects would coincide with the peak hour of the peak construction period for this project (the year 2026)
- 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.

L3.9.2 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 L-3, 18 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
- Narragamba solar farm
- Bellambi Heights BESS
- Goulburn River solar farm
- Burrendong wind farm
- Orana BESS
- Blain Road solar farm
- Wollar solar farm
- Wilpinjong coal mine Extension and Modification 2.

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 L-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, Wilpinjong coal mine Extension and Modification 2, 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 18 relevant future projects during the construction and operation of this project is provided in Table L-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).

Assessment of mid-block road locations

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 L-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 18 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.

Assessment of intersection performance

Intersection analysis of 16 key intersections along this project's construction routes was performed to assess the cumulative impact of the construction of this project in combination with the relevant future projects on intersection performance. This was done by comparing intersection performance during the AM Peak and PM peak periods for the following three scenarios:

- existing condition: existing intersection performance with existing background traffic volumes from traffic surveys and estimates (i.e. base case without project construction traffic)
- existing condition with traffic from this project: the performance of the same intersection layout with increased background traffic volumes (growth value of 1.6%) and the predicted construction traffic volumes for this project during the peak construction period
- existing condition with cumulative traffic from this project and the relevant future projects: the performance of the same intersection layout with increased background traffic volumes (growth value of 1.6%), the predicted construction traffic volumes for this project and cumulative traffic volumes from the relevant future projects during the peak construction period. The assessment was based on the assumption that the peak hour of the peak construction period of all of these projects would coincide with the peak hour of the peak construction period for this project (the year 2026).

The results of the intersection analysis are provided in Attachment A.

The intersection analysis indicates that for the majority of the assessed intersections, the predicted traffic conditions during the construction of this project in combination with the relevant future projects would be similar to predicted traffic conditions during construction of this project, with most intersections operating at LoS A and LoS B, and some intersections operating at LoS C. For some intersections, there is a decrease in performance when considering the cumulative traffic impacts from the relevant future projects in combination with this project. However, most intersections would still operate at LoS A, LoS B or LoS C under cumulative traffic conditions, with only two intersections, the Ulan Road/Cope Road (Main Street) and Ulan Road/Ulan-Wollar Road

intersections, performing at LoS D during the AM peak (which is considered typically acceptable by Transport for NSW). It is important to note:

- the majority of the access intersections required for this project would only be used temporarily during construction for a short duration of time. Once this project is operational, the majority of these intersections would revert back to existing or similar traffic conditions, unless they would be used for maintenance and operation access
- the assessment is based on the assumption that all of the 18 relevant future projects would proceed, and that the peak periods of the peak construction period for all of the projects assessed would coincide with the peak periods of the peak construction period for this project, if they do proceed.

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 18 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.

Table L-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 L-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 L-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 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 L-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 L-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 L-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.

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Narragamba solar farm	Quantitative (sensitivity analysis)	According to the Project Scoping Report, the Narragamba Solar Project is located along Merotherie Road about 15km north of Gulgong, within the Mid-Western Regional Local Government Area (LGA). The project is located north of the approved Stubbo Solar Project. The solar farm area would likely be accessed via the Golden Highway and Merotherie Road and utilise the Golden Highway/Merotherie Road and Merotherie Road/Birkalla Road intersections . The exact haulage route for heavy vehicles, worker access route for the construction, operation and decommissioning of the project will be confirmed in the EIS. Construction will start in Q4 of 2025 and run for 20-24 months till end 2027. No road or intersection upgrades proposed at this stage of reporting. It does however state that: *To support the CWO-REZ Transmission Project and connecting projects, EnergyCo has carried out investigations to understand the scope of road upgrades required to facilitate construction of projects proposed in the REZ. While EnergyCo is not the proponent for generation projects, they have taken a leading role in coordinating the delivery of required upgrades between the Port of Newcastle and the CWO-REZ. It is expected that local road upgrades would typically be specific to individual projects, however the requirements for local road upgrades would be supported by EnergyCo assisting with planning and delivery (Energy Corporation of NSW, 2023).* During peak construction periods, about 400 full-time employees are expected to be required. It is estimated that the project could require around 250 light vehicles and 100 heavy vehicles per day during the peak construction period. OSOM vehicles will be required for deliveries of transformers and other major equipment. It is assumed that peak hourly trips would equate to approximately 10% of daily heavy vehicles and 50% of daily light vehicles. That is 10 heavy vehicles and 125 light vehicles. To quantitatively assess the cumulative impact of this project along with this project, a sensitivity assessment has been completed (refer to Table L-23) to assess additional traffic potentially using the Golden Highway and Merotherie Road. The increase of 135 peak hour trips on the Golden Highway would retain the mid-block level of service at a LoS A. Therefore, no traffic impact is envisaged, and traffic would still be free-flowing.	Golden Highway, Merotherie Road	Once the project is operational, most of the vehicles accessing the site would be light vehicles, aside from some heavy vehicles that may be required to undertake maintenance activities and repairs. The project would include approximately 10 full time operational staff from year 2028. With operational traffic likely to be up to ten vehicles per average day or 20 vehicle movements per day. Due to the expected low volume of vehicle movements associated with the project during operation, there would likely be minimal impact from operational traffic.

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Bellambi Heights battery energy storage	Quantitative (sensitivity analysis)	According to the Traffic Impact Assessment, the project is in the locality of Beryl, approximately 6.5 km north-west of the township of Gulgong, in the Central West of New South Wales and within the Mid-Western Regional Council local government area. The project would be accessed from the Castlereagh Highway from the Golden Highway and travel through the Castlereagh Highway/Tucklan Road, Castlereagh Highway/Laheys Creek Road and Castlereagh Highway/Puggoon Road intersections. Construction will start in early 2025 (subject to determination) and run for 12–18 months till 2025–2026. The existing access to the site on Castlereagh Highway is not ideal due to sight distance issues. An alternative access from Puggoon Road was considered, however would require impacts to biodiversity. Therefore, new site access is proposed, located approximately 720 m north-west of Puggoon Road or 240 m south-east of the existing access to the site. This is proposed as Type BAR & BAL intersection. The existing site access will be permanently closed. Hence the project is not seeking any additional access on Castlereagh Highway, rather relocating the exiting site at a new location with better visibility on both approaches of Castlereagh Highway. At peak, there will be 100 construction personnel working on site. There will be approximately 40 light and 40 heavy vehicles per day during peak construction. Peak hourly trips would equate to approximately 10% of daily heavy vehicles and 50% of daily light vehicles. That is 4 heavy vehicles and 20 light vehicles. 50% will travel to/from the north and 50% to/from the south on Castlereagh Highway. To quantitatively assess the cumulative impact of this project along with this project, a sensitivity assessment has been completed (refer to Table L-23) to assess additional traffic potentially using the Golden Highway and Castlereagh Highway. The increase of 12 peak hour trips (travel to/from the north on Castlereagh Highway) on the Castlereagh Highway would retain the mid-block level of service at a LoS A. Therefore, no traffic impact is envisaged, and traffic would still be free-flowing.	Golden Highway, Castlereagh Highway	Operational from 2026 with no staff on site. It will operate 24 hours a day, seven days a week and will be operated remotely. Regular maintenance activities, including vegetation management, pest control and general maintenance, will be required throughout the project's operational life. Maintenance of plant and equipment may potentially include the replacement of BESS components from time to time. Light vehicles will access the site as required throughout the operations phase for maintenance activities. Heavy vehicles may also occasionally access the site to replace larger components as necessary.

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Goulburn River solar farm	Qualitative	According to the Traffic and Transport Impact Assessment, the solar farm project is proposed approximately 28 kilometres southwest of Merriwa. The site is located on Wollara Road, approximately 170 kilometres northwest of Newcastle. The Project is bounded by the Goulburn River National Park to the north, east and south and Wollara Road to the west. This is outside the traffic and transport study area and is accessed via the Golden Highway, Ringwood Road, Wollara Road, Wollar Road including the Golden Highway/Ringwood Road and Wollar Road/Ringwood Road intersections. Construction would start in 2024 and last 27 months to end 2026. The Project would include various associated infrastructure, including road repairs and upgrades to Ringwood Road and Wollara Road. An approximate 350 construction jobs would be created during peak construction. During construction, 60 light vehicle trips, 15 bus (mini bus), 55 heavy vehicle trips and 2 OSOM vehicle trips would occur daily. During operation 10 vehicle trips are proposed daily. Peak hourly trips would equate to approximately 10% of daily heavy vehicles and 100% of daily light vehicles. That is 6 heavy vehicles and 75 light vehicles.	Golden Highway, Wollar Road	Operation of the solar farm would require up to 10 concurrent staff members on-site, with 10 two-way light vehicle trips anticipated per day from 2026. In addition, infrequent heavy vehicle deliveries may be required during this phase.

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Burrendong wind farm	Quantitative (sensitivity analysis)	According to the Traffic and Transport Impact Assessment, the Project Site is to be located approximately 30km south-east of Wellington, just east of Lake Burrendong and within the Dubbo Regional Council and Mid-Western Regional Council Local Government Areas (LGAs). This is outside the traffic and transport study area and accessed via the Golden Highway. Construction would be between 24 and up to 30 months with a peak of 375 employees. From the Port of Newcastle, the OSOM vehicles will travel north-west via the Golden Highway towards Dubbo. From Dunedoo, the OSOM vehicles transporting the wind turbine blades will take a different route (via Golden Highway and Saxa Road) to the OSOM vehicles transporting the remaining wind turbine components (via Castlereagh Highway), due to the latter route not being able to accommodate the vehicles transporting the 82 metre blades. The routes will recombine north of the Project Site, with all OSOM transport vehicles then using Twelve Mile Road, Yarrabin Road and Burrendong Dam Road to reach the Project Site. OSOM deliveries are likely to occur overnight and be grouped together to minimise the impact to drivers on the road network. Access would be via the Golden Highway/Castlereagh Highway intersection. Traffic originating from Mudgee will access the Project Site via Hill End Road, Yarrabin Road and Burrendong Dam Road (Route 1). Traffic originating from Wellington and Dubbo will access the Project Site via Mitchell Highway, Goolma Road, Twelve Mile Road, Yarrabin Road and Burrendong Dam Road (Route 2). The preferred route for traffic accessing the western side of the Project Site is via Burrendong Way, Fashions Mount Road and Tara Road (Route 3A). Peak construction traffic would consist of 125 light vehicles/day and 57 heavy vehicles/day totalling 182 vehicles/day. Peak hourly trips would equate to approximately 10% of daily heavy vehicles and 50% of daily light vehicles. That is 6 heavy vehicles and 63 light vehicles. No project traffic assigned to the Golden Highway or Castlereagh Highways in reporting. It is assumed that traffic generated from Golden Highway goes via Mitchell Highway. This is 28 light vehicles and 3 heavy vehicles. To quantitatively assess the cumulative impact of this project along with this project, a sensitivity assessment has been completed (refer to Table L-23) to assess additional traffic potentially using the Golden Highway. The increase of 31 peak hour trips on the Golden Highway would retain the mid-block level of service at a LoS A. Therefore, no traffic impact is envisaged, and traffic would still be free-flowing.	Golden Highway, Castlereagh Highway	Routine maintenance is likely to be carried out by 10–15 employees during operation. Assuming each employee drives themselves to and from the Project Site, the daily traffic generation would equate to 20–30 trips.

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Orana battery energy storage	Quantitative (sensitivity analysis)	According to the Traffic Impact Assessment, the Orana BESS is located at 6945 Goolma Road, Montefiores. The site is located on the south-eastern side of Goolma Road approximately 2.0 kilometres northeast of Wellington. This is outside the traffic and transport study area and accessed via the Golden Highway, Mitchell Highway and Goolma Road. Stage 1 of 9–12 month duration starting in Q4 2023 and Stage 2 starting in Q2 2024. A maximum workforces of 150 personnel would be on-site during peak construction. Peak construction traffic would consist of 60 light vehicles/day and 60 heavy vehicles/day totalling 120 vehicles/day. Peak hourly trips would equate to approximately 10% of daily heavy vehicles and 50% of daily light vehicles. That is 6 heavy vehicles and 30 light vehicles. To quantitatively assess the cumulative impact of this project along with this project, a sensitivity assessment has been completed (refer to Table L-23) to assess additional traffic potentially using the Golden Highway. The increase of 36 peak hour trips on the Golden Highway would retain the mid-block level of service at a LoS A. Therefore, no traffic impact is envisaged, and traffic would still be free-flowing.	Golden Highway	During operation the BESS is expected to generate a minimal level of traffic associated with maintenance and operation services. The BESS is expected to be operated by up to 6 staff resulting in a traffic generation of up to 12 light vehicle movements per day and occasional heavy vehicle movements which would result in a negligible change to the traffic environment.
Blain Road solar farm	Quantitative (sensitivity analysis)	According to the Traffic Assessment Report, a solar farm is proposed for 33 Blain Road, Caerleon. The development site is located near Mudgee, approximately 2.4 km from the Hill End Road and Castlereagh Highway intersection. This is outside the traffic and transport study area and accessed via the Castlereagh Highway (assumed to be from the Golden Highway). 200 workers on site during the peak of construction. 50 light vehicle trips and 4 heavy vehicle trips per day anticipated during construction. Peak hourly trips would equate to approximately 10% of daily heavy vehicles and 50% of daily light vehicles. That is 1 heavy vehicle and 25 light vehicles. Construction over 3-month period. To quantitatively assess the cumulative impact of this project along with this project, a sensitivity assessment has been completed (refer to Table L-23) to assess additional traffic potentially using the Castlereagh Highway. The increase of 26 peak hour trips on the Castlereagh Highway would retain the mid-block level of service at a LoS A. Therefore, no traffic impact is envisaged, and traffic would still be free-flowing.	Castlereagh Highway	2 light vehicles would access the site for maintenance at 3 monthly intervals.

Project	Type of assessment	Construction traffic impacts	Access roads used by project and Central-West Orana Transmission project	Operational traffic impacts
Wollar solar farm	Quantitative (sensitivity analysis)	According to the Traffic Impact Assessment, the proposed Solar Farm site is located 7 km south of Wollar Village and is situated to the west of Barigan Road within the Mid-Western Regional Local Government Area (LGA) and is approximately 54 km north-east of Mudgee (38kms as the crow flys). Primary access to the village is via Wollar Road from the east and west and Ulan-Wollar Road from the north which connects to the Golden Highway via Ulan Road. This solar farm would be accessed via the Golden Highway, Ulan Road, Ulan-Wollar Road, Wollar Road and Barigan Road. 500 workers on site during the peak of construction. 100 light vehicle trips and 84 heavy vehicle trips per day anticipated during construction. Peak hourly trips would be 80 light vehicle trips and 16 heavy vehicle trips. 90% of trips would be to and from Mudgee. That is 72 light vehicle trips and 14 heavy vehicle trips. 10% assumed for travel to/from Newcastle. That is 8 light vehicle trips and 2 heavy vehicle trips. Construction phase of 12 months. To quantitatively assess the cumulative impact of this project along with this project, a sensitivity assessment has been completed (refer to Table L-23) to assess additional traffic potentially using Ulan Road. The increase of 86 peak hour trips on Ulan Road would reduce the mid-block level of service from LoS A to LoS B for the SB/EB travel direction in the AM peak and NB/WB travel direction in the PM peak. 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, Ulan-Wollar Road, Wollar Road, Barigan Road	5 full time employees and some operational and maintenance light vehicles accessing the site daily.
Wilpinjong coal mine extension & mod 2	Qualitative	According to the Road Transport Assessment, Wilpinjong Coal Mine is an open cut coal mining operation located approximately 40 kilometres (km) north-east of Mudgee. Mine life approved from 2026 to 2033 with peak operational workforce in 2024 with only 40 construction workforce. This mine is accessed via the Golden Highway, Ulan Wollar Road, Ulan Road and Cope Road. Peak construction traffic already included in background traffic levels and reducing from year 2024. Therefore, there will be no further increases in traffic generated by this project above those already captured in traffic surveys undertaken and hence no increased cumulative traffic assigned to the road network accordingly.	Golden Highway, Ulan Wollar Road, Ulan Road, Cope Road	Operational traffic already included in background traffic levels and reducing from year 2024.

Table L-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 • Burrendong wind farm • Orana battery energy storage	80	1	1	80	227 vph 0.13 (LOS A)	63 vph 0.04 (LOS A)	62 vph 0.03 (LOS A)	231 vph 0.13 (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 • Narragamba solar farm • Bellambi Heights battery energy storage • Burrendong wind farm • Orana battery energy storage • Birriwa solar farm	325	56	56	325	447 vph 0.25 (LOS A)	98 vph 0.05 (LOS A)	102 vph 0.06 (LOS A)	435 vph 0.24 (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 • Bellambi Heights battery energy storage • Blain Road solar farm	9	118	118	9	43 vph 0.02 (LOS A)	204 vph 0.11 (LOS A)	201 vph 0.11 (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 • Bellambi Heights battery energy storage • Blain Road solar farm	7	106	106	7	43 vph 0.02 (LOS A)	197 vph 0.11 (LOS A)	195 vph 0.11 (LOS A)	57 vph 0.03 (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 • Narragamba solar farm	3	161	161	3	11 vph 0.01 (LOS A)	228 vph 0.23 (LOS A)	228 vph 0.23 (LOS A)	11 vph 0.01 (LOS A)

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
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 • Wollar solar farm	110	218	218	110	565 vph 0.40 (LOS B)	415 vph 0.30 (LOS B)	459 vph 0.33 (LOS B)	309 vph 0.22 (LOS A)

(1) NB = Northbound; WB = Westbound; SB = Southbound; EB = Eastbound

L3.10 Waste management

L3.10.1 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 L-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.

L3.10.2 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.

L3.11 Surface water and groundwater supply

L3.11.1 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 L-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.

L3.11.2 Impact assessment

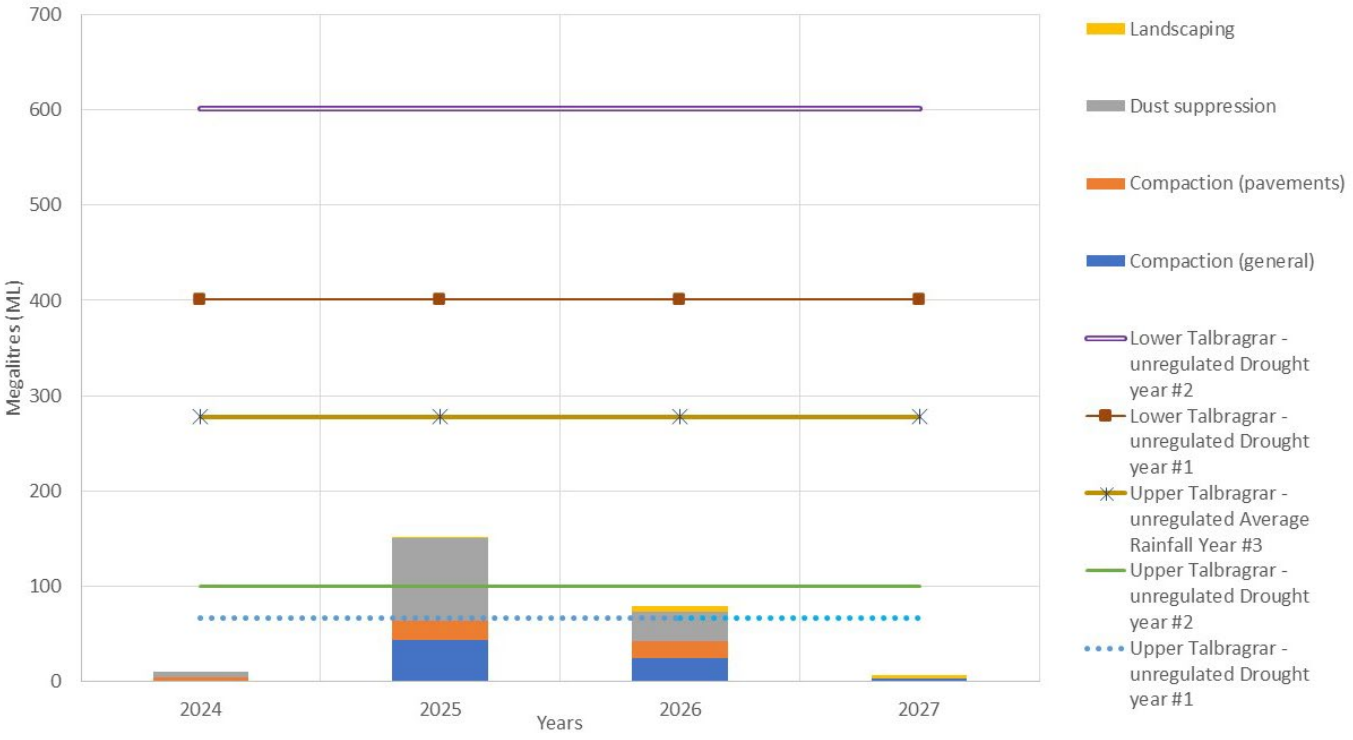
Construction

Surface water supply

During construction, the potential cumulative impacts on surface water supply is minimal. There are only three projects that have a substantial water demand overlap during the construction phase. The first is the Liverpool Range wind farm, which is primarily located upstream of this project and overlaps this project along the Cassilis connection (connecting to switching station M1). 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 (connecting to switching stations M6, M8 and M9). The solar farm project is related development which has been proposed and is under assessment. Since none 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. The third project is the Narragamba solar farm which overlaps the project along the Merotherie south connection (connecting to switching station M4). This solar farm is related

development which has been proposed and is under assessment. The Narragamba solar farm project is proposing to source water from commercially treated wastewater, and opportunistically from farm dams within the study area as agreed with landowners hosting project infrastructure, and is therefore not expected to contribute to cumulative impacts on surface water supplies. 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 L-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.



#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 L-3 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 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.

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.

L3.12 Air quality

L3.12.1 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 L-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.

L3.12.2 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 L-24. With the implementation of standard mitigation measures for each project, any potential cumulative air quality impacts are expected to be minor.

Table L-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 given the potential for direct overlap during construction along the Cassilis connection and switching station M1. There is the potential for 2 sensitive receivers to be affected by cumulative air quality impacts from this project and the wind farm project.
Narragamba solar farm	Potential for cumulative impacts given the potential for direct overlap during construction of switching station M4 and New Wollar Switching Station — Merotherie Energy Hub connection. There is the potential for 2 sensitive receivers to be affected by cumulative air quality impacts from this project and the wind farm project. Depending on construction overlap there is also the potential for cumulative impacts from construction works at the Barneys Reef wind farm.
Barneys Reef wind farm	Potential for cumulative impacts given the potential for direct overlap during construction of switching stations M4, M5, M6 and M8 and the Merotherie Energy Hub. There is the potential for 3 sensitive receivers to be affected by cumulative air quality impacts from this project and the wind farm project. Depending on construction overlap there is also the potential for cumulative impacts from construction works from the adjacent Narragamba solar farm.
Birriwa solar farm	Potential for cumulative impacts given the potential for direct overlap during construction of switching station M5. 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 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 from the adjacent Barneys Reef wind farm depending on construction overlap.
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 1 sensitive receiver 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 adjacent Sandy Creek solar farm and nearby 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 E3 and its associated transmission line and the transmission line connecting to switching station E4. 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 adjacent Sandy Creek solar farm and Spicers Creek wind farm, and the nearby Cobbora solar farm.
Approved projects	
Wollar solar farm	Potential for cumulative impacts given the potential for direct overlap during local road upgrades near the New Wollar Switching Station. There is the potential for 1 sensitive receiver to be affected by cumulative air quality impacts.
Stubbo solar farm	Potential for cumulative impacts given the potential for direct overlap during construction of the New Wollar Switching Station — Merotherie Energy Hub connection. 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 the adjacent Narragamba solar farm and nearby 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 1 sensitive receiver 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.

L4 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.

L5 References

Knopper, L. D., Ollson, C. A., McCallum, L. C., Whitfield Aslund, M. L., Berger, R. G., Souweine, K., McDaniel, M. (2014), *Wind turbines and human health*. Retrieved from: https://www.frontiersin.org/articles/10.3389/fpubh.2014.00063/full.

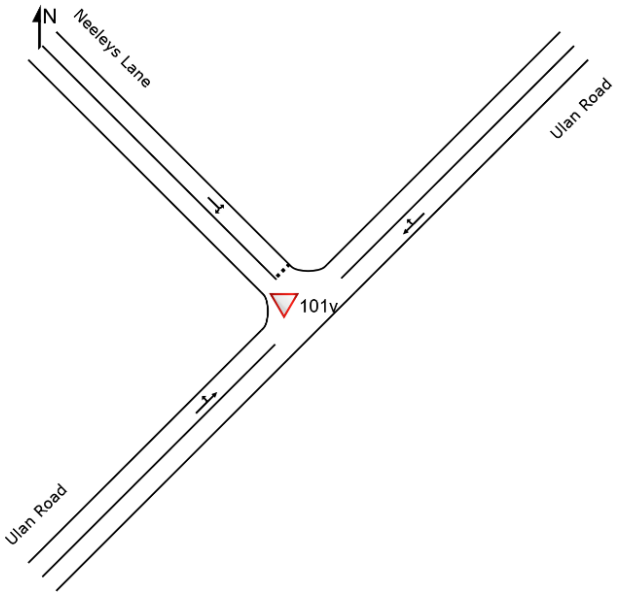
McCallum, L. C., Whitfield Aslund, M. L., Knopper, L. D., Ferguson G. M., & Ollson, C. A. (2014), *Measuring electromagnetic fields (EMF) around wind turbines in Canada: is there a human health concern?* Retrieved from: https://ehjournal.biomedcentral.com/articles/10.1186/1476-069X-13-9.

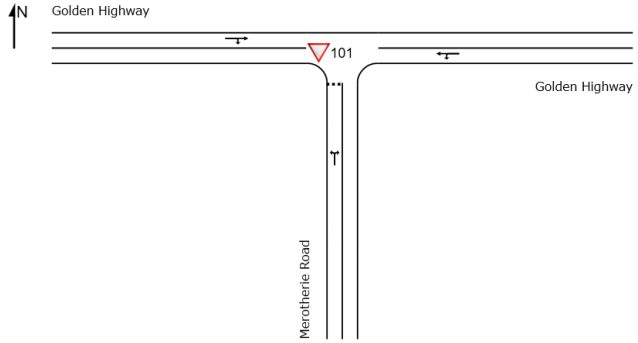
National Health and Medical Research Council (NHMRC) (2010), *Wind turbines and health: A rapid review of the evidence*. Retrieved from: https://www.aph.gov.au/DocumentStore.ashx?id=88b9e2af-3a76-4976-89b2-3f2d6224cb53.

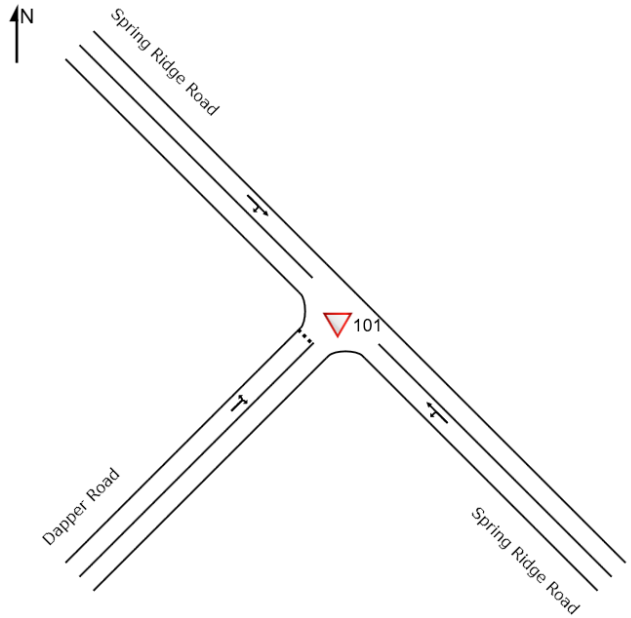
Attachment A – Intersection analysis

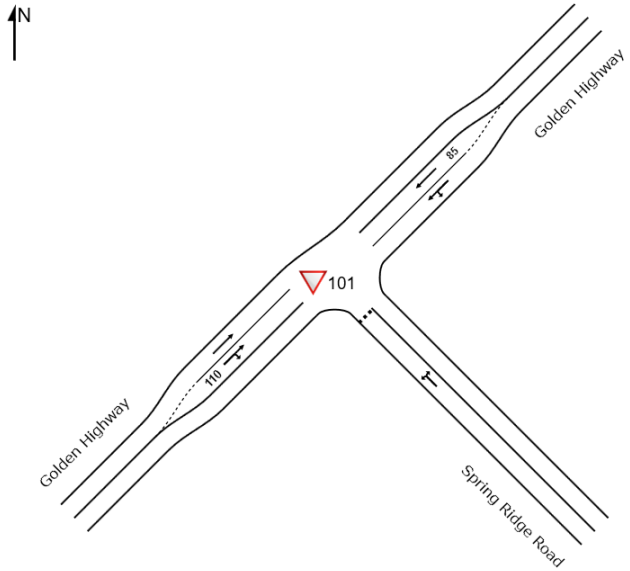
The comparative assessment involved the evaluation of the Level of Service (LoS) traffic performance indicator, which provides a qualitative indication of an intersection's operating condition, based upon quantitative measurements such as average delay experienced by each driver, queue length and Degree of Saturation. The LoS indicator provides intersection performance ratings from LoS A (free flowing intersection conditions) through to LoS F (heavily congested intersection conditions), which are described as follows:

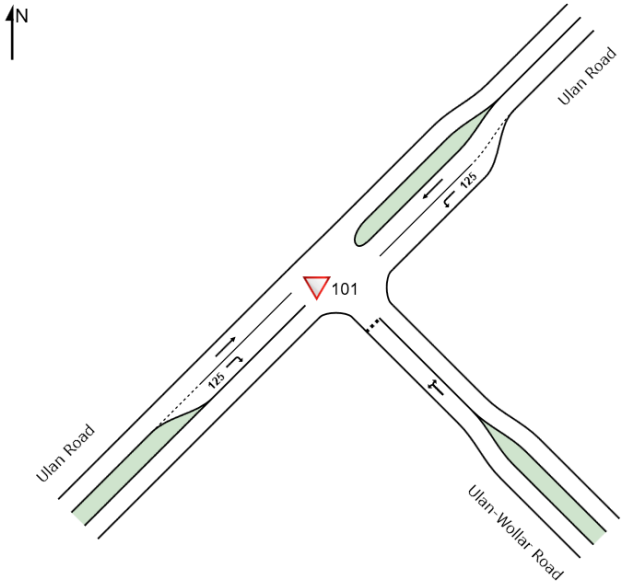
- Level of Service A indicates the intersection operates at free-flow, with minimal delays and queueing at the intersection.
- Level of Service B indicates the intersection is operating reasonably unimpeded, albeit with insignificant delays and queueing experienced by drivers at the intersection. The general level of physical and psychological comfort provided to drivers is still high.
- Level of Service C indicates the intersection is operating stably, with some noticeably minor delays and queuing experienced by drivers at the intersection. Navigating the intersection require more care and vigilance on the part of the drivers.
- Level of Service D indicates the intersection is experiencing is experiencing increasing delays, with higher degree of saturation. 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
- Level of Service E indicates the intersection is operating at or near capacity. Operations at this level are highly volatile with virtually no usable gaps in traffic, leaving little room to navigate the intersection. The physical and psychological comfort for drivers is poor.
- Level of Service F indicates the intersection is operating unstably.

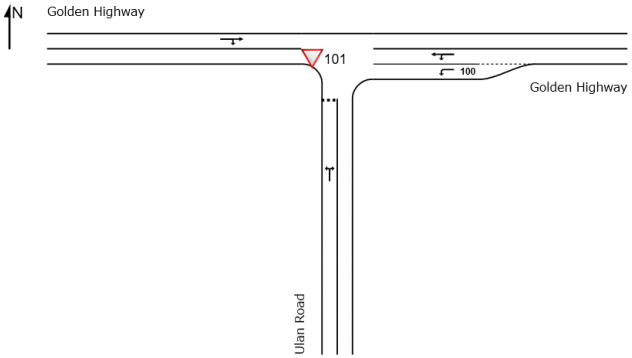
Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Neeleys Lane and Ulan Road 	Existing Condition (current intersection configuration)	AM	Northeast: Ulan Road	LoS A	0.1	0.1	0.061
			Northwest: Neeleys Lane	LoS A	8.4	0.0	0.002
			Southwest: Ulan Road	LoS A	7.8	0.0	0.087
		PM	Northeast: Ulan Road	LoS A	0.1	0.0	0.046
			Northwest: Neeleys Lane	LoS A	8.0	0.0	0.002
			Southwest: Ulan Road	LoS A	7.8	0.0	0.042
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Northeast: Ulan Road	LoS B	12.1	4.1	0.115
			Northwest: Neeleys Lane	LoS A	8.7	0.0	0.002
			Southwest: Ulan Road	LoS B	10.5	0.0	0.124
		PM	Northeast: Ulan Road	LoS A	7.6	0.0	0.049
			Northwest: Neeleys Lane	LoS A	8.1	1.4	0.054
			Southwest: Ulan Road	LoS A	7.8	0.0	0.045
	Cumulative Case	AM	Northeast: Ulan Road	LoS B	12.0	4.2	0.170
			Northwest: Neeleys Lane	LoS A	9.2	0.0	0.002
			Southwest: Ulan Road	LoS A	7.9	0.0	0.111
		PM	Northeast: Ulan Road	LoS A	8.0	0.1	0.052
			Northwest: Neeleys Lane	LoS A	8.4	0.0	0.002
			Southwest: Ulan Road	LoS A	7.8	0.0	0.101

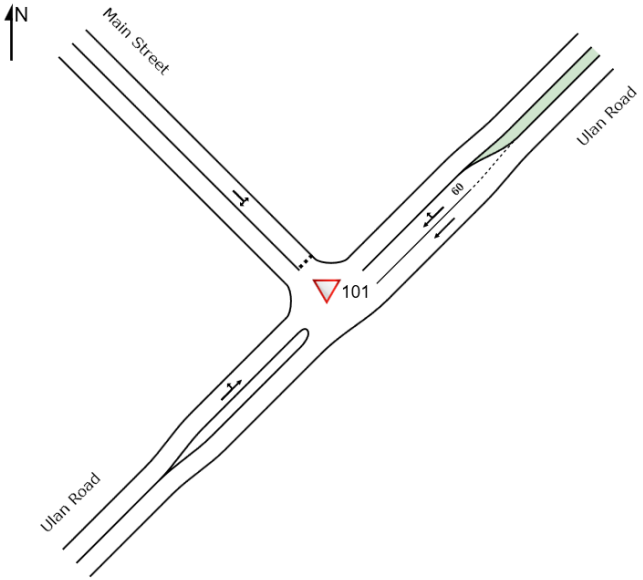
Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Golden Highway and Merotherie Road  	Existing Condition (current intersection configuration)	AM	South: Merotherie Road	LoS A	7.9	0.0	0.002
			East: Golden Highway	LoS A	7.8	0.0	0.021
			West: Golden Highway	LoS A	7.5	0.0	0.026
		PM	South: Merotherie Road	LoS A	7.9	0.0	0.002
			East: Golden Highway	LoS A	7.8	0.0	0.021
			West: Golden Highway	LoS A	7.5	0.1	0.025
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Merotherie Road	LoS A	8.4	0.0	0.002
			East: Golden Highway	LoS B	10.5	0.0	0.106
			West: Golden Highway	LoS B	11.6	5.2	0.098
		PM	South: Merotherie Road	LoS A	8.2	1.6	0.066
			East: Golden Highway	LoS A	7.8	0.0	0.025
			West: Golden Highway	LoS A	7.6	0.1	0.089
	Cumulative Case	AM	South: Merotherie Road	LoS A	9.2	0.1	0.003
			East: Golden Highway	LoS A	8.6	0.0	0.206
			West: Golden Highway	LoS B	13.7	7.0	0.122
		PM	South: Merotherie Road	LoS A	8.7	4.0	0.160
			East: Golden Highway	LoS A	7.9	0.0	0.032
			West: Golden Highway	LoS A	7.6	0.1	0.143

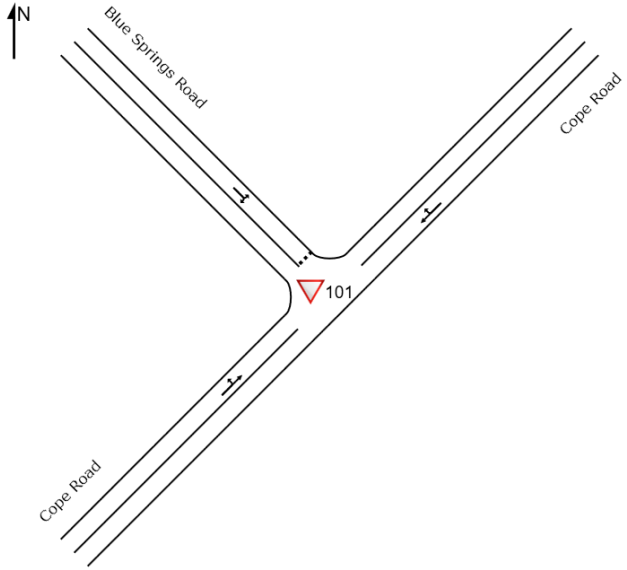
Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Spring Ridge Road and Dapper Road 	Existing Condition (current intersection configuration)	AM	Southeast: Spring Ridge Road	LoS A	7.8	0.0	0.005
			Northwest: Spring Ridge Road	LoS A	7.4	0.0	0.003
			Southwest: Dapper Road	LoS A	7.9	0.0	0.001
		PM	Southeast: Spring Ridge Road	LoS A	7.8	0.0	0.003
			Northwest: Spring Ridge Road	LoS A	7.4	0.0	0.003
			Southwest: Dapper Road	LoS A	7.8	0.0	0.001
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Southeast: Spring Ridge Road	LoS A	7.8	0.0	0.006
			Northwest: Spring Ridge Road	LoS B	10.2	4.3	0.075
			Southwest: Dapper Road	LoS A	7.9	0.0	0.002
		PM	Southeast: Spring Ridge Road	LoS A	7.8	0.0	0.003
			Northwest: Spring Ridge Road	LoS A	7.4	0.0	0.004
			Southwest: Dapper Road	LoS B	10.5	0.0	0.069
	Cumulative Case	AM	Southeast: Spring Ridge Road	LoS A	7.8	0.0	0.006
			Northwest: Spring Ridge Road	LoS B	10.2	4.0	0.068
			Southwest: Dapper Road	LoS A	7.9	0.0	0.002
		PM	Southeast: Spring Ridge Road	LoS A	7.8	0.0	0.003
			Northwest: Spring Ridge Road	LoS A	7.4	0.0	0.004
			Southwest: Dapper Road	LoS B	10.5	3.7	0.069

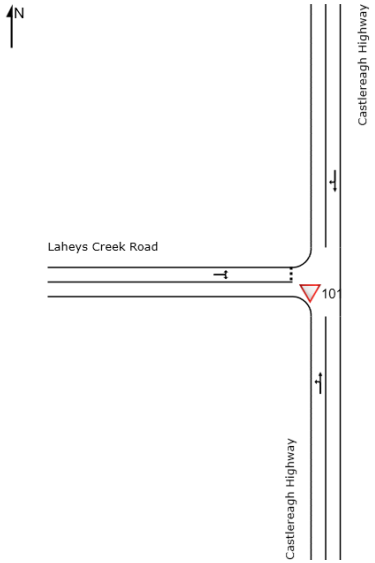
Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Golden Highway and Spring Ridge Road 	Existing Condition (current intersection configuration)	AM	Southeast: Spring Ridge Road	LoS A	9.9	0.3	0.009
			Northeast: Golden Highway	LoS A	7.8	0.0	0.026
			Southwest: Golden Highway	LoS A	7.6	0.1	0.035
		PM	Southeast: Spring Ridge Road	LoS A	9.7	0.2	0.005
			Northeast: Golden Highway	LoS A	7.8	0.0	0.032
			Southwest: Golden Highway	LoS A	9.2	0.3	0.034
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Southeast: Spring Ridge Road	LoS B	12.4	0.4	0.015
			Northeast: Golden Highway	LoS B	10.4	0.0	0.111
			Southwest: Golden Highway	LoS A	9.0	0.2	0.047
		PM	Southeast: Spring Ridge Road	LoS C	17.0	15.3	0.272
			Northeast: Golden Highway	LoS A	7.8	0.0	0.043
			Southwest: Golden Highway	LoS A	9.1	0.5	0.103
	Cumulative Case	AM	Southeast: Spring Ridge Road	LoS B	13.5	0.4	0.013
			Northeast: Golden Highway	LoS B	10.4	0.0	0.100
			Southwest: Golden Highway	LoS A	9.2	0.2	0.047
		PM	Southeast: Spring Ridge Road	LoS C	18.8	17.4	0.297
			Northeast: Golden Highway	LoS A	0.0	0.0	0.009
			Southwest: Golden Highway	LoS A	9.1	0.5	0.121

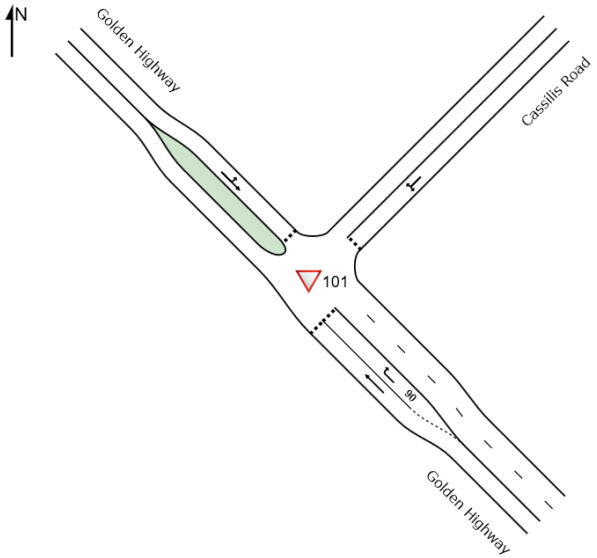
Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Ulan Road and Ulan-Wollar Road 	Existing Condition (current intersection configuration)	AM	Southeast: Ulan-Wollar Road	LoS B	10.3	1.5	0.058
			Northeast: Ulan Road	LoS A	7.9	0.0	0.014
			Southwest: Ulan Road	LoS A	8.1	8.7	0.251
		PM	Southeast: Ulan-Wollar Road	LoS A	6.9	3.0	0.113
			Northeast: Ulan Road	LoS A	7.8	0.0	0.042
			Southwest: Ulan Road	LoS A	7.8	2.6	0.088
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Southeast: Ulan-Wollar Road	LoS C	19.3	3.3	0.116
			Northeast: Ulan Road	LoS A	9.5	0.0	0.110
			Southwest: Ulan Road	LoS A	9.8	15.1	0.364
		PM	Southeast: Ulan-Wollar Road	LoS B	13.9	11.5	0.297
			Northeast: Ulan Road	LoS A	9.1	0.0	0.052
			Southwest: Ulan Road	LoS A	8.0	3.0	0.101
	Cumulative Case	AM	Southeast: Ulan-Wollar Road	LoS D	26.5	4.1	0.150
			Northeast: Ulan Road	LoS A	9.5	0.0	0.059
			Southwest: Ulan Road	LoS B	11.7	24.2	0.468
		PM	Southeast: Ulan-Wollar Road	LoS C	19.9	17.5	0.388
			Northeast: Ulan Road	LoS A	9.1	0.0	0.009
			Southwest: Ulan Road	LoS B	8.0	3.1	0.102

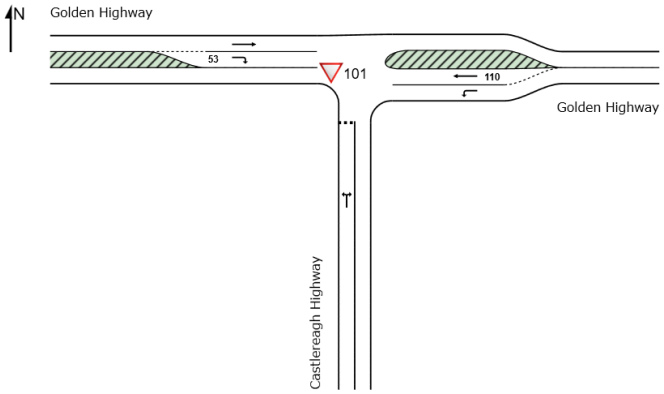
Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Golden Highway and Ulan Road 	Existing Condition (current intersection configuration)	AM	South: Ulan Road	LoS A	8.7	2.0	0.066
			East: Golden Highway	LoS A	8.3	0.0	0.025
			West: Golden Highway	LoS A	8.2	0.3	0.031
		PM	South: Ulan Road	LoS A	8.4	1.7	0.058
			East: Golden Highway	LoS A	8.2	0.0	0.035
			West: Golden Highway	LoS A	7.7	0.4	0.035
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Ulan Road	LoS B	10.5	2.8	0.092
			East: Golden Highway	LoS A	9.3	0.0	0.098
			West: Golden Highway	LoS B	11.9	6.4	0.125
		PM	South: Ulan Road	LoS B	11.7	8.7	0.196
			East: Golden Highway	LoS A	8.2	0.0	0.043
			West: Golden Highway	LoS A	7.8	0.6	0.098
	Cumulative Case	AM	South: Ulan Road	LoS B	12.1	3.7	0.126
			East: Golden Highway	LoS A	8.4	0.0	0.223
			West: Golden Highway	LoS C	16.1	6.5	0.129
		PM	South: Ulan Road	LoS B	14.9	22.1	0.420
			East: Golden Highway	LoS A	8.1	0.0	0.062
			West: Golden Highway	LoS A	8.0	0.5	0.187

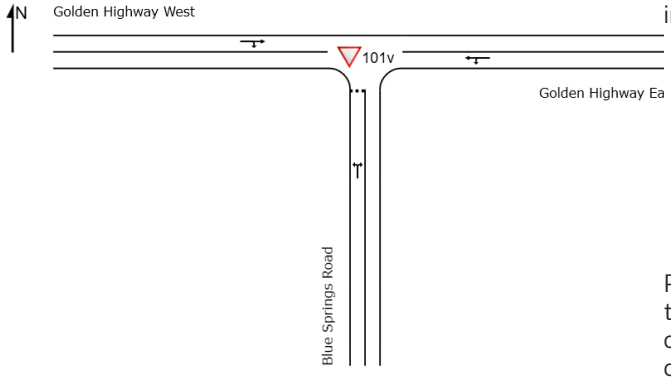
Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Ulan Road and Cope Road (Main Street) 	Existing Condition (current intersection configuration)	AM	Northeast: Ulan Road	LoS A	9.0	2.2	0.069
			Northwest: Main Street	LoS B	13.7	4.0	0.131
			Southwest: Ulan Road	LoS A	7.8	0.0	0.202
		PM	Northeast: Ulan Road	LoS A	7.9	2.7	0.108
			Northwest: Main Street	LoS B	10.0	1.8	0.063
			Southwest: Ulan Road	LoS A	7.8	0.0	0.058
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Northeast: Ulan Road	LoS B	11.4	6.6	0.153
			Northwest: Main Street	LoS C	22.5	5.8	0.188
			Southwest: Ulan Road	LoS B	10.1	0.0	0.271
		PM	Northeast: Ulan Road	LoS A	8.5	3.5	0.128
			Northwest: Main Street	LoS C	18.4	10.3	0.256
			Southwest: Ulan Road	Los A	9.0	0.0	0.128
	Cumulative Case	AM	Northeast: Ulan Road	LoS B	10.8	10.9	0.246
			Northwest: Main Street	LoS D	29.3	6.9	0.228
			Southwest: Ulan Road	LoS B	10.1	0.0	0.295
		PM	Northeast: Ulan Road	LoS A	8.5	4.3	0.155
			Northwest: Main Street	LoS C	21.7	16.2	0.363
			Southwest: Ulan Road	Los A	9.0	0.0	0.128

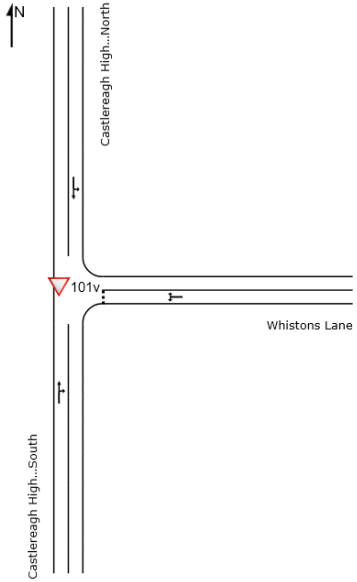
Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Cope Road and Blue Springs Road 	Existing Condition (current intersection configuration)	AM	Northeast: Cope Road	LoS A	7.6	0.0	0.017
			Northwest: Blue Springs Road	LoS A	4.4	0.1	0.002
			Southwest: Cope Road	LoS A	7.8	0.0	0.045
		PM	Northeast: Cope Road	LoS A	7.6	0.0	0.031
			Northwest: Blue Springs Road	LoS A	4.3	0.1	0.005
			Southwest: Cope Road	LoS A	7.8	0.0	0.036
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Northeast: Cope Road	LoS B	10.8	3.6	0.069
			Northwest: Blue Springs Road	LoS A	4.7	0.3	0.008
			Southwest: Cope Road	LoS A	7.8	0.0	0.049
		PM	Northeast: Cope Road	LoS A	9.7	0.5	0.041
			Northwest: Blue Springs Road	LoS A	6.3	2.7	0.057
			Southwest: Cope Road	LoS A	7.8	0.0	0.039
	Cumulative Case	AM	Northeast: Cope Road	LoS B	10.8	3.6	0.069
			Northwest: Blue Springs Road	LoS A	4.7	0.3	0.008
			Southwest: Cope Road	LoS A	7.8	0.0	0.049
		PM	Northeast: Cope Road	LoS A	9.7	0.5	0.041
			Northwest: Blue Springs Road	LoS A	6.3	2.7	0.057
			Southwest: Cope Road	LoS A	7.8	0.0	0.039

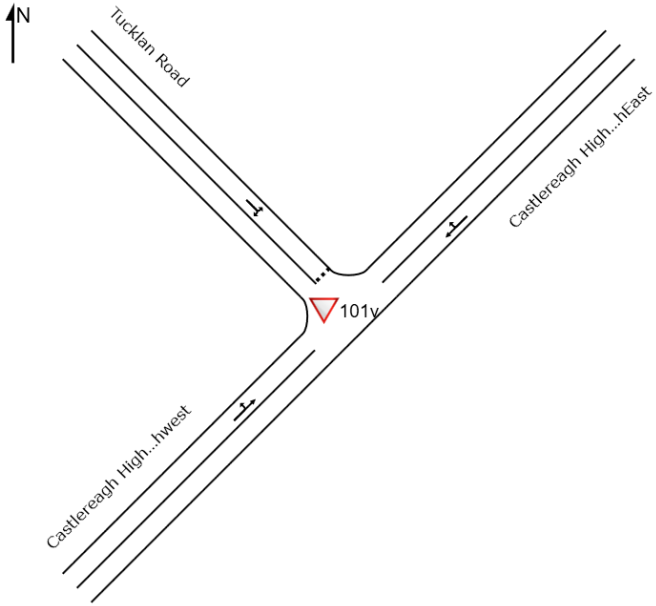
Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Castlereagh Highway and Laheys Creek Road 	Existing Condition (current intersection configuration)	AM	South: Castlereagh Highway	LoS A	7.8	0.0	0.026
			North: Castlereagh Highway	LoS A	7.5	0.0	0.032
			West: Laheys Creek Road	LoS A	8.0	0.4	0.017
		PM	South: Castlereagh Highway	LoS A	8.1	0.0	0.032
			North: Castlereagh Highway	LoS A	7.6	0.1	0.028
			West: Laheys Creek Road	LoS A	8.0	0.1	0.003
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Castlereagh Highway	LoS A	7.8	0.0	0.033
			North: Castlereagh Highway	LoS A	7.6	0.1	0.074
			West: Laheys Creek Road	LoS A	8.1	0.4	0.020
		PM	South: Castlereagh Highway	LoS A	8.1	0.0	0.075
			North: Castlereagh Highway	LoS A	7.8	0.1	0.035
			West: Laheys Creek Road	LoS A	8.2	0.1	0.005
	Cumulative Case	AM	South: Castlereagh Highway	LoS A	7.8	0.0	0.035
			North: Castlereagh Highway	LoS A	7.6	0.1	0.102
			West: Laheys Creek Road	LoS A	8.2	0.1	0.004
		PM	South: Castlereagh Highway	LoS A	8.1	0.0	0.103
			North: Castlereagh Highway	LoS A	8.0	0.1	0.037
			West: Laheys Creek Road	LoS A	8.3	0.1	0.004

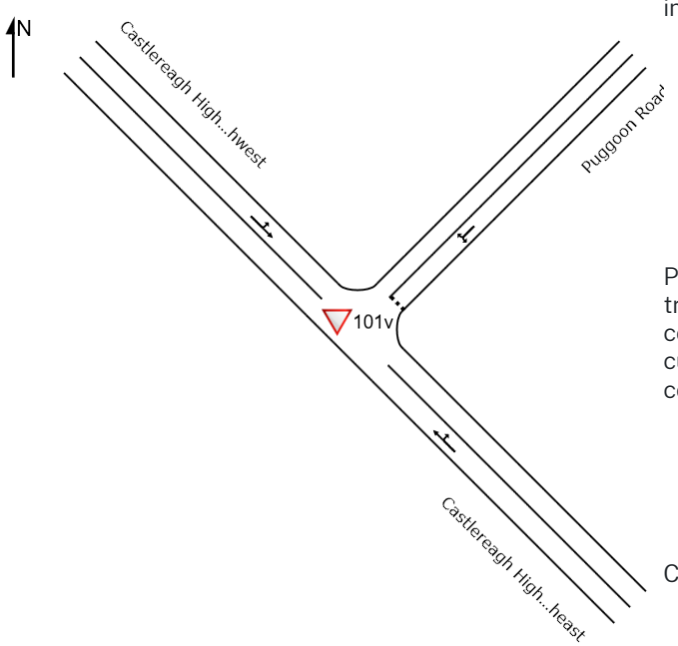
Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Golden Highway and Cassilis Road 	Existing Condition (current intersection configuration)	AM	Southeast: Golden Highway	LoS A	8.0	0.1	0.033
			Northeast: Cassilis Road	LoS A	8.0	0.1	0.005
			Northwest: Golden Highway	LoS A	7.8	0.0	0.038
		PM	Southeast: Golden Highway	LoS A	8.0	0.1	0.036
			Northeast: Cassilis Road	LoS A	8.0	0.1	0.005
			Northwest: Golden Highway	LoS A	7.8	0.0	0.040
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Southeast: Golden Highway	LoS A	8.4	0.1	0.095
			Northeast: Cassilis Road	LoS B	13.0	4.3	0.102
			Northwest: Golden Highway	LoS A	8.0	0.0	0.050
		PM	Southeast: Golden Highway	LoS A	8.9	0.1	0.044
			Northeast: Cassilis Road	LoS B	11.5	0.6	0.018
			Northwest: Golden Highway	LoS A	10.0	0.0	0.148
	Cumulative Case	AM	Southeast: Golden Highway	LoS A	8.6	0.1	0.005
			Northeast: Cassilis Road	LoS C	21.1	7.9	0.191
			Northwest: Golden Highway	LoS A	9.7	0.0	0.074
		PM	Southeast: Golden Highway	LoS A	9.7	0.1	0.006
			Northeast: Cassilis Road	LoS B	13.8	0.7	0.021
			Northwest: Golden Highway	LoS A	10.0	0.0	0.208

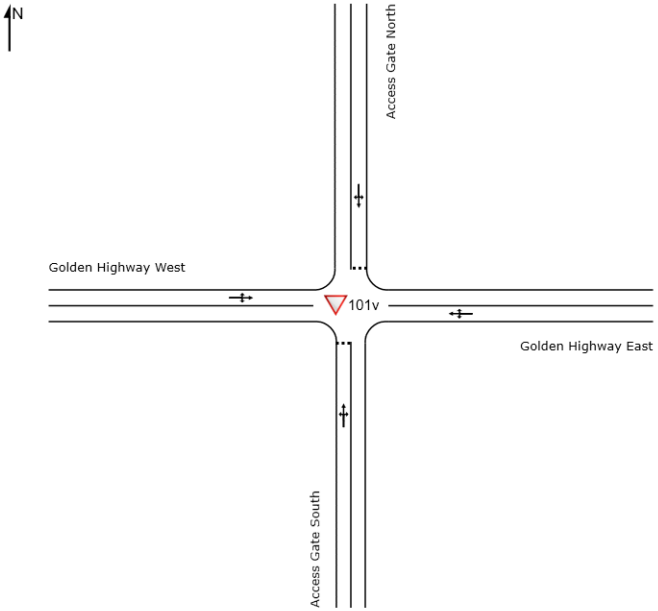
Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Golden Highway and Castlereagh Highway 	Existing Condition (current intersection configuration)	AM	South: Castlereagh Highway	LoS A	9.8	1.1	0.037
			East: Golden Highway	LoS A	9.0	0.0	0.039
			West: Golden Highway	LoS A	8.1	0.4	0.035
		PM	South: Castlereagh Highway	LoS A	9.7	1.0	0.035
			East: Golden Highway	LoS A	8.6	0.0	0.047
			West: Golden Highway	LoS A	8.8	0.6	0.031
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Castlereagh Highway	LoS B	12.4	2.0	0.061
			East: Golden Highway	LoS A	9.8	0.0	0.102
			West: Golden Highway	LoS B	10.8	2.2	0.053
		PM	South: Castlereagh Highway	LoS B	14.3	5.5	0.132
			East: Golden Highway	LoS A	8.7	0.0	0.056
			West: Golden Highway	LoS A	8.3	0.6	0.094
	Cumulative Case	AM	South: Castlereagh Highway	LoS B	13.1	2.5	0.076
			East: Golden Highway	LoS A	8.6	0.0	0.067
			West: Golden Highway	LoS B	11.8	2.5	0.062
		PM	South: Castlereagh Highway	LoS B	12.7	8.7	0.228
			East: Golden Highway	LoS A	8.6	0.0	0.024
			West: Golden Highway	LoS A	8.4	0.6	0.021

Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Golden Highway and Blue Springs Road (North) 	Existing Condition (current intersection configuration)	AM	South: Blue Springs Road	LoS A	5.8	0.0	0.002
			East: Golden Highway	LoS A	5.5	0.0	0.036
			West: Golden Highway	LoS A	5.6	0.1	0.023
		PM	South: Blue Springs Road	LoS A	5.7	0.0	0.002
			East: Golden Highway	LoS A	5.5	0.0	0.026
			West: Golden Highway	LoS A	5.6	0.1	0.028
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Blue Springs Road	LoS A	6.5	0.0	0.002
			East: Golden Highway	LoS A	6.7	0.0	0.115
			West: Golden Highway	LoS A	8.2	3.8	0.075
		PM	South: Blue Springs Road	LoS A	8.6	3.0	0.062
			East: Golden Highway	LoS A	5.5	0.0	0.033
			West: Golden Highway	LoS A	5.6	0.1	0.092
	Cumulative Case	AM	South: Blue Springs Road	LoS A	7.4	0.1	0.002
			East: Golden Highway	LoS A	6.7	0.0	0.211
			West: Golden Highway	LoS B	10.4	0.36	0.092
		PM	South: Blue Springs Road	LoS A	11.3	3.8	0.084
			East: Golden Highway	LoS A	5.6	0.0	0.048
			West: Golden Highway	LoS A	5.8	0.1	0.180

Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Whistons Lane and Castlereagh Highway 	Existing Condition (current intersection configuration)	AM	South: Castlereagh Highway	LoS A	5.6	0.0	0.026
			East: Whistons Lane	LoS A	5.7	0.2	0.008
			North: Castlereagh Highway	LoS A	5.5	0.0	0.018
		PM	South: Castlereagh Highway	LoS A	7.0	0.5	0.030
			East: Whistons Lane	LoS A	5.8	0.0	0.002
			North: Castlereagh Highway	LoS A	6.7	0.0	0.026
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Castlereagh Highway	LoS A	8.1	0.6	0.031
			East: Whistons Lane	LoS A	6.2	0.2	0.010
			North: Castlereagh Highway	LoS A	6.7	0.0	0.111
		PM	South: Castlereagh Highway	LoS A	6.8	0.6	0.072
			East: Whistons Lane	LoS A	8.2	3.3	0.075
			North: Castlereagh Highway	LoS A	6.5	0.0	0.032
	Cumulative Case	AM	South: Castlereagh Highway	LoS A	8.6	0.7	0.033
			East: Whistons Lane	LoS A	6.4	0.2	0.009
			North: Castlereagh Highway	LoS A	6.7	0.0	0.140
		PM	South: Castlereagh Highway	LoS A	6.9	0.6	0.101
			East: Whistons Lane	LoS A	8.9	3.6	0.081
			North: Castlereagh Highway	LoS A	6.5	0.0	0.034

Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Tucklan Road and Castlereagh Highway 	Existing Condition (current intersection configuration)	AM	Northeast: Castlereagh Highway	LoS A	5.5	0.2	0.027
			Northwest: Tucklan Road	LoS A	5.7	0.2	0.007
			Southwest: Castlereagh Highway	LoS A	5.5	0.0	0.019
		PM	Northeast: Castlereagh Highway	LoS A	5.6	0.2	0.024
			Northwest: Tucklan Road	LoS A	5.7	0.1	0.003
			Southwest: Castlereagh Highway	LoS A	5.5	0.0	0.026
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Northeast: Castlereagh Highway	LoS A	6.9	5.0	0.118
			Northwest: Tucklan Road	LoS A	6.3	0.2	0.009
			Southwest: Castlereagh Highway	LoS A	6.2	0.0	0.030
		PM	Northeast: Castlereagh Highway	LoS A	5.8	0.3	0.033
			Northwest: Tucklan Road	LoS A	7.4	3.1	0.063
			Southwest: Castlereagh Highway	LoS A	5.6	0.0	0.066
	Cumulative Case	AM	Northeast: Castlereagh Highway	LoS A	7.0	5.1	0.151
			Northwest: Tucklan Road	LoS A	6.5	0.2	0.008
			Southwest: Castlereagh Highway	LoS A	6.2	0.0	0.033
		PM	Northeast: Castlereagh Highway	LoS A	6.0	0.3	0.035
			Northwest: Tucklan Road	LoS A	8.0	3.2	0.066
			Southwest: Castlereagh Highway	LoS A	5.6	0.0	0.095

Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Puggoon Road and Castlereagh Highway 	Existing Condition (current intersection configuration)	AM	Southeast: Castlereagh Highway	LoS A	5.6	0.0	0.019
			Northeast: Puggoon Road	LoS A	5.7	0.0	0.002
			Northwest: Castlereagh Highway	LoS A	5.5	0.0	0.030
		PM	Southeast: Castlereagh Highway	LoS A	5.6	0.0	0.030
			Northeast: Puggoon Road	LoS A	5.8	0.0	0.002
			Northwest: Castlereagh Highway	LoS A	5.5	0.0	0.031
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	Southeast: Castlereagh Highway	LoS A	5.9	0.1	0.021
			Northeast: Puggoon Road	LoS A	5.9	0.1	0.003
			Northwest: Castlereagh Highway	LoS A	6.7	0.0	0.081
		PM	Southeast: Castlereagh Highway	LoS A	5.6	0.1	0.033
			Northeast: Puggoon Road	LoS A	7.7	3.1	0.073
			Northwest: Castlereagh Highway	LoS A	5.5	0.0	0.033
	Cumulative Case	AM	Southeast: Castlereagh Highway	LoS A	6.0	0.1	0.023
			Northeast: Puggoon Road	LoS A	7.8	0.3	0.010
			Northwest: Castlereagh Highway	LoS A	6.7	0.0	0.104
		PM	Southeast: Castlereagh Highway	LoS A	5.7	0.1	0.061
			Northeast: Puggoon Road	LoS A	8.3	3.0	0.071
			Northwest: Castlereagh Highway	LoS A	5.5	0.0	0.037

Intersection name and layout	Scenario	Peak period	Intersection approach: Road name	Level of Service	Average delay (seconds per vehicle)	Back of queue (metres)	Degree of saturation
Typical access gates on the most potentially impacted section of State Roads (Golden Highway east of Merotherie Road)  	Existing Condition (current intersection configuration)	AM	South: Access Gate	LoS A	5.9	0.1	0.003
			East: Golden Highway	LoS A	5.6	0.1	0.036
			North: Access Gate	LoS A	4.59	0.1	0.003
			West: Golden Highway	LoS A	5.6	0.1	0.024
		PM	South: Access Gate	LoS A	5.9	0.1	0.003
			East: Golden Highway	LoS A	5.6	0.1	0.026
			North: Access Gate	LoS A	5.9	0.1	0.003
			West: Golden Highway	LoS A	5.6	0.1	0.029
	Project Case (with background traffic growth and construction traffic applied on current intersection configuration)	AM	South: Access Gate	LoS A	6.8	0.1	0.003
			East: Golden Highway	LoS A	7.3	1.7	0.121
			North: Access Gate	LoS A	6.9	0.1	0.003
			West: Golden Highway	LoS A	8.2	3.4	0.079
		PM	South: Access Gate	LoS B	9.8	2.2	0.046
			East: Golden Highway	LoS A	5.9	0.1	0.033
			North: Access Gate	LoS B	9.8	2.3	0.049
			West: Golden Highway	LoS A	5.6	0.1	0.092
	Cumulative Case	AM	South: Access Gate	LoS A	8.2	0.1	0.004
			East: Golden Highway	LoS A	7.2	1.7	0.212
			North: Access Gate	LoS A	8.3	0.1	0.004
			West: Golden Highway	LoS B	9.0	4.6	0.103
		PM	South: Access Gate	LoS B	13.7	2.6	0.057
			East: Golden Highway	LoS A	6.6	0.1	0.049
			North: Access Gate	LoS B	13.7	3.1	0.067
			West: Golden Highway	LoS A	5.8	0.1	0.180