Central-West Orana Renewable Energy Zone Transmission Project

Technical Paper 3: Landscape Character and Visual Impact

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Technical Paper 3: Landscape Character and Visual Impact

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Glossary and abbreviations

Term/abbreviation	Definition
Access roads	Permanent access roads to switching stations and energy hubs.
Access tracks	Temporary and permanent access tracks to transmission lines.
Amenity	'The pleasantness of a place as conveyed by desirable attributes including visual, noise, odour etc' (Australian Institute of Landscape Architects QLD 2018)
Central-West Orana REZ (CWO REZ)	A geographic area of approximately 20,000 square kilometres centred on the regional towns of Dubbo and Dunedoo and extending west to Narromine and east beyond Mudgee and to Wellington in the south and Gilgandra in the north, that will combine renewable energy generation, storage and transmission infrastructure to deliver energy to electricity consumers.
Construction area	The area that would be directly impacted by construction of the project including (but not limited to) transmission towers and lines, brake and winch sites, access roads to switching stations and energy hubs, access tracks, energy hubs, switching stations, communications infrastructure, workforce accommodation camps, construction compounds and laydown and staging areas.
Construction compound	An area used as the base for construction activities, usually for the storage of plant, equipment and materials, and/or construction site offices and worker facilities. It can also comprise concrete batching plant, crushing, grinding and screening plant, testing laboratory and wastewater treatment plant.
construction routes	Roads used by construction vehicles (light and heavy).
Cultural Landscape	A cultural landscape is a physical area with natural features modified by human activity resulting in patterns of evidence layered in the landscape. These layers give a place its distinctive spatial, historical, aesthetic, symbolic and memorable character. Within cultural landscapes there are areas where human impact is more obvious.
cumulative impact	The combined impacts of the project on a matter with other relevant future projects
DMP	Destination Management Plan
Enabling works	Activities that would be carried out before the start of substantial construction in order to make ready the key construction sites (including workforce accommodation camps and compounds), facilitate the commencement of substantial construction, manage specific features or issues and collect additional information required to finalise the final design and construction methodology.
EnergyCo	The Energy Corporation of New South Wales constituted by section 7 of the *Energy and Utilities Administration Act 1987* as the NSW Government statutory authority responsible for the delivery of NSW's REZs.
Energy hub/s	An energy hub is a substation where energy exported from renewable energy generators or storage is aggregated, transformed to 500 kV (where required) and exported to the transmission network. For the project, this includes Merotherie Energy Hub and Elong Elong Energy Hub.
EIS	Environmental Impact Statement
Glare	'Condition of vision in which there is discomfort or a reduction in ability to see, or both, caused by an unsuitable distribution or range of luminance, or to extreme contrasts in the field of vision.' (AS4282:2019)
Landowner(s)	People who own properties/land.

Term/abbreviation	Definition
Landscape	'All aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities and infrastructure.' (TfNSW 2023)
Landscape and visual study area	Refers to the landscape surrounding the project that may be impacted by the proposed Central-West Orana Renewable Energy Zone Transmission project design. This includes a four kilometre wide corridor centred on the project, referred to as the 'landscape and visual study area' or 'study area'. This distance is based on the scale and visual characteristics of the project and includes areas where there is the potential for landscape character and visual impacts.
Landscape character	The … 'combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place'. (TfNSW 2023)
Landscape character type	Landscape character types are defined primarily by geology, topography, vegetation, watercourses, built form patterns and land use. Landscape character types are a way of grouping landscape character zones.
Landscape character zone	'An area of landscape with similar properties or strongly defined spatial qualities, distinct from areas immediately nearby.' (TfNSW 2023)
LEP	Local Environmental Plan
LGA	Local Government Area
LiDAR	Light Detection and Ranging
LSPS	Local Strategic Planning Statement
mAHD	metres above Australian Height Datum
Magnitude	Magnitude is the … 'measurement of the scale, form and character of a development project when compared to the existing condition. In the case of visual assessment this also relates to how far the project is from the viewer.' (TfNSW 2023)
NEM	National Electricity Market
NSW Transmission System	The transmission network operated by Transgrid in NSW
Operation area	The area that would be occupied by permanent components of the project and/or maintained, including transmission line easements, transmission lines and towers, energy hubs, switching stations, communications infrastructure, access roads to the switching stations and energy hubs, maintenance facilities and permanent access tracks to the easements.
(the) project	The Central-West Orana REZ as described in Chapter 3 of the Environmental Impact Statement.
Renewable Energy Zone (REZ)	A geographic area identified and declared by the NSW Government as a REZ.
Sense of place	The intangible qualities and character of a place, interpreted and valued by people.
Sensitivity	'Susceptibility of a landscape or receptor to accommodate change without losing valued attributes.' (Australian Institute of Landscape Architects QLD 2018) 'The sensitivity of a landscape character zone or view and its capacity to absorb change of the nature of the proposal. In the case of visual impact this also relates to the type of viewer and number of viewers.' (TfNSW 2023)

Term/abbreviation	Definition
Sky glow	'The brightening of the night sky that results from radiation (visible and non-visible), scattered from the constituents of the atmosphere (gaseous, molecules, aerosols and particulate matter), in the direction of observation.' It comprises natural sky glow and artificial sky glow. (AS4282:2019)
Spill light	'Light emitted by a lighting installation that falls outside of the design area. Spill light may or may not be obtrusive depending on what it affects' (AS4282:2019)
Transmission line easement	An area surrounding and including the transmission lines which is a legal 'right of way' and allows for ongoing access and maintenance of the transmission lines. Landowners can typically continue to use most of the land within transmission line easements, subject to some restrictions for safety and operational reasons.
Twin transmission line	A pair of single or double circuit transmission lines running parallel.
Values	'Any aspect of landscape or views people consider to be important. Landscape and visual values may be reflected in local, state or federal planning regulations, other published documents or be established through community consultation and engagement, or as professionally assessed.' (Australian Institute of Landscape Architects QLD 2018)
View	'Any sight, prospect or field of vision as seen from a place, and may be wide or narrow, partial or full, pleasant or unattractive, distinctive or nondescript, and may include background, mid ground and/or foreground elements or features.' (Australian Institute of Landscape Architects QLD 2018)
Viewpoint	'The specific location of a view, typically used for assessment purposes.' (Australian Institute of Landscape Architects QLD 2018)
Visual absorption capacity	'The potential for a landscape or scene to absorb a particular change without a noticeable loss of valued attributes.' (Australian Institute of Landscape Architects QLD 2018)
Workforce accommodation camps	Areas that would be constructed and operated during construction to house the construction workforce.

Summary

This technical paper assesses the potential impacts landscape character and visual impact of the construction and operation of the Central-West Orana Renewable Energy Zone Transmission project (the project) and has been prepared to support and inform the Environmental Impact Statement (EIS) for the project.

The impacts have been assessed in accordance with the Secretary's Environmental Assessment Requirements (SEARs) issued by the NSW Department of Planning and Environment (DPE) and against the relevant legislation and guidelines as they apply to landscape character and visual amenity.

Project overview

The NSW Government is leading the development of Renewable Energy Zones (REZ) across NSW to deliver renewable energy generation and storage, supported by transmission infrastructure. Energy Corporation of NSW (EnergyCo) is proposing the construction and operation of new electricity transmission infrastructure including new lines, new energy hubs and switching stations required to connect new renewable energy generation and storage projects within the Central-West Orana REZ to the NSW Transmission System (the project). The project is located within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter local government areas (LGAs) and extends generally north to south from Cassilis to Wollar and east to west from Cassilis to Goolma.

The project would enable 4.5 gigawatts of new network capacity to be unlocked by the mid-2020s (noting the NSW Government's proposal to amend the Central-West Orana REZ declaration to allow for a transfer capacity of six gigawatts) and enable renewable energy generators within the Central-West Orana REZ who are successful in their bids to access the new transmission infrastructure to export electricity to the NEM. Importantly, the development of renewable energy generation projects in the Central-West Orana REZ is the sole responsibility of private generators and subject to separate planning and environmental approvals.

Legislative and policy context

Impacts to landscape character and visual amenity from construction and operation of the project have been assessed in accordance with the relevant legislation and guidelines as they apply. Key guidelines considered as part of this assessment includes:

- Guideline for Landscape Character and Visual Impact Assessment EIA-N04, Transport for NSW, 2020
- Guidance Note for Landscape and Visual Assessment, Australian Institute of Landscape Architects Queensland, 2018
- Large-Scale Solar Energy Guideline, Technical Supplement Landscape Character and Visual Impact, Department of Planning and Environment 2022
- Guidelines for Landscape and Visual Impact Assessment, Third Edition, Landscape Institute and Institute of Environmental Management & Assessment, 2013.

Methodology

The assessment of potential landscape character and visual impacts arising from the project included the following key steps:

- review of planning context relevant to the study area
- an assessment of the potential impacts to landscape character from construction and operation of the project during the day and at night
- an assessment of the potential impacts to views from construction and operation of the project from the public domain, private dwellings and from the air
- identification of potential mitigation measures to avoid, mitigate and manage any potential impacts of the project.

Existing environment

The study area includes four broad landscape character types, within which 16 locally specific landscape character zones have been identified. The landscape character zones within the landscape character types are of moderate, low and very low landscape sensitivity.

The landscape and visual study area includes landscapes of high, moderate and low visual sensitivity at night. The site is located within the area subject to the Dark Sky Planning Guidelines, which aims to protect views of the night sky.

Potential construction impacts

The following construction impacts are temporary and would occur in the short term, with construction activity likely to occur with intermittent intensity over several years.

Landscape character impact

There would be the following landscape character impacts during construction:

- a moderate impact on eight landscape character zones
- a low-moderate impact on seven landscape character zones
- a negligible impact on one landscape character zone.

During construction the moderate landscape character impacts would be within landscape character zones within the forested hills, rural valley and undulating rural hills landscape character types where the removal of vegetation and temporary construction activities would contrast with the existing landscape character of these areas.

There would be the following landscape character impacts during construction at night:

- a moderate-high impact on six landscape character zones, and
- a moderate impact on nine landscape character zones.
- The remaining impacts would be negligible.

The moderate-high night-time visual impacts would be on the forested hills, rural valley and undulating rural hills landscape character types where there is greater vegetation removal and prominence of temporary construction activities, including night lighting at the new Wollar switching station and the energy hubs at Merotherie and Elong Elong. There would be moderate night-time landscape character impacts on the rural valley and undulating rural hills landscape character types during construction, away from the energy hubs and new Wollar switching station, where the night lighting within the construction area would be less but would contrast with the predominantly dark rural character.

Visual impact from the public domain

Of the 26 representative views assessed in this technical report, during construction there would be:

- a moderate visual impact on ten representative views
- a low-moderate visual impact on eleven representative views
- a low visual impact on five representative views.

Moderate visual impacts would be experienced where there are views of the energy hubs at Merotherie and Elong Elong, and in views from the Castlereagh Highway. Views to the energy hubs would include construction over a large area and of a large scale. In views from the Castlereagh Highway, there is broad visibility across the landscape and there would be multiple lines converging and seen under construction at multiple sites on both sides of the highway and extending over a large area. There would also be a moderate impact from Ulan Road to the workforce accommodation camp at Neeleys Lane, Cassilis.

Air traffic

There are recreational flights operating from both Dubbo and Mudgee Airports, including scenic helicopter and aircraft flights, as well as adventure joy flights and hot air ballooning flights. These flights offer views over Dubbo and the surrounding rural areas, and the winery areas of Mudgee, including the Cudgegong Valley and Lake Windamere.

While the construction of the energy hubs and interlinking easements would be visible from the air, they would not be a focus or in an area that is a destination for scenic flights from Dubbo and Mudgee, resulting in low-moderate visual impacts during construction, on views from these recreational flights.

Potential operational impacts

Landscape character impact

During operation, there would continue to be:

- a moderate impact on eight landscape character zones
- a low-moderate impact on seven landscape character zones, and
- a negligible impact on one landscape character zone.

This includes moderate landscape character impacts on the forested hills, rural valley and undulating rural hills landscape character types. This is where there would continue to be less vegetation in the predominantly vegetated forested hills landscapes, and the introduction of large transmission line towers, switching stations and energy hubs would contrast with the character of the rural valley and undulating rural hills landscape character zones.

The low-moderate impacts to landscape character zones during operation of the project would be within the rural valley and undulating rural hills landscape character types in areas away from the proposed new energy hubs at Merotherie and Elong Elong, and where existing large-scale electricity infrastructure influences the landscape character.

The landscape and visual study area includes landscapes of high, moderate and low visual sensitivity at night. During operation there would be:

- a moderate night-time visual impact on four landscape character zones
- a low-moderate night-time visual impact on five landscape character zones, and
- negligible visual impact on the remaining landscape character zones.

During operation, there would be a moderate night-time landscape character impacts on the forested hills and undulating rural hills landscape character areas, due to the operation of the proposed new energy hubs at Merotherie and Elong Elong. There would be low-moderate visual impact on landscape character zones where there would be switching stations with permanent lighting.

Visual impact from the public domain

The landscape and visual study area includes views of low and very low visual sensitivity. Of the 26 representative views assessed in this technical report, during operation there would be:

- a moderate visual impact on nine representative views
- a low-moderate visual impact on eleven representative views
- a low visual impact on five representative views
- negligible visual impact on remaining views.

The moderate impacts would be in locations close to the project area, where there are clear views towards the project, often with little intervening vegetation and where the project would introduce a new and much larger scale of development and substantially changing the character of the view. These views are mainly in the vicinity of the Merotherie and Elong Elong energy hubs, and in views from the Castlereagh Highway where there would be broad visibility across the landscape to converging transmission lines and where the project extends over a large area. The low-moderate visual impacts during operation, generally in locations away from the energy hubs and/or where the view contains existing large-scale electricity infrastructure.

Air traffic

During operation there would continue to be low-moderate visual impacts on views from these recreational flights. The energy hubs at Merotherie and Elong Elong, as well as several new switching stations and transmission line easements throughout the project, would introduce new large-scale electricity infrastructure in the rural landscape, contrasting with the character of the rural valley and undulating rural hill landscapes, which contain few large-scale built features.

Views from surrounding residences

A preliminary assessment reviewed all dwellings within two kilometres of the project footprint, a total of 128 dwellings. This desktop assessment considered screening criteria, private dwellings were eliminated from requiring further detailed view assessment if one or a number of the criteria were identified as being of a very low level of concern and / or effect.

Of the reviewed dwellings, 91 were identified as having the potential for a visual impact and requiring further detailed visual assessment. This desktop assessment is contained in Appendix I.

In summary, the detailed assessment of visual impact identified the following pre mitigation visual impacts from private dwellings:

- 13 dwellings would have a high visual impact.
- 20 dwellings would have a moderate visual impact.
- All remaining dwellings would have a low or negligible visual impact.

These visual impact levels have the potential to be further reduced by mitigation measures.

Of the 91 dwellings that were assessed in detail 52 would not host the infrastructure. Of these non-host dwellings:

- 3 dwellings would have a high visual impact, and
- 13 dwellings would have a moderate visual impact.
- All remaining dwellings would have a low or negligible visual impact.

The visual impact level of those non-host dwellings has been highlighted in blue, and highlighted with a black outline where the impact is moderate or high, and mitigation would be necessary.

Management measures

The project is anticipated to have some high and moderate landscape character and visual impacts during construction, which would be reduced through the implementation of mitigation measures outlined within the CEMP and the landscape and visual management sub-plan.

Typical provisions within the CEMP for the management of potential impacts to visual impact during construction of the project would include:

- Minimising vegetation clearance for construction and operation. Areas of vegetation to be retained will be identified during detailed construction planning to maximise existing visual screening and retention of the existing landscape character. Retained vegetation will be clearly demarcated on site as 'no-go zones' prior to the commencement of construction. Construction personnel will be made aware of no-go zones as part of environmental site induction(s)
- Minimising and managing changes to landform, ensuring the final levels and treatments are consistent with the character of the natural landform as far as practicable.
- For non-host private dwellings where the project is predicted to have a moderate-high or high visual impact, opportunities for the provision of screening vegetation will be investigated. Appropriate visual screening or other options will be confirmed in consultation with the affected landowner and implemented either before or during construction. Maintenance of vegetative screening provided on privately owned land outside of the operation area will be the responsibility of the landowner.
- The Tree Protection Zone of retained trees within or immediately adjacent to the construction area will be managed in accordance with AS4970-2009 Protection of Trees on Development Sites where practicable to minimise the impact of the works on the long-term health of these trees.
- During detailed design, a review of the lighting design for the project, including for the Merotherie Energy Hub (including the maintenance facility) and Elong Elong Energy Hub, and all switching stations would be undertaken to ensure it addresses the design guidelines contained in the Siding Springs Dark Sky Planning Guideline (DPE 2016).

Landscape and visual amenity management plan would also be prepared for the project and contain appropriate mitigation measures to be prior to and during construction. The sub-plan would include but is not limited to:

- procedures for managing the implementation of management measures related to landscape character and visual impact.

Chapter 1: Introduction

1.1 Background

New South Wales (NSW) is currently undergoing an energy sector transformation that will change how we generate and use energy. The NSW Government is leading the development of Renewable Energy Zones (REZs) across NSW to deliver renewable energy generation and storage projects, supported by transmission infrastructure. A REZ connects renewable energy generation and energy storage systems to transmission infrastructure via energy hubs, requiring the coordination of power generation, power storage and transmission infrastructure. By doing so, REZs capitalise on economies of scale to deliver clean, affordable and reliable electricity for homes, businesses and industry in NSW.

The Central-West Orana REZ was formally declared on 5 November 2021 under the Electricity Infrastructure Investment Act 2020. As NSW's first REZ, the Central-West Orana REZ will play a pivotal role in underpinning NSW's transition to a clean, affordable and reliable energy sector. The Central-West Orana REZ declaration (November 2021) provides for an initial intended network capacity of three gigawatts. The NSW Government is proposing to amend the declaration to increase the intended network capacity to six gigawatts, which would allow for more renewable energy from solar, wind and storage projects to be distributed through the NSW transmission network.

The proposed amendment is consistent with the NSW Network Infrastructure Strategy (EnergyCo, 2023) which identifies options to increase network capacity to 4.5 gigawatts initially under Stage 1 (which would be based on the infrastructure proposed in this assessment) and up to six gigawatts by 2038 under Stage 2 (which would require additional infrastructure beyond the scope of this assessment, and subject to separate approval). The proposed amendment also supports recent modelling by the Consumer Trustee in the draft 2023 Infrastructure Investment Objectives Report (AEMO, 2023) showing more network capacity will be needed to meet NSW's future energy needs as coal-fired power stations progressively retire.

Energy Corporation of NSW (EnergyCo), a NSW Government statutory authority, has been appointed as the Infrastructure Planner under the Electricity Infrastructure Investment Act 2020, and is responsible for the development and delivery of the Central-West Orana REZ. EnergyCo is responsible for coordinating REZ transmission, generation, firming and storage projects to deliver efficient, timely and coordinated investment.

EnergyCo is seeking approval for the construction and operation of new electricity transmission infrastructure and new energy hubs and switching stations that are required to connect energy generation and storage projects within the Central-West Orana REZ to the existing electricity network (the project).

1.2 Purpose of this paper

This technical paper assesses the potential impacts to landscape character and visual amenity from the construction and operation of the project and has been prepared to support and inform the Environmental Impact Statement (EIS).

This technical paper has been prepared to address the relevant Secretary's environmental assessment requirements (SEARs) for the project issued by the Secretary of the NSW Department of Planning and Environment (DPE) for the project on 7 October 2022. The SEARs relevant to the assessment of landscape character and visual amenity are presented in **Table 1-1**.

Table 1-1 SEARs relevant to this paper

Reference	Assessment requirement	Location where it is addressed
Amenity	• an assessment of the likely visual impacts of the project on:	
	– surrounding residences	Section 6.3
	– scenic or significant vistas	Section 6.2
	– night lighting	Section 5.3
	– air traffic	Section 6.2.4
	– road corridors in the public domain, and	Section 6.2
	– the Siding Spring Observatory in accordance with the Dark Sky Planning Guideline (2016).	Section 5.3

1.3 Project overview

The project comprises the construction and operation of new electricity transmission infrastructure including new lines, energy hubs and switching stations within the Central-West Orana REZ. The project would enable 4.5 gigawatts of new network capacity to be enabled by the mid-2020s (noting the NSW Government's proposal to amend the Central-West Orana REZ declaration to allow for a transfer capacity of six gigawatts) and enable renewable energy generators within the Central-West Orana REZ who are successful in their bids to access the new transmission infrastructure to export electricity onto the National Electricity Market (NEM). The detailed project description is provided in Chapter 3 of the EIS.

1.3.1 Features

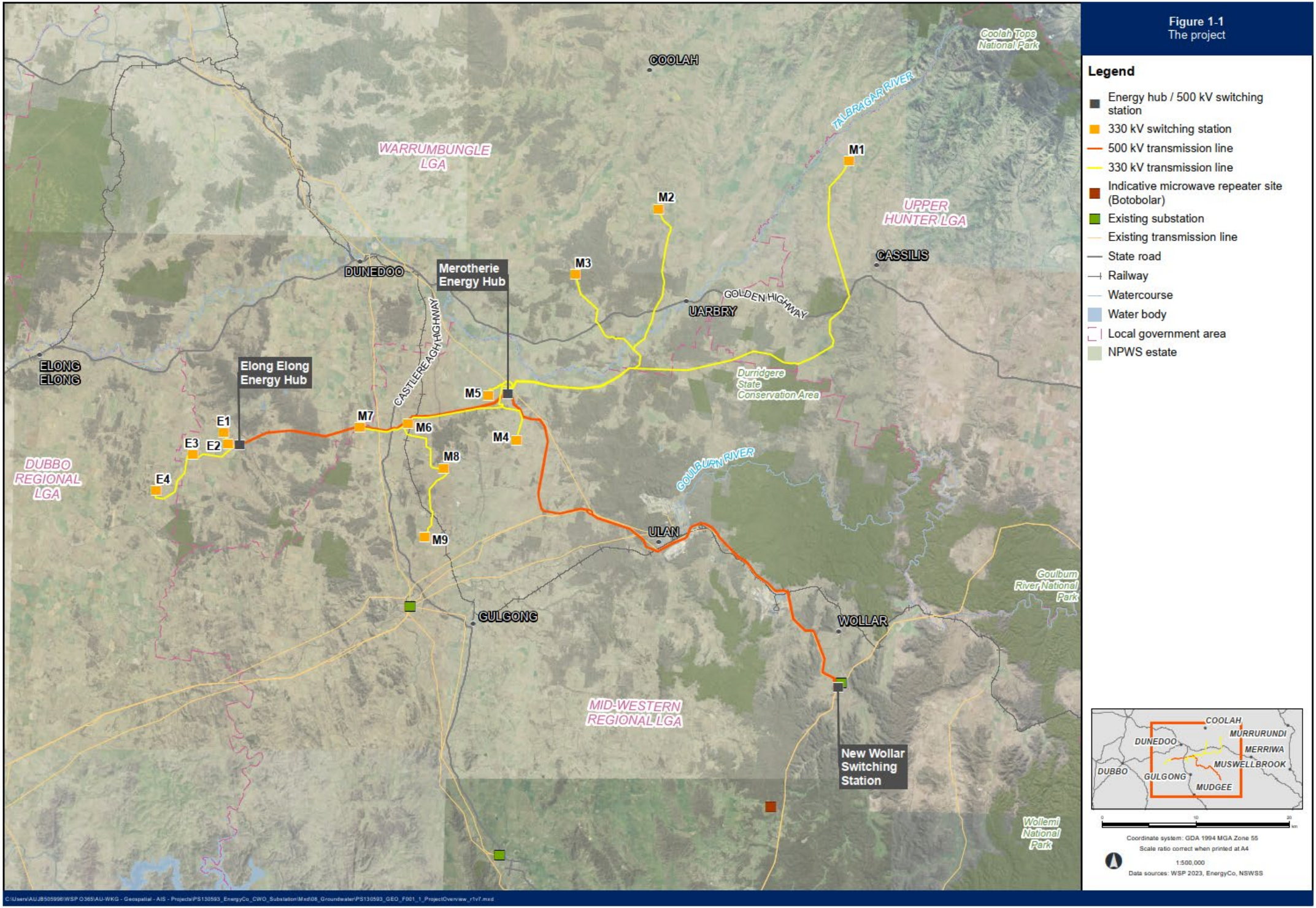
The project would comprise the following key features:

- a new switching station (the New Wollar Switching Station), located at Wollar to connect the project to the existing 500 kV lines of the NSW transmission system
- around 90 kilometres of twin double circuit 500 kV transmission lines and associated infrastructure to connect two energy hubs to the existing NSW transmission network via the New Wollar Switching Station
- energy hubs at Merotherie and Elong Elong (including potential battery storage at the Merotherie Energy Hub) to connect renewable energy generation projects within the Central-West Orana REZ to the 500 kV network infrastructure
- around 150 kilometres of single circuit, double circuit and twin double circuit 330 kV transmission lines, to connect renewable energy generation projects within the Central-West Orana REZ to the two energy hubs
- thirteen switching stations along the 330 kV network infrastructure at Cassilis, Coolah, Leadville, Merotherie, Tallawang, Dunedoo, Cobbora and Goolma, to transfer the energy generated from the renewable energy generation projects within the Central-West Orana REZ onto the project's 330 kV network infrastructure.
- underground fibre optic communication cables along the 330 kV and 500kV transmission lines between the energy hubs and switching stations
- a maintenance facility within the Merotherie Energy Hub to support the operational requirements of the project
- microwave repeater sites at locations along the alignment, as well as outside of the alignment at Botobolar, to provide a communications link between the project and the existing electricity transmission and distribution network. The Botobolar site would be subject to assessment at the submissions report stage.

- establishment of new, and upgrade of existing access tracks for transmission lines, energy hubs, switching stations and other ancillary works areas within the construction area (such as temporary waterway crossings, laydown and staging areas, earthwork material sites with crushing, grinding and screening plants, concrete batching plants, brake/winch sites, site offices and workforce accommodation camps)
- property adjustment works to facilitate access to the transmission lines and switching stations. These works include the relocation of existing infrastructure on properties that are impacted by the project
- utility adjustments required for the construction of the transmission network infrastructure, including adjustments to existing communications, water and wastewater utilities. This includes adjustments to Transgrid's 500kV transmission lines 5A3 (Bayswater to Mount Piper) and 5A5 (Wollar to Mount Piper) to provide a connection to the existing NSW transmission network, including new Transgrid transmission line towers to cut in the New Wollar Switching Station, and other locations where there is an interface with Transgrid's network.

1.3.2 Location

The project is located in central-west NSW within the Warrumbungle, Mid-Western Regional, Dubbo Regional and Upper Hunter local government areas (LGAs). It extends north to south from Cassilis to Wollar and east to west from Cassilis to Goolma. The location of the project is shown in Figure 1-1.


COOLAH
Coolah Tops National Park
TALBRAGAR RIVER
WARRUMBUNGLE LGA
M1
M2
UPPER HUNTER LGA
CASSILIS
DUNEDOO
Merotherie Energy Hub
M3
GOLDEN HIGHWAY
UARBRY
CASTLEREAGH HIGHWAY
ELONG ELONG
Elong Elong Energy Hub
Durridgere State Conservation Area
M5
M7
M6
M4
E1
E3
E2
M8
E4
DUBBO REGIONAL LGA
GOULBURN RIVER
ULAN
M9
Goulburn River National Park
GULGONG
WOLLAR
MID-WESTERN REGIONAL LGA
New Wollar Switching Station
Wollemi National Park
Figure 1-1
The project
Legend
Energy hub / 500 kV switching station
330 kV switching station
500 kV transmission line
330 kV transmission line
Indicative microwave repeater site (Botobolar)
Existing substation
Existing transmission line
State road
Railway
Watercourse
Water body
Local government area
NPWS estate
COOLAH
MURRURUNDI
DUNEDOO
MERRIWA
MUSWELLBROOK
DUBBO
GULGONG
MUDGEE
0
10
20
km
Coordinate system: GDA 1994 MGA Zone 55
Scale ratio correct when printed at A4
1:500,000
Data sources: WSP 2023, EnergyCo, NSWSS

1.3.3 Timing

Construction of the project would commence in the second half of 2024, subject to NSW Government and Commonwealth planning approvals, and is estimated to take about four years. The project is expected to be commissioned/energised (i.e. become operational) in late 2027.

1.3.4 Construction

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

- enabling works
- construction works associated with the transmission lines
- construction works associated with energy hubs and switching stations
- pre-commissioning and commissioning of the project
- demobilisation and rehabilitation of areas disturbed by construction activities.

Excavation and land forming works within the construction area would be required for transmission line tower construction, site preparation works at the energy hubs and switching station sites to provide level surfaces, to create trenches for drainage, earthing, communications infrastructure and electrical conduits, and to construct and upgrade access tracks.

Construction vehicle movements would comprise heavy and light vehicles transporting equipment and plant, construction materials, spoil and waste from construction facilities and workforce accommodation camp sites. There would also be additional vehicle movements associated with construction workers travelling to and from construction areas and accommodation camp sites. These movements would occur daily for the duration of construction.

To support the construction of the project a number of construction compounds would be required including staging and laydown facilities, concrete batching plants, workforce accommodation camps and construction support facilities. The main construction compounds would be established as enabling works and demobilised at the completion of construction. The size of the construction workforce would vary depending on the stage of construction and associated activities. During the peak construction period, an estimated workforce of up to around 1,900 people would be required.

1.3.5 Construction Hours

The workforce accommodation camps would be operational 24 hours a day, seven days a week. In addition, some out of hours work would be required at certain locations within the construction area to satisfy third party or safety requirements or to accommodate specific long lead items. This may include works such as: stringing of transmission lines across a main road or railway; transmission line construction, transmission line cutover or commissioning, the delivery of equipment or materials as requested by police or other authorities for safety reasons (such as the delivery of over dimension or over mass transformer or synchronous condenser units), oil filling of the transformers at energy hubs, emergency work to avoid the loss of lives and/or property and/or to prevent environmental harm, work timed to correlate with system planning outages (likely 24-hour operations when required to minimise impact to electrical supply services), potential utilities adjustment works (in consultation with the requirements of asset operators), large concrete pours (including concrete batching plant operation), and any works that do not exceed the applicable noise management levels in accordance with the ICNG. Operation

1.3.7 Operation

During operation, the project would transfer high voltage electricity from the Central West-Orana REZ to the NEM. 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
- stormwater maintenance
- remote asset condition monitoring
- network infrastructure performance monitoring.

Operation of the project would require the establishment of transmission line easements. These easements would be around 60 metres for each 330kV transmission line and 70 metres for each 500kV transmission line. Where network infrastructure is collocated, easement widths would increase accordingly (for example, a twin double circuit 500kV transmission line would have an easement about 140 metres wide). Vegetation clearing would be required to some extent for the full width of the transmission line easement, depending on the vegetation types present.

1.4 Structure of this technical paper

The structure and content of this report is as follows:

- Chapter 1 – introduces this technical paper (this chapter).
- Chapter 2 – provides an overview of the regulatory context for the assessment of impact on landscape character and visual amenity, including an overview of the relevant legislation, policy and guidelines that apply to the project.
- Chapter 3 – outlines the methodology adopted for this landscape character and visual impact assessment.
- Chapter 4 – describes the existing conditions of the project location and surrounds, including the topography, landscape features, sensitivities, and a general description of the visibility of the project.
- Chapter 5 – Landscape character impact assessment: Describes the potential impacts on landscape character associated with the project.
- Chapter 6 – Visual impact assessment: Describes the potential visual impacts associated with the project.
- Chapter 7 – Recommended management and mitigation measures: provides recommended mitigation and management measures to avoid, minimise and manage any potential impacts to landscape character and visual amenity from construction and/or operation of the project.
- Chapter 8 – identifies the key reports and documents used to generate this paper.

The appendices to this paper are:

- Appendix A: Site location plan
- Appendix B: Topography plans
- Appendix C: Landscape character plans
- Appendix D: Visibility plans
- Appendix E: Viewpoint location plans
- Appendix F: Viewpoint photomontages
- Appendix G: Private dwelling location plans
- Appendix H: Horizontal field of view plans
- Appendix I: Preliminary private dwelling assessment tables
- Appendix J: Private dwelling detailed assessment
- Appendix K: Combined detailed assessment results plans

Chapter 2: Legislative and policy context

Environmental planning approval for the project is required in accordance with the *Environmental Planning and Assessment Act 1979* (EP&A Act). The project is also a controlled action and therefore requires Commonwealth assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Sections 5.12 and 5.13 of the EP&A Act provide for the declaration of State significant infrastructure (SSI) and Critical State significant infrastructure (CSSI). On 23 November 2020, the Minister for Planning made the Environmental Planning and Assessment Amendment (Central-West Orana Renewable Energy Zone Transmission Order) 2020. The Order declares the whole Central-West Orana REZ Transmission project to be CSSI.

This section describes the State and local legislation and policies relevant to the assessment of landscape character and visual impacts.

2.1 State and regional planning framework

2.1.1 Electricity Infrastructure Investment Act 2020

The *Electricity Infrastructure Investment Act 2020* (Electricity Infrastructure Investment Act) aims, among other things, to co-ordinate investment in new generation, storage and network infrastructure in NSW. It establishes a process under which the NSW Minister for Energy can declare a geographical area of the State a REZ and specify the generation, storage or network infrastructure that will be implemented in that zone. There are currently five REZs declared in the Act, including the Central-West Orana REZ. This project forms Stage 1 of the Central-West Orana REZ network infrastructure.

2.1.2 Central West and Orana Regional Plan 2041

The western half of the project is situated on land which is classified as the Central West and Orana Region. The Central West and Orana Regional Plan 2041 (DPE, 2022b) identifies the CWO REZ as a key project in the region's vision to become a 'renewable energy leader'. Although Objective 2 promotes the development of solar and wind energy projects, which generally includes transmission infrastructure, it also recognises… 'There are also concerns about projects impacting on the rural landscape and visual catchment values of the regional cities in particular.' (DPE, 2022b)

2.1.3 Hunter Regional Plan 2041

The eastern half of the of the project is located in the rural western portion of the Hunter Region, to which the Hunter Regional Plan 2041 applies. This includes the Upper Hunter district, west of the Liverpool Range and Cassilis. The project is not located near the strategic centres and growth areas of the Hunter region and is also located outside of the Viticulture Growth Area and Equine Growth Areas where the scenic amenity of the landscape is particularly valued in this plan.

The rural and natural landscapes in the Upper Hunter district are identified as important assets and a drawcard for visitors and residents. This plan states that: 'There is a need to retain rural landscape character of the district. New development proposals for large tourism, industry and residential uses in rural lands should include a character impact assessment.' (DPE, 2022c)

Objective 1 of this plan is to… 'Diversify the Hunter's mining, energy and industrial capacity', including the development of… 'renewable energy generation' as well as 'transmission infrastructure' (DPIE, 2022c).

2.1.4 Dark Sky Planning Guideline, 2016

Australia's most important visible-light observatory at Siding Spring is located on the edge of the Warrumbungle National Park, and to the north of the project. The observatory contains over 20 telescopes and is one of few in the world that can observe the whole southern-hemisphere sky. A Dark Sky Region extends across all land within a 200-kilometre radius of Siding Spring Observatory to ensure the effective operation of the observatory. The Dark Sky Planning Guideline (NSW DPE, 2016) informs the management of light within the Dark Sky Region and explains how light from development can be managed to reduce impacts on the operation of the observatory. The project is located around 100 kilometres to the south of the Siding Springs Observatory at its closest point and is within the Dark Sky Region.

This Dark Sky Planning Guideline includes planning controls for development surrounding Siding Spring Observatory as well as other guidance for good lighting design. This Guideline …'is a matter for consideration for all development under the Environmental Planning & Assessment Act 1979 (the Act) before development consent is granted within the local government areas of Coonamble, Dubbo, Gilgandra and Warrumbungle'. (NSW DPE, 2016 p.5) The guideline also states that … 'A consent authority must also consider this guideline under clause 92 of the Environmental Planning & Assessment Regulation 2000 (the Regulation) for development described in Schedule 4A to the Act, State significant development or designated development that is likely to impact the night sky and is within 200 kilometres of the Siding Spring Observatory. The Regulation also requires a proponent to consider this guideline when preparing an environmental impact statement for State significant infrastructure.' (NSW DPE, 2016 p.5) This guideline has increased requirements for areas within 12 kilometres, and between 12 and 18 kilometres of the Observatory. The project is not within 18 kilometres of the observatory, and as such the increased requirements do not apply to the project.

An update of the Dark Sky Planning Guideline and related planning controls has been prepared by the Department of Planning and Environment and released in September 2022. The proposed changes are outlined in the Update of the Dark Sky Planning Guideline and related planning controls Explanation of Intended Effect (DPE, September 2022), and mainly relates to illuminated signage and skylights, including additional provisions for lighting in buildings within 18 kilometres of the observatory. This project is outside this area.

Consideration of the good lighting design principles contained in Part 4 of the Dark Sky Planning Guideline (NSW DPE, 2016) will be applied throughout the detailed design and operation of the project, as outlined in the mitigation measures at Chapter 7 of this technical paper.

This guideline also emphasises the role of dust, together with lighting, in causing light pollution. Measures to minimise dust during the construction and operation of the project would be addressed through the project mitigation measures included in Chapter 21 of the EIS for the project.

2.2 Local planning schemes

The project is located on land within the following local government areas (LGAs):

- Mid-Western Regional Council
- Warrumbungle Shire Council
- Upper Hunter Shire Council
- Dubbo Regional Council.

The location of the project within these LGAs is shown on Figure 1-1.

As the project is declared as Critical State significant infrastructure (CSSI) it is not assessed against the clauses and provisions of the local planning schemes. However, the following section identifies those provisions relating to landscape character and visual amenity, particularly in relation to electricity generation, storage and transmission infrastructure, to provide context for this landscape character and visual amenity assessment.

2.2.1 Mid-Western Regional Council

Mid-Western Regional Local Strategic Planning Statement

Planning Priority 3 of the Mid-Western Regional Local Strategic Planning Statement (LSPS) (Mid-Western Regional Council, 2020a) aims to maintain and promote the aesthetic appeal of the towns and villages within the Region, such as Ulan and Wollar. The Merotherie Energy Hub and the project transmission lines are located in the northern part of the Mid-Western Regional LGA and not near the townships of Gulgong, Ulan and Wollar. The plan states:

> The unique landscapes surrounding the towns and village are highly valued and contribute to the overall appeal of the Region. Protecting these landscapes and rural settings into the future will ensure a positive experience for visitors and a good quality of life for residents.

In addition, Planning Priority 7 of the Mid-Western Regional LSPS is that renewable energy development be located in areas that …

> … avoids impacts on the scenic rural landscape and preserves valuable agricultural land.

Mid-Western Regional Local Environmental Plan 2012

The Mid-Western Regional Local Environmental Plan 2012 (Mid-Western Regional LEP) (Mid-Western Regional Council, 2012) aims to … 'encourage the proper management, development and conservation of resources within Mid-Western Regional LGA by protecting, enhancing and conserving scenic values' (clause 1.2(2(b)(v)).

The provisions of the Mid-Western Regional LEP which provide some relevant context for this project include the following:

Land use zoning

The majority of the project (where it is located in the Mid-Western Regional LGA) is located on land zoned as RU1 Primary Production. The aims of this land use zone include to … 'minimise the fragmentation and alienation of resource lands' and 'minimise conflict between land uses within this zone'. (Part 2, Land Use Table, Zone RU1 objectives).

A small part of the project is located within land zoned as C3 Environmental Management, including an area which forms part of Barneys Reef, southwest of the proposed Merotherie Energy Hub; to the south and east of Ulan; and west of the new Wollar Switching Station. In this land use zone, a limited range of development types are permissible, ensuring development … 'does not have an adverse effect on … aesthetic values' (Part 2, Land Use Table, Zone C3 objectives).

The landscape and visual study area also includes a small area of land zoned as C1 National Parks and Nature Reserves, associated with Goulburn River National Park, north of Wilpinjong and to the east of the construction area.

The Gwabegar branch of the Main Western railway line crosses the construction area of the project, to the south of Birriwa, and is zoned as SP2 Infrastructure. There is also RU5 Village zoning at Ulan, north of the project, and IN3 Heavy Industrial zoning to the southwest of Ulan, including some areas within the construction area. The objectives for these zones do not refer to maintaining landscape character or visual amenity.

Visually sensitive land

Clause 6.10 of the Mid-Western Regional LEP aims to… 'protect the visually and environmentally significant land on the urban fringe of the town of Mudgee'. However, there is no mapped visually sensitive land in the landscape and visual study area.

Heritage

Heritage items of local significance within or near the construction area of the project that are listed under the Mid-Western Regional LEP include the Goulburn River National Park, Munghorn Gap Nature Reserve and Wandoona Homestead, south of Wollar. Clause 5.10 of the LEP aims to conserve these items, including their 'settings and views'.

It should be noted that parts of the Goulburn River National Park are being considered for inclusion on the National Heritage List (NHL: 105696 – Nominated Place) as part of an extension to the Greater Blue Mountains Area (World Heritage List – WHL: 105127 and NHL: 105999). But at the time of writing, this has yet to occur. The provisions of Clause 5.10 of the Mid-Western Regional LEP have been referred to, where relevant, in the description of the existing environment and to inform the landscape character and visual sensitivity levels used in this assessment.

Mid-Western Regional Council Development Control Plan 2013

Amendment No.5 of the Mid-Western Regional Council Development Control Plan 2013 (Mid-Western Regional Council DCP (Mid-Western Regional Council, 2020b)) aims to provide clear and concise development guidelines for various forms of development within the Mid-Western Regional LGA, including transmission lines and battery storage associated with renewable energy projects, including wind and solar farms.

For these types of development assessed under the Mid-Western Regional Council DCP, Council requires a description and assessment of the visual effects on neighbouring and public view locations, and identification of potential impacts on the scenic value and character of the locality.

While this project is not assessed under the provisions of this DCP (due to its declaration as CSSI), this technical paper identifies visual impacts on the public domain and private dwellings and identifies impacts on landscape character which incorporates the scenic value and character of the localities along the project.

2.2.2 Warrumbungle Shire Council

Warrumbungle Local Strategic Planning Statement

The Warrumbungle landscape is described as a 'peaceful rural landscape' (Warrumbungle Shire Council, 2020). Priority 5 of the Warrumbungle LSPS aims to protect the region's agricultural lands and manage land use conflicts within agricultural areas by separating or avoiding incompatible land uses.

The Elong Elong Energy Hub and a portion of the project transmission lines would be located in the southern part of the Warrumbungle LGA and are considered works which would enable transmission line connections with future renewable energy projects within the Warrumbungle LGA, including the Sandy Creek and Cobbora Solar Farms.

Warrumbungle Local Environmental Plan 2013

Provisions of the Warrumbungle Local Environmental Plan 2013 (Warrumbungle LEP (Warrumbungle Shire Council, 2013)) which provide some relevant context for this project include:

Land use zoning

The majority of the project (where it is located within the Warrumbungle LGA) is located on land zoned as RU1 Primary Production, which aims to… 'minimise the fragmentation and alienation of resource lands' and 'minimise conflict between land uses within this zone'. (Part 2, Land Use Table, Zone RU1 objectives).

The project is located adjacent to Tuckland State Forest, which is zoned as RU3 Forestry under the Warrumbungle LEP. The LEP enables other development on this land that is… 'compatible with forestry land uses'. (Part 2, Land Use Table, Zone RU3 objectives).

Heritage

There are no listed heritage items near the project identified in the Warrumbungle LEP. However, there are two potential (unlisted) local heritage items near the project (but outside of the construction area), including Laheys Creek Cemetery and Avondale homestead. While these are not listed as heritage items within the Warrumbungle LEP, they are noted here as they provide some heritage character to the study area.

These provisions have been referred to, where relevant, in the description of the existing environment and inform the landscape character and visual sensitivity levels used in this assessment.

Warrumbungle Development Control Plan 2015

Warrumbungle Development Control Plan 2015 (Warrumbungle DCP (Warrumbungle Shire Council, 2015)) provides guidelines for various types of development, encouraging a high standard of development that respects and maintains the existing urban, rural and natural environment of the Warrumbungle LGA.

Section 5 of the Warrumbungle DCP provides the development objectives for the RU1 Primary Production Zone, including:

> To protect the amenity of the locality in which the development is situated.
>
> To ensure that development preserves and complements any natural and/or cultural heritage characteristics of the area.

These clauses have been considered generally in relation to the assessment of landscape character and view impacts.

2.2.3 Upper Hunter Shire Council

Draft Upper Hunter Shire Council Local Strategic Planning Statement

Planning Priority 7.0.18 of the Draft Upper Hunter LSPS recognises the 'scenic landscapes' of the Upper Hunter Shire as an important and valuable drawcard for tourism (Upper Hunter Shire Council, 2020). There are no areas specifically mapped as scenic landscapes in this LSPS.

The project is located in the western part of this LGA, with project transmission line infrastructure enabling connections between the project and proposed renewable energy projects within the LGA, including the approved Liverpool Range Wind Farm.

Upper Hunter Local Environmental Plan 2013

The Upper Hunter Local Environmental Plan 2013 (Upper Hunter LEP) aims to… 'encourage the proper management, development and conservation of natural and human-made resources in the Upper Hunter by protecting, enhancing and conserving… the environmental, scenic and cultural heritage of the Upper Hunter' (Upper Hunter Shire Council, 2013, clause 1.2(2(a)(iii)).

The provisions which provide some relevant context for this project include the following:

Land use zoning

The majority of the project is located on land zoned as RU1 Primary Production, which aims to… 'maintain the rural landscape character of the land in the long term' (Part 2, Land Use Table, Zone RU1 objectives).

A small part of the project is located on land zoned as C1 National Parks and Nature Reserves, associated with the Durridgere State Conservation Area, southwest of Cassilis.

Heritage

Heritage items near the project that are listed under the Upper Hunter LEP and outside of the construction area include: Munmurra Road woolshed, south of Cassilis; Dalkeith and Llangollen, both rural stations/properties west of Cassilis; Yarrawonga, Rotherwood Road, a rural station/property northwest of Cassilis. Clause 5.10 aims to conserve these items, including the associated 'settings and views'.

These provisions have been referred to, where relevant, in the description of the existing environment and inform the landscape character and visual sensitivity levels used in this assessment.

Upper Hunter Development Control Plan 2015

Part 7 of the Upper Hunter Development Control Plan 2015 (Upper Hunter DCP (Upper Hunter Shire Council, 2015)) provides objectives for development in rural areas within the Upper Hunter LGA, including:

- ensure that development respects the scenic qualities of the site and the local area
- minimise the disturbance of land and preserve natural landforms
- ensure that developments have adequate regard for site topography
- ensure that development does not dominate the surrounding landscape and is visually unobtrusive
- minimise impacts on the visual amenity and privacy of adjoining development.

These clauses have been considered generally in relation to the assessment of landscape character and view impacts.

2.2.4 Dubbo Regional Council

Dubbo Local Strategic Planning Statement

The project is located in the eastern rural part of Dubbo Regional LGA, and north of Dapper Nature Reserve.

The vision for Dubbo in the LSPS says … 'We will take advantage of technological innovation to become a smart city while protecting our natural environment, and being recognised as the inland capital of regional NSW.' (Dubbo Regional Council, 2020)

Planning priority 3 aims to… 'Promote renewable energy generation', whilst minimising… 'impacts on local amenity while accessing the transmission grid' (Dubbo Regional Council, 2020). Planning priority 20 aims to… 'Plan for the delivery of infrastructure to support growth' while protecting and enhancing rural lands. (Dubbo Regional Council, 2020).

Dubbo Regional Local Environmental Plan 2022

The Dubbo Regional Local Environmental Plan 2022 (Dubbo Regional LEP (Dubbo Regional Council, 2022)) aims to encourage development that complements and enhances the… 'unique character and amenity' of the Dubbo region, including its settlements, localities and rural areas (clause 1.2(2)(a)).

The provisions of this LEP which provide some relevant context for this project include the following:

Land use zoning

The project (where it is located in the Dubbo Regional LEP) is situated on land zoned as RU1 Primary Production zone. RU1 zoning objectives aim to encourage diversity in primary industry enterprises and systems appropriate for the area whilst minimising conflict between land uses within this zone (Part 2, Land Use Table, Zone RU1 objectives).

Heritage

There are no heritage items identified in this LEP located within or near the construction area or the operation area.

These provisions have been referred to, where relevant, in the description of the existing environment and inform the landscape character and visual sensitivity levels used in this assessment.

Dubbo Development Control Plan 2015

The Dubbo Development Control Plan 2015 development objectives for the RU1 Primary Production Zone requires development and infrastructure to be positioned in the most suitable location to achieve 'physical comfort' but does not refer to managing impacts on landscape character or visual amenity (Section 2.4, Dubbo Regional Council, updated in 2019).

Chapter 3: Methodology

3.1 Guidance for landscape and visual impact assessment

There is no specific guidance for the assessment of landscape and visual impacts of transmission lines in NSW. However, there is guidance available for the assessment of landscape and visual impact generally and for specific project types.

The assessment of this project is approached generally in accordance with the following guidance for landscape character and visual impact assessment:

- Guidance Note for Landscape and Visual Assessment, Australian Institute of Landscape Architects Queensland, 2018
- Guidelines for Landscape and Visual Impact Assessment, Third Edition, 2013, prepared by the Landscape Institute and Institute of Environmental Management & Assessment.

Also, relevant to the assessment of this project, is the following guideline that guide the assessment of landscape character and visual impact for infrastructure projects in NSW, including:

- Guideline for Landscape Character and Visual Impact Assessment EIA-N04, Transport for NSW, 2023
- Large-Scale Solar Energy Guideline, Technical Supplement Landscape Character and Visual Impact, 2022, Department of Planning and Environment

The methodology prepared for this technical paper draws upon the guidance in these documents, as appropriate to the scale and particular landscape and visual characteristics of this project.

Generally, the project would comprise a landscape character and visual impact assessment, which considers impacts to landscape character during the day and at night-time, and visual impacts in both the public domain and from private dwellings as shown in Figure 3-1.

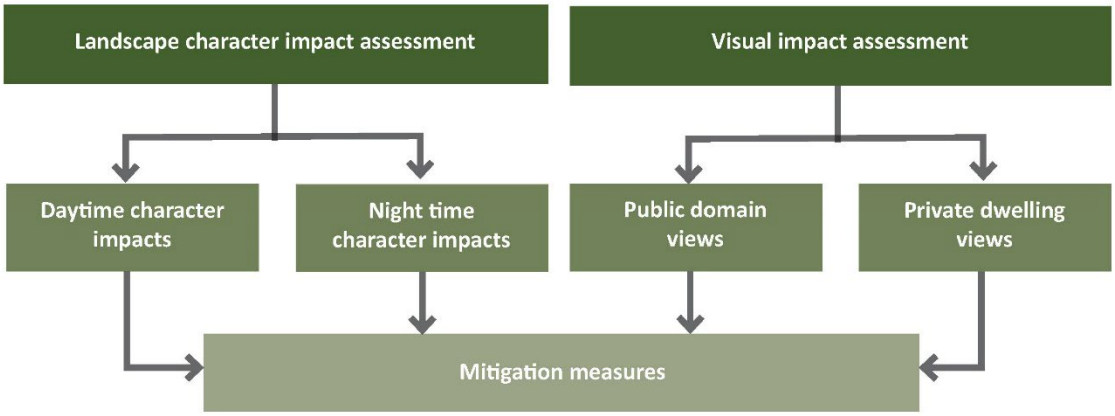


Figure 3-1 Structure of this landscape character and visual impact assessment

3.2 Overview

Landscape character and visual impacts are generally determined by combining sensitivity with magnitude of change. Sensitivity considers the value placed on a landscape or view and its susceptibility to change. The magnitude of change refers to the changes to landscape character or a view that would occur as a result of the project.

The following key steps were undertaken as part of this assessment of landscape character and visual amenity impacts.

For the **landscape character assessment**

- Identification of landscape character types and zones within the study area
- A **daytime landscape character assessment** (refer also to section 3.4), which involved:
  - Determining the daytime landscape character sensitivity for each identified landscape character type
  - Describe the magnitude of change that would be experienced in each zone, during construction and operation as a result of the project during the day
  - Assigning a level of landscape character impact during the day by combining the landscape character sensitivity and magnitude of change level for each zone.
- A **night time landscape character assessment** (refer also to section 3.4.3), including:
  - Determining the night time landscape sensitivity (referencing the environmental zones defined by *AS4282 Control of the obtrusive effects of outdoor lighting* (2019)) for each landscape character type
  - Describe the magnitude of change that would be experienced in each landscape character zone (grouped by type), during construction and operation as a result of the project at night
  - Assigning a level of landscape character impact at night by combining the landscape character sensitivity and magnitude of change level for each landscape character zone (grouped by type).

For the **visual impact assessment**:

- The potential visibility of the project was identified using a digital elevation model. This model was generated using GIS Software, using topographic data from recent LiDAR data collected for the project, and the project reference design.
- A **visual impact assessment for public viewpoints** (refer also to section 3.5.2), which involved:
  - A site inspection to identify publicly accessible locations across the study area from which the project would be visible, and to select representative viewpoints to be used in the assessment.
  - Representative viewpoint photography and the preparation of photomontages for some viewpoints to support the assessment of potential visual impact for public viewpoints
  - Determining the daytime visual sensitivity for each representative viewpoint
  - Describe the magnitude of change that would be experienced in each representative viewpoint
  - Assigning a level of visual impact for each representative viewpoint location by combining the visual sensitivity and magnitude of change level for each viewpoint.
- **Visual impact assessment for private dwellings** (refer also to section 3.5.3), which involved:
  - A **preliminary visual impact screening assessment** to identify potentially impacted private dwellings in the study area to be subject to a more detailed view assessment. This involved:
    - Identifying all private dwellings within the study area (up to two kilometres from the project)
    - Apply screening criteria to each dwelling and shortlisting of private dwellings to be carried forward into a detailed view assessment, by eliminating dwellings where there would be a very low concern and / or effect.
  - A **detailed private dwelling visual assessment** for each shortlisted dwelling, which involved:
    - A detailed site inspection and photography at a sample of the shortlisted private dwellings, selected to represent a range of private dwelling views.

  - › Preparation of photomontages and 3D modelled views for a sample of the shortlisted dwellings to illustrate the size and scale of the project and assist in representing the visibility of the project.
  - › Identifying the visual sensitivity of the view from each dwelling, by combining viewpoint sensitivity and scenic quality of the existing view
  - › Determining the magnitude of change that each dwelling would experience as a result of the project
  - › Assigning a level of visual impact by combining the visual sensitivity with the magnitude of change.
- Identification of recommended mitigation measures to avoid, minimize and manage any potential impacts of the project on landscape character and visual amenity.

This process is shown in Figure 3-3.

3.3 Landscape and visual study area

The study area for this technical paper generally comprises a four kilometre wide corridor centred on the project, referred to as the ‘landscape and visual study area’ or ‘study area’. This distance is based on the scale and visual characteristics of the project and includes areas where there is the potential for landscape character and visual impacts. The study area is shown in Figure 3-2.

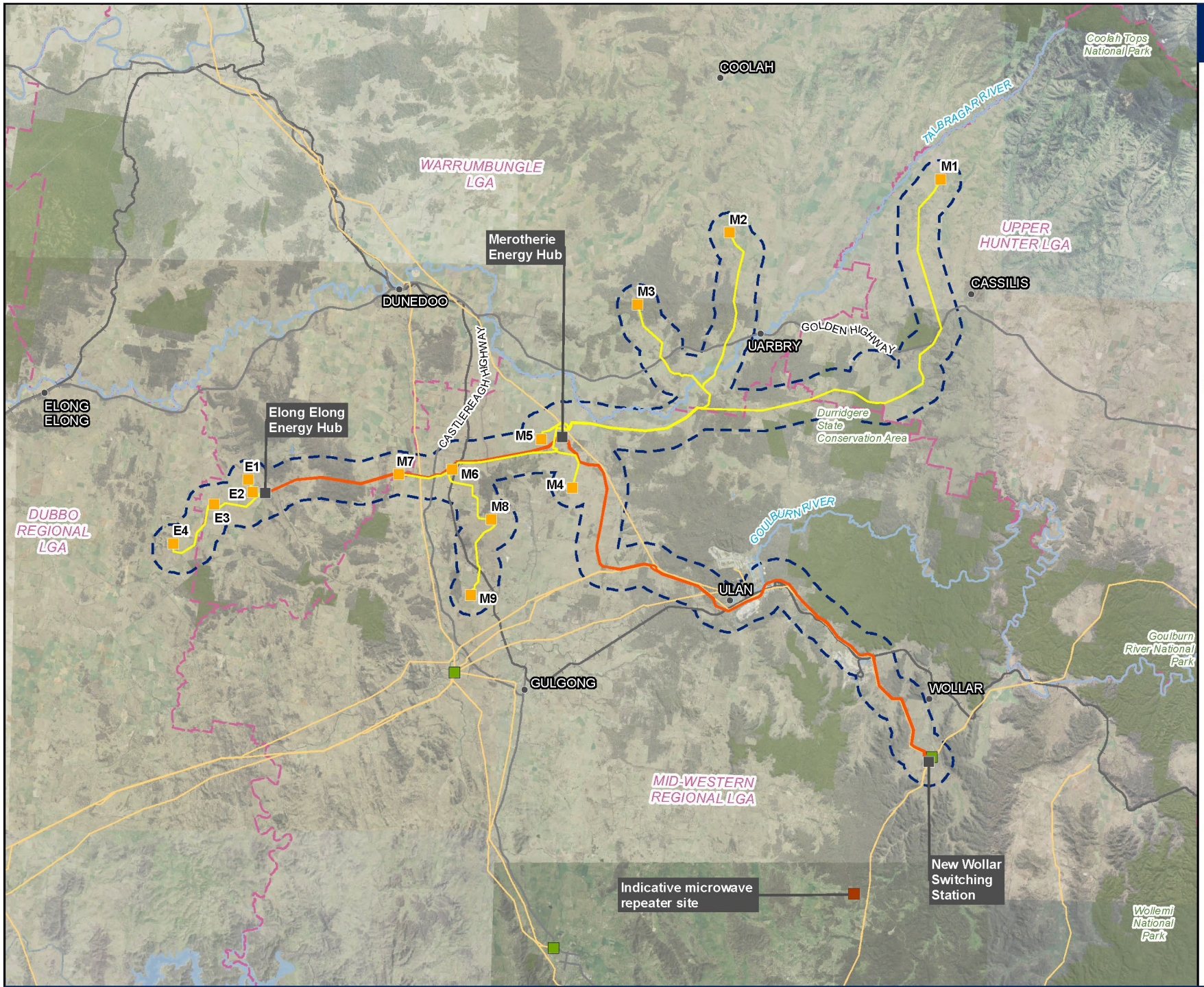
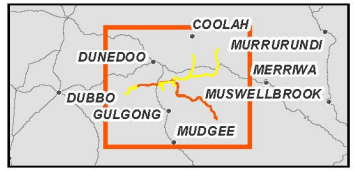


Figure 3-2
Landscape character and visual study area

Legend

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



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

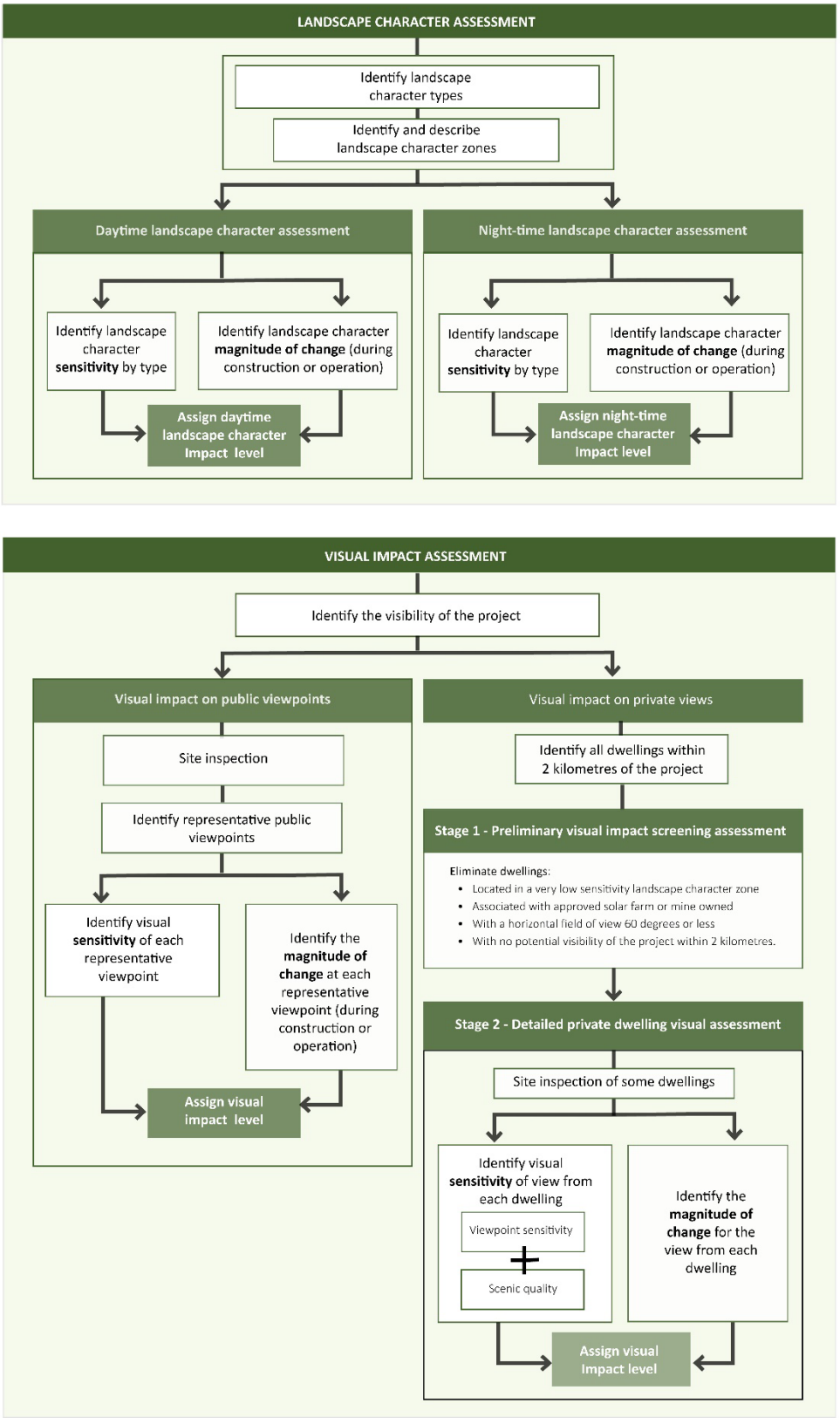


Figure 3-3 Detailed overview of methodology

3.4 Landscape character assessment

Landscape is defined as … 'All aspects of a tract of land, including landform, vegetation, buildings, villages, towns, cities and infrastructure.' (TfNSW, 2023). Landscape character is the … 'combined quality of built, natural and cultural aspects which make up an area and provide its unique sense of place' (TfNSW, 2023).

The landscape character assessment of the project begins with the identification of landscape character types and zones. An assessment of landscape character impact was then carried out by identifying the sensitivity of each zone, describing the magnitude of change expected as a result of the construction and operation of the project, and combining these factors to make an overall assessment of the potential landscape character impact.

Landscape character impact includes an assessment of day time and night time impacts.

The structure of the landscape character assessment was undertaken as shown in Figure 3-4.

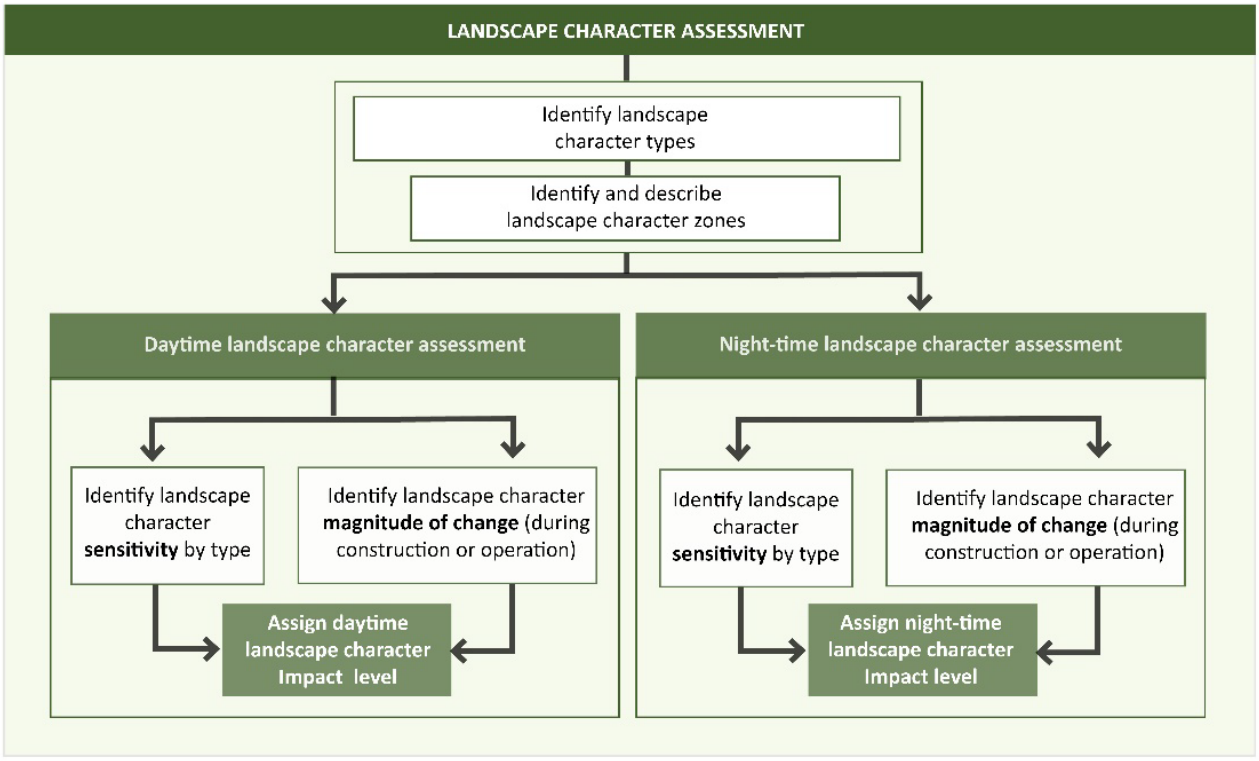


Figure 3-4 Structure of this landscape character assessment

3.4.1 Identification of landscape character types and zones

Due to the nature and scale of this project there are several landscape character types across the landscape and visual study area which have similar characteristics in terms of geology, topography, vegetation cover, watercourses, built form and land use pattern. These landscape character types have been further sub-divided into landscape character zones which are used as the basis of the assessment. The landscape character zones are based on the key attributes present in the locality and reflect local landscape features (refer to Chapter 5). The identification of landscape character was based on site observations and map interpretation.

3.4.2 Assessment of daytime landscape character impact

The assessment of potential daytime landscape character impacts was undertaken by combining the identified landscape character sensitivity of each landscape character zone with the magnitude of change to determine a landscape character impact level. Figure 3-5 illustrates this process.

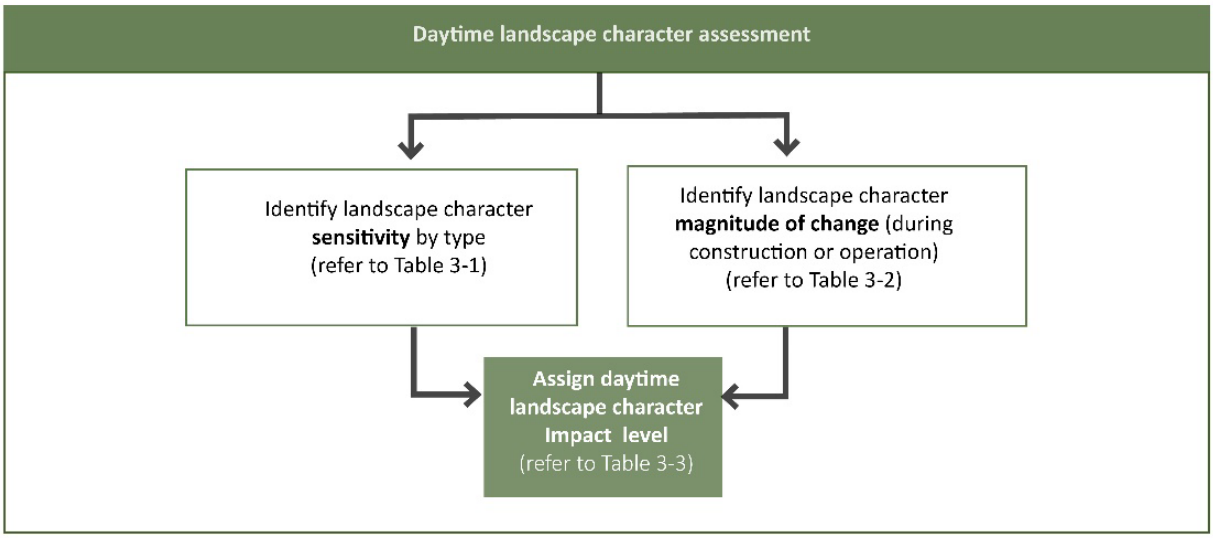


Figure 3-5 Daytime landscape character assessment process

3.4.2.1 Landscape character sensitivity

Landscape sensitivity refers to the value placed on a landscape and its susceptibility to change. The sensitivity of a landscape reflects the frequency and volume of users, type of activities occurring in the landscape as well as valued characteristics such as its scenic quality, its contribution to sense of place, and rarity. The value of landscapes can be described in Federal, State and local government masterplans and planning documents and protected by legislation. These values reflect the importance of a landscape to the local, regional and wider community.

The scenic quality of the landscape is also considered, with areas with more distinctive terrain, greater vegetation cover, natural waterbodies, heritage or cultural landscape and built form features, for example, having a higher landscape sensitivity and greater susceptibility to change. Landscapes with less terrain, fewer trees, human created farmland and areas with a more dominating presence of development, would have a lower landscape sensitivity and a greater capacity to accommodate change.

Landscape sensitivity in this assessment has been considered in the broadest possible context, from those landscapes of national importance through to those considered to be landscapes of importance locally.

Table 3-1 lists the landscape sensitivity levels that apply to this assessment. The descriptions of landscape sensitivity in this table incorporate the scenic quality values referenced in the NSW Large-Scale Solar Guideline, Technical Supplement, Table 6 (NSW DPE, 2022).

Table 3-1 Landscape character sensitivity levels

Landscape character sensitivity	Description
Very high	• Landscape feature or place that is strongly valued, nationally iconic and/or protected under national legislation or international policy e.g. World Heritage Areas and National Parks. • Typically includes distinctive, unique and landscape features which are uncommon across the nation and internationally. This may include dramatic landform (isolated peaks, steep rocky ridges, cones, escarpments), distinctive natural water bodies (prominent lakes, reservoirs, rivers, streams, wetlands and swamps, harbour, inlet, bay or open ocean), vegetation and iconic heritage places.
High	• Landscape feature or place that is heavily used and/or is iconic to the State. • Typically includes some unique landscape features which are uncommon within the state, such as dramatic landform, iconic heritage places, attractive natural water bodies and vegetation.
Moderate	• Landscape feature or place that is heavily used and/or valued by residents of a major portion of a city or a non-metropolitan region and/or places with regionally important scenic value or landscape features. • May include landscape features that are uncommon within the region, including: – locally distinctive landform features (hilly and undulating ranges, broad shallow valleys, moderately deep gorges or moderately steep valley walls, and rocky outcrops) – attractive natural waterbodies (streams, lakes, rivers, swamps and reservoirs), – vegetation (native bushland, streamside vegetation, avenues and/or distinctive stands of exotic trees including human influenced vegetation such as vineyards and orchards), – state and local heritage places which contribute to character and/or – a dispersed presence of human settlement (such as villages, small towns, isolated pockets of production and industry, lower scale and trafficked transport infrastructure).
Low	• Landscape valued and experienced by concentrations of residents and/or local recreational users and/or places of local scenic value or local landscape features. • May include regionally common landscapes and features such as: – gentle landforms (hilly and undulating ranges, broad shallow valleys, open plains), – modified natural and human made watercourses (streams, lakes, rivers, swamps and reservoirs), scattered or sparsely vegetated (scattered trees in fields with limited variation), – local heritage places and/or a dispersed presence of human settlement (such as villages, small towns, isolated pockets of production and industry, lower scale and trafficked transport infrastructure).
Very low	• Places without any particular scenic values or local landscape features, or which are common across the region and beyond. May include: – indistinct landform features (large expanses of flat or gently undulating landform), – limited tree cover such as extensively cleared and cropped areas with very limited variation in colour and texture, – pastoral areas, human created paddocks, pastures or grasslands and associated buildings typical of grazing lands), – human created waterbodies (farm dams, irrigation canals or stormwater infrastructure), – vegetation (native bushland, streamside vegetation, avenues and/or distinctive stands of exotic trees), and/or – dominating presence of human settlement (dominating presence of infrastructure such as solar farms, human settlements, highly modified landscapes such as mines, and higher density populations such as regional cities, industrial areas, agricultural transport or electricity infrastructure).

3.4.2.2 Magnitude of change levels

The magnitude of change refers to the changes to the landscape character that would occur as a result of the project. The magnitude of change considers both direct and indirect changes. The magnitude of change is assigned a level based on the categories described in Table 3-2.

The project is likely to have both direct and indirect impacts on the landscape. Direct impacts are those where landscape features are altered or removed and include the clearing and trimming of vegetation, the modification of landform, any changes to watercourses or the use of a landscape.

The project may also result in indirect impacts, such as changes to the characteristics of the landscape that form its sense of place and unique identity, such as a construction site disrupting the sense of remoteness and tranquillity of a landscape. It is important to note that visibility is a part of landscape character and areas which are more widely seen would have a greater influence on landscape character.

Table 3-2 Landscape character magnitude of change levels

Landscape character magnitude of change	Description
Very High	• The landscape is altered such that the project dominates and/or transforms its character, amenity and/or function. • This would result in an extensive and/or severe change in landscape values, such as extensive vegetation removal, dramatic landform changes, introduction of built elements that are widely visible and contrast substantially with the characteristics of the existing landscape character.
High	• The project substantially changes and/or is not compatible with the character, amenity, and function of the landscape. • This would result in an extensive and/or severe change in landscape values, including the removal of large areas of vegetation, dramatic landform changes, introduction of built elements that are widely visible and contrast substantially with the characteristics of the existing landscape character.
Moderate	• The project somewhat changes and/or is not compatible with the character, amenity, and function of the landscape. • This would result in a considerable and/or unsympathetic change in landscape values.
Low	• The project changes are minor and/or are compatible with the character, amenity, and function of the landscape. • It would result in a slight change in landscape values.
Negligible	• The project would not change the character, amenity and/ or function of the landscape. • If there is a change, it would not be perceived as altering the landscape values

3.4.2.3 Assigning landscape character impact levels

An assessment of landscape character impact has been made by combining the landscape sensitivity and magnitude of change levels for each landscape character zone and assigning an impact level using the levels identified in Table 3-3.

Table 3-3 Landscape character impact levels

		Sensitivity				
		Very high	High	Moderate	Low	Very low
Magnitude	Very high	Very high	Very high	High	Moderate-high	Moderate
	High	Very high	High	Moderate-high	Moderate	Low-moderate
	Moderate	High	Moderate-high	Moderate	Low-moderate	Low
	Low	Moderate-high	Moderate	Low-moderate	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

3.4.3 Assessment of night-time landscape character impact

An assessment of the potential impacts of the project at night has been undertaken for each landscape character type. The assessment of night-time impact has been carried out with a similar methodology to the daytime assessment. However, the assessment also draws upon the guidance contained within the *Dark Sky Planning Guideline* (NSW Department of Planning and Environment, 2016) and the *AS4282 Control of the obtrusive effects of outdoor lighting* (2019).

A qualitative assessment of night lighting with consideration of the 'Design Principles' contained in the *Dark Sky Planning Guideline* (NSW DPE, 2016) has been included in Section 6.2 of this technical paper.

AS4282 Control of the obtrusive effects of outdoor lighting, (2019) identifies four main potential effects of lighting, which are, the effects on residents, transport system users, transport signalling systems and astronomical observations. Of relevance to this assessment is the effects of lighting on the visual amenity of residents and transport system users.

AS4282 identifies environmental zones which are useful for categorising night-time landscape settings. The following assessment has used these environmental zones to describe the existing night-time visual condition and assign a sensitivity to these settings.

This process is illustrated in figure 3-6.

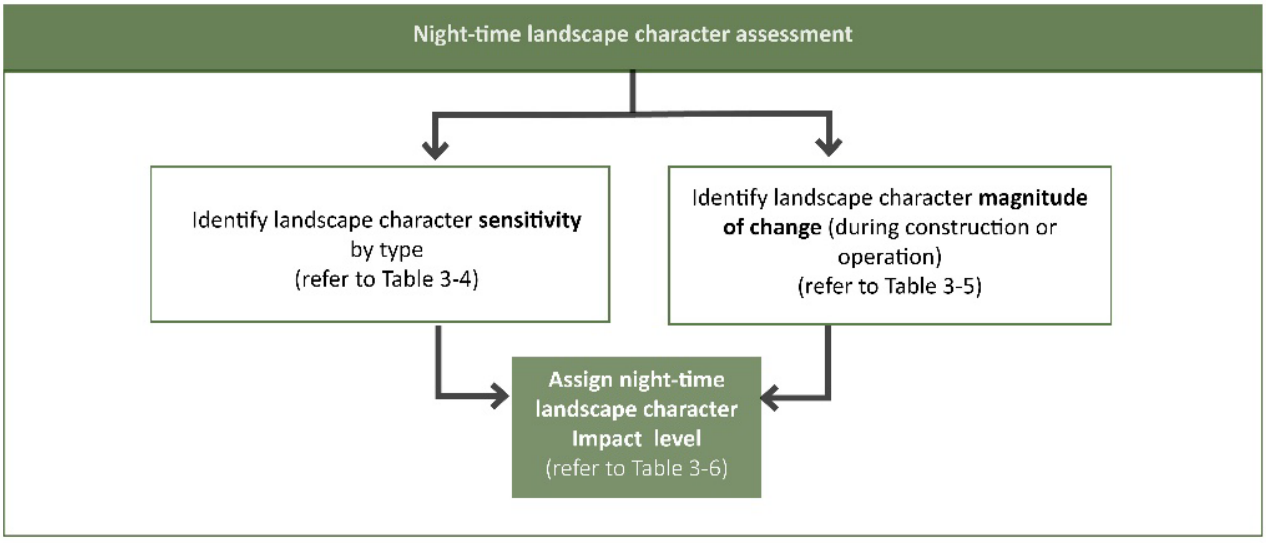


Figure 3-6 Night-time landscape character assessment process

3.4.3.1 Night-time visual sensitivity

AS 4282 identifies night time environmental zones which can each be associated with a level of landscape character sensitivity, as summarised in Table 3-4. Night time visual sensitivity is determined by assigning an environmental zone to each landscape character type based on the zone which best describes the existing night-time visual condition of the site. These zones are typical night-time settings and reflect the predominant light level of each landscape character type. Each environmental zone is assigned a level of sensitivity as shown in Table 3-4.

For each landscape character zone, a level of landscape character sensitivity is identified according to these descriptions.

Table 3-4 Landscape character sensitivity levels – night-time

	Environmental zones (AS4282:2019)	
Landscape character sensitivity at night	**Environmental zone**	**Examples**
Very high	A0: Intrinsically dark	• UNESCO Starlight Reserve • IDA Dark Sky Parks • Major optical observatories • No road lighting – unless specifically required by the road controlling authority • NSW Dark Sky Region and 0-12 kilometres from the Siding Spring Observatory
High	A1: Dark	• Relatively uninhabited rural areas • No road lighting – unless specifically required by the road controlling authority • NSW Dark Sky Region and 12-18 kilometres from the Siding Spring Observatory
Moderate	A2: Low district brightness	• Sparsely inhabited rural and semi-rural areas • NSW Dark Sky Region and over-18 kilometres from the Siding Spring Observatory
Low	A3: Medium district brightness	• Suburban areas in towns and cities • Land uses including night lighting such as coal mines and processing plants.
Very low	A4: High district brightness areas	• Town and city centres and other commercial areas • Residential areas abutting commercial areas

3.4.3.2 Night-time magnitude of change

Following the sensitivity assessment, the magnitude of change that would be expected within each landscape character type at night is then identified. These changes are described for each landscape character type, with specific reference to views from public and private domain (private dwelling) locations as appropriate. The likely changes to views and the setting at night has been described in terms of skyglow, glare and light spill where relevant (refer to the glossary for definition of these terms). Table 3-5 lists the categories used to describe the magnitude of change at night.

Table 3-5 Landscape character magnitude of change levels – night-time

Magnitude	Description
High	• Substantial change to the level of skyglow, glare or light spill expected, and/or • The lighting of the project would transform the character of the surrounding setting at night, and/or • The effect of lighting would be experienced over an extensive area.
Moderate	• Alteration to the level of skyglow, glare or light spill would be expected, and/or • The lighting of the project would contrast somewhat with the surrounding landscape at night, and/or • The effect of lighting would be experienced across a moderate portion of the landscape
Low	• Alteration to the level of skyglow, glare or light spill would be expected, and/or • The lighting of the project would not contrast substantially with the surrounding landscape at night, and or • The effect of lighting would be experienced across a small portion of the landscape.
Negligible	• Either the level of skyglow, glare and light spill is unchanged or • if it is altered, the change is generally unlikely to be perceived by viewers or • compatible with the existing or intended future use of the area.

3.4.3.3 Night-time landscape character impact levels

An assessment of night-time landscape character impact has been made by combining the visual sensitivity of the environmental zone with the night-time visual magnitude of change for each area generally and assigning an impact level, as shown in Table 3-6. This technical report has been undertaken for construction and operational impacts.

Table 3-6 Landscape character impact levels – night-time

		Sensitivity (AS4282:2019 Environmental Zone)				
		Very high (A0)	High (A1)	Moderate (A2)	Low (A3)	Very low (A4)
Magnitude	High	Very high	High	Moderate-high	Moderate	Low-moderate
	Moderate	High	Moderate-high	Moderate	Low-moderate	Low
	Low	Moderate-high	Moderate	Low-moderate	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

3.5 Visual impact assessment

The following visual impact assessment includes an assessment of both public and private property views. This assessment will be undertaken as described in the following section.

3.5.1 Visibility analysis

Visibility analysis was undertaken to identify the area from which the project is potentially visible. This visibility analysis used a 3D digital terrain model (i.e. a digital graphic representation of elevation data to represent existing landform) and points at the height of each transmission tower, to identify the areas from which views to the transmission line may be seen. This visibility is limited to a distance of two kilometres from each tower on the alignment, as this is the distance at which there is the potential for towers to be prominent in the view.

The analysis shows areas where a larger part of the project is visible, as a progressively darker colour. The model used for this analysis did not include land cover features (i.e. trees and buildings), and therefore identifies a worst-case scenario and is the first step in the analysis process. Visibility plans for the project are provided in Appendix D.

3.5.2 Visual impact assessment- public domain

The assessment of visual impacts from the public domain has been completed using a representative viewpoint assessment approach.

A site visit was undertaken October of 2022 and viewpoints were selected to include a range of geographical locations and landscape character types, to show a range of different types of views towards the project. For each representative viewpoint, the visual sensitivity and magnitude of change created by the project has been identified and a visual impact level assigned. This methodology is explained in more detailed in sub-sections 3.5.2.1 to 3.5.2.4.

Figure 3-7 outlines the process of this assessment.

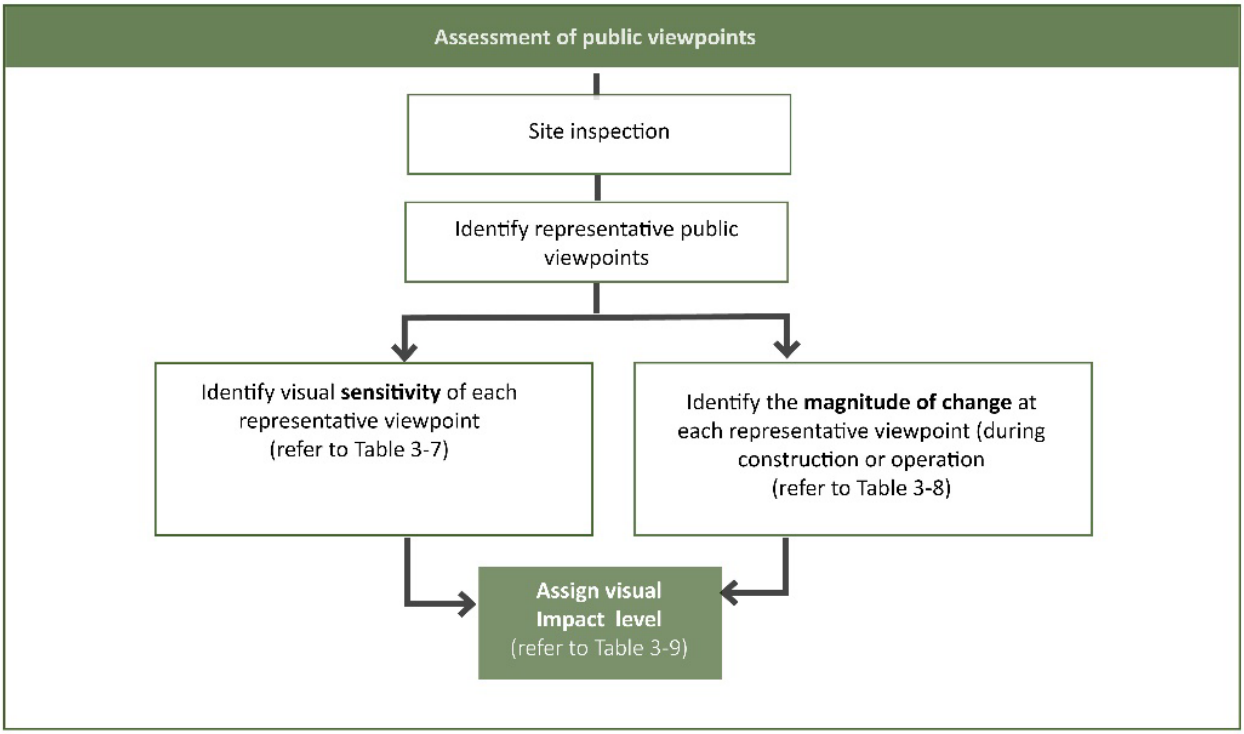


Figure 3-7 Public domain viewpoint assessment process

3.5.2.1 Representative viewpoint assessment

Site inspections were carried out during October and December 2022 as well as April 2023 to verify the desk-top assessment and to support the selection of representative viewpoints. Views representative of the project from the public domain were selected during the site inspections. Representative viewpoints within the public domain were chosen to include locations where the greatest number of viewers are likely to congregate, such as lookouts and road corridors, as well as locations in sensitive recreational and natural areas. On this project, due to the lack of parks, reserves and lookouts in the study area, most public domain vantage points were from highways and roads.

Photomontages have been prepared for some viewpoints to support the assessment of potential visual impact. These views illustrate locations where the project would be seen from locations of higher visual sensitivity and also to show a typical view within some of the landscape character types.

3.5.2.2 Visual sensitivity

Visual sensitivity refers to the nature and duration of views. Locations from which a view would potentially be seen for a longer duration, where there are higher numbers of potential viewers and where visual amenity is important to viewers can be regarded as having a higher visual sensitivity.

To ensure the impacts are attributed fairly, the sensitivity of each representative viewpoint is considered in the broadest context of possible views, including those of national importance through to those considered to have a neighbourhood importance. Table 3-7 lists and describes the categories used to rank the level of visual sensitivity in this technical paper for visual impact assessment in the public domain.

Table 3-7 Visual sensitivity levels – daytime

Visual sensitivity	Description
Very high	• Heavily experienced view to a national icon, and/or • Views to areas with a scenic value or to landscape features of national importance, and/or • These views are generally unique and uncommon nationally.
High	• Heavily experienced view to a feature or landscape that is iconic to the state, and/or • Views to areas with a scenic value recognised by the state. • These views are generally unique or uncommon within the state.
Moderate	• Heavily experienced view to a feature or landscape that is iconic to a major portion of a city or a non-metropolitan region, or an important view from an area of regional open space, and/or • Views to areas of regionally important scenic value or to landscape features of the region. • These views are generally unique or uncommon within the region.
Low	• High quality view experienced by residents and/or local recreational users, and/or road or rail users, and/or • Views to areas of local scenic value or to local landscape features such as Barneys Reef and the Talbragar and Munmurra river valleys. • These views are somewhat common within the landscape.
Very low	• Views where visual amenity is not particularly important to the wider community, such as lower quality views seen from roads. • These views are likely to be common within the landscape.

3.5.2.3 Magnitude of change

The magnitude of change describes how the characteristics and scenic quality (which inform scenic value) of a view are modified by the project, from a given viewpoint. This includes what has changed, and how it has changed. The visual magnitude of change describes the extent of change and identifies elements which are removed or in this case added, and compatibility of new elements with the existing view.

A high magnitude of change would result if the project contrasts strongly with the existing characteristics and scenic quality of a view. Whereas a low magnitude of change occurs if there is visual compatibility or minimal visual contrast between the project and the characteristics and scenic quality of the view.

Table 3-8 lists the terminology used to describe the visual magnitude of change in this technical paper.

Table 3-8 Visual magnitude of change levels

Visual magnitude	Description
Very high	• The view is altered such that the project visually dominates and transforms the characteristics and scenic quality of the view. • The project would result in a substantial change in the amenity of the view.
High	• The project is visually prominent, and/or contrasts with the characteristics and scenic quality of the view. • The project would result in a considerable change in the amenity of the view.
Moderate	• The project is somewhat prominent and/or is not compatible with the characteristics and scenic quality of the view. • The project would result in a noticeable change in the amenity of the view.
Low	• The project is not visually prominent and/or is compatible with the characteristics and scenic quality of the view. • The project would result in a slight change in the amenity of the view.
Negligible	• The project is not visible, is not visually prominent in the view and/or is compatible with the characteristics and scenic quality of the view. • The project would result in no perceived change in the amenity of the view.

There are some general principles regarding the relationship between the project and the landscape which determine the visual magnitude of change level. These principles, or assumptions, relate to how well transmission line infrastructure can be absorbed into the characteristics and scenic quality of views and what is considered to be more or less visually harmonious. These principles have been applied generally to the viewpoint assessment, and include:

- Distance- the greater the distance, the less prominent the infrastructure is likely to be.
- Form- Towers with less visual clutter, such as pole towers, are less visually prominent than more complex forms such as lattice towers with multiple arms, larger scale bracing structures, more groups of wires with spacers and other attachments.
- Backdrop and setting – Towers viewed against a backdrop are likely to be less visually prominent than those visible against the sky.
- Scale of land use and built form - transmission lines viewed near development of a larger scale, such as industrial buildings and mining, would contrast less than transmission lines in natural areas. Also, the presence of other existing infrastructure of a similar character (e.g. existing transmission and energy related infrastructure) can increase the compatibility of development within a view.
- Alignment and line – Simple straight lines contrast less than transmission lines that change direction and intersect.

Figure 3-8 shows examples of these principles in relation to transmission line infrastructure.

Figure 3-8 Visual magnitude of change example images

3.5.2.4 Assigning visual impact levels

An assessment of daytime visual impact from the public domain has been made by combining the visual sensitivity and magnitude of change levels identified for each representative viewpoint as part of this assessment, and assigning an impact level using the visual impact levels matrix shown in Table 3-9.

Table 3-9 Visual impact levels

		Sensitivity				
		Very high	High	Moderate	Low	Very low
Magnitude	Very high	Very high	Very high	High	Moderate-high	Moderate
	High	Very high	High	Moderate-high	Moderate	Low-moderate
	Moderate	High	Moderate-high	Moderate	Low-moderate	Low
	Low	Moderate-high	Moderate	Low-moderate	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible

3.5.3 Visual impact assessment- private dwellings

3.5.3.1 Approach to private dwelling view assessment

There is no guidance for the assessment of visual impact on views for private property that applies to energy transmission projects in NSW. However, the *Technical Supplement – Landscape and Visual Impact Assessment, Large-Scale Solar Energy Guideline* (DPE 2022) includes a two-stage process for the assessment of visual impacts on private dwellings.

The first step includes a number of tools that indicate whether a dwelling needs further detailed assessment or not, based on factors such as elevation and distance. Due to the scale of this project, and number of potential private dwellings, a similar approach has been applied to suit the scale and nature of linear transmission infrastructure, energy hubs and associated infrastructure. For this reason, not all dwellings have been assessed in detail.

The assessment of visual impact from private dwellings was undertaken in two stages, as listed below.

- **Stage 1- Preliminary visual impact screening assessment** - to identify potentially impacted private dwellings in the study area to be subject to a more detailed view assessment
- **Stage 2- Detailed view assessment** for each shortlisted dwelling-to determine impact levels of those potentially impacted private dwellings identified as requiring further detailed assessment in the Stage 1 preliminary impact screening.

This process for undertaking the stage 1 and stage 2 of the daytime private view assessment for the project is described in the following paragraphs to .

It is important to note, that simply having a view to the project does not constitute a potential visual impact. Although some of the private dwellings eliminated in stage 1 (and not carried through to the stage 2 assessment) may have a view to the project, these views are not considered to result in a material visual impact.

In this assessment those dwellings on properties, or are part of a broader land holding, that also would host the project infrastructure have been identified. This is relevant as these land holders would have a negotiated landholder agreement that would form compensation for the impacts of the project.

Figure 3-9 illustrates the two-stage process of this assessment.

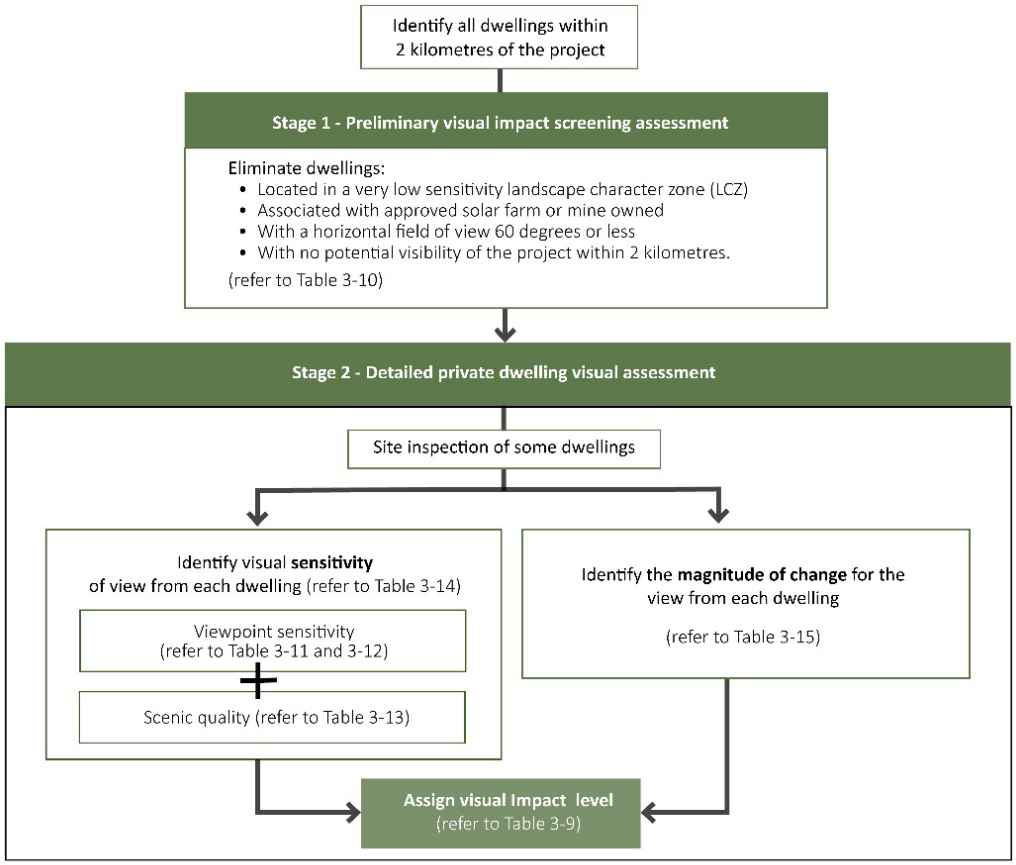


Figure 3-9 Private dwelling view assessment process

Stage 1 – Preliminary visual impact screening assessment

The preliminary view assessment is a desktop based task that seeks to eliminate those dwellings within the study area that would not experience a visual impact due to the project. The intention of the preliminary assessment is not to assign an impact, but to shortlist dwellings for a more detailed assessment (refer to Stage 2). The preliminary view assessment includes the use of a number of tools that indicate whether a dwelling needs further detailed assessment or not, based on factors such as dwelling sensitivity (land use and character) and visibility (line of sight and horizontal field of view).

The key steps of the preliminary view assessment are:

- Identify all residential dwellings within the study area (i.e. within two kilometres of the project)
- A desktop assessment to identify the screening impact criteria relevant to the project that would be used to undertake the preliminary impact screening (refer to Table 3-10)
- Undertake an impact screening for each residential dwelling within the study area. By applying the impact screening criteria, private dwellings were eliminated from requiring further detailed view assessment if one or a number of the following is identified as being of a very low level of concern/effect:
  - There is a low or no visibility of towers within two kilometres
  - The dwelling is located in a landscape with a very low scenic quality (such as Ulan Mining LCZ)
  - There is a horizontal field of view of 60 degrees or less, within two kilometres of the dwelling
  - Dwelling is associated with an approved renewable energy project (e.g. solar farm) and would not be in residential use or mine owned.

Where a dwelling has been eliminated and would not be subject to further detailed view assessment.

When identifying all dwellings within two kilometres of the project, dwellings that were inhabited and uninhabited, regardless of their ownership, were included. This included some dwellings that are derelict but could be renovated and occupied.

Table 3-10 Visual impact screening impact criteria

	Visual impact screening criteria:			
Level of concern / effect	**Land use and ownership**	**Scenic quality based on landscape character type**	**Number of towers visible***	**Horizontal field of view**
Very low (Eliminate from assessment)	Dwelling associated with approved solar farm project, industrial or mining	Landscape with very low scenic quality e.g. Ulan Mining LCZ)	No visible towers	< 60 degrees
Low	Secondary dwelling (temporary workers accommodation)	Landscape with low scenic quality e.g. Rural valley LCZ)	1-7 towers potentially visible	< 90 degrees
Moderate-low	Dwelling in residential use / primary residence	Landscape with moderate-low scenic quality e.g. Neighbourhood or locally significant landscape	8-15 towers potentially visible	< 120 degrees
Moderate	Dwelling in residential use / primary residence	Landscape with moderate scenic quality e.g. Forested Hills LCZ)	16-25 towers potentially visible	< 180 degrees
Moderate-high	Church, dwelling with state heritage listing	State or regionally significant landscape	26-35 towers potentially visible	< 240 degrees
High	View from location with National heritage listing	nationally significant or World Heritage Listed landscape	36+ towers potentially visible	240 degrees +

** Based on indicative tower locations (subject to detail design) within 2km, based on screening by landform only.*

Stage 2 – Detailed private dwelling visual assessment

A more detailed assessment has been undertaken on all of those dwellings that have not been eliminated as a part of the preliminary assessment (Stage 1).

Site inspections were undertaken of about 30 of the shortlisted dwellings. These inspections were undertaken in December of 2022 and April of 2023. Photographs from these inspections were used to inform this view assessment and some were used as a base for photomontages. Some 3D modelled images were also prepared to illustrate the view from a sample of other dwellings to provide further evidence of the assessment results.

The following section describes the assessment steps undertaken for the detailed visual assessment of each of the shortlisted private dwellings.

This assessment has been undertaken in the following steps:

- For each residential dwelling, Identify the visual sensitivity by:
  - Determining the viewpoint sensitivity (refer Table 3-11)
  - Determining the scenic quality of the view (refer Table 3-13)
  - Combining the viewpoint sensitivity and scenic quality to identify the visual sensitivity (refer Table 1-15)
- Determine the magnitude of change (refer Table 3-14).

- Combine the visual sensitivity and magnitude of change to assign a level of visual impact (refer Table 3-17).
- Identify any opportunities for mitigation of the identified impact (if moderate or higher) in accordance with the visual performance objectives (refer Table 3-18).

This approach to determining visual sensitivity, impact levels and mitigation measure approach are based on tables and assessment rating matrices contained in the *Technical Supplement – Landscape and Visual Assessment* (DPE 2022).

Figure 3-10 outlines the process of the stage 2 detailed visual assessment.

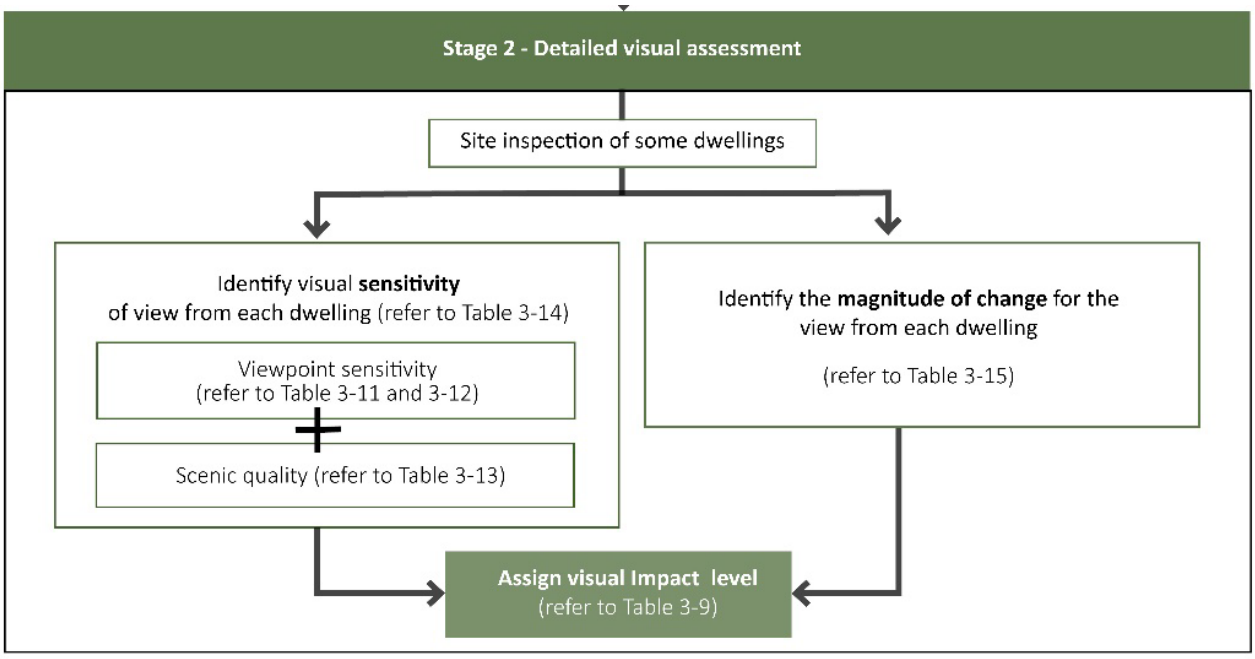


Figure 3-10 Stage 2- Detailed visual assessment process

In undertaking this detailed assessment, a sample of dwellings were visited and photographs taken to inform the assessment. Those dwellings identified for detailed inspection and photography were selected to:

- represent the potential worst-case visual impacts (from within groups of dwellings),
- include dwellings across the length of the project where possible, and
- comprise dwellings that were permanently occupied as a residence.

In addition, dwellings were selection where access to the dwellings was permitted by the landowner.

During these site visits, the layout of the dwelling was observed and noted, and the primary views from the dwelling at a location immediately adjacent to the house were identified and photographed.

Where a site visit was not undertaken, and the orientation of the dwelling is not clear from site observations and aerial photography, it is assumed the view towards the project would be a primary view.

These photographs are presented in the detailed assessment, some were used as a base for photomontages to support the assessment. In addition, 3D modelled images were prepared to illustrate the view from a sample of other dwellings to provide further evidence of the assessment results.

Table 3-11 Residential viewpoint sensitivty levels (Technical Supplement, DPE, 2022)

Viewpoint type	Very low viewpoint sensitivity	Low viewpoint sensitivity	Moderate viewpoint sensitivity	High viewpoint sensitivity
Residential	No place of residence present	Secondary view from dwellings in rural areas (zoned RU1, RU2, RU3, RU4, and RU6), large lot residential areas (zoned R5) and in environmental or conservation areas (zoned C2, C3, and C4)	Primary view from dwellings in rural areas (zoned RU1, RU2, RU3, RU4, and RU6), large lot residential areas (zoned R5) and in environmental or conservation areas (zoned C2, C3, and C4)	Dwellings in residential areas and rural villages (land zoned R1, R2, R3, R4 and RU5)

Table 3-12 Primary and secondary viewpoints from rural dwellings (Technical Supplement, DPE, 2022)

Primary viewpoint	Secondary viewpoint
Principal/frequented living spaces (e.g., living rooms, kitchens, dining areas)	Less frequented living and service areas (e.g., bedrooms, laundries, bathrooms, garages, studies)
Front and rear views from a dwelling, particularly from any porch, balcony, veranda, deck or patio	Side views from a dwelling

Table 3-13 Scenic quality levels

Scenic quality level	Description
Low scenic quality	Landscape character includes features (landform, vegetation, waterbodies, social/cultural, human presence) which have scenic quality values of predominantly low scenic quality (refer to Table 1-14). These landscapes have a high inherent capability to absorb changes from the project.
Moderate scenic quality	Landscape features (landform, vegetation, waterbodies, social/cultural, human presence) are predominantly of moderate scenic quality (refer to Table 1-14). These landscapes have a moderate inherent capability to absorb changes from the project.
High scenic quality	Landscape features (landform, vegetation, waterbodies, social/cultural, human presence) are predominantly of high scenic quality (refer to Table 1-14). These landscapes have a low inherent capability to absorb changes from the project.

A visual reference for scenic quality is provided in the DPE Technical Supplement – Landscape and Visual Impact Assessment, Large-Scale Solar Energy Guideline. (Refer to Figure 3-11).

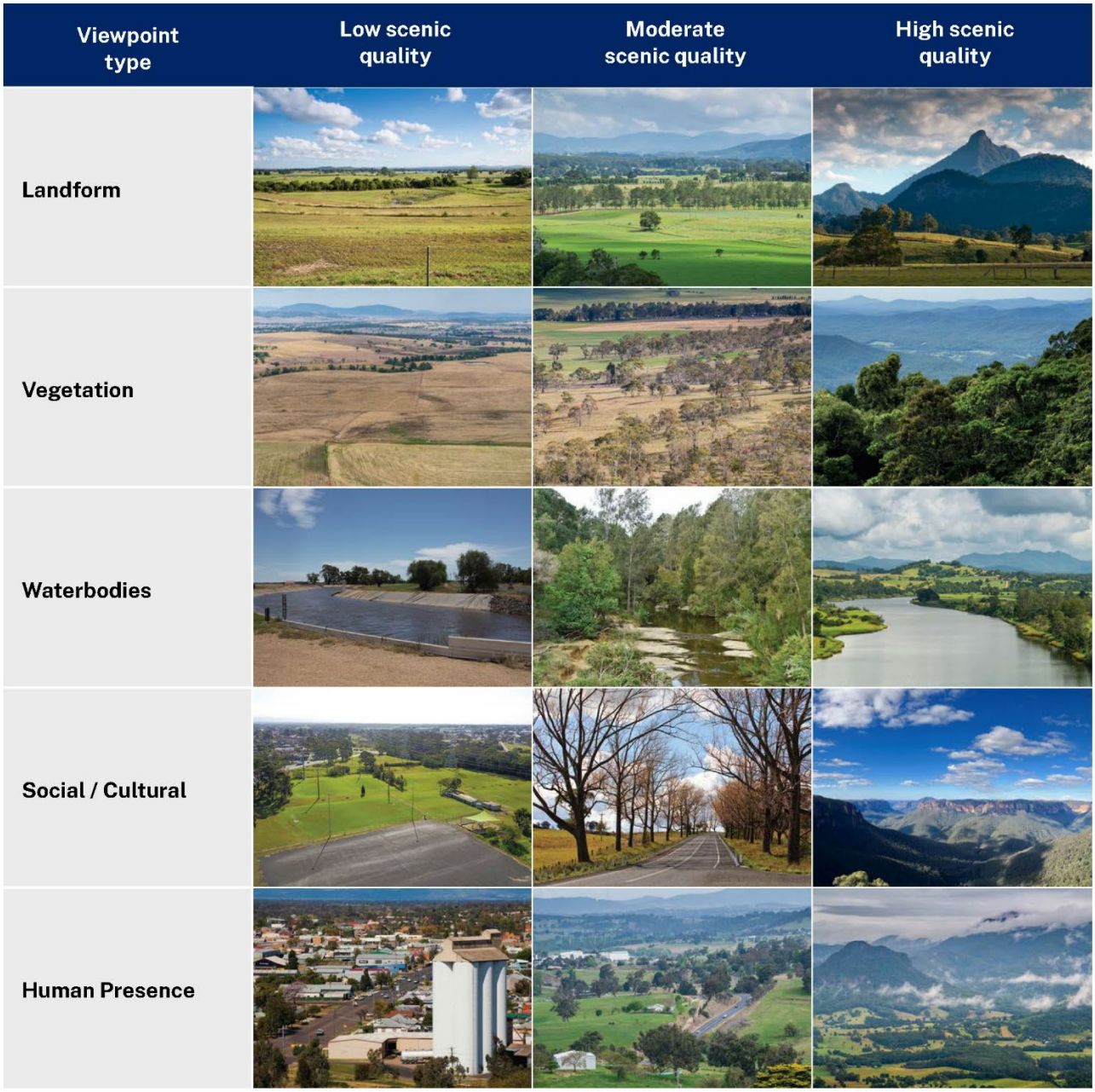


Figure 3-11 Visual reference for Scenic Quality (Source: DPE Large Scale Solar Energy Guideline)

Table 3-14 Frame of reference for scenic quaity values (Technical Supplement, DPE, 2022)

	Low scenic quality	Moderate scenic quality	High scenic quality
Landform	Large expanses of flat or gently undulating terrain. Indistinct, dissected or unbroken landforms that provide little illusion of spatial definition or landmarks with which to orient.	Steep, hilly and undulating ranges that are not visually dominant Broad shallow valleys Moderately deep gorges or moderately steep valley walls Minor rock outcrops	Isolated peaks, steep rocky ridges, cones or escarpments with distinctive form and/or colour contrast that become focal points Large areas of distinctive rock outcrops or boulders Well defined, steep sided valley gorges
Vegetation	Extensively cleared and cropped areas with very limited variation in colour and texture Pastoral areas, human created paddocks, pastures or grasslands and associated buildings typical of grazing lands	Predominantly open forest or woodland combined with some natural openings in patterns that offer some visual relief Vegetative stands that exhibit a range of size, form, colour, texture and spacing including human influenced vegetation such as vineyards, and orchards	Strongly defined patterns with combinations of native forest, naturally appearing openings, streamside vegetation and/or scattered exotics Distinctive stands of vegetation that may create unusual forms, colours or textures in comparison to surrounding vegetation
Waterbodies	Absence of natural waterbody Farm dams, irrigation canals or stormwater infrastructure	Intermittent streams, lakes, rivers, swamps and reservoirs	Visually prominent lakes, reservoirs, rivers, streams, wetlands and swamps Presence of harbour, inlet, bay or open ocean
Social / cultural	Places of worship, cemeteries/memorial parks, private open spaces	Local heritage sites Distinguishable entry ways to a regional city identified in the Transport and Infrastructure SEPP	Culturally important sites, world heritage areas, national parks/reserves Commonwealth and state heritage sites
Human presence	Dominating presence of infrastructure, human settlements, highly modified landscapes and higher density populations such as regional cities, industrial areas, agricultural transport or electricity infrastructure	Dispersed yet evident presence of human settlement such as villages, small towns, isolated pockets of production and industry, lower scale and trafficked transport infrastructure	Natural/undisturbed landscape Minimal evidence of human presence and production

Higher magnitude of change

Lower magnitude of change

Distance

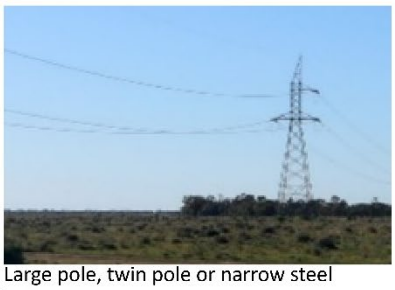
Foreground

Middleground

Background

Form

Tall and wide steel lattice



Large pole, twin pole or narrow steel lattice

Small local pole

Backdrop and setting

Viewed against the sky

Partly viewed against background

Viewed against hills

Scale of land use / built form

Small scale development

Moderate scale development

Large scale and / or highly modified

Alignment / line

Intersecting

Transmission towers and overhead wires extending away from viewer

Cables extending across the view

Figure 3-12 Visual magnitude of change example images

Table 3-15 Visual sensitivity matrix (Technical Supplement, DPE, 2022)

	High scenic quality	Moderate scenic quality	Low scenic quality
High viewpoint sensitivity	High	High	Moderate
Moderate viewpoint sensitivity	High	Moderate	Moderate
Low viewpoint sensitivity	Moderate	Low	Low
Very low viewpoint sensitivity	Low	Very low	Very low

Table 3-16 Visual magnitude of change levels

Visual magnitude	Description
High	• The view is altered such that the project visually dominates and transforms the character of the view. • The project would result in a substantial change in the amenity of the view.
Moderate-High	• The project is visually prominent, and/or contrasts with the character of the view. • The project would result in a considerable change in the amenity of the view.
Moderate	• The project is somewhat prominent and/or is not compatible with the character of the view. • The project would result in a noticeable change in the amenity of the view.
Low	• The project is not visually prominent and/or is visually compatible with the character of the view. • The project would result in a slight change in the amenity of the view.
Negligible	• The project is not visible, is not visually prominent in the view and/or is compatible with the character of the view. • The project would result in no perceived change in the amenity of the view.

Table 3-17 Visual impact levels (based on Technical Supplement, DPE, 2022)

	High visual sensitivity	Moderate visual sensitivity	Low visual sensitivity	Very low visual sensitivity
High magnitude	High	High	Moderate	Moderate
Moderate-high magnitude	High	Moderate	Moderate	Low
Moderate magnitude	Moderate	Moderate	Low	Low
Low magnitude	Moderate	Low	Low	Very low

Table 3-18 Visual performance objectives (Technical Supplement, DPE, 2022)

Impact level	Visual performance objective
High visual impact	This level of impact should be avoided unless the applicant can justify that: – All reasonable efforts have been made to avoid the impact and alternative project designs are not feasible or would be unlikely to materially reduce the impact – All reasonable mitigation options have been considered – The proposed mitigation measures would effectively mitigate the impact and would not result in a significant obstruction of views – The project site is strategically important because of its location – The project is in the public interest.
Moderate visual impact	Visual impact mitigation is required in consultation with the affected landowner and should be proportionate to the scale of the impact. There is no expectation this mitigation should eliminate the view of the development entirely but must reduce the impact to an acceptable level. Appropriate mitigation options include vegetation screening or project landscaping to reduce impacts. If available mitigation options would not be effective in reducing impacts or are unsuitable due to the nature of the impact (e.g. screening would result in the obstruction of views), then project redesign and/or impact agreements should be considered.
Low and very low visual impact	No mitigation is required.

3.5.3.2 Visual impacts during construction

A general discussion of the potential visibility of the project during construction has been included. This discussion identifies those dwellings that may have a view to construction of the project and is based on the findings of the private dwelling assessment.

3.5.3.3 Visual impacts at night

A general discussion of the potential visibility of the project at night has been included. This discussion identifies those dwellings that may experience a view to areas of the project that would be lit at night during construction and operation. This is based on the on the findings of the private dwelling assessment and night-time landscape character assessment.

3.6 Mitigation and management measures

Where a visual impact has been identified as a result of the project, methods for minimising and managing these impacts have been considered and specific mitigation approaches recommended, where required. These mitigation and management measures address both construction and operational impacts identified for landscape character and visual impacts from the public domain.

For private dwellings, opportunities for mitigation will be proposed in accordance with the visual performance objectives (refer Table 3-18). Any opportunities to provide vegetation that could potentially screening of the project to minimise the visual impact on views from private dwellings, would be further refined in consultation with landowners during the detailed design stage of the project.

3.7 Cumulative landscape character and visual impacts

An assessment of cumulative landscape character and visual impact is contained in a separate technical assessment (Appendix E) of the EIS. This assessment has been informed by the analysis and assessment undertaken for this technical paper.

3.8 Photomontages and 3D modelled views

Photomontages are photorealistic images intended to illustrate the size and scale of the project and aim to accurately represent the project according to the design detail available. Photomontages are created using a combination of 3D modelling and photo editing techniques.

Photomontages have been prepared for some of the representative public domain views to illustrate the expected changes in these views. For public domain locations, photomontages have been prepared using photographs with a 50mm focal length. This dimension has similar spatial relationships to what can be seen with the human eye but is cropped so the wider view is not captured. This approach is generally accepted as the best practice approach to the preparation of photomontages. These photomontages have been prepared generally in accordance with the Technical Guidance Note (06/19) Visual Representation of development proposals, prepared by the Landscape Institute, UK (2019).

Photomontages have also been prepared for some private dwellings as a part of the Stage 2 detailed view assessment of potential visual impacts at private dwellings, where access and permission to take photographs was granted by the landowner.

These private dwelling photomontages have been prepared in accordance with the most recent guidance contained in the Large-Scale Solar Energy Guideline, Technical Supplement (DPE, 2022). These guidelines require photographs to be taken with the camera turned vertically, at increments to capture 180 degrees. While this approach distorts the scale of the transmission towers in some areas of the panorama, it allows for the greater context of the view to be illustrated.

The process used to prepare photomontages was as follows:

- photographs were taken of the site and the GPS coordinates noted
- a 3D model was created by combining the terrain and some surface elements using LiDAR point cloud data
- the project elements were modelled in 3D and located within the model
- the camera location was positioned in the model and the camera specifications set in the model
- the digital elevation model was used to align the view
- the project elements are rendered and imported into a photo editing software
- these modelled views are then edited to locate the project within the image including removing vegetation.

The photomontages used in this assessment illustrate the potential impacts of the project during operation. For public domain views, the viewpoints used to create these photomontages were chosen to represent a range of viewing locations, from a distance and orientation where the project would be most visible. The photomontage locations were also chosen to illustrate views from areas with the greatest visual sensitivity and where the greatest number of viewers would be located.

For private dwelling views, photomontages were prepared where it was determined that it would assist in representing the visual impacts of the project.

3D modelled views have been prepared for some dwellings to provide further illustrations to support the visual impact assessment. These 3D modelled images do not have a base image but rely on a 3D model created using high quality LiDAR point cloud data available for this project. These 3D modelled images include show the existing landform created from the point cloud data, existing vegetation represented by the point cloud, and a 3D model of the project. While these 3D

modelled views are not photorealistic, they accurately show the location and scale of the project and are useful for illustrating visibility.

The photomontages used in this assessment illustrate the potential impacts of the project during operation. The 3D model has been prepared based on indicative designs for all operational infrastructure including the transmission towers, switching stations, substations, synchronous condensers, BESS etc. Refer to Figure 3-13 for an illustration of the indicative tower models which have been used.

500kV double circuit lattice tower (72m) | 500kV double circuit lattice tower (63m) | 330kV single circuit lattice tower (54m) | 330kV single circuit lattice tower (45m) | 330kV double circuit pole (52m)

Figure 3-13 3D modelled tower designs

3.9 Limitations

This assessment has been undertaken with the following limitations:

- Field work was undertaken during the day and the night time assessment has been made from daytime observations
- The assessment of private dwellings is informed by site inspections from a sample of dwellings, those dwellings not visited have been assessed with consideration of available desktop data, aerial photography and observations from nearby dwellings and roads where possible.
- The project design is subject to detail design. Assumptions have been made as to tower designs and locations. Similarly, the detailed layout of infrastructure at the switching stations and energy hubs (including the maintenance facility) is based on assumptions relating to the likely layout and scale of the components.
- Project construction planning would be undertaken by the project construction contractor at a later stage. For this assessment, assumptions have been made as to the scale and types of activities and infrastructure that would be required at the workforce accommodation camps and construction compounds.
- The extent and details of project lighting, required during construction and operation, is not yet defined and is subject to detail design. Assumptions have been made as to the type and extent of lighting required.

Where uncertainty exists the assessment considers a worst-case scenario where possible.

It is noted that at the time of finalising the LCVIA assessment, and following fieldwork, it became known there was a newly constructed dwelling at 121 Cliffdale Road, Uarbry, that is in proximity to the construction area. As this dwelling was constructed after fieldwork had been completed and identified in the final stages of the report preparation, it has not been included. To address this issue a visual impact assessment will be carried out for this dwelling and the results presented in the response to submissions report. At this time a search will be conducted to confirm if any there are any newly approved DA's for dwellings in the study area that also need to be included in the assessment.

Chapter 4: Existing environment

4.1 Topography, vegetation and land use

The project traverses a landscape containing varied topography and vegetation cover. The landform in the southern and central part of the project includes flat to gently undulating landform, where the study area is formed by river valleys and creeks such as the Talbragar River. To the south of Cassilis, the landscape is more undulating, defined by the rural hills and valleys along the Munmurra River.

The north eastern part of the project is located in the foothills of the Great Dividing Range, including rolling hills and valleys between Cassilis and Coolah. This rural area is bordered by steep forested hills associated with the Liverpool and Warrumbungle Ranges to the east, and Mount Hope and Terraban Gap to the west.

Further to the south and west, the project passes through steeper landform, with large tracts of native bushland near Ulan and Merotherie. Goulburn River National Park and Munghorn Gap Nature Reserve as well as Barneys Reef are important landscape features contributing to the scenic quality of this area. West of Barneys Reef, the landscape comprises a mixture of gently undulating rural hills and valleys around Birriwa and Sandy Creek, divided by sections of forested hills at Tuckland and Spring Ridge.

The landscape and visual study area is sparsely settled, with scattered rural dwellings and several small towns, such as Wollar, Ulan and Cassilis. The larger towns of Dunedoo and the historic Gulgong are located beyond the landscape and visual study area. There are some heritage items within the landscape and visual study area, including homesteads such as Wandoona Homestead south of Wollar and Avondale homestead at Dapper.

Land uses within the landscape and visual study area includes extensive areas of agricultural land used for crops and grazing pastures. These rural areas are largely cleared of vegetation, with remnant trees located along roads, and river and creek valleys. These rural uses contrast with the areas of native bushland within the study area, including National Parks, State Forests and conservation areas such as Goulburn River National Park, Durridgere State Conservation Areas and Tuckland and Cope State Forests. There are also extensive areas of surface and underground coal mining activity in the vicinity of Ulan.

Other land uses that would be in proximity to the project include renewable power generation projects (approved and under consideration by NSW DPE) such as Wollar Solar Farm, which has recently commenced construction. Other proposed (approved) renewable energy generation and storage projects near the project include Liverpool Range Wind Farm extending between Ulan, Cassilis and the Liverpool Range, and Stubbo Solar Farm to the north of Gulgong.

Appendix A shows the location of the project with an aerial image that shows the roads, towns, vegetation cover and protected areas such as national parks and state forests. Appendix B shows the topography of the site.

4.2 Landscape character and visual sensitivity of the study area

The landscape character and visual sensitivity of the landscape and visual study area is influenced by scenic, historic and recreational sites. For example, the location of a view on a tourist route or lookout would increase its sensitivity due to the greater number of likely viewers and the greater emphasis that travellers, tourists and recreational users have on appreciating the landscape and views.

Localities identified as likely to have an elevated landscape character and visual sensitivity within and near the landscape and visual study area are:

- Conservation and recreational landscapes such as Goulburn River National Park and Munghorn Gap Nature Reserve
- Local highpoints offering views, such as Coolah Valley lookout
- Small rural towns, such as Ulan, Wollar and Cassilis
- Places with historic character such as Laheys Creek Cemetery along Spring Ridge Road and Wandoona Homestead south of Wollar.

Chapter 5: Landscape character assessment

The following landscape character assessment begins by identifying the landscape character of the study area (refer to section 5.1). It then identifies the landscape character impacts of the project during the day (refer to section 5.2) and at night (refer to section 5.3).

5.1 Landscape character types and zones

Four broad landscape character types have been identified across the landscape and visual study area for the purposes of this assessment. These landscape character types are based on similar topography, vegetation type and cover, land use and built form. Within these four landscape character types, there are zones which have their own local landscape character, referred to as landscape character zones. The location of these landscape character types and zones relative to the project is shown in Appendix C.

These landscape character types, and zones, are:

- Rural valley landscape character type
  - Wollar rural valley landscape character zone (RV-1)
  - Cumbo rural valley landscape character zone (RV-2)
  - Talbragar River rural valley landscape character zone (RV-3)
  - Munmurra River rural valley landscape character zone (RV-4)
- Forested hills landscape character type:
  - Wollar forested hills landscape character zone (FH-1)
  - Durridgere, Goulburn River and Munghorn Gap forested hills landscape character zone (FH-2)
  - Terraban Gap forested hills landscape character zone (FH-3)
  - Barneys Reef forested hills landscape character zone (FH-4)
  - Spring Ridge and Tuckland forested hills landscape character zone (FH-5)
- Mining landscape character type
  - Ulan mining landscape character zone (M-1)
- Undulating rural hills landscape character type
  - Narragamba to Blue Springs undulating rural hills landscape character zone (URH-1)
  - Birriwa to Tallawang undulating rural hills landscape character zone (URH-2)
  - Uarbry undulating rural hills landscape character zone (URH-3)
  - Tongy undulating rural hills landscape character zone (URH-4)
  - Cassilis to Coolah undulating rural hills landscape character zone (URH-5)
  - Dapper and Elong Elong undulating rural hills landscape character zone (URH-6).

Section 5.3.1 to 5.3.4 includes a description of the existing conditions and sensitivity of each landscape character type, as well as the magnitude of change expected because of the project, and assigns an impact level.

5.2 Landscape character assessment

5.2.1 Rural valley landscape character type

Existing landscape character: The rural valley landscape character type is defined by the creek and river valleys within the landscape and visual study area, and adjacent land which generally consists of wide flat areas of agricultural uses, including arable farmland and some areas of grazing pastures. Although the landform varies between each character zone, it is generally low-lying and flat to gently undulating, including rural plains, which have been cleared for agriculture. Whilst it is mostly a cleared rural landscape, there are scattered trees generally to the edges of arable fields and within pasture fields, along watercourses, road corridors, and at steeper locations where the land is less suited to agricultural use.

It is a settled landscape, containing a network of rural roads, homesteads and cottages on rural properties. Other infrastructure in this zone includes rural structures such as sheds, yards and workshops, supporting the surrounding agricultural uses. Existing electricity transmission infrastructure present within this landscape include the Wollar to Mount Piper 500 kV and Wellington to Wollar 330 kV transmission lines, and an existing substation south of Wollar.

Refer to Figure 5-1 for character images of the Rural valley landscape character type. This landscape character type occurs in four locations along the project (refer to Appendix C: Landscape character plans):

- The Wollar rural valley landscape character zone (RV-1) which is located south of Wollar, including the Wollar, Barigan and Springs Flat Creek valleys. This rural valley is visually contained by the surrounding north south aligned forested ridges and hills, including the Razorback Ridge to the east, and Munghorn Gap Nature Reserve to the west. Existing built features in this zone include the existing Wollar substation and Transgrid Transmission Line 5A5 (Wollar to Mount Piper) transmission lines.
- The Cumbo rural valley landscape character zone (RV-2) which is located to the west of Wollar, including the Cumbo Creek valley, and includes a mixture of rural uses and areas of revegetation, as part of the enhancement and conservation areas of nearby Wilpinjong Coal Mine. Existing built features in this zone include the Transgrid Transmission Line 5A5 (Wollar to Mount Piper) transmission lines.
- The Talbragar River rural valley landscape character zone (RV-3) which is located in the central part of the project, following the Talbragar River and associated tributaries such as Cockabutta, Mona and Salty creeks. The valley contains large areas of flat grazing pastures and dryland crops, with occasional rocky outcrops and small hills such as Cockabutta Hill. This zone contains few built features other than roads, rural dwellings and farm related structures.
- The Munmurra River rural valley landscape character zone (RV-4) which is located south of Cassilis, south of the Golden Highway. The river has wide bends, meandering through an undulating valley, and is visually enclosed by the surrounding ridges and hills. Existing built features in this zone include the Golden Highway.

Potential landscape future character: The Wollar rural valley landscape character zone (RV-1) will continue to change to include the approved Wollar solar farm development, south of Wollar. This project was under construction during the preparation of this assessment and will include solar panel arrays, inverters, battery storage facilities, a substation, and associated operations and maintenance facility buildings.

Refer to Figure 5-1 for character images of the Rural valley landscape.

Figure 5-1 Rural valley landscape character type – character images

5.2.2 Forested hills landscape character type

Existing landscape character: The forested hills landscape character type is undulating, consisting of hilly ridges and escarpments rising above the surrounding rural valleys. It is an elevated landscape, with heights of 644 metres Australian Height Datum (AHD) at Barneys Reef and 589 metres AHD in the southern part of Goulburn River National Park. The uniting feature of this landscape is the concentration of native bushland. There are also patches of native cypress pine forest and managed pine plantations, which are clearly visible and different from nearby tracts of native bushland and areas of farmland, such as the Tuckland State Forest.

This landscape character type is located north of Munghorn Gap Nature Reserve and includes large areas of rugged sandstone plateau and includes part of Goulburn River National Park. Generally, the vegetation in this zone consists of native bushland, dominated by eucalyptus species. The main recreational features of Goulburn River National Park, including camping and picnic sites, walking tracks and lookouts that provide scenic views over the surrounding area such as Lees Pinch lookout track, are located to the north east of Wollar, outside of the study area of this technical paper.

There has been a long history of mining activity near the town of Ulan, including both underground and open cut coal mining operations within Ulan, Moolarben and Wilpinjong coal mine holdings, to the south and west of the Goulburn River National Park. There are also existing transmission line easements connecting to the mines, and crossing the lower ridgelines within this landscape, including the steel lattice 330 kV transmission lines extending east-west between the existing Wollar substation and Wellington, and the 500 kV Wollar to Mount Piper transmission lines.

Refer to Figure 5-2 for character images of the forested hills landscape.

This landscape character type occurs in five locations along the project (refer to Appendix C:Landscape character plans):

- The Wollar forested hills landscape character zone (FH-1) which is located south of Wollar, including the ridges and hills enclosing the Wollar Rural Valley landscape character zone. The forest and steep landform are unique features in this landscape that provide interest and scenic value.
- The Durridgere, Goulburn River and Munghorn Gap forested hills landscape character zone (FH-2) which is located in the eastern part of the project, including the forest areas in Durridgere State Conservation Area and Goulburn River National Park.
- The Terraban Gap forested hills landscape character zone (FH-3) which is located in the north eastern part of the project, north of the Golden Highway and south of Coolah, including dense areas of forest and steep terrain.
- The Barneys Reef forested hills landscape character zone (FH-4) which is located in the central part of the project. Barneys Reef has a distinctive landform, rising abruptly from the surrounding rural area and covered by forest. While not a protected area or reserve, Barneys Reef is zoned C3 Environmental Management in the Mid-Western Regional LEP 2012.
- The Spring Ridge and Tuckland forested hills landscape character zone (FH-5) which is located in the western part of the project and incorporating the forested areas between Tucklan Road and Spring Ridge Road, including Tuckland State Forest.

Potential future landscape character: This landscape character type will include renewable energy development with the approved Wollar Solar Farm in the Wollar forested hills landscape character zone (FH-1). This project will introduce new large-scale built elements such as solar panel arrays or wind turbines, inverters, battery storage facilities, substations, operations and maintenance facility buildings into the landscape, transforming the character of this area somewhat.

Refer to Figure 5-2 for character images of the Forested hills landscape.

Figure 5-2 Forested Hills landscape character type – character images

5.2.3 Mining landscape character type

Existing landscape character: This landscape is characterised by underground and surface coal mining activities between Wollar and Ulan, including Ulan, Moolarben and Wilpinjong coal mines. This landscape character type occurs in one location along the project, Ulan Mining landscape character zone (M-1), located between Wollar and Ulan (refer to Appendix C:Landscape character plans).

The landform in this zone has been highly modified, due to the long history of mining activity, including extensive benches and embankments surrounding the mines. The zone includes large-scale mining infrastructure such as excavating equipment, conveyors, water storage tanks and concrete batching plants. There is also existing electricity infrastructure in this zone, including the Transgrid Wellington to Wollar 330 kV transmission lines (Transmission Line 79) and several transmission lines extending to the Ulan coal handling and processing plant. A rail line is located to the south of Ulan-Wollar Road, with trains regularly seen transporting coal between the mines and processing plant. Although this zone is largely treeless, there are areas of vegetation at varying stages of growth, in the mine restoration and revegetation zones.

Refer to Figure 5-3 for character images of the Ulan mining landscape.

Figure 5-3 Ulan mining landscape character type – character images

5.2.4 Undulating rural hills landscape character type

Existing landscape character: This landscape consists of the low rolling hills which rise above the surrounding low-lying rural valleys. It is an elevated and gently undulating landscape, which has mostly been cleared for agricultural use, predominantly pastoral grazing, creating an open, rural landscape character. In northern parts of this landscape, the land use is more varied, including some areas of arable farmland in flatter areas nearing Coolah. Vegetation is generally limited to road verges, fence lines, scattered within fields and within steeper areas such as hillsides and deep valleys. It is a settled landscape, with rural residences scattered on some of the low hills and flatters areas, offering views across the surrounding landscape. Cassilis is a small historic town in this landscape, located in the north eastern part of the project, beside the Munmurra River. Refer to Figure 5-4 for character images of the Undulating rural hills landscape. There are few existing transmission line easements crossing this landscape, including the 66 kV transmission lines extending south and southeast of Dunedoo.

This landscape character type occurs in six locations along the project (refer to Appendix C:Landscape character plans):

- The Narragamba to Blue Springs undulating rural hills landscape character zone (URH-1) which is located in the southern part of the project, alongside Blue Springs Road. This zone is characterised by flat to gently undulating grazing and dry land cropping areas with scattered dams, creeks and rural dwellings. Built features in this zone include the existing Transgrid Transmission Line 5A5 (Wollar to Mount Piper) transmission lines. The approved Stubbo solar farm will influence the character of this zone in the future, located adjacent to the project, west of Blue Springs Road.
- The Birriwa to Tallawang undulating rural hills landscape character zone (URH-2) which is located in the central part of the project, including the mixed farmland area surrounding Barneys Reef. This zone is characterised by grazing and dry land cropping areas with scattered dams, creeks and rural dwellings. Built features in this zone include the Castlereagh Highway, local existing transmission lines and the Gwabegar branch of the Main Western railway line.
- The Uarbry undulating rural hills landscape character zone (URH-3) which is located in the central part of the project, north of the Talbragar River, including Uarbry Pinnacle. This zone is characterised by grazing and dry land cropping areas with scattered rural dwellings, dams and creeks such as Moreton Bay and Cainbil creeks. Built features in this zone include the Golden Highway and local existing transmission lines.
- The Tongy undulating rural hills landscape character zone (URH-4) which is located in the north eastern part of the project, north of Moorefield Road, along the western side of Talbragar River valley west of Cassilis, including the upper reaches of Cainbil Creek. This zone is characterised by remote, undulating grazing areas with few built features other than scattered rural dwellings, farm related structures and dams.
- The Cassilis to Coolah undulating rural hills landscape character zone (URH-5) which is located in the north eastern part of the project, between the Talbragar and Munmurra river valleys, west and north west of Cassilis. This zone is characterised by remote, grazing and cropping areas with steep terrain and few built features other than scattered rural dwellings, farm related structures and dams.
- The Dapper and Elong Elong undulating rural hills landscape character zone (URH-6) which is located in the western part of the project, between Mount Dapper and Cobra Hill. This zone is characterised by remote, flat to undulating grazing and cropping areas along the Sandy and Spring creek valleys, containing few built features other than scattered rural dwellings, farm related structures and dams.

Potential future landscape character: The approved Liverpool Range wind farm will strongly influence the character of the Cassilis to Coolah undulating rural hills landscape character zone (URH-5) in the future. It would be located on the hilltops and ridgelines extending north and northwest of Cassilis towards the Liverpool Range. Including new large-scale wind turbines, and supporting infrastructure such as inverters, battery storage facilities, substations, and facility buildings into the landscape.

Refer to Figure 5-4 for character images of the Undulating rural hills landscape.

Figure 5-4 Undulating rural hills landscape character type – character images

5.3 Assessment of daytime landscape character

The following assessment of potential daytime landscape character impacts was undertaken by combining the identified landscape character sensitivity of each landscape character type (and zone where relevant) with the magnitude of change to determine a landscape character impact level. Figure 5-5 illustrates this process.

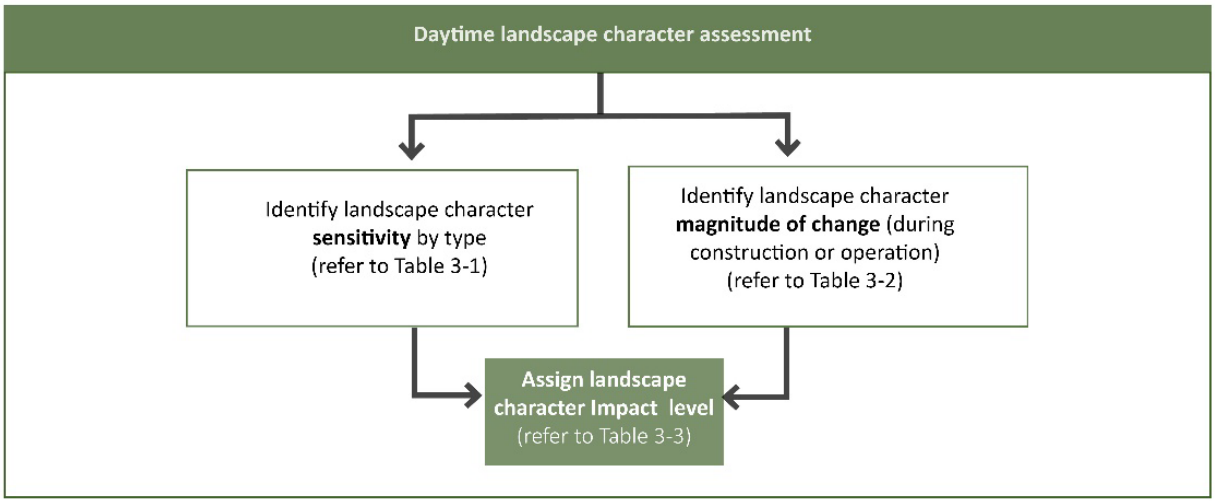


Figure 5-5 Daytime landscape character assessment approach

5.3.1 Rural valley landscape character type

Landscape character sensitivity: This rural landscape would be appreciated by small numbers of people travelling along the network of rural roads, including mainly local residents and their visitors, as well as some tourists visiting and passing through the area. This is a regionally common landscape and includes features such as gentle landforms, modified watercourses, local heritage places and lower scale transport infrastructure. There are existing transmission lines and approved renewable energy projects in some areas. Overall, this landscape character type, and landscape character zones, has a low landscape sensitivity.

Landscape character impact during construction: All trees and other vegetation within the construction area may be removed or trimmed to allow for construction of the project. This would include vegetation within the easement, at each transmission line tower site, for construction access tracks and the brake and winch sites. Noting that the vegetation clearing strategy for the project would be seeking to minimise and avoid clearing of native vegetation where feasible.

There would be a large construction site at the new Wollar switching station, located in the Wollar rural valley landscape character zone (RV-1). Large-scale 500 kV and 330 kV steel lattice transmission line towers would be introduced into this landscape type as part of the project, following the existing towers in some locations and introducing new infrastructure into other areas which currently don't host transmission infrastructure. As the landform of this landscape type is predominantly flat, there would only be small and localised modifications to the terrain.

Existing access roads would be used where possible to avoid further disruption to the circulation and rural function (e.g. livestock grazing and cropping), and vehicular access and movement.

Overall, during construction, the character of these landscape character zones zone would be temporarily altered with the presence of construction activity along the transmission line easement as well as vehicles transporting materials and equipment within the surrounding areas.

In the Wollar rural valley landscape character zone (RV-1), the project would introduce extensive construction activity, particularly associated with the new Wollar switching station and construction of the new twin double circuit 500 kV

transmission lines alongside the existing Transgrid 330 kV transmission line easement (Line 79). There would be a construction compound in this location including staging and laydown areas, concrete batching plant and cement silo, maintenance sheds, staff facilities, and a helipad with occasional helicopter activity. Overall, this would result in a moderate magnitude of change and a **low-moderate landscape character impact** during construction.

Similarly, in the Cumbo (RV-2) rural valley landscape character zone, the construction of the new twin double circuit 500 kV transmission alongside the existing 330 kV transmission line easement, would result in a scale of construction works that would result in a moderate magnitude of change and a **low-moderate landscape character impact** during construction.

In the Talbragar River (RV-3) and Munmurra River (RV-4) rural valley landscape character zones, the project would introduce large-scale construction activity which would contrast more notably with this more remote rural landscape, with works including the construction of several new transmission line easements with large-scale towers, within landscapes not currently containing large-scale electricity infrastructure. Establishment of the Neeleys Lane workforce accommodation camp at Ulan Road, Cassilis would also contrast with the rural character of the Munmurra River (RV-4) rural valley landscape character zone. This would result in a high magnitude of change to these landscapes, and a **moderate landscape character impact** during construction.

Landscape character impact during operation: In this landscape character type the predominantly agricultural land uses would continue under the new transmission lines and around the transmission line towers within the easement. While there would be some access tracks maintained for access during operation, all other areas impacted by construction, outside the tower sites would be stabilised and rehabilitated to a standard as close as practicable to the pre-existing conditions and/or as agreed with the landowner.

In the Wollar (RV-1) and Cumbo (RV-2) rural valley landscape character zones, the new twin double circuit 500 kV transmission line would follow the existing 330 kV transmission line easement, the new Wollar switching and approved Wollar Solar Farm would be located near to an existing substation, reducing the contrast of the project with the character of these areas somewhat. However, overall, the presence of new twin double circuit 500 kV transmission lines and additional infrastructure at the new Wollar Switching Station would alter the prevailing character of these rural landscapes, resulting in a moderate magnitude of change and a **low-moderate landscape character impact** during operation.

During operation, the Neeleys Lane workforce accommodation camp at Ulan Road would have been removed from the Munmurra River (RV-4) rural valley landscape character zone. In the Talbragar River (RV-3) and Munmurra River (RV-4) rural valley landscape character zones, the project would be a new feature, introducing large-scale transmission towers into these rural valley landscapes. The transmission lines would cross the Talbragar River and several creeks, roads, and across rural properties. The character of these rural valleys is scenic, contributing to the landscape setting of towns such as Cassilis. Overall, there would be a high magnitude of change and a **moderate landscape character impact** in these landscape character zones during operation.

5.3.2 Forested hills landscape character type

Landscape character sensitivity: This landscape character type includes extensive areas of native bushland. This landscape would generally be appreciated by small numbers of people travelling along roads and trails accessible to the public, including tourists and visitors to the area. The forested hills are a regionally common landscape and includes features such as gentle landforms, modified watercourses, and local heritage places and lower scale transport infrastructure. There are existing transmission lines and approved renewable energy projects in some areas. Landscape features with regionally important scenic value include locally distinctive landform features, hilly and undulating ranges, native bushland, and a lower presence of human settlement. Overall, this landscape character type, and landscape character zones, have a **moderate landscape character sensitivity**.

Landscape character impact during construction: In the Wollar (FH-1) landscape character zone, the project would be located beside the existing Wellington to Wollar 330 kV transmission line easement (Transmission Line 79). In the Durridgere, Goulburn River and Munghorn Gap landscape character zone (FH-2), the project would be collocated with the

existing 330 kV easement where possible, with the exception of an area of bushland south west of Ulan, between Blue Springs Road and Cliffdale Road, and west to Birkalla Road, where the removal of vegetation would be noticeable through a newly formed transmission line easement.

In the Terraban Gap forested hills landscape character zone (FH-3), the project would extend through an area of bushland between the Golden Highway and Moorefield Road, requiring the removal of vegetation within a newly formed transmission line easement. In the western part of this character zone, a new switching station would be constructed, which would be set back from the road, behind a partially forested area.

In the Barneys Reef forested hills landscape character zone (FH-4), a new easement to accommodate new 330 kV transmission line infrastructure for the (proposed) Tallawang Solar Farm and Barneys Reef Wind Farm would extend south of the Merotherie Energy Hub through elevated parts of this character zone, requiring removal of vegetation within the easement as well as the brake and winch site south of the hub.

In the Spring Ridge and Tuckland forested hills landscape character zone (FH-5), the project would extend through an area of bushland between Tucklan Road and Spring Ridge Road, requiring the removal of vegetation within a newly formed transmission line easement.

All vegetation within the construction area may be trimmed or removed as required. This would include vegetation within the easement, for construction access tracks and brake and winch sites. Noting that the vegetation clearing strategy for the project would be seeking to minimise and avoid clearing of native vegetation where feasible. Due to the undulating and at times hilly landform, there would be some landform modification required to prepare each tower site and install the foundations.

Overall, due to the more challenging terrain for construction, greater vegetation cover and absence of transmission infrastructure in the Durridgere, Goulburn River and Munghorn Gap (FH-2), Terraban Gap forested hills (FH-3), Barneys Reef (FH-4) and Spring Ridge and Tuckland (FH-5) landscape character zones, there would be a moderate magnitude of change, and a **moderate landscape character impact** during construction.

In the Wollar landscape character zone (FH-1), the magnitude of change would be low, due to the presence of electricity infrastructure and inconsistency in vegetation cover, resulting in a **low-moderate landscape character impact** during construction in these areas.

Landscape character impact during operation: Due to the undulating terrain and extensive removal of vegetation and creation of cleared easements, and absence of transmission infrastructure in the Durridgere, Goulburn River and Munghorn Gap (FH-2), Terraban Gap forested hills (FH-3), Barneys Reef (FH-4) and Spring Ridge and Tuckland (FH-5) landscape character zones, there would be a moderate magnitude of change to these landscapes, which are of moderate landscape sensitivity, and a **moderate landscape character impact** during operation.

In the Wollar landscape character zone (FH-1), the magnitude of change would be low, due to the presence of transmission infrastructure, resulting in a **low-moderate landscape character impact** during construction.

5.3.3 Mining landscape character type

Landscape sensitivity: This landscape is experienced by staff and visitors to the mines and small numbers of people travelling along local roads such as Ulan-Wollar Road, including mainly local residents. This is a highly modified landscape with large-scale support infrastructure. There are existing transmission lines and ongoing mining leases that will continue to alter the vegetation cover and landform of this area. Overall, this landscape character type has limited scenic quality and is of **very low landscape sensitivity**.

Landscape character impact during construction: Vegetation within the construction area may be removed or trimmed as required for construction. This would include vegetation within the transmission line easements, noting that the vegetation clearing strategy for the project would be seeking to minimise and avoid clearing of native vegetation where feasible. All

vegetation would be removed at each transmission line tower site, and for construction access tracks, brake and winch sites, laydown and compound areas. In some areas this would involve the removal of trees but mostly, due to the largely cleared landscape, this would mainly involve the removal of shrubs and groundcovers between areas of mining. As the landform in this landscape is highly modified, further changes to the landform would be largely absorbed and in character with this landscape. Overall, there would be a low magnitude of change to a landscape of very low landscape sensitivity, and a **negligible landscape character impact** during construction.

Landscape character impact during operation: The mining activities would continue adjacent to the project transmission lines during operation. While there would potentially be some access tracks maintained for access during operation along the new easement, all other areas impacted by construction would be reinstated and revegetated as appropriate. There would however be new twin double circuit 500 kV transmission lines alongside the existing Wellington to Wollar 330 kV transmission lines, with towers up to 72 metres tall and regularly spaced across this landscape character type. The new easement would be collocated, with the exception of an area east of Ulan, where the new easement would divert around of the existing processing plant. Overall, there would be a low magnitude of change to a landscape of very low landscape sensitivity, resulting in a **negligible landscape character impact** during operation.

5.3.4 Undulating rural hills landscape character type

Landscape sensitivity: This rural landscape character type would be appreciated by small numbers of people travelling along the highways and network of rural roads, including mainly local residents and their visitors, as well as some tourists visiting and passing through the area. This is a regionally common landscape which includes features such as undulating landforms, modified and natural watercourses and lower scale transport infrastructure. There are existing transmission lines and approved renewable energy projects in some areas. Local historic places such as the Laheys Creek cemetery and Avondale homestead are unique features in this landscape that provide interest and scenic value. Overall, the undulating rural hills landscape character zones are of **low landscape sensitivity**.

Landscape character impact during construction: All vegetation within the construction area may be removed or trimmed within the easement as required for construction, noting that the vegetation clearing strategy for the project would be seeking to minimise and avoid clearing of native vegetation where feasible. All vegetation would be removed at the energy hubs, site of the Merotherie workforce accommodation camp and construction compound, maintenance facility, switching stations, transmission line tower sites, brake and winch sites and for construction access tracks. While this rural landscape is already largely cleared of vegetation, there would be some areas where vegetation is more mature and denser, requiring more clearing of vegetation and effecting a greater change in landscape character.

Construction of the energy hubs would require extensive earthworks and construction activity. Works would include the installation of several new transmission lines, electrical equipment, battery storage, the construction of several permanent buildings, formation of roads and fencing.

The energy hub construction sites would also host temporary construction facilities including site offices, amenities, storage, stockpiles and laydown areas. In addition to this, there would be a concrete batching plant and helipad at each energy hub, and workforce accommodation camp at the Merotherie energy hub. These facilities would be large in scale with temporary buildings and plant, helicopter activity, heavy vehicles and equipment.

Overall, these changes would extend over a large geographic area and contrast with the scenic qualities and landscape characteristics of the Birriwa to Tallawang (URH-2) and Dapper and Elong Elong (URH-6) undulating rural hills landscape character zones.

Due to the intensity and extent of construction activities in these areas, the project would result in a high magnitude of change, and a **moderate landscape character impact**.

Elsewhere, the construction activity would result in a moderate magnitude of change, in the Narragamba to Blue Springs (URH-1), Uarbry (URH-3), Tongy (URH-4) and Cassilis to Coolah (URH-5) landscape character zones, which are of low sensitivity, resulting in a **low-moderate landscape character impact** during construction.

Landscape character impact during operation: The energy hubs at Merotherie and Elong Elong would be major new pieces of electricity infrastructure, with accompanying large-scale buildings and multiple new transmission lines extending from the hubs through the Birriwa to Tallawang (URH-2) and Dapper and Elong Elong (URH-6) undulating rural hills landscape character zones. These elements would change the character of these areas, resulting in a high magnitude of change, and a **moderate landscape character impact** during operation.

In other areas of the undulating rural hills landscape character type, the project would result in a moderate magnitude of change, including at the Narragamba to Blue Springs (URH-1), Uarbry (URH-3), Tongy (URH-4) and Cassilis to Coolah (URH-5) landscape character zones, which are of low sensitivity, resulting in a **low-moderate landscape character impact** during construction.

5.3.5 Summary of landscape character impacts

A summary of the landscape character impacts is provided in Table 5-1.

Table 5-1 Summary of landscape character impacts

			Construction		Operation	
No.	Location	Landscape sensitivity	Magnitude of change	Landscape character impact	Magnitude of change	Landscape character impact
Rural valley landscape character type						
RV-1	Wollar rural valley landscape character zone	Low	Moderate	Low-moderate	Moderate	Low-moderate
RV-2	Cumbo rural valley landscape character zone	Low	Moderate	Low-moderate	Moderate	Low-moderate
RV-3	Talbragar River rural valley landscape character zone	Low	High	Moderate	High	Moderate
RV-4	Munmurra River rural valley landscape character zone	Low	High	Moderate	High	Moderate
Forested hills landscape character type						
FH-1	Wollar forested hills landscape character zone	Moderate	Low	Low-moderate	Low	Low-moderate
FH-2	Durridgere, Goulburn River and Munghorn Gap forested hills landscape character zone	Moderate	Moderate	Moderate	Moderate	Moderate
FH-3	Terraban Gap forested hills landscape character zone	Moderate	Moderate	Moderate	Moderate	Moderate
FH-4	Barneys Reef forested hills landscape character zone	Moderate	Moderate	Moderate	Moderate	Moderate

			Construction		Operation	
FH-5	Spring Ridge and Tuckland forested hills landscape character zone	Moderate	Moderate	Moderate	Moderate	Moderate
Mining landscape character type						
M-1	Ulan mining landscape character zone	Very low	Low	Negligible	Low	Negligible
Undulating rural hills landscape character type						
URH-1	Narragamba to Blue Springs undulating rural hills landscape character zone	Low	Moderate	Low-moderate	Moderate	Low-moderate
URH-2	Birriwa to Tallawang undulating rural hills landscape character zone	Low	High	Moderate	High	Moderate
URH-3	Uarbry undulating rural hills landscape character zone	Low	Moderate	Low-moderate	Moderate	Low-moderate
URH-4	Tongy undulating rural hills landscape character zone	Low	Moderate	Low-moderate	Moderate	Low-moderate
URH-5	Cassilis to Coolah undulating rural hills landscape character zone	Low	Moderate	Low-moderate	Moderate	Low-moderate
URH-6	Dapper and Elong Elons undulating rural hills landscape character zone	Low	High	Moderate	High	Moderate

5.4 Assessment of landscape character impacts at night

The assessment of night-time impacts of the project on landscape character have been considered and the landscape character type level, with reference made to specific landscape character zones where appropriate. This approach has been taken to avoid repetition. The following section includes a description of the existing conditions in each of these landscapes at night, the night-time sensitivity of each landscape, the magnitude of change expected because of the project during the night-time and assigns an impact level, during construction and operation using the matrix included in Table 3-6 (refer to section 3.4.4).

This approach is illustrated in Figure 5-6.

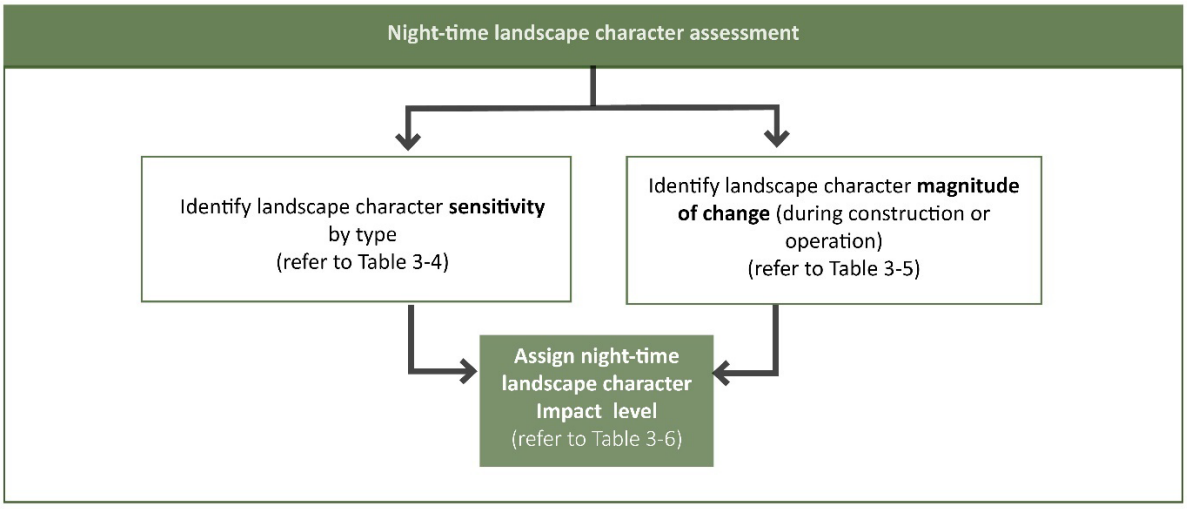


Figure 5-6 Night-time landscape character assessment approach

While the landscape within the landscape and visual study area is within the NSW Dark Sky Region, the project is around 100 kilometres at the closest point from the Siding Spring Observatory, reducing the sensitivity of the landscape and visual study area.

5.4.1 Rural valleys landscape character type

Existing conditions and sensitivity: The rural valley landscape character type has low level light sources at night, such as lighting associated with the scattered homesteads and agricultural buildings on rural properties and vehicles travelling along local roads and highways such as the Golden Highway. There would be some denser clusters of residences in the vicinity of the towns such as Wollar and Cassilis, where there would also be more vehicles travelling along local roads. Overall, the landscape character zones in this type are of low district brightness (A2) and have a **moderate visual sensitivity** at night.

Landscape character impact during construction: Construction at the new Wollar Switching Station and along the transmission line easement may require works to occur outside of standard construction hours. This activity would require lighting at each transmission line tower site as well as headlights from staff and construction vehicles accessing and moving along the transmission line easement. For construction of the transmission lines, construction activity would occur intermittently throughout the construction process as different activities are undertaken, so that there would not be lighting at any one location for the entire duration of construction, but for short periods within this time.

There would be task lighting and lighting associated with construction staging areas for construction of the switching stations and energy hubs. The workforce accommodation camp in Cassilis would also be a 24-hour facility that would require bright lighting associated with vehicles and accommodation. This facility would introduce some skyglow to this area of the rural landscape.

Overall, the lighting would contrast with the surrounding low district brightness landscape. There would be a moderate to high magnitude of change to the Wollar rural valley landscape character zone (RV-1), where there would be a switching station constructed, and the Munmurra River rural valley LCZ (RV-4), where the Cassilis workforce accommodation camp would be located. These landscape character zones are of moderate visual sensitivity, and there would be a **moderate-high visual impact** at night. This impact would be experienced from localised areas surrounding the easement and switching station, including from local roads where they are located within view of the works, including Barigan Road.

Elsewhere, the lighting of construction activity occurring along the new easements would result in a moderate magnitude of change. This would apply to the Cumbo (RV-2) and Talbragar River (RV-3) landscape character zones. In these areas there would be a **moderate landscape character impact** at night during construction.

Landscape character impact during operation: During operation the workforce accommodation camps would have ceased operation and there would not be any lighting proposed along the transmission line alignment. This would result in a negligible magnitude of change to the Cumbo (RV-2), Talbragar River (RV-3) and Munmurra River (RV-4) landscape character zones, and a **negligible landscape character impact** during operation.

There would however be low-level lighting (designed in accordance AS4282-2019) at the new Wollar Switching Station, affecting the Wollar rural valley landscape character zone (RV-1), resulting in a low magnitude of change to this area, which is of moderate sensitivity, and a **low-moderate landscape character impact** at night during operation.

5.4.2 Forested hills landscape character type

Existing conditions and sensitivity: At night, this landscape character type would have low light levels. Comprised mainly of National Park, state forest and reserves, this landscape contains very few dwellings, with only lights from vehicles travelling along local roads and occasional night-time works at forestry sites contributing to the light levels. Overall, this is a dark (A1) landscape and has a **high landscape character sensitivity** at night.

Landscape character impact during construction: There would be construction works along the transmission line easements that would occur outside standard working hours for construction, and which would require lighting. This would include lighting at each transmission line tower site as well as headlights from staff and construction vehicles accessing and moving along the transmission line easement. This activity would occur intermittently throughout the construction process as different tasks are undertaken, so that there would not be lighting at any one location for the entire duration of construction, but for short periods within this time. There would also be lighting associated with the construction of the switching station within the Terraban Gap forested hills landscape character zone (FH-3) and some lighting associated with the construction of the Merotherie energy hub influencing the character of the Barneys Reef forested hills LCZ (FH-4).

Overall, the lighting needed for construction activity at these sites would contrast with the surrounding predominantly dark landscape and there would be a moderate magnitude of change to these landscape character zones, which is of high visual sensitivity, resulting in a **moderate-high landscape character impact** in these locations at night. This impact would be experienced in very limited and localised areas surrounding the project and from local roads where they are located within view of the works, including Ulan Road and Upper Laheys Creek Road.

Landscape character impact during operation: During operation there would be some permanent lighting proposed for the switching station, in the Terraban Gap forested hills landscape character zone (FH-3), and permanent lighting proposed at the Merotherie energy hub, partly within the Barneys Reef forested hills LCZ (FH-4). This permanent lighting (designed in accordance AS4282-2019) would contrast with the character of the existing setting, and there would be a low magnitude of change to the character in the vicinity of these sites. This would result in a **moderate landscape character impact**.

During operation there would not be any lighting proposed along the transmission line easement and a negligible magnitude of change to the remaining landscape character zones, which are of high sensitivity, resulting in a **negligible visual impact** at night during operation.

5.4.3 Mining landscape character type

Existing conditions and sensitivity: At night, this landscape character type would have medium light levels with the presence of lighting from the operation of the existing active Ulan, Moolarben and Wilpinjong coal mines. Existing night-lighting would be primarily concentrated in areas where surface infrastructure (including the processing plant), access roads and within open cut pits operations is present. Truck movements at night would be associated headlights and warning lights, including flashing lights and lighting on moving vehicles, within the mine access roads as well as public roads, all contributing to the light levels. There would be a general sky glow above the mine which would also influence this character of this landscape. Overall, this landscape character type is of medium district brightness (A3) and has a **low visual sensitivity** at night.

Visual impact during construction: At night there would be construction works along the transmission line easement at. This would include lighting at each transmission line tower site as well as headlights from staff and construction vehicles accessing and moving along the transmission line easement, near Ulan-Wollar Road. This lighting is likely to be absorbed within the surrounding area of medium district brightness. This effect would only occur for a short duration each day and for a short time within the project construction program. Overall, there would be a low magnitude of change to the Ulan Mining landscape character zone, which is of low sensitivity, and a **low visual impact** at night.

Visual impact during operation: During operation there would not be any lighting proposed along the transmission line. There would be a negligible magnitude of change to this landscape which is of low sensitivity, and a **negligible visual impact** at night during operation as a result of the project.

5.4.4 Undulating rural hills landscape character type

Existing conditions and sensitivity: At night, the landscape character zones within the undulating rural hills landscape character type would have low light levels with scattered rural residences across the landscape. There would be some denser clusters of residences in the vicinity of towns such as Dunedoo, where there would also be more vehicles travelling along local roads and highways, such as the Golden and Castlereagh highways, contributing to the light levels. There would be a general sky glow above the towns which would also influence this character of this landscape. Overall, the landscape character zones in this type are of low district brightness (A2) and have a **moderate visual sensitivity** at night.

Visual impact during construction: Construction at the energy hub sites at Merotherie and Elong Elong would include site offices, amenities and construction support facilities, which may operate outside standard construction hours and would require lighting. There would also be a workforce accommodation camp at Merotherie, which would be brightly lit with lighting typically associated with urban residential areas.

There would also be construction works along the transmission line easement that would occur at night which would require lighting. This would include lighting at each transmission line tower site as well as headlights from staff and construction vehicles accessing and moving along the transmission line easement. This effect would only occur for a short duration each day and for a short time within the project construction program.

This lighting is likely to contrast with the surrounding area of low district brightness. Overall, there would be a high magnitude of change to the Birriwa to Tallawang (URH-2) and Dapper and Elong Elong (URH-6) undulating rural hills landscape character zones, due to the construction activity at the Merotherie and Elong Elong energy hubs. As these landscapes are of moderate sensitivity, there would be a **moderate-high visual impact** at night.

Otherwise, there would be a moderate magnitude of change, resulting in a **moderate visual impact** at night, within the Narragamba to Blue Springs (URH-1), Uarbry (URH-3), Tongy (URH-4) and Cassilis to Coolah (URH-5) landscape character zones.

Visual impact during operation: During operation there would not be any lighting proposed along the transmission line easements, however, there would be some minor lighting at the switching stations, within the Narragamba to Blue Springs (URH-1), Uarbry (URH-3), Tongy (URH-4) and Cassilis to Coolah (URH-5) landscape character zones. This would result in a low magnitude of change in the vicinity of these locations, within these landscape character zones which are of moderate sensitivity, resulting in a **low landscape character impact** during operation at night.

Within the Birriwa to Tallawang (URH-2) and Dapper and Elong Elong (URH-6) undulating rural hills landscape character zones, the lighting at the new energy hubs would substantially increase the amount of permanent lighting in these areas, and contrast with the prevailing character of these areas. This would result in a high magnitude of change and a **moderate-high landscape character impact** at night during operation.

5.4.5 Summary of landscape character impacts at night

The night-time visual impacts are listed in Table 5-2.

Table 5-2 Summary of landscape character impacts at night

			Construction		Operation	
No.	Location	Landscape character sensitivity	Magnitude of change	Landscape character impact	Magnitude of change	Landscape character impact
Rural valley landscape character zones						
RV-1	Wollar rural valley landscape character zone	Moderate	High	Moderate-high	Low	Low-moderate
RV-2	Cumbo rural valley landscape character zone	Moderate	Moderate	Moderate	Negligible	Negligible
RV-3	Talbragar River rural valley landscape character zone	Moderate	Moderate	Moderate	Negligible	Negligible
RV-4	Munmurra River rural valley landscape character zone	Moderate	High	Moderate-high	Negligible	Negligible
Forested hills landscape character zones						
FH-1	Wollar forested hills landscape character zone	High	Low	Moderate	Low	Low-moderate
FH-2	Durridgere, Goulburn River and Munghorn Gap forested hills landscape character zone	High	Low	Moderate	Negligible	Negligible
FH-3	Terraban Gap forested hills landscape character zone	High	Moderate	Moderate-high	Low	Moderate
FH-4	Barneys Reef forested hills landscape character zone	High	Moderate	Moderate-high	Low	Moderate
FH-5	Spring Ridge and Tuckland forested hills landscape character zone	High	Low	Moderate	Negligible	Negligible
Mining landscape character zone						
M-1	Ulan mining landscape character zone	Low	Low	Low	Negligible	Negligible
Undulating rural hills landscape character zones						
URH-1	Narragamba to Blue Springs undulating rural hills landscape character zone	Moderate	Moderate	Moderate	Low	Low-moderate

			Construction		Operation	
URH-2	Birriwa to Tallawang undulating rural hills landscape character zone	Moderate	High	Moderate-high	High	Moderate-high
URH-3	Uarbry undulating rural hills landscape character zone	Moderate	Moderate	Moderate	Low	Low-moderate
URH-4	Tongy undulating rural hills landscape character zone	Moderate	Moderate	Moderate	Low	Low-moderate
URH-5	Cassilis to Coolah undulating rural hills landscape character zone	Moderate	Moderate	Moderate	Low	Low-moderate
URH-6	Dapper and Elong undulating rural hills landscape character zone	Moderate	High	Moderate-high	High	Moderate-high

Chapter 6: Visual impact assessment

6.1 Introduction

The following section describes the assessment of visual impacts as a result of the project. This assessment is based on views from the public domain (Section 6.2) and views from private dwellings (Section 6.3). Views from private domain are subject to a preliminary visual impact screening (Section 6.3.1) to identify dwellings within two kilometres of the project that should be subject to a more detailed view assessment (Section 6.3.2), based on the potential for a moderate or higher impact.

6.2 Assessment of daytime visual impacts – public domain

6.2.1 Visibility analysis

The visibility of the project is determined by the landform, and screening effect of existing building and vegetation cover. As such, there would be greater potential visibility of the project in areas where the landform is flatter and there is less vegetation.

The maps at Appendix D show the potential visibility of the project. This analysis is based on the maximum heights of the proposed transmission line towers and is identified using a 3D digital terrain model of the landform of the landscape and visual study area. It does not take into account the screening effect of vegetation and therefore represents a conservative approach by overestimating visibility. This visibility analysis is used to scope the following stages of the assessment by directing field analysis to public domain viewpoints and private dwellings where there is a higher level of potential visibility.

This visibility of the project is illustrated in Appendix G with darker colours showing where a greater extent of the project would be visible. It shows white where there would be no points visible, and a series of browns gradually getting darker as the number of theoretically visible points of the project increases. This includes increments of 1-5 points, 6-15 points, 16-25 points, 26-35 points, and 36 or more points.

Generally, this analysis shows:

- Low-moderate and moderate levels of visibility in southern parts of the project between the new Wollar Switching Station and Wollar Road, where the valley landform is gently undulating and enclosed by the surrounding ridgelines and hills to the east and west. There is a small number of rural residences in this area, which would potentially have views to the project, including in the vicinity of the proposed New Wollar Switching Station and twin double circuit 500 kV transmission lines, which would be seen alongside existing transmission lines and substations.
- Varied levels of visibility between Wollar Road and Ulan, where the landform transitions into forested hills and Ulan mining areas. The potential visibility of the project through this section of the project includes areas of moderate-high visibility along Ulan-Wollar Road and moderate visibility in the vicinity of the township of Ulan, where the twin double circuit 500 kV transmission lines would be located in close proximity, although the tree cover outside of the mining areas would limit views to the project. Although much of this area is uninhabited due to mining activity, there are a few dwellings near Ulan and publicly accessible roads in this area which would have views of the project.
- Areas of low, low-moderate and moderate visibility between Ulan and Narragamba, where the project passes through an undulating rural area with a small number of dwellings. There are areas of moderate visibility near Blue Springs Road, including where the project changes direction and crosses the road. In this area there is one dwelling near the new twin double circuit 500 kV transmission lines and a public road (Blue Springs Road) that would have views of the project.

- Areas of moderate-high and high visibility in the vicinity of the new energy hub at Merotherie, where the project is located at the foot of Barneys Reef in a slightly elevated rural area. In this area the project would be seen from several dwellings and public roads, including Merotherie Road, Birkalla Road and Birriwa Bus Route north and south.
- To the east of Merotherie Energy Hub, there would be moderate levels of visibility as the twin 500 kV transmission lines cross over Cockabutta Hill and pass through the Talbragar River valley. There would be views of the project in this area from a small number of rural dwellings and from Blue Springs Road.
- In the northern and north eastern part of the project, north of the Golden Highway and between the Talbragar and Munmurra River valleys, there would be areas of low and low-moderate visibility. However, as the project passes through areas of bushland near Cliffdale and Ulan roads, the vegetation would limit views to the project.
- To the west of Merotherie Energy Hub, there would be high and moderate-high visibility as the project crosses through the foothills and undulating rural landscape north of Barneys Reef and west towards Tucklan Road. In this location there would be three adjacent transmission lines as part of the project, including the new twin double circuit 500 kV and an adjacent single 330 kV transmission line easement, crossing over the Castlereagh Highway. The project would also be visible from the highway and several rural dwellings in this area.
- Immediately south of Barneys Reef, there would be moderate levels of visibility as the 330 kV transmission lines cross through elevated terrain and in the vicinity of a new switching station (M8). Further to the south, the visibility would reduce to low-moderate and low, in the vicinity of Puggoon Road. There are a small number of rural dwellings in this area, which would have views to the project.
- Areas of high and moderate visibility in the vicinity of the new energy hub at Elong Elong, where the extent of project infrastructure is greater but with a small number of residences. The project would be seen from several dwellings and public roads in this area, including Spring Ridge and Dapper roads.
- Generally low-moderate and low visibility between the Elong Elong Energy Hub and Cobra Hill. Although there are large areas of cleared rural land with dwellings, the undulating landform and scattered trees would reduce the potential visibility of the project.

6.2.2 Selection of representative viewpoints

The following 26 publicly accessible viewpoints were selected as representative of the range of views to the project from public areas. This includes key or significant views, which are on this project, mainly views from local roads and highways. There were no areas of open space, lookouts or other recreational areas identified within the study area that would have a view to the project.

The location of views that have been assessed in this technical paper are shown in **Appendix E**. An assessment of each view is contained in Section 6.2.3.

Identification of the potential future conditions of each view have also been identified where relevant, to note energy related projects that have been approved or are under consideration by DPE. While these future projects are noted as they would change the existing visual conditions, this assessment considers the impacts of the project only.

6.2.3 Assessment of representative viewpoints

The following sections include an assessment of each representative view and identifies the daytime visual impacts.

The assessment of daytime visual impacts is based on visual sensitivity of the viewpoint and the magnitude of change during construction and operation (as described in Chapter 3). The assessment is based on the existing condition. Where relevant, the future condition, reflecting approved projects not yet constructed, is also identified.

Viewpoint 1: View south west from Barigan Road

Figure 6-1 View south west from Barigan Road

Location: 32°24'25.13"S, 149°57'33.81"E

Existing conditions: This view shows the entrance to the existing Wollar substation from Barigan Road (refer to Figure 6-1). The landscape surrounding the substation includes a wide rural valley, including the Barigan and Spring Flat creeks, with scattered rural dwellings amongst cleared agricultural land, used mainly for livestock grazing. The landform rises in the background of view, towards Munghorn Gap Nature Reserve, including large tracts of bushland vegetation. The Wollar to Mount Piper 500 kV transmission line towers are seen in this view, extending east from the substation.

Future conditions: Further to the south, this view will also include solar farm development with the approved Wollar Solar Farm, including new large-scale built elements such as solar panel arrays, inverters, battery storage facilities, substation, and facility buildings potentially seen in the background of view.

Visual sensitivity: Barigan Road is a sealed road providing access to local homesteads and properties south of Wollar, used mainly by residents, visitors and staff at nearby properties and facilities such as the existing Wollar substation. While the rural landscape and backdrop of Munghorn Gap Nature Reserve has higher scenic value, the substation and transmission line towers detract from the scenic quality view. Due to the remote location and presence of existing large-scale energy generation and transmission infrastructure, this view has very low visual sensitivity.

Visual impact during construction: Construction of the new Wollar Switching Station would be seen in the background of this view, beyond the existing substation. The adjacent construction compound would also be visible, including site offices, amenities, and construction support facilities and occasional helicopter activity. Installation of the twin double circuit 500 kV transmission lines would be seen with towers spaced along a route extending in a north westerly direction from the substation. This would include the erection of steel lattice towers and stringing of the wires and conductors.

From this location, the construction activity would be seen through the existing substation and transmission lines and viewed against a backdrop of forested hills at Munghorn Gap Nature Reserve. Furthermore, the presence of existing electricity infrastructure and future solar farm development would increase the compatibility of this construction activity, with the view, reducing the prominence of the construction activity in this view.

Overall, there would be a moderate magnitude of change to a view of very low visual sensitivity and a low visual impact during construction.

Visual impact during operation: The new Wollar Switching Station would be visible beyond the existing Wollar substation, so that some areas would be screened by this intervening infrastructure. The switching station would, however, extend to include the sloping land beyond the existing substation, increasing the visibility of some areas of the new infrastructure. Despite this, the switching station gantries would not rise above the backdrop of hills, reducing their prominence in the view.

The switching station and two double circuit 500 kV transmission line towers would be large-scale electricity infrastructure, visible in the background of this view. While the new transmission lines would generally be located parallel to the existing 330 kV transmission lines, they would be substantially taller, up to 72 metres tall (around double to triple the height of the existing towers), with a wider base and broader shape. The new towers would also be spaced at wider intervals than the existing towers, and would not necessarily be grouped together, side-by-side with the existing towers, spreading them across the valley.

The areas impacted by the construction compound would have been reinstated, including pasture fields and existing rural uses that would continue to be seen around and within the new easement.

Overall, the project would further add to the visual clutter of electricity infrastructure seen from this location, detracting from the amenity of this view. There would be a moderate magnitude of change to a view of very low sensitivity, and a low visual impact during operation.

Viewpoint 2: View west from Barigan Road

Figure 6-2 View west from Barigan Road

Location: 32°22'45.20"S, 149°57'8.35"E

Existing conditions: This view shows the rural landscape south of Wollar, as seen from Barigan Road (refer to Figure 6-2). The landscape consists of a wide rural valley, defined by Barigan and Spring Flat creeks. The landform is flat to gently undulating, with low plateaus as seen in the centre of view. The valley has been mostly cleared for agricultural use, including livestock grazing with scattered rural dwellings. The landform rises in the background of view to rolling hills and plateaus, including large tracts of native bushland nearing Munghorn Gap Nature Reserve. The Wellington to Wollar 330 kV transmission lines extend across the background of view, through the valley and then crossing over the vegetated hills, to the north west.

Visual sensitivity: Barigan Road is a sealed road providing access to local homesteads and properties south of Wollar, used mainly by residents, visitors and workers at facilities such as the nearby existing Wollar substation and future Wollar Solar Farm. Wandoona Homestead (right of view) and the vegetated hills in the background are features which contribute to the scenic quality of this view. Views such as this are somewhat common in the landscape south of Wollar. This view has low visual sensitivity.

Visual impact during construction: The project would be located around two kilometres away from this location, in front of, and aligned generally parallel to, the existing Wellington to Wollar transmission lines, extending across the background of view. The installation of several large steel lattice transmission towers would be visible. Machinery and construction vehicles would be seen, accessing the corridor and involved in the installation of the towers, and stringing the wires and conductors. As the new easement passes over the hills in the background (right of view), the removal of vegetation would be seen, forming a wider cleared corridor through the bushland, at the foot of the plateau.

While this construction activity would be seen in the background of view, and viewed against the backdrop of hills, reducing its visual prominence, there would be vegetation removal and construction activity that reduce the amenity of this view. Overall, there would be a moderate magnitude of change and a **low-moderate visual impact** during construction.

Visual impact during operation: The project would be seen in the background of this view, located in front and aligned parallel to the existing transmission lines and within a wide easement cleared of vegetation. The presence of double circuit 500 kV transmission line towers within a new transmission line easement would be much larger than the existing towers along Transmission Line 79, up to 72 metres tall, around double to triple the height of the existing towers, with a wider base and broader shape. The towers would be spaced at similar locations and intervals to the existing towers.

The project would be noticeable in the background, increasing the amount of electricity infrastructure seen from this location. While the project would detract from the amenity of this view, the distance of the alignment and backdrop of vegetated hills would reduce the visibility of the project. Overall, there would be a moderate magnitude of change to this view, which is of low sensitivity, and a **low-moderate visual impact** during operation.

Viewpoint 3: Views from Wollar Road

Figure 6-3 View south east from Wollar Road

Figure 6-4 View north west from Wollar Road

Location: 32°21'31.12"S, 149°54'16.84"E

Existing conditions: These views show the rural landscape extending either side of Wollar Road, west of Wollar (refer to Figure 6-3 and Figure 6-4). A wide rural valley is seen along the Cumbo Creek, with flat to gently undulating landform. The valley has been mostly cleared for agricultural use, including livestock grazing with scattered rural dwellings. The Wellington to Wollar 330 kV transmission line towers are seen crossing the road and traversing through the valley. The landform rises in the background of view to rolling hills and plateaus, including large tracts of native bushland nearing Munghorn Gap Nature Reserve.

Future conditions: Although there is no coal mining visible, the landscape in view is within the Wilpinjong Coal Mine Extension area application boundary (SSD6764, approved).

Visual sensitivity: Wollar Road is a sealed road providing access for residents and visitors to local homesteads and properties west of Wollar, as well as workers approaching the nearby Wilpinjong and Moolarben coal mines. The rural landscape and backdrop of Munghorn Gap Nature Reserve have scenic value, however, there are existing large-scale transmission towers which detract from the scenic quality of these views. This view has very low visual sensitivity.

Visual impact during construction: The project would be located on the northern side of and aligned generally parallel to the existing Wellington to Wollar transmission lines. The installation of several transmission line towers as part of this project would be visible from this location, crossing Wollar Road, in the foreground, and extending into the background of the view. There would be machinery and construction vehicles visible accessing the site from Wollar Road and working to install the towers and string the wires and conductors within the new easement and crossing over Wollar Road. To the east of Wollar Road, there would be a brake and winch site visible, as the transmission lines change direction towards the hill crossing. As the new easement passes over these hills in the background of view (refer to Figure 6-3), the removal of vegetation would be seen, forming a wider cleared corridor through the bushland.

The construction activity would be seen in close proximity to Wollar Road and include vegetation removal which would be prominent and reduce the amenity of this view. Overall, there would be a high magnitude of change to a view of very low sensitivity and a **low-moderate visual impact** during construction.

Visual impact during operation: The project would be seen running parallel to the existing transmission lines, forming a wide easement cleared of vegetation. The project would be seen together with the existing transmission line, the new twin double circuit 500 kV transmission line towers would be substantially taller, up to around 72 metres tall (around double to triple the height of the existing towers), with a wider base and broader shape. The new towers would also be spaced at wider intervals than the existing towers, and would not necessarily be grouped together, side-by-side with the existing towers, spreading them across the valley.

The project would Increase the prominence of electricity infrastructure seen in this view. The project would be seen at close range, crossing over Wollar Road, and extending both east and west into the surrounding rural valley. Overall, there would be a high magnitude of change to a view of very low sensitivity, and a **low-moderate visual impact** during operation.

Viewpoint 4: View west from Wollar-Ulan Road

Figure 6-5 View west from Wollar-Ulan Road

Location: 32°19’29.19”S, 149°53’29.05”E

Existing conditions: This view shows the northern part of the Wilpinjong coal mine exploration area, extending alongside Wollar-Ulan Road, in a wide valley (refer to Figure 6-5). The valley landform is highly modified, due to the history of coal mining. The rail line is located to the south of the road, with trains regularly seen transporting coal. The open cut pits are concealed behind the embankments south of the rail line. To the north and south, the landform rises in the background of view to forested hills and plateaus, nearing Munghorn Gap Nature Reserve and Goulburn River National Park. The Wellington to Wollar 330 kV transmission line towers are seen crossing the road, around 300 metres away.

Visual sensitivity: Wollar-Ulan Road is a sealed road providing access for staff and visitors to nearby Ulan, Moolarben and Wilpinjong coal mines, as well as residents and visitors to local homesteads and properties between Ulan and Wollar. Although the forested hills and plateaus have scenic value, the mine and transmission line towers detract from the view. This view has **very low visual sensitivity**.

Visual impact during construction: The project would be aligned parallel and to the north of the existing Transgrid transmission line easement, closer to this view. The construction of several transmission towers would be seen from this location and there would be a brake and winch site on the flat area to the north of Wollar-Ulan Road (refer to Figure 6-5, right of view). The new transmission lines would cross Wollar-Ulan Road and change direction towards the west, away from Goulburn River National Park (right of view). Construction vehicles and machinery would be seen in this view, travelling along the easement, clearing vegetation, installing the transmission line towers and stringing the wires and conductors. While the construction activity would be seen in close proximity to the road, including some vegetation removal at the foothills, it would be viewed in the context of a working coal mine where there is extensive clearing, modified landform and large construction vehicles. Overall, there would be a moderate magnitude of change to a view of very low sensitivity, and a **low visual impact** during construction.

Visual impact during operation: The project would be seen in the middle ground of this view, crossing Wollar-Ulan Road, running parallel to the existing Transmission Line 79 transmission line and located in a wide easement cleared of vegetation. There would be new twin double circuit 500 kV transmission line towers. These towers would be substantially larger in size, up to 72 metres tall (around double to triple the height of the existing towers), with a with a wider base and broader shape and spaced at wider intervals than the existing towers. The project would increase the prominence of electricity infrastructure seen in this view. The project would be seen at close range, and would avoid vegetation clearing within Goulburn River National Park. The project would be viewed against the backdrop of a working coal mine and surrounding vegetated hills. Overall, there would be a moderate magnitude of change to a view of very low sensitivity, and a **low visual impact** during operation.

Viewpoint 5: View south west from Main Street, Ulan

Figure 6-6 View south west from Main Street, Ulan

Location: 32°17'1.54"S, 149°44'30.83"E

Existing conditions: This viewpoint (refer to Figure 6-6) is located on the southern outskirts of Ulan, looking south west along Main Street towards the Ulan Road junction. The landform in this location is largely flat to gently undulating, alongside the Moolarben Creek valley. The Sandy Hollow-Gulgong rail line located around 200 metres away, crossing Main Street, with trains regularly seen transporting coal from the nearby coal mines. Beyond the road and rail line, the landscape is partly forested and forms part of the Moolarben Coal biodiversity offset area. The Wellington to Wollar 330 kV transmission line towers are seen in the background of view, around 350 metres away.

Visual sensitivity: Main Street is one of three roads providing access to Ulan, generally used by local residents, staff working in the local area and visitors to the town. Views such as this are common within the landscape near Ulan. This view has very low visual sensitivity.

Visual impact during construction: The project would be located parallel to and behind the existing transmission line. The vegetation in the middle ground of this view and in front of the project would be retained, screening views to the ground level works at several transmission line tower sites. Construction vehicles and machinery would be visible above the vegetation, travelling along an access track within a new easement, installing the new towers and stringing the wires and conductors, crossing over the rail line and Ulan Road, in the background of view.

Overall, the construction activity would be partially screened by vegetation and would be seen in the context of a freight rail line and nearby active, operational coal mines. The works would be visible in the middle to background of view reducing its visual prominence. There would be a moderate magnitude of change to a view of very low sensitivity, and a low visual impact during construction.

Visual impact during operation: There would be an additional two rows of transmission line towers seen behind and adjacent to the existing easement. The new twin double circuit 500 kV transmission line towers would be up to 72 metres tall, around double to triple the height of the existing transmission line towers along Transmission Line 79, with a broader shape and spaced at wider intervals. The vegetation along the rail line, Ulan Road and in adjacent fields would screen the lower section of some of the towers. While there are existing transmission towers seen in this view, the scale and extent of the project, would increase the prominence of electricity infrastructure in this location. Overall, there would be a moderate magnitude of change to a view of very low visual sensitivity and a **low visual impact** during operation.

Viewpoint 6: View south from Blue Springs Road, Stubbo

Figure 6-7 View south from Blue Springs Road, Stubbo

Location: 32°14'33.03"S, 149°36'54.75"E

Existing conditions: This viewpoint (refer to Figure 6-7) shows the rural landscape along the Blue Springs and Cope creek valleys, northeast of Gulgong. This area is sparsely settled, including a small number of rural dwellings (refer to Figure 6-7, centre of view). The landform is gently undulating, descending from north to south, between the Bungaba hills and Blue Springs and Cope creeks. The existing Wellington to Wollar 330 kV transmission line towers can be seen in the background of this view, around 1.8 kilometres away. The great diving range in seen in the distance, providing a backdrop to the view.

Visual sensitivity: Blue Springs Road is a sealed road providing access for residents and visitors to local homesteads and properties north east of Gulgong. Although the rural landscape and backdrop of the Great Dividing Range add to the scenic value, the presence of transmission line towers detract from the view. This view has **very low visual sensitivity**.

Visual impact during construction: The project would extend through the undulating terrain, in front of the existing transmission line, in the background of view. The new easement would not be aligned parallel with the existing easement and would be located between the existing transmission line and buildings visible from this location (refer to Figure 6-7). Due to the varied and partly intervening landform and vegetation, the construction works at a number of transmission line towers sites would be visible across the landscape, somewhat receding into the background of view, and viewed against a distant backdrop of vegetated hills. Construction vehicles and machinery would be visible, travelling along an access track within a new easement, and undertaking construction activities including removal of vegetation, levelling works and foundation construction. The installation of the transmission line towers and stringing of the wires and conductors would also be seen as construction progresses. While the construction activity would detract from the rural character of this view, it would be located in the background, reducing its visual prominence. Overall, there would be a moderate magnitude of change to a view of very low sensitivity, and a **low visual impact** during construction.

Visual impact during operation: A new easement containing twin double circuit 500 kV transmission line towers would be seen in front of the existing transmission lines, in the background of view. These towers would be substantially larger than the existing transmission line towers, around double to triple the height and would have a broader shape. While there is some existing transmission in this view, the project would increase the visual prominence and presence of electricity infrastructure in this view. Overall, here would be a moderate magnitude of change to a view of very low sensitivity, and a **low visual impact** during operation.

Viewpoint 7: View east from Merotherie Road (Merotherie and Birkalla Road junction)

Figure 6-8 View east from Merotherie Road

Location: 32° 9’44.70”S, 149°34’55.89”E

Existing conditions: This view from the Merotherie and Birkalla Road junction (refer to Figure 6-8) shows the undulating rural landscape east of Barneys Reef. The fields in the forefront of this view have been cleared for agricultural use, including grazing pastures with scattered trees. The landform is gently undulating, ascends gradually to a small hill in the background of view, with dense tree cover. Small transmission line poles and overhead wires cross through the fields, around 170 metres away.

Future conditions: This area forms the north eastern part of the proposed Barneys Reef wind farm site (currently preparing an EIS), which may include a cluster of around eight wind turbines in this location, based on the preliminary design in the scoping report.

Visual sensitivity: Merotherie and Birkalla roads are unsealed roads providing access for residents and visitors to local homesteads and properties around Merotherie, north of Gulgong. This rural landscape has some gentle undulations and areas of vegetation on the high points, contributing to the scenic qualities of this view. Views such as this are common within the landscape north of Gulgong. This view is of very low visual sensitivity.

Visual impact during construction: The project would be located in the middle ground of this view, crossing and extending south along Merotherie Road, and east of Birkalla Road through the fields, forming two separate new transmission line easements. The construction works at multiple transmission line towers sites would be visible, including removal of vegetation, leveling works and foundation construction for both the 330 kV and 500 kV transmission lines. Vehicles and machinery would be seen in this view, travelling along an access track within each new transmission line easement. The installation of the transmission line towers and stringing of the wires and conductors would also be prominent in this view. The construction activity would be extensive and contrast with the rural character of this view. Overall, there would be a high magnitude of change to a view of very low sensitivity, and a low-moderate visual impact during construction.

Visual impact during operation: In this view, two new and separate transmission line easements would be visible. The proposed single circuit 330 kV transmission lines would be seen in the right of view, crossing then running parallel to Merotherie Road, extending into the background of view, including towers up to around 45 metres tall. To the left of view, the new twin double circuit 500 kV transmission lines would be prominent, crossing Merotherie Road then diverting away from the existing 330 kV line to the east of Birkalla Road in a straight line through the fields, including towers up to around 72 metres tall. The project would introduce large-scale energy transmission infrastructure into this view which would contrast with the prevailing rural view, which does not currently include large-scale electricity infrastructure. Due to the proximity and extent of the project seen from this location, there would be a high magnitude of change to a view of very low sensitivity, and a low-moderate visual impact during operation.

Viewpoint 8: View south from Birriwa Bus Route South

Figure 6-9 View south from Birriwa Bus Route South

Location: 32° 7’58.80”S, 149°33’43.25”E

Existing conditions: This view from Birriwa Bus Route South (refer to Figure 6-9) shows the rural landscape north of Barneys Reef. The vegetated hills which form Barneys Reef form a backdrop to this view and are a local visual feature of the area. From Barneys Reef, the landform gently descends north towards the Talbragar River valley. The land in this area has been cleared for agricultural use, including a mixture of grazing pastures and crops, with scattered trees and rural dwellings.

Future conditions: The area in the background of view forms the part of the north eastern section of the proposed Barneys Reef wind farm site (proponent currently preparing an EIS), which may include two wind turbines behind Barneys Reef, based on the preliminary design in the scoping report.

Visual sensitivity: Birriwa Bus Route South is an unsealed road providing access for residents and visitors to local homesteads and properties around Merotherie, east of Birriwa. The backdrop of Barneys Reef adds to the scenic quality of the view. This view has low visual sensitivity.

Visual impact during construction: Construction of the new energy hub at Merotherie and a temporary construction compound at this location would be prominent in this view, including site offices, amenities, and construction support facilities. Works to install the switching stations and several converging transmission lines would also be present. This would include a corridor of twin double circuit 500 kV transmission lines, extending either side of the proposed 500kV switching station, in the middle ground of this view. Construction of the northern hub switching stations and transmission lines would also be seen to the east (left of view). The main workforce accommodation camp and construction compound would be seen from this location, to the north of Birriwa Bus Route South. Construction activity, including occasional

helicopter flights, the use of vehicles and machinery, would be clearly seen from this location due to the open landform and limited intervening vegetation. The construction activity would be viewed against the backdrop of the surrounding rural landscape, including Barneys Reef.

The scale and proximity of the project, as well as the lack of screening would increase the prominence of the construction activity in this view. Overall, there would be a high magnitude of change to a view of low sensitivity, resulting in a **moderate visual impact** during construction.

Visual impact during operation: Operation of the new energy hub at Merotherie would be prominent in this view, occupying an area of around 200 hectares and transforming the rural landscape seen in this view under existing conditions. This would include new electrical equipment, buildings, battery storage, access roads and fencing that would contrast with the existing rural character of this view. A new transmission line easement containing twin 500 kV transmission line towers would be seen in the middle ground of view, connecting to the new Merotherie Energy Hub. New steel lattice towers would be around 72 metres tall, introducing a new and much larger scale of development to this rural view. The new northern hub switching stations would be prominent, with transmission line towers up to around 63 metres tall extending to the north. While the areas impacted by the construction compound and workforce accommodation camp would have been reinstated and returned to rural use, including pasture fields; overall, the project would substantially change the character of this view. Due to the scale and extent of infrastructure seen from this location, there would be a high magnitude of change to a view of low sensitivity, resulting in a **moderate visual impact** during operation.

Viewpoint 9: View south east from Birriwa Bus Route South

Figure 6-10 View south east from Birriwa Bus Route South

Location: 32° 8’3.48”S, 149°32’38.03”E

Existing conditions: This view from Birriwa Bus Route South (refer to Figure 6-10) shows the rural landscape north of Barneys Reef. From Barneys Reef, the landform gently descends north towards the Talbragar River valley. The land in this area has been cleared for agricultural use, including a mixture of grazing pastures and crops, with scattered trees and rural dwellings.

Future conditions: The area in the background of view, behind Barneys Reef, forms part of the proposed Barneys Reef wind farm site (proponent currently preparing an EIS). The area in the view foreground forms the southern part of the proposed Birriwa solar farm site (EIS prepared).

Visual sensitivity: Birriwa Bus Route South is an unsealed road providing access for residents and visitors to local homesteads and properties around Merotherie and Birriwa. Barneys Reef is a landscape feature in this view, adding to the scenic quality. Overall, this rural view has low visual sensitivity.

Visual impact during construction: Construction of the new energy hub at Merotherie would be prominent in this view, including switching stations and construction compound with site offices, amenities, and construction support facilities. In the view foreground, installation of the new single circuit 330 kV transmission lines (Merotherie west connection) would be visible, extending from the new switching station (M5), including a brake and winch site. In the background of view, construction of the new twin double circuit 500 kV transmission line and double circuit 330 kV transmission line (Tallawang west connection) would be visible, at the foot of Barneys Reef, extending across the view. In the background of the view the workforce accommodation camp at Merotherie and construction compound may be visible, with facilities including site offices, tower assembly areas, concrete batching plant and a helipad with occasional helicopter flights. Construction activity including the use of vehicles and machinery would be clearly seen from this location, due to the open fields and gently undulating landform. The scale and proximity of the project, combined with limited intervening vegetation, would increase the prominence of the construction activity in this view. Overall, there would be a high magnitude of change to a view of low sensitivity, resulting in a moderate visual impact during construction.

Visual impact during operation: The new energy hub at Merotherie would be a prominent, large-scale piece of infrastructure in this view, occupying an area of around 200 hectares and transforming the rural landscape seen in this view. A new switching station (M5) and easement containing single circuit 330 kV transmission line towers up to around 63 metres tall would be seen in the foreground of view, extending to a new switching station, located around 350 metres away. Two additional new transmission line easements containing new large-scale twin 500 kV and 330 kV transmission line towers would also be seen in the background of view, extending across the view at the foot of Barneys Reef. The new electricity infrastructure would introduce a new and much larger scale of development to this rural view. The areas impacted by the construction compound would, however, have been reinstated and returned to rural use, including pasture fields. The project would substantially alter the character of this view. Overall, due to the scale and extent of change and contrasting character of the project infrastructure, there would be a high magnitude of change to this view, which is of low sensitivity, and a moderate visual impact during operation.

Viewpoint 10: View south west from Blue Springs Road

Figure 6-11 View south west from Blue Springs Road

Location: 32’ 7'51”97"S, 149’39'29”13"E

Existing conditions: This view from Blue Springs Road (refer to Figure 6-11) shows the rural landscape rising south from the Talbragar River valley to a small ridgeline at Cockabutta Hill, east of Birriwa. The land in this area has been cleared for agricultural use, including a mixture of grazing pastures and crops, with scattered trees and rural dwellings. This view contains a strong rural character with few large-scale built structures other than rural sheds and local power transmission poles.

Visual sensitivity: This section of Blue Springs Road is an unsealed road providing access for residents and visitors to local homesteads and properties the Talbragar River valley, east of Birriwa. The rural character and backdrop of Cockabutta Hill contribute to the scenic quality of this view. Overall, this view has **low visual sensitivity**.

Visual impact during construction: The project would extend across this view, passing over Cockabutta Hill and through this rural valley landscape, in the middle ground of view. The construction works at multiple transmission line tower sites would be visible, along the new twin 330 kV transmission line easement, including removal of vegetation on the hills in the background of view, leveling works and foundation construction. Vehicles and machinery would be seen in the construction area, travelling along an access track within a new easement. The construction activity would be viewed against the scenic backdrop of hills and detract from the rural character of this view. Overall, there would be a high magnitude of change to a view of low sensitivity, and a **moderate visual impact** during construction.

Visual impact during operation: There would be a new transmission line easement seen in the centre of this view, with twin double circuit 330 kV transmission lines (Coolah and Cassilis connections) on towers up to around 63 metres tall. The project would cross over Cockabutta Hill and Blue Springs Road, then extend in a straight line through the gently undulating

rural landscape of the Talbragar River valley. The project would introduce new large-scale electricity infrastructure into this view, detracting from the prevailing rural character and scenic qualities of this view, which does not currently include large-scale built features or infrastructure. Overall, due to the scale, proximity and extent of the project seen from this location, there would be a high magnitude of change to a view of low sensitivity, and a **moderate visual impact** during operation.

Viewpoint 11: View north east from Blue Springs Road, Bungaba

Figure 6-12 View north east from Blue Springs Road, Bungaba

Location: 32’ 7'27”48"S, 149’40'56”98"E (Figure 6-12)

Existing conditions: This view (refer Figure 6-12) show the rural landscape south of Uarbry, alongside the Talbragar River valley. The landform is flat to gently undulating, gradually rising at the edges of the valley to small hills and ridges. The land in this area has been predominantly cleared for agricultural use, including a mixture of grazing pastures and crops, with scattered trees and rural dwellings. There are occasional rocky outcrops, providing visual interest, as seen in the middle ground of this view. Views from this location have a rural character with few large-scale built structures.

Visual sensitivity: This section of Blue Springs Road is an unsealed road providing access for residents and visitors to local homesteads and properties along the Talbragar River valley, south of Uarbry. The rural character and rocky outcrops contribute to the scenic quality of this view. Overall, this view has **low visual sensitivity**.

Visual impact during construction: The project would be located around 150 metres to the south of Blue Springs Road (right of this view), aligned generally to the road and south of the rocky outcrop. Construction of the twin double circuit 330 kV transmission lines (Coolah connection) would be visible, extending through the southern side of the Talbragar River valley. The works at multiple transmission line tower sites would be visible, along the new easement, including removal of vegetation within fields, leveling works, foundation construction, as well as the installation of the transmission line towers and stringing of the wires and conductors. Vehicles and machinery would be seen in this view, travelling along access tracks

within the new easement and along Blue Springs Road. The construction activity would contrast with the rural character of this view. Overall, there would be a high magnitude of change to views of low sensitivity, and a **moderate visual impact** during construction.

Visual impact during operation: There would be new twin double circuit 330 kV transmission lines seen from this location, extending through the pasture fields south of Blue Springs Road, containing steel lattice towers up to around 63 metres tall. Some of the areas impacted by construction would have been reinstated and returned to rural use, including pasture fields that would continue to be seen around and within the new easement. The rocky outcrop would be visible, although now seen adjacent to large the towers. The project would introduce new large-scale electricity infrastructure, contrasting with the rural character of the views from this location, which do not currently contain large-scale built features or infrastructure. Due to the scale, proximity and extent of the project seen from this location, there would be a high magnitude of change to views of low sensitivity, and a **moderate visual impact** during operation.

Viewpoint 12: View from Blue Springs Road north

Figure 6-13 View south east from Blue Springs Road, Uarbry

Location: 32’ 5'4”20"S, 149’42'25”92"E

Existing conditions: This view (refer to Figure 6-13) show the Talbragar River valley, south of Uarbry. The Ross crossing bridge is seen in the view foreground, extending over the Talbragar River. The landform is flat to gently undulating, gradually rising at the edges of the valley to small hills and ridges such as Uarbry Pinnacle. The land in this area has been predominantly cleared for agricultural use, including a mixture of grazing pastures and crops, with scattered trees and rural dwellings. Views from this location have a rural character with few large-scale built structures other than rural sheds and local power transmission poles and wires.

Visual sensitivity: This section of Blue Springs Road is an unsealed road providing access for residents and visitors to local homesteads and properties along the Talbragar River valley, south of Uarbry. The rural character and backdrop of hills contribute to the scenic quality of this view. Overall, this view has **low visual sensitivity**.

Visual impact during construction: The project would be seen in multiple areas from this location. To the east of Blue Springs Road, construction of the new double circuit 330 kV transmission lines (Coolah connection) would be visible, extending along the eastern side of the Talbragar River valley. The transmission lines would change directions in several locations, including multiple brake and winch sites visible to the east of the road. In the background of view, a second easement would be constructed, crossing over Blue Springs Road and extending north west, through the Talbragar River, including single circuit 330 kV transmission lines (Leadville connection).

The works at multiple transmission line tower sites would be visible, along two separate easements, including removal of vegetation within fields, leveling works, foundation construction, as well as the installation of the transmission line towers and stringing of the wires and conductors. Vehicles and machinery would be seen in this view, travelling along access tracks within the new easements and along Blue Springs Road. The construction activity would contrast with the rural character of this view. Overall, there would be a high magnitude of change to views of low sensitivity, and a **moderate visual impact** during construction.

Visual impact during operation: There would be two new transmission line easements seen in this view, containing 330 kV transmission line towers between around 45 and 63 metres tall. The project would cross Blue Springs Road and extend through the scenic Talbragar River valley, and split into two separate easements, creating a complex arrangement of transmission lines and transmission towers of varied heights. The project would introduce new large-scale electricity infrastructure, contrasting with the rural character of the views from this location, which do not currently contain large-scale built features or infrastructure. Due to the scale, proximity and extent of the project seen from this location, there would be a high magnitude of change to views of low sensitivity, and a **moderate visual impact** during operation.

Viewpoint 13: View north east from the Golden Highway, Leadville

Figure 6-14 View north east from the Golden Highway, Leadville

Location: 32° 4’29.05”S, 149°39’36.23”E

Existing conditions: This view (refer to Figure 6-14) shows the Golden Highway, extending through the Cainbil Creek valley, between the Talbragar River and Uarbry. The landform gently ascends from the Cainbil Creek valley to the surrounding low hills and ridges around Uarbry. Land use in this valley includes a mixture of cleared agricultural land, used mainly for livestock grazing and some arable farmland, with scattered rural dwellings. There are no large-scale existing transmission line towers seen in this view.

Future conditions: The area north of the highway forms the Leadville cluster of the proposed Valley of the Winds wind farm project (under consideration by NSW DPE), which may include a temporary construction compound beside the highway and cluster of around six wind turbines on the hills further to the north, based on the preliminary design in the EIS.

Visual sensitivity: Rural views such as this are experienced by people travelling along the Golden Highway, including residents, tourists and workers using the road. The rural character and backdrop of low hills add to the scenic quality of this view. Overall, this view has low visual sensitivity.

Visual impact during construction: The project would extend across this view, through the Cainbil Creek valley, crossing over the Golden Highway and rising over the hills to the north (refer to Figure 6-14, left of view). The construction of several transmission line tower sites would be visible, along the proposed new single circuit 330 kV transmission line easement (Leadville connection), including removal of vegetation on the hills in the background of view, leveling works and foundation construction near the Golden Highway. Vehicles and machinery would be seen in the construction area, travelling along an access track within a new easement. The construction activity would be visible in the middle ground of

view and with tower construction rising above the scenic backdrop of hills. The construction activity would detract from the rural character of this view. Overall, there would be a moderate magnitude of change to a view of low sensitivity, and a **low-moderate visual impact** during construction.

Visual impact during operation: There would be a new transmission line easement seen in the centre of this view, containing single circuit 330 kV transmission line towers up to around 54 metres tall. The project would cross through the Cainbil Creek valley, over the Golden Highway, then change direction, extending up and over the hills in the background of view. The project would introduce large transmission towers into this view, which does not currently include large-scale built features or infrastructure. These towers would rise above the existing vegetation and across the hillside. Due to the scale, proximity and extent of the project seen from this location, there would be a moderate magnitude of change to a view of low sensitivity, and a **low-moderate visual impact** during operation.

Viewpoint 14: View west from the Golden Highway, Uarbry

Figure 6-15 View west from the Golden Highway, Uarbry

Location: 32’ 3'18”85"S, 149’44'23”40"E

Existing conditions: The view in Figure 6-15 shows the Golden Highway, extending west of Uarbry, consisting of a two lane carriageway. The landform gently rises from the Talbragar River valley to the north west, reaching a local highpoint at Uarbry Pinnacle (refer to Figure 6-15, right of view). Land use along the Talbragar River valley includes a mixture of cleared agricultural land, used mainly for livestock grazing and some arable farmland, with scattered rural dwellings. Nearing Uarbry Pinnacle, the landform is steeper, containing large tracts of bushland. There are no existing large-scale existing transmission line towers seen in this view.

Visual sensitivity: Rural views such as this are experienced by people using the Golden Highway, including residents, tourists and workers travelling on the road between Uarbry and Dunedoo. The rural character and backdrop of hills including Uarbry Pinnacle add to the scenic quality of this view. While this view has some scenic qualities, overall, this view has **low visual sensitivity**.

Visual impact during construction: The project would extend along the eastern side of the Golden Highway in this view (refer to Figure 6-15, left of view), crossing the highway to the hillside near Uarbry Pinnacle and extending north (right of view) across the upper slopes of the fields. The construction of several transmission line tower sites would be visible, along the new double circuit 330 kV transmission line easement (Cassilis connection), including removal of scattered trees on the hill in the background of view, leveling works and foundation construction beside the highway. Vehicles and machinery would be seen in the construction area, travelling along an access track within a new easement. The construction activity would be partly viewed against the hillside, but rise above the backdrop of vegetation, contrasting with the undulating rural landscape which does not currently include energy transmission infrastructure. Overall, there would be a moderate magnitude of change to a view of low sensitivity, resulting in a **low-moderate visual impact** during construction.

Visual impact during operation: There would be a new transmission line easement seen along the eastern side of the highway, containing double circuit 330 kV transmission line towers up to around 63 metres tall. The project would cross over the hill in the background of view and extend along the upper slopes of the hillside. The project would introduce large transmission towers, detracting from the rural character and amenity of this view, which does not currently include large-scale built features or infrastructure. Due to the scale of the towers, proximity and extent of the project seen from this location, there would be a moderate magnitude of change to a view of low sensitivity, resulting in a **low-moderate visual impact** during operation.

Viewpoint 15: View north from Ulan Road, Cassilis

Figure 6-16 View north from Ulan Road, Cassilis

Location: 32’ 5'1”24"S, 149’53'9”17"E

Existing conditions: This view shows the rural landscape north of the Durridgere State Conservation Area, south of Golden Highway (refer to Figure 6-16). The landform gently ascends north towards a small ridgeline in the background of view. The land in this area has been cleared for agricultural use, including mainly grazing pastures with scattered trees and a rural dwelling and sheds. The buildings are located on top of the ridge, screened in this view by intervening vegetation.

Visual sensitivity: Rural views such as these are experienced by people travelling south of Cassilis, including residents and visitors to local homesteads and properties along Ulan Road. The undulating rural character with an absence of large-scale built infrastructure contribute to the scenic quality of this view. Views such as this a common in this location. Overall, this view has **very low visual sensitivity**.

Visual impact during construction: The construction and operation of a workforce accommodation camp (Neeleys Lane) would be seen in the centre of this view. The camp would be located in the pasture field in the middle ground of this view and extending north to the ridge in the background of view, requiring removal of pastures and trees. There would be machinery and construction vehicles seen accessing the site from Ulan Road and working to install the camp. Once installed, the camp would include demountable and modular accommodation unit structures to accommodate staff and other facilities, with vehicles seen accessing the site, generally in the mornings and evenings. The construction and operation of the workforce accommodation camp would introduce large-scale construction support facilities into an otherwise rural landscape. The camp would be prominent and reduce the amenity of this view. Construction of the new easement containing double circuit 330kV transmission lines towers up with 63 metres tall would be located around 2.3 kilometres to the south, and not seen in this view. Overall, there would be a high magnitude of change to a view of very low sensitivity, resulting in a **low-moderate visual impact** during construction.

Visual impact during operation: At the end of construction, the workforce accommodation camp would be disassembled. The site would be returned to rural use and the rural character of this view would be restored. There would be a negligible magnitude of change and a **negligible visual impact** during operation in this view.

Viewpoint 16: Views from the Golden Highway, Cassilis

Figure 6-17 View east from the Golden Highway

Figure 6-18 View north east from the Golden Highway

Location: 32° 2’39.29”S, 149°56’41.52”E (Figure 6-17) and 32° 2’23.86”S, 149°56’46.82”E (Figure 6-18)

Existing conditions: The landform around this section of the Golden Highway is elevated and undulating (refer to Figure 6-17 and Figure 6-18). A view across the Mummurra valley towards Cassilis, can be seen as the highway crosses a ridgeline, framed by trees (refer Figure 6-18). The bushland to the north of the highway forms part of Durridgere State Conservation Area, channelling views along the road. There are no large-scale existing transmission line towers seen in this view.

Future conditions: Although the area to the east and north of the highway form part of the approved Liverpool Range wind farm site, the wind turbines will be located on the hills further to the north, north of Cassilis, and would be over four kilometres away.

Visual sensitivity: Rural views such as this are experienced by people using the Golden Highway, including residents, tourists and workers travelling on this route. The Mummurra River valley and vegetation within Durridgere State Conservation Area are landscape features, adding to the scenic quality of the view. The view over the crest of the hill (refer Figure 6-18) is a framed view which forms a gateway to the Mummurra valley. Overall, this view has **low visual sensitivity**.

Visual impact during construction: The project would extend in a straight line at a slightly lower level along the eastern side of the Golden Highway (refer to Figure 6-17), including the construction of several transmission line tower sites for the double circuit 330 kV transmission line (Cassilis connection). In this section, the construction area would be partially screened by intervening vegetation and landform beside the highway, including road cuttings and embankments. Further to the north, the transmission lines would cross the Golden Highway in the middle ground of view (refer Figure 6-18), and extend to the north west (refer Figure 6-18, left of view). There would be some vegetation removal seen in this area.

Construction activity would be seen intermittently, in northerly and easterly views from the highway, including removal of vegetation, leveling works, foundation construction and a brake and winch site to the east of the Golden Highway. Vehicles and machinery would be visible working in the construction area, travelling along an access track within a new easement. While the construction activity would be seen in close proximity, the presence of vegetation and landform would screen and filter views. Overall, there would be a moderate magnitude of change to a view of low sensitivity, and a **low-moderate visual impact** during construction.

Visual impact during operation: There would be a new transmission line easement seen along the eastern side of the highway (refer to Figure 6-17), containing double circuit 330 kV transmission line tower poles up to around 63 metres tall. Further to the north, the project would cross over the highway in the middle ground of view, extending through a cleared easement to the north west, west of the highway (refer Figure 6-18) and through the rural valley. There would be no vegetation cleared within Durridgere State Conservation Area and views to this vegetation from the highway would be retained. The project would, however, introduce large-scale transmission tower poles, contrasting with the rural character and amenity of this view, which does not currently include large-scale built features or infrastructure. Overall, there would be a moderate magnitude of change to a view of low sensitivity, resulting in a **low-moderate visual impact** during operation.

Viewpoint 17: Views from Coolah Road

Figure 6-19 View south from Coolah Road

Figure 6-20 View east from Coolah Road

Location: 31°59'44.44"S, 149°56'13.02"E (Figure 6-19) and 31°59'30.65"S, 149°55'24.58"E (Figure 6-20)

Existing conditions: These views (refer Figure 6-19 and Figure 6-20) show the undulating rural hills between Cassilis and Coolah, east of the Liverpool Range. The land in this area has been cleared for agricultural use, including mainly grazing pastures with scattered trees and rural dwellings. Views from this location contain a strong rural character with few large-scale built structures other than rural sheds and local power transmission poles.

Future conditions: The proposed Liverpool Range wind farm site (approved) is located to the north of Coolah Road, on the hilltops and ridgelines extending north and north west of Cassilis towards the Liverpool Range. Multiple wind turbines will be seen in north easterly views from Coolah Road. The closest wind turbine will be located on a ridgeline, around 1.8 kilometres to the north west of the view Figure 6-20 (out of view).

Visual sensitivity: Rural views such as these are experienced by people travelling between Coolah and Cassilis, including residents and visitors to local homesteads and properties. The rural character with rolling hills contributes to the scenic quality of this view, however, this will be somewhat transformed by approved large-scale infrastructure, including wind turbines and associated development. Overall, this view has low visual sensitivity.

Visual impact during construction: The project would cross over Coolah Road and extend in a straight line to the south east and north west, through the undulating rural landscape, across these views (refer Figure 6-19 and Figure 6-20). The works at multiple transmission line tower sites would be visible, including leveling works, and foundation construction. Vehicles and machinery would be seen travelling along an access track within a newly formed easement. Installation of the tower poles and stringing of the wires and conductors would also be visible, crossing over the hills and seen against the skyline. The construction activity would be seen in proximity near the road and extend into the background of view, detracting from the rural character. Overall, there would be a moderate magnitude of change to a view of low sensitivity, resulting in a low-moderate visual impact during construction.

Visual impact during operation: There would be a new transmission line easement seen in the centre of these views, containing large-scale transmission line tower poles up to around 63 metres tall. The transmission line would cross Coolah Road diagonally, and extend in a straight line through the undulating landscape to the south east and north west. The project would contrast with the rural character of this view, which will contain large-scale wind farm turbines. Due to the proximity and extent of the project seen from this location, there would be a moderate magnitude of change to a view of low sensitivity, resulting a low-moderate visual impact during operation.

Viewpoint 18: Views from Rotherwood Road

Figure 6-21 View south east from Rotherwood Road

Figure 6-22 View east from Rotherwood Road

Location: 31°54'43.79"S, 149°56'11.21"E

Existing conditions: These views show the undulating rural hills north of Cassilis, along the upper Talbragar River valley (refer to Figure 6-21 and Figure 6-22). The land in this area has been cleared for agricultural use, including mainly grazing pastures with scattered trees and rural dwellings. Views from this location contain a strong rural character with few large-scale built structures other than rural sheds.

Future conditions: The proposed Liverpool Range wind farm site (approved) is located either side of Rotherwood Road, on the hilltops and ridgelines extending north and north west of Cassilis towards the Liverpool Range. Multiple wind turbines with interconnecting access roads would be seen in views from Rotherwood Road. The closest wind turbine will be located around three kilometres to the south east, beyond the ridgeline and would be seen in these views (refer to Figure 6-21 and Figure 6-22).

Visual sensitivity: Rural views such as these are experienced by small numbers of people travelling between north of Cassilis, including residents and visitors to local homesteads and properties. The rural character with rolling hills contributes to the scenic quality of these views, however, there will be several wind turbines visible, introducing large-scale infrastructure to these views. Overall, this view has low visual sensitivity.

Visual impact during construction: The project would extend across these views, crossing over Rotherwood Road, then extending along the ridgeline in the middle ground of these views. The works at multiple transmission line tower sites would be visible, along the new double circuit 330 kV transmission line easement (Cassilis connection), including leveling works and foundation construction. Construction of a new switching station (M1) would be seen in Figure 6-22, around 900 metres from the road, terminating at the new easement. Vehicles and machinery would be seen in the construction area, at the switching station and travelling along an access track within a new easement. The construction activity would be viewed against the backdrop of hills and detract from the strong rural character. Overall, there would be a moderate magnitude of change to a view of low sensitivity, resulting in a low-moderate visual impact during construction.

Visual impact during operation: There would be a new transmission line easement extending across these views, containing large-scale transmission line tower poles up to around 63 metres tall. The transmission line would cross Rotherwood Road diagonally, and extend in a straight line to the north east along a ridgeline. There would be a new switching station seen in this rural landscape, at the end of the transmission line, around 900 metres away, with the infrastructure located on top of a ridge and seen against the skyline. The project would increase the presence of large-scale electricity infrastructure in this view. Due to the proximity and extent of the project seen from this location, there would be a moderate magnitude of change to views of low sensitivity, and a low-moderate visual impacts during operation.

Viewpoint 19: Views from the Castlereagh Highway, Tallawang

Figure 6-23 View north east from the Castlereagh Highway, Tallawang

Figure 6-24 View south east from the Castlereagh Highway, Tallawang

Location: 32°10’52.10”S, 149°26’8.57”E (refer to Figure 6-23) and 32° 9’32.05”S, 149°26’15.27”E (refer to Figure 6-24)

Existing conditions: The views in Figure 6-23 and Figure 6-24 show the Tallawang Creek valley, north of Gulgong. The landform is gently undulating, including rolling hills and valleys. The land in this area has been cleared for agricultural use, including a mixture of grazing pastures and crops, with scattered trees and rural dwellings. Views from this location contain a strong rural character with few large-scale built structures other than rural sheds and local power transmission poles.

Future conditions: The proposed Barneys Reef wind farm site (EIS currently being prepared) is located to the east of the highway, around two kilometres away, which may include 63 turbines (280 metres tall), battery storage and associated infrastructure, based on the preliminary design in the scoping report.

Visual sensitivity: Rural views such as this are experienced by people using the Castlereagh Highway between Gulgong and the Golden Highway near Dunedoo, including residents, tourists and workers travelling on the road. Barneys Reef and long distant views to the great diving range add to the scenic quality of these views. Overall, these views have low visual sensitivity.

Visual impact during construction: The project would be seen in several areas in these views (refer to Figure 6-23 and Figure 6-24). Construction of the easement containing the new twin double circuit 500 kV transmission lines (Merotherie Energy Hub – Elong Elong Energy Hub connection) and single circuit 330 kV transmission lines (Tallawang west connection) would be visible, crossing the highway and extending to the north east and west, through the undulating rural landscape. Construction of a new switching station (M6) would be visible, at the foot of Barneys Reef. To the south of the new M6 switching station, construction of a new easement containing the double circuit 330 kV transmission lines (Tallawang south connection) would be seen, extending south towards Gulgong, with several changes in direction and associated brake and winch sites visible.

The works at multiple transmission line tower sites would be visible, along two separate easements, including removal of vegetation within fields, leveling works, foundation construction, installation of the transmission line towers and stringing of the wires and conductors. Vehicles and machinery would be seen in this view, travelling along access tracks within the new easements and at the M6 switching station. The construction activity would contrast with the existing rural character of this view. Overall, there would be a high magnitude of change to views of low sensitivity, and a moderate visual impact during construction.

Visual impact during operation: The project would extend across these views (refer to Figure 6-23 and Figure 6-24), creating a network electricity easements, containing large transmission towers up to 72 metres tall, as well as the new M6 switching station. A triple row of transmission line towers would cross the highway (refer to Figure 6-23) and extend to the west. To the east of the highway, the triple row of transmission line towers, the new M6 switching station and Tallawang south connection easement would be visible. The easements would include several changes in directions, creating a complex network of converging transmission lines and electricity infrastructure across the view.

Overall, the project would introduce new large-scale electricity infrastructure, in multiple locations, extending across and detracting from the rural character and amenity of these views, which do not currently contain large-scale built features or infrastructure. Due to the scale, proximity and extent of the project seen from these locations, there would be a high magnitude of change to views of low sensitivity, and a moderate visual impact during operation.

Viewpoint 20: View west from Tucklan Road

Figure 6-25 View west from Tucklan Road

Location: 32°10’49.19”S, 149°24’55.91”E

Existing conditions: This view shows the rural landscape west of Barneys Reef, between the Castlereagh Highway and Tuckland State Forest (refer to Figure 6-25). The landform gently ascends west towards a small ridgeline in the background of view. The land in this area has been cleared for agricultural use, including mainly grazing pastures with scattered trees and rural dwellings.

Visual sensitivity: Rural views such as these are experienced by people travelling south of Dunedoo, including residents and visitors to local homesteads and properties along Tucklan Road. The rural character with rolling hills contributes to the scenic quality of this view. Views such as this a common in this location. Overall, this view has very low visual sensitivity.

Visual impact during construction: In this view, the project would cross over and extend west of Tucklan Road, extending towards the small ridgeline in the background of view. The installation of several transmission line towers would be visible, forming a triple row of towers. There may be glimpses to the construction of a new switching station (M7 switching station) located around 1.4 kilometres away, and partially screened by dense group of trees in the background of view. There would be machinery and construction vehicles would be seen working to install the M7 switching station, towers and string the wires and conductors. The removal of vegetation within the construction area would be seen, forming a wide cleared corridor through this rural landscape. The construction activity would be prominent from this location and transform the character of this view. Overall, there would be a high magnitude of change to a view of very low sensitivity, resulting in a low-moderate visual impact during construction.

Visual impact during operation: Three rows of transmission line towers, up to around 72 metres tall, would be prominent and large-scale electricity infrastructure, crossing Tucklan Road and extending into the background of this view.

Part of the M7 switching station would be seen in the background of view, partly screened by the group of trees in the background of view. Some of the areas impacted by construction would have been reinstated and returned to rural use, including pasture fields that would continue to be seen around and within the new easement. However, the project would introduce large-scale electricity infrastructure in this location, contrasting with the rural character and reducing the scenic quality of this view. Overall, there would be a high magnitude of change to a view of very low sensitivity, resulting in a **low-moderate visual impact** during operation.

Viewpoint 21: Views from Puggoon Road

Figure 6-26 View north west from Puggoon Road

Figure 6-27 View south from Puggoon Road

Location: 32’17'1”.4"S 149’29'1”.5"E (refer to Figure 6-26) and 32’15'5”.4"S, 149’28'5”.9"E (refer to Figure 6-27)

Existing conditions: The views in Figure 6-26 and Figure 6-27 show the rural landscape south of Barneys Reef, between the Castlereagh Highway and Puggoon Road. The landform is undulating and gently ascends west towards a small, forested ridgeline in the background of view. The land in this area has been cleared for agricultural use, including mainly grazing pastures with scattered trees and rural dwellings.

Future conditions: This area forms part of the proposed Tallawang solar farm site (under consideration by NSW DPE), located to the west of Puggoon Road. The proposed Bellambi Heights solar farm is also located along Puggoon Road, further to the south, around five kilometres from this viewpoint.

Visual sensitivity: Rural views such as these are experienced by people travelling north west of Gulgong, including residents and visitors to local homesteads and properties along Puggoon Road. This view has a rural character with an undulating landform, a character that is common within the region Overall, this view has **low visual sensitivity**.

Visual impact during construction: Construction of a new switching station (M9 switching station) would be seen in the background of the view shown in Figure 6-26, at a distance of around 1.3 kilometres. Installation of new single circuit 330 kV transmission lines would be seen extending in a northerly direction from the M9 switching station, including steel lattice towers up to around 63 metres tall and stringing of the wires and conductors. From this location, the construction activity would be seen within an undulating rural landscape, against a backdrop of forested hills. The scale and proximity of the project, including the switching station and transmission lines, with little intervening vegetation would increase the prominence of the construction activity in this view. Overall, there would be a moderate magnitude of change to a view of low visual sensitivity, resulting in a **low-moderate visual impact** during construction.

Visual impact during operation: The new M9 switching station would be visible located on gently sloping land in the background of view shown in Figure 6-26. The switching station would be located in a clear field and would be viewed against a backdrop of trees. The switching station gantries would not rise above the backdrop of vegetated hills, reducing the prominence in this view. The new single circuit 330 kV transmission line towers would be seen extending north from the switching station, through an undulating rural landscape, with several minor bends and small changes in direction, spreading them across the landscape. Some of the areas impacted by the transmission construction would have been reinstated and returned to rural use, including pasture fields and existing rural uses that would continue to be seen around and within the new easement.

Overall, the project would introduce large-scale electricity infrastructure to views from Puggoon Road, contrasting with the rural character and scenic qualities of the views along this road. Overall, there would be a moderate magnitude of change to views of low sensitivity, resulting in low-moderate visual impacts during operation.

Viewpoint 22: Views from Spring Ridge Road

Figure 6-28 View south west from Spring Ridge Road

Figure 6-29 View south from Spring Ridge Road

Location: 32’10'45”48"S, 149’15'39”96"E (refer to Figure 6-28) and 32’11'18”37"S, 149’16'12”59"E (refer to Figure 6-29)

Existing conditions: These views (refer to Figure 6-28 and Figure 6-29) show the undulating rural landscape south west of Dunedoo, west of Spring Ridge Road. The land in this area has been cleared for agricultural use, including grazing pastures and crops with scattered rural dwellings and pockets of vegetation on ridgelines, field boundaries, roads and creeks, such as Laheys Creek, seen in the view foreground of Figure 6-29. Views from this location contain a strong rural character with few large-scale built structures other than rural sheds and local power transmission poles. Laheys Creek cemetery is a historic feature in this area, seen in the view shown at Figure 6-29 (right of image), including a large granite monument and headstones, fenced off from the surrounding rural fields.

Future conditions: This area forms part of the proposed Cobbora solar farm site (EIS currently being prepared), located on the western side of Spring Ridge Road.

Visual sensitivity: Rural views such as these are experienced by local residents and visitors to local homesteads and properties along Spring Ridge Road. The strong rural character and presence of a historic local cemetery add to the scenic quality of this view. Overall, this view has **low visual sensitivity**.

Visual impact during construction: Construction of two switching stations (E1 and E2) as well as the new energy hub at Elong Elong would be prominent in this view. This would include a construction compound with site offices, amenities and construction support facilities including laydown, tower assembly areas, stock piles, concrete batching plant and helipad. The trees in the background of view would be removed, and the project would be installed on land rising from Spring Ridge Road. Installation of several new transmission lines would be visible, connecting to the switching stations and energy hub, including new twin double circuit 500 kV transmission lines crossing Spring Ridge Road, extending between the Elong Elong and Merotherie energy hubs, and several 330 kV transmission line easements extending north and west of the energy hub. The switching stations (E1 and E2) would be constructed to the north and west of the energy hub, however, intervening

landform would largely screen these sites. Construction activity including the use of vehicles and machinery would be seen from this location through the trees along Spring Ridge Road. The cemetery would be protected and retained during construction with details confirmed during detailed design such as perimeter fencing and setbacks.

The scale and proximity of the project, as well as the clearance of trees within fields, would increase the prominence of the construction activity in this view. Overall, there would be a high magnitude of change to a view of low sensitivity, and a **moderate visual impact** during construction.

Visual impact during operation: The new energy hub at Elong Elong would be a prominent, large-scale piece of infrastructure in this view, occupying an area of around 200 hectares and transforming the rural landscape seen in these views. A new easement containing new large-scale twin 500 kV transmission line towers would be seen crossing Spring Ridge Road to the south and connecting to the new energy hub. The new steel lattice towers would be around 72 metres tall, introducing large-scale infrastructure development to this rural view. To the west of the hub, two other smaller switching stations would be visible (E1 and E2), with new single and double circuit 330 kV transmission lines extending between the energy hub and switching stations. The new energy hub and easements would substantially change the character of these views.

Overall, the project would detract from the amenity of these views, and while Laheys Creek cemetery would be retained, it would lose its rural setting and would be viewed against a backdrop of large-scale electricity infrastructure . Overall, there would be a high magnitude of change to views of low sensitivity and a **moderate visual impact** during operation.

Viewpoint 23: View north west from Dapper Road, near Spring Ridge Road

Figure 6-30 View north west from Dapper Road

Location: 32’11'51”83"S, 149’16'10”22"E

Existing conditions: This view shows the rural landscape ascending west from Laheys Creek, west of Spring Ridge Road (refer to Figure 6-30). The land in this area has been cleared for agricultural use, including grazing pastures and crops with scattered rural dwellings and pockets of vegetation on ridgelines, field boundaries and roads. Views from this location contain a strong rural character with few large-scale built structures other than rural sheds and local power transmission poles.

Future conditions: This area forms part of the proposed Cobbora solar farm site (EIS currently being prepared), located to the north of Dapper Road.

Visual sensitivity: Rural views such as these are experienced by people travelling south of Cobbora, including residents and visitors to local homesteads and properties along Dapper Road. The strong rural character and lack of large-scale development add to the sense of remoteness and scenic quality of this view. Overall, this view is of low visual sensitivity.

Visual impact during construction: Construction of the new energy hub at Elong Elong would be prominent, occupying an area of around 200 hectares and transforming the rural landscape seen in this view. Construction activity would include major earthworks and vegetation clearance, including the removal of the hilltop trees in the background of view and within fields. The formation of several new transmission line easements would be seen, extending to the energy hub, including vegetation clearance, foundation construction and installation of large-scale steel lattice towers, between around 54 to 72 metres tall, introducing a new and much larger scale of development to this rural view. In the background of the view there would be a construction compound with facilities including site offices, tower assembly areas, concrete batching plant and a helipad with occasional helicopter flights. Overall, the project would be seen in close proximity and extend across this entire view, detracting from the rural character and scenic qualities of the view. There would be a high magnitude of change to a view of low sensitivity, and a moderate visual impact during construction.

Visual impact during operation: The new energy hub at Elong Elong would be prominent and in close proximity, extending from the view foreground, into the background of view, transforming the rural character of this view to one of dominated by large-scale electricity infrastructure. New 500 kV and 330 kV switching stations would be visible, and other support equipment and infrastructure such as access roads and fencing. Several transmission line easements would also be visible, including two double circuit 500 kV transmission lines extending east of the energy hub towards Spring Ridge Road, containing towers up to around 72 metres tall. To the west of the energy hub, the upper section of three lines of double circuit 330 kV transmission towers would be visible, in the background of view, extending west towards three switching stations (E1, E2 and E3) at Cobbora. Overall, the project would substantially change the character and detract from the amenity of this view. There would be a high magnitude of change to a view of low sensitivity, and a moderate visual impact during operation.

Viewpoint 24: Views from Dapper Road east

Figure 6-31 View north from Dapper Road east

Figure 6-32 View west along Dapper Road east

Location: 32’12'27”35"S, 149’15'16”83"E (Figure 6-31) and 32’12'29”86"S, 149’15'2”20"E (Figure 6-32)

Existing conditions: These views show the undulating rural landscape north of Dapper Road (refer to Figure 6-31 and Figure 6-32). The land in this area has been cleared for agricultural use, including grazing pastures and crops with scattered trees and rural dwellings. This location is slightly elevated above the Sandy and Laheys creek valleys, with long range views to the north and east towards the forested hills at Cobbora State Conservation Area and Tuckland State Forest. Views from this location have a rural character with few large-scale built structures other than rural sheds.

Future conditions: This area forms part of the proposed Sandy Creek solar farm site (EIS currently being prepared), located to the north of Dapper Road.

Visual sensitivity: Rural views such as these are experienced by residents and visitors to local homesteads and properties along Dapper Road. The rural character and sense of remoteness and scenic quality of this view. Overall, this view is of low visual sensitivity.

Visual impact during construction: Construction of the new energy hub at Elong Elong would be prominent in the view shown in Figure 6-31. There would be a construction compound in the view foreground, extending north towards a newly formed easement, extending west of the energy hub. This compound would include site offices and amenities, storage areas. There would be stockpiles, laydown and tower assembly areas, concrete batching plant and helipad with intermittent helicopter use. The power line easement would be generally aligned to Dapper Road, offset around 700 metres, and include installation of several large transmission towers, up to around 63 metres tall. Construction activity at the energy hub would be seen in the background of view, including earthworks, vegetation clearance and installation of the energy hub infrastructure. Further to the north, the construction of two switching stations (E1 and E2) would be visible, at Cobbora, with two associated newly formed transmission line easements, connecting between the switching stations and energy hub.

To the west, construction of the double circuit 330 kV transmission line (Cobbora west connection) would be prominent in the view shown in Figure 6-32. The easement would extend diagonally through the field in the foreground of view, before changing directions, crossing and running parallel with Dapper Road, in the background of view, towards a new switching station (E3), located around four kilometres away.

Overall, the project would be a prominent feature in these views, introducing extensive construction activity and detracting from the amenity of these views. There would be a high magnitude of change to these views, which are of low sensitivity, resulting in moderate visual impacts during operation.

Visual impact during operation: The project would introduce large-scale electricity infrastructure in these views. The energy hub and transmission line towers in several easements would be prominent, extending to/from the energy hub, containing towers up to around 54 to 72 metres tall. The project would extend across these views, transforming and detracting from the rural character and amenity, which currently does not contain large-scale built features or electricity infrastructure. While the energy hub would be seen against a backdrop of trees and the gantries would not be seen against the skyline in Figure 6-31, the energy hub would spread across a large part of the middle ground of view, dominating northerly views from this location. Overall, there would be a high magnitude of change to views of low sensitivity, resulting in a moderate visual impact during operation.

Viewpoint 25: View south from Dapper Road

Figure 6-33 View north from Dapper Road

Figure 6-34 View south from Dapper Road

Location: 32°12’28.19”S, 149°12’16.23”E

Existing conditions: The view in Figure 6-34 shows the rural landscape ascending east from the Spring Creek valley, along Dapper Road. The land in this area has been cleared for agricultural use, including grazing pastures and crops with scattered rural dwellings and pockets of vegetation along field boundaries and roads. Views from this location contain a strong rural character with few large-scale built structures.

Visual sensitivity: Rural views such as these are experienced by residents and visitors to local homesteads and properties along Dapper Road. The rural character and sense of remoteness contribute to the scenic qualities of this view. There are no particular landscape features in this view and views such as this are common in this area. Overall, this view is of **very low visual sensitivity**.

Visual impact during construction: In Figure 6-33, the project would generally align parallel to Dapper Road, extending across the fore and middle ground of these views. In this largely cleared rural landscape, the construction of several transmission towers sites and a new switching station (E3) would be seen from this location, alongside Dapper Road.

In the view shown in Figure 6-33, the project would generally extend along the northern side and parallel to Dapper Road. The trees along the road would be retained, filtering views from this location. The flat area to the right of view would be used as a brake and winch site during construction, as the new transmission lines cross Dapper Road and change direction to the south. In the view shown in Figure 6-34, the project would extend along the eastern side and parallel to Dapper Road. Construction vehicles and machinery would be seen in this view, travelling along the easement and installing the new switching station, transmission line towers and stringing the wires and conductors. The construction activity would be seen in close proximity, extending across each view from this location. Overall, there would be a high magnitude of change to a view of very low sensitivity, resulting in a **low-moderate visual impact** during construction.

Visual impact during operation: The project would be seen running parallel to Dapper Road, along the northern side of the road in Figure 6-33, changing direction and crossing over Dapper Road to the south. In Figure 6-34 the project would be aligned running parallel to Dapper Road, on the eastern side, along the edge of a field. The new double and single circuit 330 kV transmission line towers would be prominent in this view, consisting of steel lattice towers reaching between around 63 and 54 metres tall and rising above the surrounding vegetation. The new switching station (E3) would also be prominent in Figure 6-33, north of Dapper Road, around 500 metres away. A large section of the project would be visible at close range, crossing over Dapper Road and extending into the rural landscape either side, resulting in a high magnitude of change to a view of very low sensitivity, and a **low-moderate visual impact** during operation.

Viewpoint 26: View north west from Dapper Road west

Figure 6-35 View north west from Dapper Road west

Location: 32°15'1.61"S, 149°11'46.14"E

Existing conditions: This view shows the undulating rural hills extending west of Dapper Road, north of Dapper Nature Reserve (refer to Figure 6-35). The land in this area has been cleared for agricultural use, including mainly grazing pastures with scattered trees and rural dwellings. Views from this location contain a strong rural character with few large-scale built structures. The landform gently rises to a small ridgeline in the background of view, including Cobra Hill.

Future conditions: This area forms part of the proposed Spicers Creek wind farm site (EIS currently being prepared), located to the north of Dapper Road, including up to 122 wind turbines, with transmission connection and associated infrastructure.

Visual sensitivity: Rural views such as these are experienced by people travelling south of Cobbora, including residents and visitors to local homesteads and properties along Dapper Road and nearby Bald Hill Road. The rural character and sense of remoteness contribute to the scenic quality of this view. Overall, this view is of low visual sensitivity.

Visual impact during construction: In the background of view, construction of a new switching station (E4 Goolma) would be seen around 2.5 kilometres away, beyond and partially screened by a small ridgeline. The switching station would be installed on part of a cleared field, with the surrounding trees retained and filtering views to the site. Installation of new single circuit 330 kV transmission lines would be seen extending in a southerly direction from the switching station, including erection of steel lattice towers and stringing of the wires and conductors. The transmission lines would then extend in an easterly and northerly direction in the middle ground of view, through the undulating rural landscape towards the new energy hub at Elong Elong, further to the north east. From this location, the construction activity would be seen in a rural landscape, against a backdrop of partially forested ridgeline, near Cobra Hill. The scale and proximity of the project,

including the switching station construction and new transmission lines, within a mostly cleared rural landscape with little intervening vegetation would increase the prominence of the construction activity in this view. Overall, there would be a high magnitude of change to a view of low visual sensitivity and a **moderate visual impact** during construction.

Visual impact during operation: The new Goolma switching station at would be visible in the background of view, beyond and slightly below the ridgeline, so that the lower part of the substation would be screened by this intervening landform. The gantries at the new switching station would however rise above the treeline of vegetation along this ridge, increasing the prominence of the project in the view. The new single circuit 330 kV transmission line towers would be prominent large-scale electricity infrastructure, visible in the middle ground of this view. The towers would be around 54 metres tall, within an easement extending south from the switching station then traversing in an easterly and northerly direction, spreading them across the undulating rural landscape seen in this view. While some of the areas impacted by the construction compound would have been reinstated and returned to rural use, including pasture fields and existing rural uses that would continue to be seen around and within the new easement, the project would introduce large-scale electricity infrastructure into a view with few large-scale built structures. Overall, the project would contrast with the rural character and detract from the amenity of this view. There would be a high magnitude of change to a view of low sensitivity, and a **moderate visual impact** during operation.

6.2.4 Views from the air

Views from the air have been addressed for the whole landscape and visual study area, generally using the daytime visual impact method described in section 3.5.

Existing conditions: The Dubbo Airport is located approximately 56.2 km (30.34 nautical miles) and the Mudgee Airport is located approximately 31.5 kilometres (17 nautical miles) from the project.

Visual sensitivity: There are recreational flights operating from Dubbo Airport, including scenic helicopter and aircraft flights, as well as adventure joy flights, offering views over Dubbo and the surrounding rural areas. The project is located over 50 kilometres from Dubbo and the landscape and visual study area does not appear to be the focus of these flights.

There are also recreational flights operating from the Mudgee Airport, including scenic helicopter and aircraft flights, offering views over Mudgee and the surrounding vineyards, Cudgegong Valley and Lake Windamere, including stops to local vineyards and country pubs. There are also hot air ballooning flights leaving from Mudgee. The project is located around 30 kilometres from Mudgee at its closest point. The site does not appear to be an area overflown by these flights.

The scenic flights offered from these airports are for tourist and recreational purposes, from both helicopters and planes. The views from these flights are the focus of these journeys and, where they fly over the surrounding landscape, are of **moderate visual sensitivity**.

Visual impact during construction: Construction of the project would be visible, unobstructed from the air. In areas to the south east of the project, construction would be seen within a complex landscape, including a variety of land uses and built form, such as mining activity near Ulan and other electricity infrastructure such as the existing Wollar substation. In northern, central and western parts of the project, the undulating landform and vegetation within the rural landscape would provide some visual enclosure to the project construction.

Although the construction of the energy hubs and interlinking easements would be visible from the air, they would not be a focus or area likely to be overflown by scenic flights from Dubbo and Mudgee.

However, if there were views, there would be rural areas where there would be extensive clearing the construction activity associated with the proposed infrastructure, this would include clearing and construction of transmission lines creating long, straight corridors within the landscape contrasting in particular with the undulating and hilly landforms. The energy hubs and switching stations would also be located in areas where there are several transmission lines under construction, culminating in greater visibility of the project.

Overall, there may be isolated areas where the construction of the project would result in a moderate magnitude of change to views from the air, which are of moderate visual sensitivity, resulting in a temporary **moderate visual impact** during construction.

Visual impact during operation: The project, particularly the new transmission line easements, would create a strong line across the landscape in views from the air. Within the forested areas, the project would present a new built feature which would be visually noticeable from the air due to the clearance of vegetation. The energy hubs at Merotherie and Elong Elong, as well as several new switching stations throughout the operation area, would introduce new large-scale electricity infrastructure in the rural landscape, contrasting with the character of the rural valley and undulating rural hill landscapes, which currently contain few large-scale built features. There would also be areas where the transmission lines are located within approved solar and wind farms, reducing the level of visual contrast between the project and the existing landscape.

While the project would be visible from the air during operation of the project, they would not be a focus or destination in scenic flights from Dubbo and Mudgee. Overall, there would be a low magnitude of change to views from the air, which are of moderate visual sensitivity, resulting in a **low-moderate visual impact** during construction.

6.2.5 Summary of daytime visual impacts

The daytime visual impacts are listed in **Table 6-1**.

Table 6-1 Summary of daytime visual impacts

			Construction		Operation	
No.	Location	Visual sensitivity	Magnitude of change	Visual impact	Magnitude of change	Visual impact
1	View north east from Barigan Road	Very low	Moderate	Low	Moderate	Low
2	View west from Barigan Road	Low	Moderate	Low-moderate	Moderate	Low-moderate
3	Views from Wollar Road	Very low	High	Low-moderate	High	Low-moderate
4	View west from Wollar-Ulan Road	Very low	Moderate	Low	Moderate	Low
5	View south west from Main Street, Ulan	Very low	Moderate	Low	Moderate	Low
6	View south from Blue Springs Road, Stubbo	Very low	Moderate	Low	Moderate	Low
7	View east from Merotherie Road	Very low	High	Low-moderate	High	Low-moderate
8	View south from Birriwa Bus Route South	Low	High	Moderate	High	Moderate
9	View south east from Birriwa Bus Route South	Low	High	Moderate	High	Moderate
10	View south west from Blue Springs Road	Low	High	Moderate	High	Moderate

			Construction		Operation	
11	View from Blue Springs Road, Bungaba	Low	High	Moderate	High	Moderate
12	View from Blue Springs Road north	Low	High	Moderate	High	Moderate
13	View north east from the Golden Highway, Leadville	Low	Moderate	Low-moderate	Moderate	Low-moderate
14	View west from the Golden Highway, Uarbry	Low	Moderate	Low-moderate	Moderate	Low-moderate
15	View from Ulan Road, Cassilis	Very low	High	Moderate	Negligible	Negligible
16	Views from the Golden Highway, Cassilis	Low	Moderate	Low-moderate	Moderate	Low-moderate
17	Views from Coolah Road	Low	Moderate	Low-moderate	Moderate	Low-moderate
18	View east from Rotherwood Road	Low	Moderate	Low-moderate	Moderate	Low-moderate
19	Views from the Castlereagh Highway, Tallawang	Low	High	Moderate	High	Moderate
20	View west from Tucklan Road	Very low	High	Low-moderate	High	Low-moderate
21	View south from Puggoon Road	Low	Moderate	Low-moderate	Moderate	Low-moderate
22	Views from Spring Ridge Road	Low	High	Moderate	High	Moderate
23	View north west from Dapper Road, near Spring Ridge Road	Low	High	Moderate	High	Moderate
24	Views from Dapper Road east	Low	High	Moderate	High	Moderate
25	View south from Dapper Road	Very low	Moderate	Low	Moderate	Low
26	View north west from Dapper Road west	Low	Moderate	Low-moderate	Moderate	Low-moderate
Views from the air						
-	Views from the air	Moderate	Low	Low-moderate	Low	Low-moderate

6.3 Assessment of visual impact – private dwellings

The assessment of views from private dwellings has been undertaken as a two stage process, as described in Chapter 3 of this technical paper. Stage one being a preliminary visual impact screening to shortlist dwellings that may have the potential for a visual impact, and Stage 2 being a detailed view assessment.

6.3.1 Stage 1- Preliminary visual impact screening

128 private dwellings were identified within two kilometres of the project. All 128 private dwellings were then subject to a preliminary visual impact screening. This preliminary visual impact screening process applied several criteria to eliminate private dwellings that were considered as being of a very low level of concern and / or effect. The impact visual impact screening criteria included consideration of land use and ownership, scenic quality (based on landscape character type), the number of towers that would theoretically be visible (based on landform only), and the potential horizontal field of view (refer to Table 3-10 in section 3.5.3.1 for more information).

Following this screening process, there were 91 private dwellings remaining that required further detailed visual assessment. The desktop visual impact screening is provided in full in Appendix I. Table 6-2 provides a summary of the preliminary visual impact screening results. This table also identifies whether the dwelling is hosting transmission infrastructure as this is relevant to the provision of mitigation.

Table 6-2 Summary of preliminary visual impact screening

Dwelling ID	Distance to Project operational area (metres)	Location	Project host (Y/N)	Potential for a visual impact (Y/N)
9	900	96 Maree Road, Tichular	N	N
19	950	Barigan Road, Wollar	N	Y
31	1,900	Barigan Road, Wollar	Y	N
68	0	130 Wilpinjong Road, Wilpinjong	Y	N
119	0	1239 Ulan-Wollar Road, Wilpinjong	Y	N
130	0	31 Trgo Close, Wilpinjong	Y	N
134	40	31 Trgo Close, Wilpinjong	Y	N
181	215	684 Ulan Wollar Road, Ulan	Y	N
311	150	349 Ulan-Wollar Road, Ulan	Y	N
274	850	112 Main Street, Ulan (Mining Camp)	N	N
256	760	94 Main Street, Ulan (Mining Camp)	N	N
245	780	28 Robison Street, Ulan,	N	Y
236	750	15 Robison Street, Ulan	N	Y
228	690	20 Robison Street, Ulan	N	Y
224	680	18 Robison Street, Ulan	N	Y
216	670	6 Bent Street, Ulan	N	Y
207	500	2236 Cope Road, Cope	N	Y
198	220	Main Street, Ulan	N	Y
151	1,360	3646 Ulan Road, Ulan	N	N
166	760	9-127 Toole Road, Ulan	N	Y
188	660	3812 Ulan Road, Ulan	N	Y
162	1,240	127 Toole Road, Ulan	N	N
204	990	2034 Cope Road, Cope	N	Y
247	710	1977 Cope Road, Cope	N	Y
230	910	1976 Cope Road, Cope	N	N
244	1,140	1936 Cope Road, Cope	N	Y
267	920	1910 Cope Road, Cope	N	Y
328	420	1863 Cope Road, Cope	Y	Y
333	630	1713 Cope Road, Cope	N	Y
335	820	1679 Cope Road, Cope	Y	Y

Dwelling ID	Distance to Project operational area (metres)	Location	Project host (Y/N)	Potential for a visual impact (Y/N)
350	660	1601 Cope Road, Cope	N	Y
357	650	1599 Cope Road, Cope	N	Y
367	430	1599 Cope Road, Ulan	Y	Y
373	640	440 Blue Springs Road, Stubbo	N	Y
399	290	654 Blue Springs Road, Stubbo	Y	Y
410	1,690	709 Blue Springs Road, Stubbo	Y	N
462	1,650	917 Blue Springs Road, Cope	N	Y
1483	210	86 Rissler Road, Stubbo	Y	Y
485	1,650	1083 Blue Springs Road, Cope	N	Y
616	1,300	1303 Blue Springs Road, Cope	N	Y
1351	220	1089 Rotherwood Road, Cassilis	Y	Y
1475	930	Summerhill Road, Turill	N	Y
1480	140	9843 Golden Highway, Cassilis	Y	Y
1482	760	135 Birkalla Road, Merotherie	Y	Y
1308	1,600	Coolah Road, Cassilis	N	Y
1159	650	Golden Highway, Cassilis	Y	Y
1163 / 1162	520	9843 Golden Highway, Cassilis	Y	Y
1103	1,410	Ulan Road, Turill	Y	Y
991	1,900	6215 Ulan Road, Turill	N	N
971	1,960	6161 Ulan Road, Turill	N	N
960	2,250	6182 Ulan Road, Turill	N	N
964	1,980	6190 Ulan Road, Turill	N	N
975	1,870	6149 Ulan Road, Turill	N	N
979	280	2178-2461 Blue Springs Road, Bungaba	Y	Y
1010	910	140 Turill Bus Route, Turill	N	Y
1015	870	140 Turill Bus Route, Turill	N	Y
1044	880	6293 Ulan Road, Turill	N	Y
1066	600	6293 Ulan Road, Turill	N	Y
1091	280	6569 Ulan Road, Turill	Y	Y
1200	990	11880 Golden Highway, Uarbry	N	Y
1003	400	Turill Bus Route, Turill	Y	Y
1202	510	Golden Highway, Uarbry	Y	Y
1288	660	1370 Moorefield Road, Uarbry	Y	Y
1261	1,250	247 Moorefield Road, Uarbry	Y	Y
1316	780	1280 Moorefield Road, Uarbry	N	Y
1323	1,320	1370 Moorefield Road, Coolah	N	Y
1324	520	Moorefield Road, Coolah	Y	Y
1223 / 1221	1,450	12700 Golden Hwy, Uarbry	N	N
1246	1,710	995 Wardens Road, Leadville	N	N
1184	1,700	190 Melrose Road, Leadville	N	Y
1195	520	12694 Golden Hwy, Uarbry	N	Y
1037	1,220	Cliffdale Road, Uarbry	N	Y
1152	680	Cliffdale Road, Leadville	Y	Y
1119	350	121 Cliffdale Road, Uarbry	N	Y
1057	910	549 Blue Springs Road Uarbry	Y	Y
1070	2,180	390 Cliffdale Road, Uarbry	N	N
998	1,410	Blue Springs Road, Leadville	N	Y
929	210	2178 Blue Springs Road, Bungaba	Y	Y
927	320	944 Birkalla Road, Bungaba	Y	Y
955	800	782 Birkalla Road, Bungaba	N	Y
941	460	782-944 Birkalla Road, Bungaba	N	Y
947	580	675 Birkalla Road, Bungaba	N	Y
846	1,910	1811 Blue Springs Road, Bungaba	N	N
1027	1,830	951 Birriwa Bus Route North, Merotherie	N	N
880/876	240	908 Birriwa Bus Route, Merotherie	Y	Y

Dwelling ID	Distance to Project operational area (metres)	Location	Project host (Y/N)	Potential for a visual impact (Y/N)
965	1,210	Birriwa Bus Route north, Merotherie	Y	Y
826	1,150	82 Birkalla Road, Merotherie	N	Y
697	1,950	57 Wonga Roo Road, Bungaba	N	N
703	280	677 Merotherie Road, Merotherie	Y	Y
627	670	633 Merotherie Road, Merotherie	N	N
588	1,480	463 Merotherie Road, Merotherie	N	N
354	350	775 Puggoon Road, Tallawang	N	Y
365	1,120	800 Puggoon Road, Tallawang	N	Y
385	580	980 Puggoon Road, Tallawang	N	Y
429	1,780	1450 Castlereagh Hwy, Tallawang	N	N
902	2,420	Birriwa Bus Route south, Birriwa	N	N
868	1,780	2832 Castlereagh Hwy, Birriwa	N	N
636	1,320	2282 Castlereagh Highway, Tallawang	N	Y
663/659	980	2330 Castlereagh Highway, Tallawang	N	Y
672	930	2342 Castlereagh Hwy, Tallawang	Y	Y
741	480	2493 Castlereagh Highway, Tallawang	N	Y
790	1,280	2610 Castlereagh Highway, Tallawang	Y	Y
792	1,350	1744 Tucklan Road, Tallawang	N	N
772	990	1776 Tucklan Road, Dunedoo	N	Y
775	1,090	2584 Castlereagh Hwy, Tallawang	Y	Y
732	20	41 Spir Road, Tallawang	Y	Y
705	530	Spir Road, Tallawang	N	Y
717	400	145 Spir Road, Tallawang	N	Y
789	1,690	327 Laheys Creek Road, Dunedoo	N	N
747	930	745 Laheys Creek Road, Dunedoo,	N	N
609	1,750	1420 Laheys Creek Road, Dunedoo	N	Y
611	1,100	Laheys Creek Road, Dunedoo	Y	Y
619	1,780	142B Suzanne Road, Tallawang	N	N
621	1,600	158 Suzanne Road, Tallawang	N	N
730 / 733	390	1010 Laheys Creek Road, Dunedoo	Y	Y
719	1,060	1050 Spring Ridge Road, Cobbora	Y	Y
543	1,110	330 Whistons Lane, Tallawang	Y	Y
531	95	330 Whistons Lane, Tallawang	Y	Y
487	1,340	250 Whistons Lane, Tallawang	N	Y
539	55	Dapper Road, Dunedoo	Y	Y
646	1,350	1069 Sandy Creek Road, Cobbora	N	Y
580	220	Sandy Creek Road, Dunedoo	Y	Y
584/585	300	1198 Sandy Creek Road, Cobbora	Y	Y
480	1,460	1484 Sandy Creek Road, Dunedoo	N	Y
560	1,010	Dapper Road, Dunedoo	Y	Y
464	590	Dapper Road, Dunedoo	N	Y
392	1,150	317 Bald Hill Road, Goolma	N	N
380	1,980	190 Bald Hill Road, Goolma	N	N

6.3.2 Stage 2- Detailed view assessment of shortlisted private dwellings

A more detailed assessment has been undertaken on those dwellings identified as having the potential for a moderate or higher visual impact. This assessment is contained in Appendix J. A summary of the results of this assessment is contained in Table 6-3.

In summary, the detailed assessment of visual impact identified the following pre mitigation visual impacts from private dwellings:

- 13 dwellings would have a **high** visual impact
- 20 dwellings would have a **moderate** visual impact, and
- All remaining dwellings would have a low or negligible visual impact.

These visual impact levels have the potential to be further reduced by mitigation measures.

Of the 91 dwellings that were assessed in detail 52 would not host project infrastructure. Of these dwellings on non-host properties:

- 3 dwellings would have a **high** visual impact
- 13 dwellings would have a **moderate** visual impact, and
- All remaining dwellings would have a low or negligible visual impact.

In the following Table 6-3, the visual impact level of those dwellings on no-host properties have been shaded in green, and highlighted with a black outline where the impact is moderate or high, and mitigation would be necessary.

Table 6-3 Summary of Stage 2 Detailed dwelling view assessment – daytime during operation

Receiver ID	Distance to Project operational area (metres)	Location / address	Project host (Y/N)	Detailed visual assessment (Y/N)	Visual Sensitivity	Magnitude of Change	Visual Impact level	Detailed assessment provided
19	950	Barigan Road, Wollar	N	Y	Moderate	Low	Low	Appendix J Page 1
31	1,900	Barigan Road, Wollar	Y	N	Moderate	Low	Low	Appendix J Page 2
245	780	28 Robison Street, Ulan,	N	Y	Moderate	Low	Low	Appendix J Page 3
236	750	15 Robison Street, Ulan	N	Y	Moderate	Low	Low	Appendix J Page 3
228	690	20 Robison Street, Ulan	N	Y	Moderate	Low	Low	Appendix J Page 4
224	680	18 Robison Street, Ulan	N	Y	Moderate	Low	Low	Appendix J Page 4
216	670	6 Bent Street, Ulan	N	Y	Moderate	Low	Low	Appendix J Page 5
207	500	2236 Cope Road, Cope	N	Y	Moderate	Moderate	Moderate	Appendix J Page 5
198	220	Main Street, Ulan	N	Y	Moderate	Moderate	Moderate	Appendix J Page 6
166	760	9-127 Toole Road, Ulan	N	Y	Moderate	Low	Low	Appendix J Page 7
188	660	3812 Ulan Road, Ulan	N	Y	Moderate	Low	Low	Appendix J Page 8
204	990	2034 Cope Road, Cope	N	Y	Moderate	Low	Low	Appendix J Page 8

Receiver ID	Distance to Project operational area (metres)	Location / address	Project host (Y/N)	Detailed visual assessment (Y/N)	Visual Sensitivity	Magnitude of Change	Visual Impact level	Detailed assessment provided
247	710	1977 Cope Road, Cope	N	Y	Moderate	Low	Low	Appendix J Page 9
244	1,140	1936 Cope Road, Cope	N	Y	Moderate	Low	Low	Appendix J Page 9
267	920	1910 Cope Road, Cope	N	Y	Moderate	Moderate	Moderate	Appendix J Page 10
328	420	1863 Cope Road, Cope	Y	Y	Moderate	Moderate	Moderate	Appendix J Page 14
333	630	1713 Cope Road, Cope	N	Y	Moderate	Negligible	Negligible	Appendix J Page 15
335	820	1679 Cope Road, Cope	Y	Y	Moderate	Low	Low	Appendix J Page 15
350	660	1601 Cope Road, Cope	N	Y	Moderate	Moderate	Moderate	Appendix J Page 16
357	650	1599 Cope Road, Cope	N	Y	Moderate	Moderate	Moderate	Appendix J Page 17
367	430	1599 Cope Road, Cope	Y	Y	Moderate	Low	Low	Appendix J Page 18
373	640	440 Blue Springs Road, Stubbo	N	Y	Moderate	Moderate	Moderate	Appendix J Page 18
399	290	654 Blue Springs Road, Stubbo	Y	Y	Moderate	High	High	Appendix J Page 19
462	1,650	917 Blue Springs Road, Cope	N	Y	Low	Negligible	Negligible	Appendix J Page 25
485	1,650	1083 Blue Springs Road, Cope	N	Y	Low	Negligible	Negligible	Appendix J Page 25
1483	210	86 Rissler Road, Stubbo	Y	Y	Moderate	High	High	Appendix J Page 26
616	1,300	1303 Blue Springs Road, Cope	N	Y	Moderate	Negligible	Negligible	Appendix J Page 27
826	1,150	82 Birkalla Road, Merotherie	N	Y	Low	Low	Low	Appendix J Page 28
703	280	677 Merotherie Road, Merotherie	Y	Y	Low	Low	Low	Appendix J Page 31
1482	760	135 Birkalla Road, Merotherie	Y	Y	Moderate	Negligible	Negligible	Appendix J Page 32
1027	1,830	951 Birriwa Bus Route North, Merotherie	N	N	Moderate	Low	Low	Appendix J Page 33
880 / 876	240	908 Birriwa Bus Route, Merotherie	Y	Y	Moderate	High	High	Appendix J Page 33
902	2,420	Birriwa Bus Route south, Birriwa	N	N	Low	Moderate	Low	Appendix J Page 34
965	1,210	Birriwa Bus Route north, Merotherie	Y	Y	Moderate	Negligible	Negligible	Appendix J Page 37

Receiver ID	Distance to Project operational area (metres)	Location / address	Project host (Y/N)	Detailed visual assessment (Y/N)	Visual Sensitivity	Magnitude of Change	Visual Impact level	Detailed assessment provided
998	1,410	Blue Springs Road, Leadville	N	Y	Moderate	Low	Low	Appendix J Page 38
955	800	782 Birkalla Road, Bungaba	N	Y	Low	Low	Low	Appendix J Page 38
929	210	2178 Blue Springs Road, Bungaba	Y	Y	Low	High	High*	Appendix J Page 39
927	320	944 Birkalla Road, Bungaba	Y	Y	Low	Low	Low	Appendix J Page 43
941	460	782-944 Birkalla Road, Bungaba	N	Y	Low	Moderate-High	Moderate	Appendix J Page 44
947	580	675 Birkalla Road, Bungaba	N	Y	Low	Negligible	Negligible	Appendix J Page 47
846	1,910	1811 Blue Springs Road, Bungaba	N	N	Moderate	Low	Low	Appendix J Page 48
979	280	2178-2461 Blue Springs Road, Bungaba	Y	Y	Moderate	High	High	Appendix J Page 48
1152	680	Cliffdale Road, Leadville	Y	Y	Moderate	Low	Low	Appendix J Page 49
1057	910	549 Blue Springs Road Uarbry	Y	Y	Moderate	Low	Low	Appendix J Page 52
1195	520	12694 Golden Hwy, Uarbry	N	Y	Moderate	Moderate	Moderate	Appendix J Page 52
1184	1,700	190 Melrose Road, Leadville	N	Y	Low	Negligible	Negligible	Appendix J Page 53
1202	510	Golden Highway, Uarbry	Y	Y	Low	Negligible	Negligible	Appendix J Page 53
1200	990	11880 Golden Highway, Uarbry	N	Y	Moderate	Low	Low	Appendix J Page 55
1261	1,250	247 Moorefield Road, Uarbry	Y	Y	Low	Low	Low	Appendix J Page 54
1288	660	1370 Moorefield Road, Uarbry	Y	Y	Moderate	Moderate	Moderate	Appendix J Page 56
1316	780	1280 Moorefield Road, Uarbry	N	Y	Low	Low	Low	Appendix J Page 59
1323	1,320	1370 Moorefield Road, Coolah	N	Y	Moderate	Low	Low	Appendix J Page 62
1324	520	Moorefield Road, Coolah	Y	Y	Moderate	Moderate	Moderate	Appendix J Page 63
1119	350	121 Cliffdale Road, Uarbry	N	Y	Low	Moderate	Low	Appendix J Page 66
1070	2,180	390 Cliffdale Road, Uarbry	N	N	Moderate	Low	Low	Appendix J Page 69
1010 / 1015	870	140 Turill Bus Route, Turill	N	Y	Moderate	Low	Low	Appendix J Page 69
1037	1,220	Cliffdale Road, Uarbry	N	Y	Moderate	Moderate	Moderate	Appendix J Page 70
1003	400	Turill Bus Route, Turill	Y	Y	Low	Low	Low	Appendix J Page 73

Receiver ID	Distance to Project operational area (metres)	Location / address	Project host (Y/N)	Detailed visual assessment (Y/N)	Visual Sensitivity	Magnitude of Change	Visual Impact level	Detailed assessment provided
1044	880	6293 Ulan Road, Turill	N	Y	Moderate	Low	Low	Appendix J Page 77
1066	600	6293 Ulan Road, Turill	N	Y	Moderate	Moderate	Moderate	Appendix J Page 74
1091	280	6569 Ulan Road, Turill	Y	Y	Moderate	Moderate	Moderate	Appendix J Page 78
1103	1,410	Ulan Road, Turill	Y	Y	Moderate	Negligible	Negligible	Appendix J Page 79
1475	930	Summerhill Road, Turill	N	Y	Moderate	Low	Low	Appendix J Page 80
1159	650	Golden Highway, Cassilis	Y	Y	Low	Low	Low	Appendix J Page 80
1163 / 1162	520	9843 Golden Highway, Cassilis	Y	Y	Low	Low	Low	Appendix J Page 81
1308	1,600	Coolah Road, Cassilis	N	Y	Moderate	Low	Low	Appendix J Page 81
1480	140	9843 Golden Highway, Cassilis	Y	Y	Low	Low	Low	Appendix J Page 82
1351	220	1089 Rotherwood Road, Cassilis	Y	Y	Low	Negligible	Negligible	Appendix J Page 83
741	480	2493 Castlereagh Highway, Tallawang	N	Y	Moderate	High	High	Appendix J Page 84
790	1,280	2610 Castlereagh Highway, Tallawang	Y	Y	Moderate	Moderate	Moderate	Appendix J Page 89
775	1,090	2584 Castlereagh Hwy, Tallawang	Y	Y	Moderate	High	High	Appendix J Page 91
663 / 659	980	2330 Castlereagh Highway, Tallawang	N	Y	Moderate	High	High	Appendix J Page 92
672	930	2342 Castlereagh Hwy, Tallawang	Y	Y	Moderate	High	High	Appendix J Page 95
636	1,320	2282 Castlereagh Highway, Tallawang	N	Y	Moderate	Moderate	Moderate	Appendix J Page 95
772	990	1776 Tucklan Road, Dunedoo	N	Y	Moderate	Negligible	Negligible	Appendix J Page 96
789	1,690	327 Laheys Creek Road, Dunedoo	N	N	Moderate	Low	Low	Appendix J Page 97
732	20	41 Spir Road, Tallawang	Y	Y	Moderate	High	High	Appendix J Page 97
792	1,350	1744 Tucklan Road, Tallawang	N	Y	Moderate	Negligible	Negligible	Appendix J Page 98
717	400	145 Spir Road, Tallawang	N	Y	Moderate	High	High	Appendix J Page 99

Receiver ID	Distance to Project operational area (metres)	Location / address	Project host (Y/N)	Detailed visual assessment (Y/N)	Visual Sensitivity	Magnitude of Change	Visual Impact level	Detailed assessment provided
705	530	Spir Road, Tallawang	N	Y	Moderate	Moderate	Moderate	Appendix J Page 103
543	1,110	330 Whistons Lane, Tallawang	Y	Y	Moderate	Low	Low	Appendix J Page 103
730 / 733	390	1010 Laheys Creek Road, Dunedoo	Y	Y	Moderate	Moderate	Moderate	Appendix J Page 104
531	95	330 Whistons Lane, Tallawang	Y	Y	Moderate	High	High	Appendix J Page 105
487	1,340	250 Whistons Lane, Tallawang	N	Y	Low	Negligible	Negligible	Appendix J Page 105
429	1,780	1450 Castlereagh Hwy, Tallawang	N	N	Moderate	Negligible	Negligible	Appendix J Page 106
385	580	980 Puggoon Road, Tallawang	N	Y	Low	Moderate	Low	Appendix J Page 106
365	1,120	800 Puggoon Road, Tallawang	N	Y	Low	Low	Low	Appendix J Page 107
354	350	775 Puggoon Road, Tallawang	N	Y	Low	Moderate	Moderate	Appendix J Page 107
609	1,750	1420 Laheys Creek Road, Dunedoo	N	Y	Moderate	Low	Low	Appendix J Page 108
611	1,100	**1350 Spring Ridge Road, Dunedoo**	Y	Y	Moderate	Low	Low	Appendix J Page 108
719	1,060	1050 Spring Ridge Road, Cobbora	Y	Y	Moderate	Moderate	Moderate	Appendix J Page 109
539	55	Dapper Road, Dunedoo	Y	Y	Moderate	High	High	Appendix J Page 110
646	1,350	1069 Sandy Creek Road, Cobbora	N	Y	Moderate	Low	Low	Appendix J Page 114
580	220	Sandy Creek Road, Dunedoo	Y	Y	Low	Low	Low	Appendix J Page 114
584/ 585	300	1198 Sandy Creek Road, Cobbora	Y	Y	Low	Low	Low	Appendix J Page 115
480	1,460	1484 Sandy Creek Road, Dunedoo	N	Y	Moderate	Low	Low	Appendix J Page 115
464	590	Dapper Road, Dunedoo	N	Y	Moderate	Negligible	Negligible	Appendix J Page 116
560	1,010	Dapper Road, Dunedoo	Y	Y	Moderate	Low	Low	Appendix J Page 117

** Assessment level increased from moderate due to the close proximity of towers that would be seen in multiple directions from the dwelling.*

6.3.2.1 Potential daytime visual impacts during construction

During construction of the transmission line infrastructure, there would be various construction activities occurring at multiple locations within the construction area at any one time, and progressively as different activities are required for site preparation, ground works, installation of the structures and electrical equipment. The timing of construction, therefore, would vary during the construction program so that there would be works seen intermittently from locations along the transmission line, and with the extent and character of construction activity changing throughout the process.

Construction of the new energy hubs and new maintenance facility, would have larger scale construction activities present for a longer duration, due to the scale of the infrastructure. At the Merotherie energy hub this construction site would be co-located with the construction compound and workforce accommodation camp, and there would be work to construct a workforce accommodation camp at Neeleys Lane. Construction at these locations would be present for a longer duration as these sites are established and operate for construction workers for the duration of the project construction.

Generally, the following is noted:

- Construction of the energy hubs would be more prominent than the view to the operational project in views from those private dwellings that have a view to the works, which includes dwellings 902 and 880/876, at Merotherie and dwellings number 611 and 719 at Elong Elong, where views to the enabling and site preparation works, civil construction works (including views to large construction plant and equipment), as well as the installation of project infrastructure (e.g. switching stations, transmission lines) may be possible.
- The construction compounds at the Merotherie and Elong Elong energy hubs may also be visible from those dwellings with a view to the energy hub sites, including views to the concrete batching plant and silos, staging and laydown areas, and construction support facilities, depending on the final layout of these sites.
- There would be views to helicopter activity from dwelling 719 near the Elong Elong energy hub, dwellings 876 / 880 and 965 near the Merotherie energy hub, and dwellings9 and 19 near the new Wollar switching station.
- Dwelling 880 / 876 may also have a distant view to the Merotherie workforce accommodation camp and may experience views to temporary infrastructure such as demountable accommodation buildings, parking areas and access roads, office and associated amenities facilities. There would also be views to workers being transported between the construction accommodation camp via shuttle buses, to other parts of the project and using Merotherie Road North to access the Golden Highway.
- There are potential for a view to the Neeleys Lane workforce accommodation camp at Cassilis from dwelling number 1103, which may experience glimpses to the site preparation works and installation of temporary infrastructure, through to the operation of the camp during construction. This may include views to demountable accommodation and office buildings and amenities. Workers would be transported between the construction areas and the workforce accommodation camp via shuttle buses, which would be seen from public roads and dwellings along Ulan Road with a view to the road.
- Construction activity at each of the switching stations would be seen from nearby dwellings, as described in the operational assessment. These dwellings would experience views to construction activity associated with installing each switching station as well as the installation of connecting transmission line towers.
- Those dwellings that have a view to the proposed transmission lines, would also have views to the tower installation works and stringing of wires, occurring progressively during construction.
- Construction vehicle movements would occur on the public road network to travel to and from the construction area on a daily basis, which would be seen from dwellings that have a view of these roads. Vehicle movements would comprise both heavy and light vehicles and would vary across the road network depending on the construction activity being undertaken. Non-standard or oversized loads would also be required for the energy hubs (such as delivery of transformer units), switching stations and transportation of transmission line tower

materials, which would be seen from nearby dwellings, particularly on the approach to the construction compounds at the New Wollar Switching Station and each of the energy hubs, which would first receive and then store these oversized loads for distribution across the project.

- Construction of the maintenance facility (within the Merotherie Energy Hub) is unlikely to be visible from surrounding dwellings.

During construction there would be the potential for a visual impact from all dwellings identified as having an impact during operation. Generally, views to the construction works would be of a larger scale and would contrast more noticeably with the existing setting in most rural and forested settings, because of the broader construction footprint, ground disturbance, the use of large scale equipment and supporting infrastructure. This would result in a slightly greater potential visual impact than the operational project. Furthermore, there would be a greater visual impact from those dwellings which have a view to temporary construction facilities and / or construction at the new energy hubs. These impacts would, however, be intermittent along the transmission line corridor, and temporary in all locations.

6.3.2.2 Potential visual impacts at night during construction

To support construction during night time hours, operation of the main construction compounds at the energy hubs at Merotherie and Elong Elong and at the New Wollar Switching Station would be required. There may also be work requiring lighting across the project during evening periods, outside of daylight hours, particularly during winter when it becomes dark earlier.

The energy hub sites would therefore be lit at night, including lighting at the construction compounds and the staging and laydown areas, which may receive delivery of equipment or materials overnight. Large concrete pours at the energy hubs may also occur outside of standard daytime hours, including lighting at the concrete batching plant. Nearby dwellings including dwellings number 880 / 876 at Merotherie and dwellings 719 and 611 at Elong Elong, may experience views to lighting for construction at the energy hubs at night.

The Merotherie and Neeleys Lane workforce accommodation camps would be operational 24 hours a day, seven days a week, requiring lighting at night-time for the duration of construction. Therefore, there would be views to the camps at night-time, from dwellings 1103 near the Neeleys Lane workforce accommodation camp and from dwellings 880/876 near the Merotherie workforce accommodation camp.

Construction works associated with the transmission line infrastructure may also be required during the night-time, which would require the use of lighting at active construction areas only for the site preparation, construction of foundations, installation of the tower and stringing of the wires. This would be temporary task-related lighting as well as vehicle headlighting travelling along the access tracks, which may be seen from nearby dwellings for a short period of time. Refer to Appendix I for the Preliminary private dwelling assessment for dwellings in close proximity to the project, which would have views to the associated construction area. These impacts would occur intermittently across the duration of the project construction.

6.3.2.3 Potential visual impacts at night during operation

During operation, the transmission line would not require any lighting and would therefore have no impact during operation at night. While there are regular maintenance activities that would be required for the transmission lines during operation of the project, this would generally occur during daytime hours. If maintenance is required at night, there would be temporary task-related lighting as well as vehicle headlighting travelling along the access tracks, which may be seen from nearby dwellings for a short period of time.

The energy hubs at Merotherie (including the maintenance facility) and Elong Elong would have low-level lighting at night during operation for security and maintenance access. While the energy hubs (including the maintenance facility) would not accommodate any full-time staff or contractors, maintenance activities at these sites may occur at night as required,

for unplanned works, faults and emergencies. Nearby dwellings which would experience views to the energy hub lighting at night include 880 / 876 near the Merotherie Energy Hub and dwellings 719 and 611 near the Elong Elong Energy Hub.

The switching stations, including the New Wollar Switching Station, would also be lit at night, including low-level lighting for security and maintenance access, to allows for unplanned works, faults and emergency access at night, as required. Nearby dwellings which may experience views to the switching station lighting at night.

The workforce accommodation camps would be disassembled at the end of construction and would therefore not have a visual impact at night, during operation.

Chapter 7: Recommended management and mitigation measures

7.1 Environmental management

This assessment indicates that there is the potential for landscape character and visual impacts as a result of the project. The final scope of works would be subject to confirmation as part of the detailed design process. However, a Landscape Character and Visual Impact Management Plan (LCVIMP) will be prepared which will identify the methods and protocols to be implemented to ensure that that the project minimises impacts on landscape character, and visual impacts to views within the public domain and private dwelling views.

The LCVIMP would address the following as a minimum, measures that will be implemented to manage:

- potential impacts on landscape character during the day during construction and operation
- potential impacts on landscape character at night during construction and operation
- potential impacts on views from the public domain during construction and operation where there is a moderate or higher potential visual impact
- potential impacts on views from private dwellings, that are not associated with property that is hosting project infrastructure, and that have a predicted moderate or higher potential visual impact during construction and operation.
- Details regarding the installation and maintenance of any proposed on-site mitigation measures such as vegetation for screening.

The measures in the LCVIMP would be reviewed and updated at regular intervals to confirm they reflect project design development and ensure their effectiveness.

Detailed mitigation measures to be implemented as part of the delivery of the project are provided below in Table 7-1.

7.2 Mitigation already incorporated into the project

The location of the project, indicative transmission line easement and key project components has been developed in consideration of visual amenity, including through extensive consultation with landowners. This included:

- where possible, co-locating the project with existing transmission line easements to minimise the establishment of transmission line easements in new areas where there is currently no visual precedent and therefore minimise impacts to landowners, including their views
- selecting an alignment that passes through the mining areas to minimise the impacts to views from private dwellings
- consideration of the topography and any existing screening vegetation or other features
- maximising the distance between project infrastructure and existing dwellings and towns along the transmission line easement, including by following a route which is located away from the towns of Gulgong and Dunedoo
- positioning the new Wollar Switching Station close to the existing Wollar substation so as to utilise a location which is away from a large number of residential receivers.

There are only a few mitigation techniques that can reduce the visual impacts of the project due to the nature and size of the transmission line towers, length of the transmission line easement and character of the infrastructure. Subject to other technical design considerations, these opportunities are described in the following section.

7.3 Mitigation measures

Mitigation measures to minimise potential impacts to landscape and visual impacts during construction and operation are outlined in Table 7-1.

Table 7-1 Proposed mitigation measures

Reference	Mitigation measures	Timing	Applicable location(s)
LV1	Vegetation clearance for the project will be limited to the minimum extent necessary for construction and operation to maximise existing visual screening and retention of the existing landscape character. Retained vegetation will be clearly demarcated on site as 'no-go zones' prior to the commencement of construction. Construction personnel will be made aware of no-go zones as part of environmental site induction(s)	Pre-construction, Construction, Operation	Whole of project
LV2	Lighting at construction compounds and workforce accommodation camp(s) will be designed and operated in accordance with Australian and New Zealand Standard AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting.	Pre-construction and construction	Construction compound and workforce accommodation camp(s)
LV3	For private dwellings on non-host properties where the project is predicted to have a moderate or high visual impact, reasonable and feasible opportunities to reduce the visual impact (including the provision of screening vegetation) will be investigated. Appropriate visual screening or other options will be confirmed in consultation with the affected landowner (supported by detailed landscape plans where appropriate) and implemented either before or during construction. Maintenance of vegetative screening provided on privately owned land outside of the operation area will be the responsibility of the landowner.	Pre-construction, Construction	Private dwellings on non-host properties with a moderate or high visual impact
LV4	Lighting at the Energy Hubs (including the maintenance facility) and switching stations will be designed and operated in accordance with: • Australian and New Zealand Standard AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting. • the design guidelines contained in the Siding Springs Dark Sky Planning Guideline (DPE 2016). This will include: – eliminating upward spill light – ensuring lighting is directed downwards – using shielded fittings – avoiding overlighting – switching lights off when not required, such as with the use of sensor lights – using energy efficient bulbs – using asymmetric beams if floodlighting is required – ensuring lights are not directed towards reflective surfaces – using warm white colours	Pre-construction, Construction, Operation	Merotherie Energy Hub (including the maintenance facility) and Elong Elong Energy Hub.

Related mitigation measures can be found in other Technical Papers prepared for this project. Particularly, relating to vegetation protection in Technical paper 4 – Biodiversity development assessment report, heritage in Technical paper 5 – Aboriginal cultural heritage assessment report and Technical paper 6 – Non-Aboriginal heritage, erosion control in the Technical paper 14 – Hydrology and water quality and dust suppression in Technical paper 18 – Air quality.

Chapter 8: References

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Appendices

Appendix A:
Site location plan

Appendix B:Topography plans

Appendix C:
Landscape character plans

Appendix D:
Visibility of towers within 2 kilometres

This analysis is based on towers in indicative locations which would be subject to change during detail design..

Appendix E:
Viewpoint location plans

Appendix F:
Viewpoint photomontages

Appendix G:
Private dwelling locations

Appendix H:
Private dwellings, indicative horizontal field of view

Appendix I:
Preliminary private dwelling assessment

Appendix J:
Detailed private dwelling assessment

Appendix K:
Combined detailed visual assessment results plan