APPENDIX F

Landscape & Visual Impact Assessment

Author: Moir Landscape Architecture Pty Ltd

Client: Burrendong Wind Farm Pty Ltd

Burrendong Wind Farm

Landscape and Visual Impact Assessment

moir
landscape architecture

Burrendong Wind Farm

Landscape and Visual Impact Assessment

Prepared for
Eco Logical Australia Pty Ltd

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Executive Summary

Moir Landscape Architecture (Moir LA) have been commissioned by Eco Logical Australia on behalf of Ark Energy to prepare a Landscape and Visual Impact Assessment (LVIA) for the proposed Burrendong Wind Farm (the Project).

The Project is located within both the Dubbo Regional Council LGA and Mid-Western Regional Council LGA in New South Wales. The Project Site is approximately 30 km south-east of Wellington. The Project is sited on the vegetated ridges to the east of Lake Burrendong. The Project would consist of up to 70 wind turbines with a combined maximum installed capacity of approximately 450 MW.

In addition to the wind turbines, ancillary infrastructure including access tracks, road upgrades, underground and overhead electricity cabling, high voltage transmission line, substations, potential battery energy storage system, switching station, quarrying locations, concrete batching plants, operations and maintenance facility and grid connection to the existing 330 kV transmission line have been assessed in this LVIA.

Moir LA have undertaken a quantitative study with regards to the guidelines of the Department of Planning and Environments *Wind Energy: Visual Assessment Bulletin* (the Bulletin). Relevant literature and guidelines relating to large scale energy projects and Moir LA's previous experience on large scale infrastructure projects has also been considered in the Study Method.

The LVIA includes a comprehensive assessment of the existing landscape character, scenic quality and visibility of the Project. Visual influence zones have been established from viewpoints and sensitive receptors and assessed against visual performance objectives outlined in the Bulletin.

The Bulletin states generally, the visual impact of a wind energy project will depend upon the characteristics and values of the existing landscape, the extent to which the existing landscape is changed by the Project and how these changes are perceived by individuals and the broader community. The assessment, in conjunction with community consultation identified the key landscape features and viewpoints within the Study Area.

Field work was undertaken by Moir LA to develop a visual baseline against which the Project has been assessed. The assessment determined the regional landscape character is typical of the Central-West Tablelands region characterised by agricultural land predominately utilised for grazing, with some areas of remnant vegetation. The landscape was categorised into seven (7) Landscape Character Units (LCUs). A quantitative frame of reference was applied to establish the Scenic Quality Rating of these LCUs which ranged from low to moderate / high.

The Scenic Quality Ratings are utilised in defining Visual Influence Zones which are assessed against objectives outlined in the Bulletin.

Key features which form a part of the existing landscape character would assist in reducing the potential for viewing the Project. These include large areas of vegetation on ridgelines and grazing paddocks, undulating topography, roadside vegetation and riparian vegetation associated with rivers or creek lines. The assessment found the Project could be undertaken whilst maintaining the key visual features of the landscape.

In accordance with the Bulletin, Moir LA applied the Preliminary Assessment Tools to the Project Layout to determine dwelling receptors that require detailed assessment. The assessment identified a total of 20 non-involved dwellings within the blue line of visual magnitude (4,950 m of the nearest turbine). Site inspections and desktop assessment identified:

- Two (2) non-involved dwellings have the potential for a high visual impact (R14-1 and Q13-1);
- Two (2) non-involved dwellings have the potential for a moderate visual impact;
- Nine (9) non-involved dwellings were assessed as having a low visual impact rating;
- Two (2) non-involved dwellings were assessed as having a very low visual impact rating; and
- Five (5) non-involved dwellings were assessed as having no visual impact rating

Practical and feasible mitigation measures have been proposed for each of the four (4) non-involved dwellings with a moderate or high visual impact rating. The proposed mitigation methods recommended in the report will assist in significantly reducing the visual impacts resulting from the majority of these dwellings. Mitigation measures in keeping with the existing character include screen planting and supplementary planting of existing vegetation.

On evaluation, the Project is compliant with the performance objectives as per the Visual Assessment Bulletin.

01
Introduction

1.0 Introduction

1.1 Introduction

Moir Landscape Architecture (Moir LA) have been commissioned by Eco Logical Australia Pty Ltd (ELA) to prepare a Landscape and Visual Impact Assessment (LVIA) for the proposed Burrendong Wind Farm (referred to hereafter as the Project).

The Project includes the construction, operation and decommissioning of an approximately 450 megawatts (MW) wind farm generally comprising wind turbine generators (WTGs), access roads, underground and above ground cables, on-site substation, large scale battery storage, and associated operational facilities including the construction of a new 330kV overhead transmission line to a new TransGrid switchyard.

The purpose of this report is to provide a comprehensive assessment of visibility and potential visual impacts associated with the Project on the landscape character, landscape values, landscape amenity and any scenic vistas. The report details the results of the field work, documents the assessment of the landscape character and visual setting, and makes recommendations to assist in the mitigation of any potential impacts resulting from the proposed development.

This LVIA has been prepared in accordance with the *Wind Energy: Visual Assessment Bulletin for State Significant Wind Energy Development*, December 2016 (referred to hereafter as 'the Bulletin'). This LVIA forms a part of the Environmental Impact Statement (EIS) to be submitted to the Department of Planning and Environment (DPE). This information will assist the community and the DPE to understand and assess the likely visual impacts.

1.2 Relevant Experience

The Bulletin states: *the proponent is expected to engage professionals from relevant natural resource management and design professions (for example environmental planners, geographers, landscape architects, architects, or other visual resource specialists), with demonstrated experience and capabilities in visual assessment to carry out a wind energy project visual assessment.*

Moir LA is a professional design practice and consultancy specialising in the areas of Landscape Architecture, Landscape Planning and Landscape and Visual Impact. Our team has extensive experience in undertaking Landscape and Visual Impact Assessments for large scale infrastructure projects, including the mining industry, sustainable energy sector and commercial / residential developments in visually sensitive areas. Our capabilities include digital terrain modelling, viewshed assessment, photo montage development, landscape character assessment and community consultation.

Our team has extensive experience in undertaking Landscape and Visual Impact Assessments for wind energy projects. In the context of our experience and with guidance from the Visual Assessment Bulletin we have developed methodologies to ensure a comprehensive and qualitative assessment of the Project. Relevant experience includes the preparation of Landscape and Visual Impact Assessments for the following Wind Energy Projects:

- Uungula Wind Farm (Wellington, New South Wales)
- Crudine Ridge Wind Farm (New South Wales)
- Bodangora Wind Farm (Bodangora, New South Wales)
- Capital II Wind Farm (Bungendore, New South Wales)
- Cherry Tree Wind Farm (Seymour, Victoria)
- Lakeland Wind Farm (Lakeland, Queensland)
- Hills of Gold Wind Farm (Nundle, New South Wales)
- Barneys Reef Wind Farm PVIA (Barneys Reef, New South Wales)
- Thunderbolt Wind Farm Stage 1 (Kentucky, New South Wales)

02

Study Method

2.0 Study Method

2.1 Secretary's Environmental Assessment Requirements (SEARs)

The Project is classified as State Significant Development (SSD) and will be assessed and determined under the provisions of the Environmental Planning and Assessment Act 1979.

Secretary's Environmental Assessment Requirements (SEARs) issued on the 30th of September 2022 for the Project state the EIS must address the following specific issues for the wind farm and associated infrastructure:

Landscape and Visual – including a detailed assessment of the visual impacts of all components of the project (including turbines, transmission lines, substations, and any other ancillary infrastructure in accordance with the NSW Wind Energy: Visual Assessment Bulletin (DPE, 2016), including detailed consideration of potential visual impacts on local residences (including approved developments, lodged development applications and dwelling entitlements), amenity values of the recreation areas surrounding Lake Burrendong, scenic or significant vistas and road corridors in the public domain, and on the Siding Spring Observatory in accordance with the Dark Sky Planning Guideline (2016).

A brief overview of the requirements of the Wind Energy: Visual Assessment Bulletin for State Significant Wind Energy Development is provided in **Section 2.2.**

2.2 Wind Energy: Visual Assessment Bulletin

The Bulletin was adopted by the then Department of Planning and Environment in December 2016. The Bulletin has been developed to guide the appropriate location of wind energy development in NSW and to establish an assessment framework for the assessment of visual impacts associated with wind energy. Visual impacts are one of a range of issues considered in the assessment and determination of wind energy projects.

The objectives of the Bulletin are to:

- provide the community, industry and decision-makers with a framework for visual impact analysis and assessment that is focused on minimising and managing the most significant impacts;
- facilitate improved wind turbine and ancillary infrastructure siting and design during the pre-lodgement phase of a project, and encourage early consideration of visual impacts to minimise conflicts and delays where possible, and provide for a better planning outcome;
- provide the community and other stakeholders with greater clarity on the process along with an opportunity to integrate community landscape values into the assessment process; and
- provide greater consistency in assessment by outlining appropriate assessment terminology and methodologies.

The visual assessment process is broken into two main stages:

Stage 1: Preliminary Environmental Assessment and
Stage 2: EIS

This LVIA responds to the requirements of Stage 2 of the Bulletin. The Preliminary Visual Impact Assessment (PVIA) prepared for Stage 1 was undertaken by Moir LA in September 2022 and the findings of the assessment undertaken have been included in this report.

2.3 Overview of the Study Method

In accordance with the Visual Assessment Bulletin, the visual assessment includes:

- a baseline study that includes analysis of the landscape character, scenic quality and visibility from viewpoints of different sensitivity levels;
- establishment of visual influence zones from viewpoints using data collected in the baseline study;
- assessment of the proposed layout against visual performance objectives; and
- justification for the final proposed layout and identification of mitigation and management measures.

Moir LA have formulated a quantitative study methodology with regards to the Visual Assessment Bulletin and with consideration of previous experience on large scale infrastructure projects and relevant literature and guidelines relating to large scale energy projects.

Extensive field work and photographic survey work for the study was undertaken in March, May and December 2021 and March 2023 from public and private properties.

2.4 Report Structure

The flow chart on the following page provides a high level overview of the LVIA process utilised to undertake the assessment. *Table 1* provides an outline of the report structure, a brief overview of the objectives of the Bulletin and a summary of how these have been addressed in the LVIA.

Detailed methodologies for each part of the assessment have been included in the relevant chapters of the report.

2.5 Landscape and Visual Impact Assessment (LVIA) Process

Project Overview

Provide an overview of the aspects of the Project and the parameters against which the assessment is based.

Visual Baseline Study

Comprehensive assessment of the existing landscape character to determine the baseline against which the Project will require assessment against. Input from the community to determine landscape values is integral in this phase.

Define the Visual Catchment

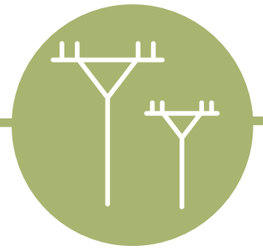
Determine the visual catchment through the use of preliminary assessment tools and GIS mapping to determine the extent of visibility and identify areas upon which to undertake detailed assessment.

Key Viewpoint Analysis

Undertake assessments from key viewing locations identified within the ‘visual catchment’ to determine the impact of the Project. This includes an assessment from public and private viewing locations.

Visualisations

The use of visualisation tools (including photomontages and wire frame diagrams) to assist in the assessment of the Project.



Other Considerations

Assessment of other aspects which have the potential to contribute to the visual impact. This includes: an assessment of associated infrastructure, cumulative impact from surrounding Projects and night lighting

Summary and Recommendations

Summary of the findings of the report and preliminary recommendations for reducing the identified impacts.

Landscape and Visual Impact Assessment Report Structure:

PROJECT	**Section 3.0: Project Overview**	**Visual Bulletin / SEARs Requirements Addressed:**
	• Detailed Project Description • Wind Turbines & Associated Infrastructure	• The VIA is to include a full description of the proposed wind energy project design, the layout, structural elements and scenarios being considered.
VISUAL BASELINE STUDY	**Section 4.0: Community Consultation**	
	• Community Consultation Process • Community Landscape Values • Community Perception	• The proponent is to further consult with the community to verify the community consultation findings from the scoping and design stage.
	Section 5.0: Visual Baseline Study	
	• Detailed assessment of Landscape Character and Key Features of the Region • Landscape Character Unit Classification • Application of Scenic Quality Class Ratings **Refer to Appendix B - LCU Overviews**	• A visual baseline study must be undertaken to establish the existing landscape and visual conditions. The baseline study is prepared and evaluated by the proponent prior to undertaking any visual analysis. • Describe, assess and map these factors in written and graphic forms supported by photographic representations of the area. • Identify Scenic Quality Classes
VISUAL CATCHMENT	**Section 6.0: Preliminary Assessment Tools**	

	Define the Visual Catchment of the Project:
	• Preliminary Assessment Tools:
	  • Visual Magnitude
	  • Multiple Wind Turbine Effect
		• Visual Magnitude Assessment: Mapping the dwellings, key viewpoints and proposed turbines at scale to establish the potential visual magnitude.
		• Map into six sectors of 60º any proposed turbines and any existing or approved turbines within each dwelling or key public viewpoint.

	Section 7.0 - Zone of Visual Influence	
	• Zone of Visual Influence (ZVI)	• Establish the theoretical 'zone of visual influence' of the proposal (the area from which the proposal is theoretically visible or the 'visual catchment').
KEY RECEPTOR ASSESSMENT	**Section 8.0: Public Viewpoint Analysis**	
	Assessment of viewpoints from areas identified within the visual catchment. **Refer to Appendix C - Public Viewpoint Analysis**	• All key public viewpoints and individual dwellings within the 'visual catchment' should be identified and assessed. • Detailed consideration of amenity values of the recreation areas surrounding Lake Burrendong, scenic or significant vistas and road corridors in the public domain,
	Section 9.0: Photomontage & Wire Frame Diagrams	**Visual Bulletin / SEARs Requirements Addressed:**
	• Photomontage selection process • Photomontage development process **Refer to Appendix E - Public Photomontages & Wire Frame Diagrams**	• Photomontages shall be prepared in accordance with the Scottish Natural Heritage Visual Representation of Wind Farms. • The visual assessment needs to include a concise description of the complete methodology used to create any photomontages presented in the visual assessment.
	Section 10.0: Dwelling Assessments	
	• Summary of impact on Dwellings **Refer to Appendix D - Dwelling Assessments** **Refer to Appendix F - Lots with Dwelling Entitlements**	• Detailed consideration of potential visual impacts on local residences (including approved developments, lodged development applications and dwelling entitlements
OTHER ASPECTS	**Section 10.0: Photomontage & Wire Frame Diagrams**	**Visual Bulletin / SEARs Requirements Addressed:**
	• Photomontage selection process • Photomontage development process **Refer to Appendix E - Public Photomontages & Wire Frame Diagrams**	• Photomontages shall be prepared in accordance with the Scottish Natural Heritage Visual Representation of Wind Farms. • The visual assessment needs to include a concise description of the complete methodology used to create any photomontages presented in the visual assessment.
	Section 11.0 Cumulative Visual Impacts	
	• Cumulative Visual Impacts	• Address potential cumulative impacts of wind energy projects in the region (the wind energy project as well as existing and approved projects).
	Section 12.0 Shadow Flicker & Blade Glint Assessment	
	Section 13.0 Associated Infrastructure	
	• Overview of impact resulting from Associated infrastructure	• the assessment of visual impacts from all ancillary facilities and infrastructure will be required.
	Section 14.0 Night Lighting	
	• Night Lighting Assessment	• Consider whether any obstacle lighting required is likely to result in any significant increase in visual impacts. • Detailed consideration of the Siding Spring Observatory in accordance with the Dark Sky Planning Guideline (2016).
SUMMARY AND RECOMMENDATIONS	**Section 15.0 Visual Impact on Landscape Character**	
	• Overview of LCUs with regards to Visual Performance Objectives • Summary of impact on Landscape Character	• Assess the Project using visual performance objectives.
	Section 16.0 Mitigation Methods	
	• Wind Farm Design • Mitigation Methods for Residences **Refer to Appendix G - Mitgation Measures**	• An outline of any mitigation and management options proposed, including consultation with affected property owners regarding the proposed mitigation works
	Section 17.0 Visual Performance Evaluation	
	• Evaluation of Visual Performance Objectives **Refer to Appendix A - VIZ Methodology**	• An assessment of the proposed wind energy project against each visual performance objective and demonstration of whether each objective is achieved and how the standard has been achieved.
	Section 18.0 Conclusion	

Table 1 Report Structure

2.6 Additional Literature

In addition to the Bulletin, the following literature has assisted in the formulation of the study methodology and where relevant have been referenced in the report:

- Scottish Natural Heritage, Visual Representation of Wind Farms - Guidance Version 2.2 (February, 2017)
- Department of Planning and Environment Technical Supplement - Landscape and Visual Impact Assessment Large-Scale Solar Energy Guideline (August, 2022).
- Environment Protection and Heritage Council, Draft National Wind Farm Development Guidelines (July, 2010)
- Landscape Institute and Institute of Environmental Management & Assessment, Guidelines for Landscape and Visual Impact Assessment Third edition (2013)
- Clean Energy Council, Best Practice Guidelines for Wind Energy Development (June, 2018)

2.7 Policy Considerations

2.7.1 Local Government Policies

The Project is considered a State Significant Development (SSD) and will be assessed as such by the NSW DPE. Relevant local government policies have also been considered. The Project spans across two Local Government Areas (LGAs) including the Dubbo Regional Council and Mid-Western Regional Council areas.

2.7.2 NSW Roads and Maritime Services

The assessment of shadow flicker, blade glint and reflectivity is to include an assessment of the impact on road users. This has been included in **Section 12.0** of this LVIA.

2.7.3 Civil Aviation Safety Authority (CASA)

This LVIA includes an assessment of potential visual impact associated with night lighting. Recommendations have been made in accordance with the Civil Aviation Safety Authority (CASA). Advisory Circular: AC 139.E-05v1.1 *Obstacles (including wind farms) outside the vicinity of a CASA certified aerodrome* (October 2022). Refer to **Section 14.0** of this LVIA.

2.7.4 Dark Sky Planning Guidelines

Section 14.0 provides an assessment of proposed night lighting associated with the Project in accordance with the NSW Department of Planning and Environment *Dark Sky Planning Guideline* (June, 2023). The Dark Sky Planning Guideline informs state and local government, industry and the community about managing light in the Dark Sky Region. It shows how we can manage light from development to reduce effects on the observatory's operation. The guideline informs assessment of significant development within 200 kilometres of the observatory. It supports the design and operation of development in the region and gives key information to ensure that lighting used in development does not reduce the effectiveness of the observatory.

03

Project Overview

3.0 Project Overview

3.1 Regional Context

The Project Site is located approximately 30 km southeast of Wellington and to the east of Lake Burrendong (**Figure 1**) and is situated within two (2) Local Government Areas (LGAs), being:

- Dubbo Regional Council
- Mid-Western Regional Council.

The Project Site is currently primarily used for agriculture, including farming and grazing operations, and lies within the Lake Burrendong Catchment.

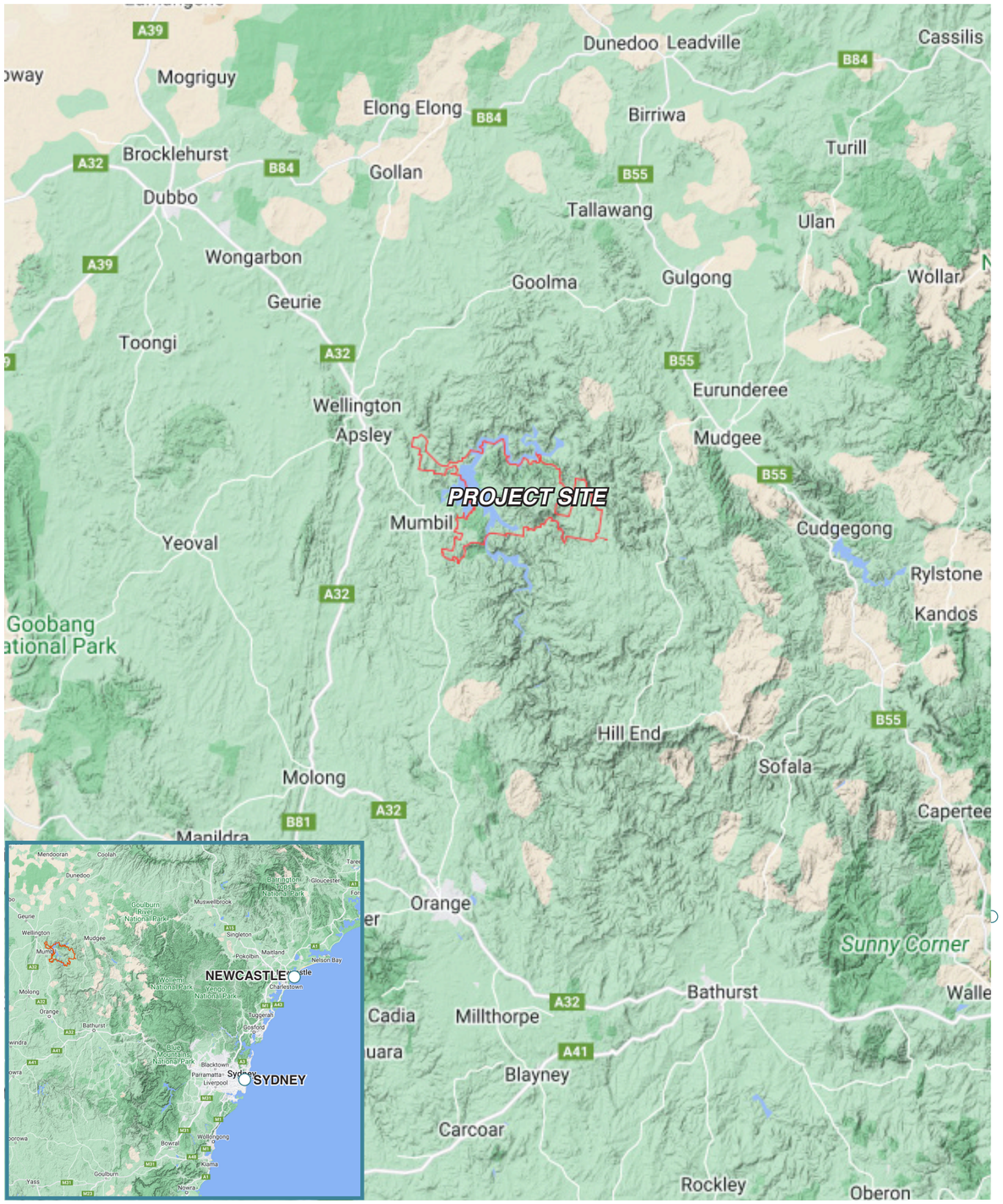


Figure 1 Regional Context (Map Source: Google Maps 2023)

3.2 The Study Area

The Study Area refers to the land associated with and surrounding the Project. For the purpose of this report, the Study Area is loosely defined by an 8 km radius around the Project, however assessment of land outside of this radius will be undertaken as necessary.

Figure 2 Birds Eye View - The Project Site (Source: Google Earth 2023)

3.3 The Project Site

The Project is located within both the Dubbo Regional Council LGA and Mid-Western Regional Council LGA in the NSW state electorate of Dubbo. The Project Site is approximately 30 km south-east of Wellington (refer to **Figure 1**). It is located across multiple land holdings, including 17 private landowners (containing 147 freehold lots), 58 lots owned by the State of NSW, and 46 lots owned by WaterNSW.

Land in the area consists of largely uninhabited undulating hills.

Figure 2 and **Figure 3** present the Project Site Locality.

3.4 The Project

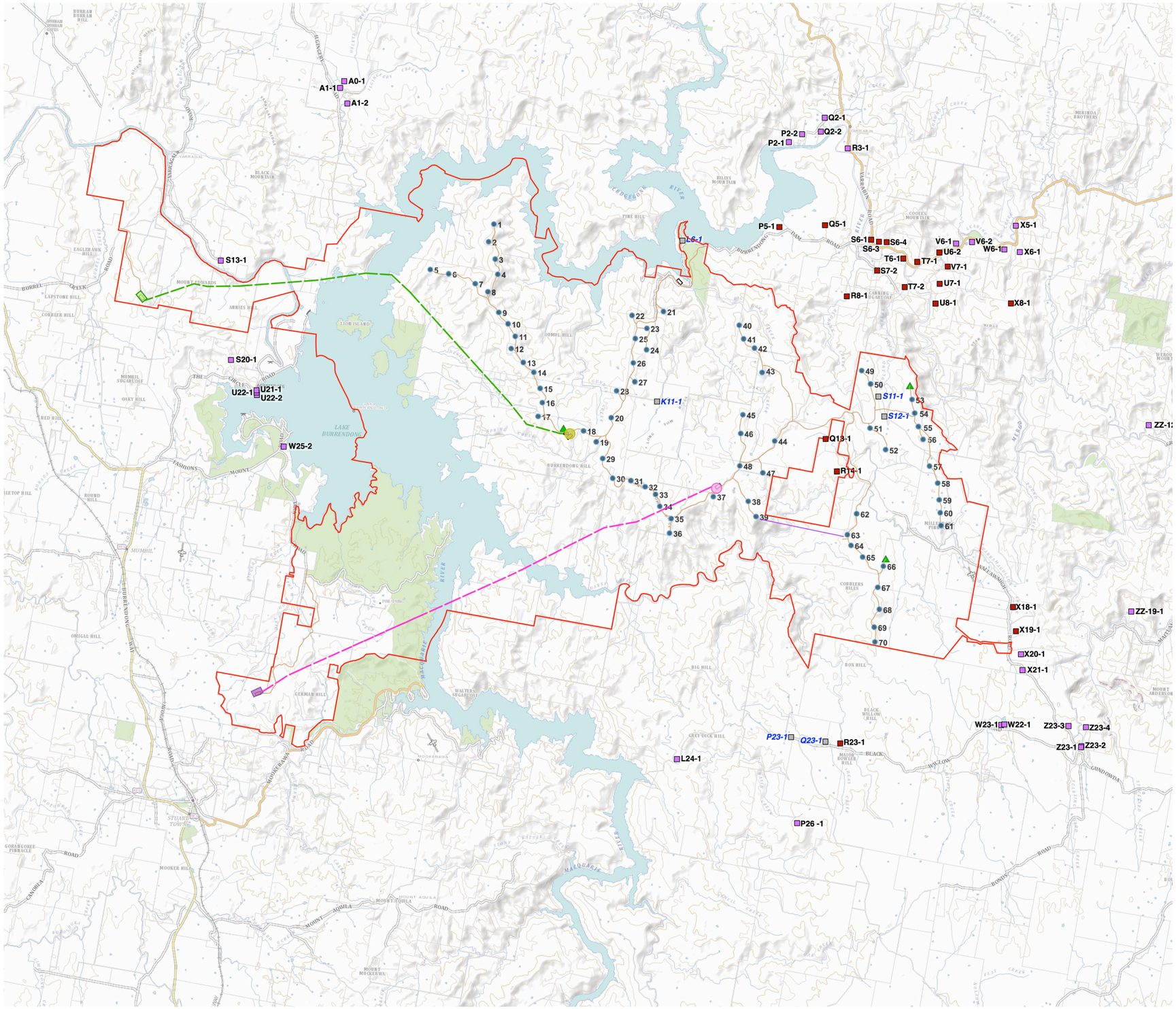
The Project would consist of up to 70 wind turbines (WTGs) with a maximum blade tip height of 250 metres above ground level.

The Project would also include:

- An internal electrical reticulation network (both overhead and underground);
- New and upgraded access roads;
- Up to two (2) substations;
- One (1) Operation and Maintenance (O&M) building; and
- Temporary construction facilities (including concrete batching plants); and
- Three (3) meteorological masts

The Project Layout is presented as **Figure 4.**

The Project
Burrendong Wind Farm



LEGEND

- Project Boundary
- Proposed 250 m WTG Location
- Involved Dwelling
- Non-involved Dwelling (Within 4,950 m)
- Non-involved Dwelling (In excess of 4,950 m)
- Substation Location
- Main Road
- Minor Road
- National Park / Nature Reserve
- Preferred Overhead Transmission Line (Up to 330kV)
- Preferred Switch Yard Location
- Preferred Substation Location
- Alternative Overhead Transmission Line (Up to 330kV)
- Alternative Switch Yard Location
- Alternative Substation Location

Figure 3 The Project (Map Source: Six Maps 2023)

3.5 Wind Turbine Design

The WTG market is continuously developing with a trend towards larger, higher capacity WTGs, which reduces the cost of energy. The Project has therefore been designed to accommodate a WTG of up to 250 m from the ground to upper blade tip.

The WTGs will be three-bladed, semi-variable speed, pitch-regulated machines with the rotor and nacelle mounted on a tower with an internal ladder or lift.

Table 2 provides an overview of dimensions of the WTG components that have been used for this assessment. **Figure 4** shows the dimensions of the WTG and all visual elements referred to in this report. To best represent a worst case scenario, the maximum hub height of 160 metres and tip height of 250 metres has been used for modelling and visualisation purposes in this report.

An image of a typical wind turbine has been provided as **Image 3.**

Wind Turbine Components		
Project Component	**Dimensions used in LVIA:**	**Quantity**
Uppermost Blade Tip	250 metres AGL	**70**
Tower (hub) height	160 metres (maximum)	
Blade length	90 metres (including nacelle)	

Table 2 Wind Turbine Parameters for Visual Assessment

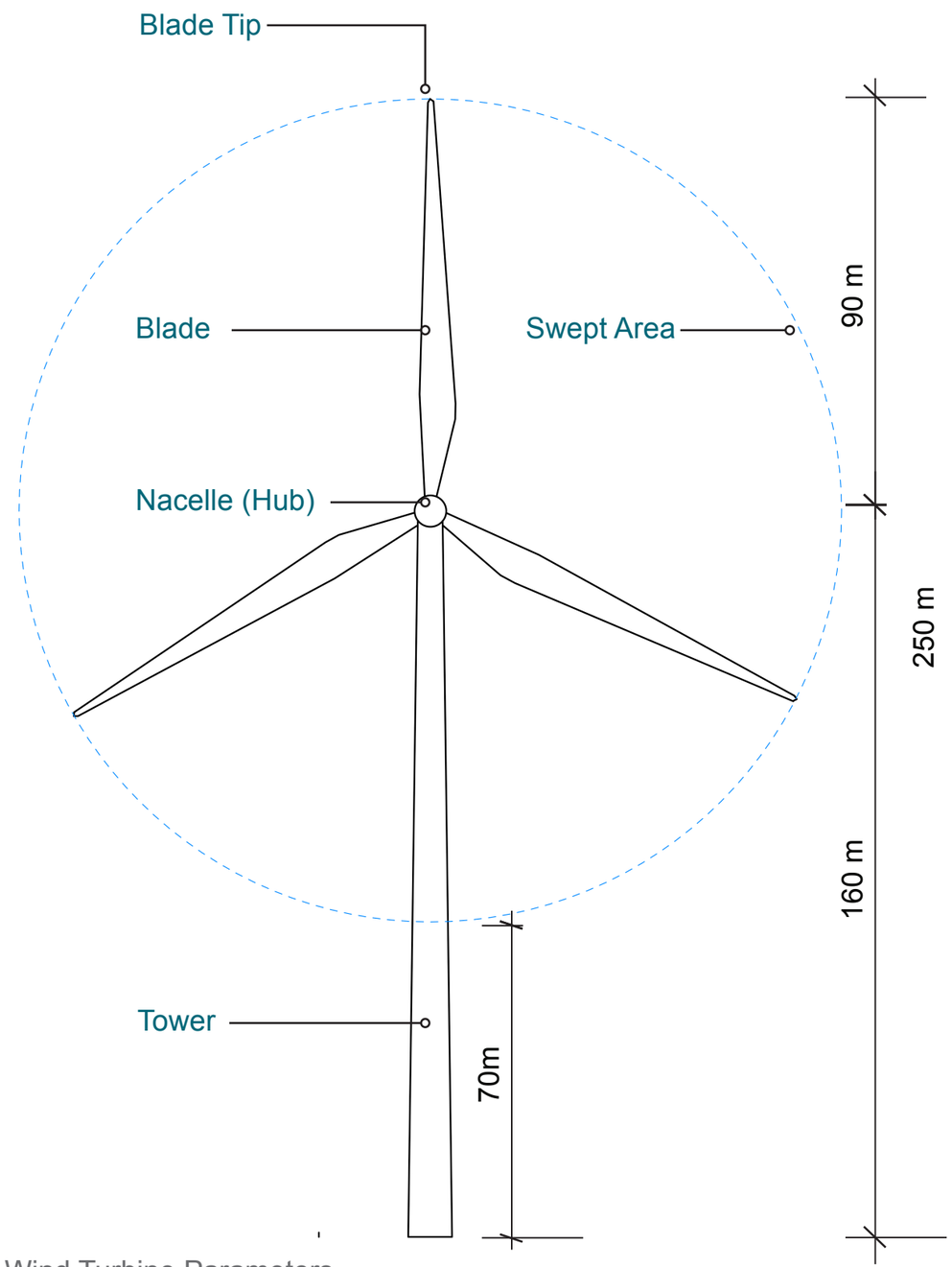


Figure 4 Wind Turbine Parameters

3.6 Associated Infrastructure

In addition to the turbines, **Table 3** provides an overview of the permanent associated infrastructure components proposed for the Project which may contribute to the visual impact of the proposal. An overview of the assessment of the potential visual impacts resulting from the associated infrastructure has been provided in **Section 13** of this report.

Project Elements		
	Project Component	**Description**
Ancillary Infrastructure	**Internal Roads and Drainage**	9 m x 79.04 km
	Substations	Up to two (2) substations 100 x 200 metres.
	O&M Compound	One (1) Operations and Maintenance (O&M) Compound approximately 100 x 100 metres.
	Medium voltage (33 kV) electrical connections	2.94 km of overhead transmission cables 56.61 km of underground transmission cables
	Permanent Meteorological Masts	Up to three (3) masts
Temporary Facilities	**Concrete (or asphalt) batching plants**	Two (2) 50 x 100m concrete (or asphalt) batching plants
	Rock crushing facilities	Two (2) 50 x 100m facilities
	Site compound and office	One (1) site compound and office approximately 300 x 200 metres
	Stockpiles and materials storage compounds	Subject to requirements
	Temporary field laydown areas	Subject to requirements
	Temporary Meteorological Masts	Two (2) temporary masts

Table 3 Associated Infrastructure

Image 1 Typical Substation (Gullen Range Wind Farm)

Image 2 Typical Transmission Line

Image 3 Typical Wind Turbine Design (Gullen Range Wind Farm)

04

Community Consultation

4.0 Community Consultation

4.1 Community Consultation Process

Community consultation was undertaken in the early stages of the Project to establish landscape values, key landscape features, important viewpoints and the community's perception of the Project. It is important to note that whilst taken into consideration when undertaking the Visual Baseline Study, the landscape values of the community are considered to be subjective.

The Proponent consulted with the community on the preliminary Project boundary to gather feedback and an understanding of the key landscape features, areas of scenic quality and key public viewpoints. The community feedback has been reflected in the Visual Baseline Study that informs this LVIA.

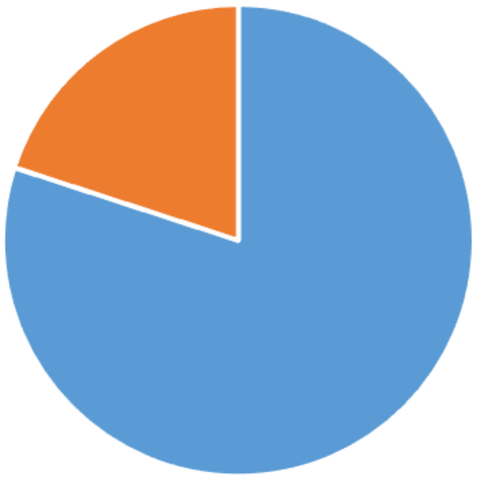
The Bulletin suggests community members rate the scenic quality of the landscape character as low, medium or high. However, in the context of a proposed development this is a complex process and it is likely that the results would be highly subjective. It is best practice to utilise a objective frame of reference which can be applied by professionals. This process can be undertaken whilst also taking into account (but not being driven by) values identified by the community.

4.2 Community Perception

Understanding of the community perception towards the proposed development is an important element of the LVIA.

A CSIRO study published in 2012: Exploring community acceptance of rural wind farms in Australia provides a snapshot of community acceptance levels regarding Australian wind farms from a variety of stakeholder perspectives. It found levels of acceptance among the public are highly subjective and can differ depending on location, local context and place attachment.

The questionnaire developed for the Project aimed to gain understanding of the communities concerns. **Figure 5** and **Figure 6** illustrate the responses to questions aimed at gauging the communities level of acceptance of renewable energy Projects in the local area and anticipated impact on the visual landscape.



Question 1:
Do you support renewable energy investment in the local area?

Response:

Yes *(80% of responses)*

No *(20% of responses)*

Figure 5 Response to Questionnaire Question 1

Question 2:
What impact do you think the proposed Burrendong WF would have on the visual landscape within the local area?

Response:

Positive *(20% of responses)*

Negative *(40% of responses)*

Neutral *(40% of responses)*

Figure 6 Response to Questionnaire Question 2

4.3 Community Landscape Values

Landscape values are highly subjective and can differ depending on location, local context and place attachment.

The questionnaire provided to the community aimed to gain an understanding of the values associated with the landscape. The results of the questionnaire indicated the community and its people, farming and agriculture were of highest value to the respondents. Views and outlook and employment opportunities were rated as having low value to the community. Refer to **Figure 7**.

Question 5:
Please consider the below aspects of the local area. Re-order the below list to rank them (top is highest value, bottom is lowest value).

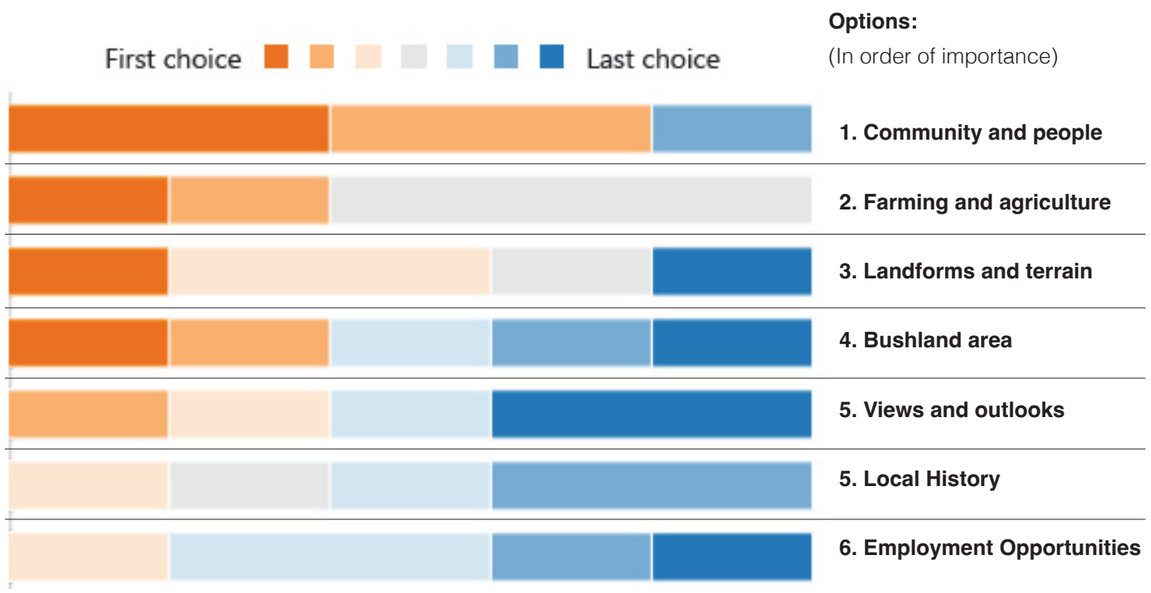


Figure 7 Response to Questionnaire Question 5

4.4 Scenic Qualities and Key Viewpoints

Respondents were asked to assign a level of visual significance to local landscape features and areas. The results of which have assisted in the scenic quality rating of Landscape Character Units (LCU) in the Visual Baseline Assessment (refer to **Section 5.0**). The results have been included as **Figure 8.**

Additionally, the community was asked to identify important public viewpoints and areas of public visibility for further assessment. Where specific locations have been identified, these have been mapped within the Visual Baseline Study (**Section 5.0**). Moir LA have undertaken viewpoint analysis from public locations identified by the community (refer to **Section 8.0** and **Appendix C**). Refer to **Table 4** for responses.

Question 3: Where are the most important public viewpoints in the local area?
Responses:
• Likely the higher “tops” West of the village of Hargraves, Burrendong recreation / Arboretum areas and within the lake.
• Wilderness landscape without wind farms.
• The scenic drives of Hill end road, Black Willow Road, Wallawaugh Road and Gundowda Road.
• From the high country looking west and from the Dam looking east.
• Foreshores of Burrendong dam.
Question 4: What lookouts or areas of public visibility do you think would be negatively impacted by the proposed Burrendong Wind Farm?
Responses:
• My property. Local traffic. Users of the area.
• The scenic drives of Hill End Road, Black Willow Road, Wallawaugh Road and Gundowda Road.
• I do not feel that turbines negatively impact an environment. Care needs to be taken situating the access roads to prevent unnecessary loss of vegetation.

Table 4: Key public viewpoints identified by the Community

Question 6:

For the below areas within the local landscape, please assign a level of visual significance.

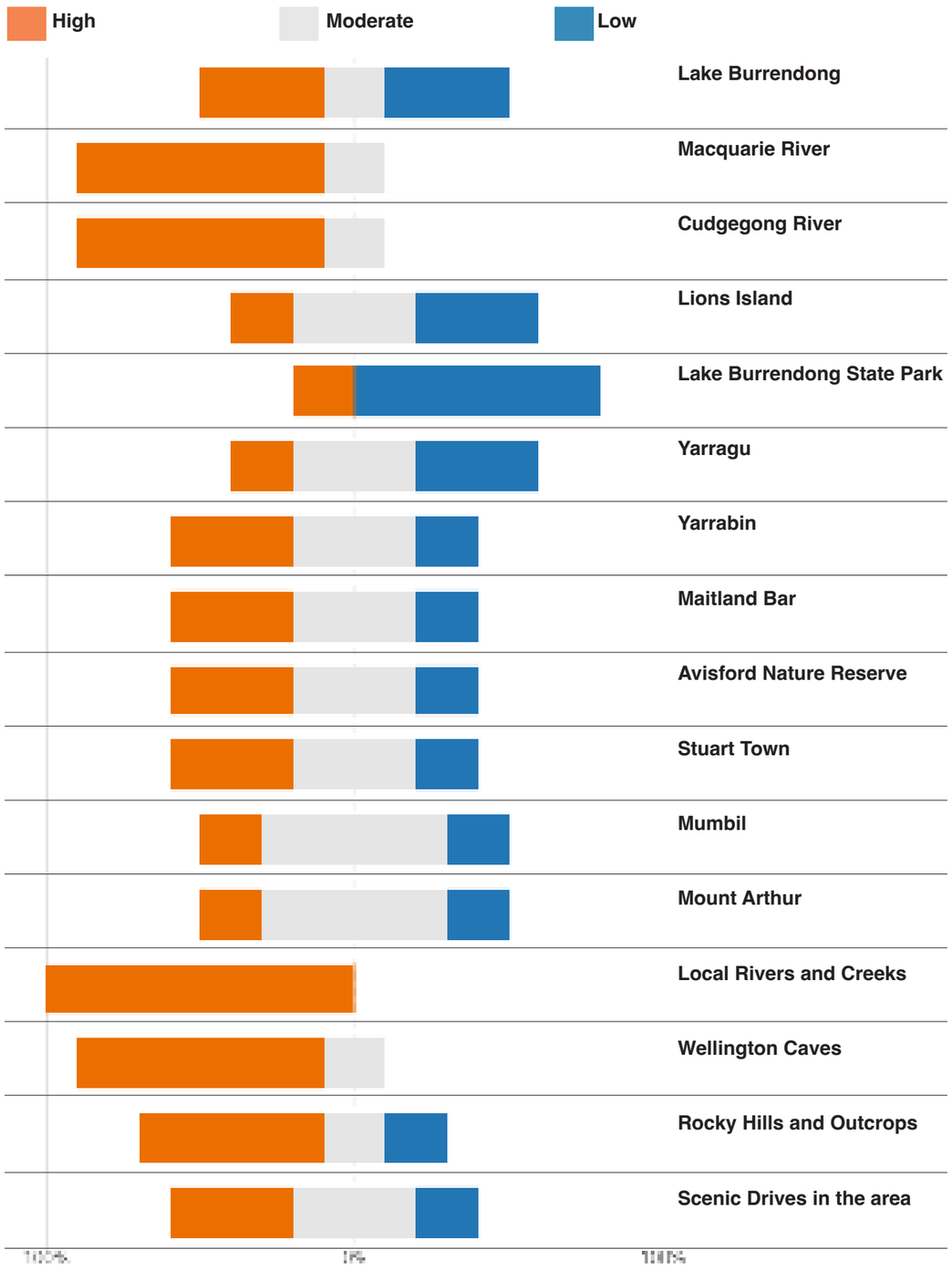


Figure 8 Response to Questionnaire Question 6

05

Visual Baseline Study

5.0 Visual Baseline Study

5.1 Visual Baseline Study

In accordance with the Bulletin: *A visual baseline study must be undertaken to establish the existing landscape and visual conditions. This forms the basis of determining the level of impacts of a proposed wind energy project. The baseline study is prepared and evaluated by the proponent prior to undertaking any visual analysis.*

A PVIA was undertaken by Moir LA as part of Stage 1: Preliminary Environmental Assessment (pre-lodgement). In accordance with the Bulletin a preliminary landscape baseline study was prepared. Moir LA have developed upon the study undertaken in Phase 1 to provide a detailed baseline study.

The baseline study should consider the following inputs in the 'visual catchment' for the project:

- elements of the landscape important to the community, including public and private viewpoints;
- the sensitivity of the viewers who use those viewpoints, and the distances at which they may view the landscape and potential wind turbines and other ancillary facilities;
- the character of the landscape involved, its key features and the relative scenic quality of the area; and
- the location of any existing operational or approved wind energy projects within both a regional and local context, including any nearby surrounding wind energy projects within eight kilometres which may have the potential to create direct or indirect visual impacts between the proposed and any other operational, approved or proposed wind energy projects.

The purpose of the Visual Baseline Study is to establish the existing landscape and visual conditions through descriptions, mapping and photographic representations. The study method for undertaking the Visual Baseline Study has been established in accordance with *Appendix B of the Bulletin* where relevant and in conjunction with previous experience on large scale wind energy projects.

Table 5 provides an overview of the methodology used to establish a quantitative approach to defining and assessing the landscape character.

Visual Baseline Study Inputs:	
Landscape Character Type	
• Describe the broad area of land in which the wind energy project is located.	**Refer to Section 5.2**
Sensitive Land Use Designations	
• Map Layer identifying National and State Sensitive Land use Designations and LEP Zones.	**Refer to Section 5.3 & Refer to Section 5.4**
Key Landscape Features	
• Identify areas of visual interest or quality that stand out visually in the landscape.	**Refer to Section 5.5**
Landscape Character Unit Classification	
• Landscape is categorised into Landscape Character Units (LCU) and Scenic Quality Ratings are applied to each LCU.	**Refer to Section 5.6 & Appendix B**
Viewpoint Inventory and Sensitivity Levels	
• Undertake a viewpoint inventory from public and private locations and establish the Visual Influence Zones for each.	**Refer to Section 8.0**

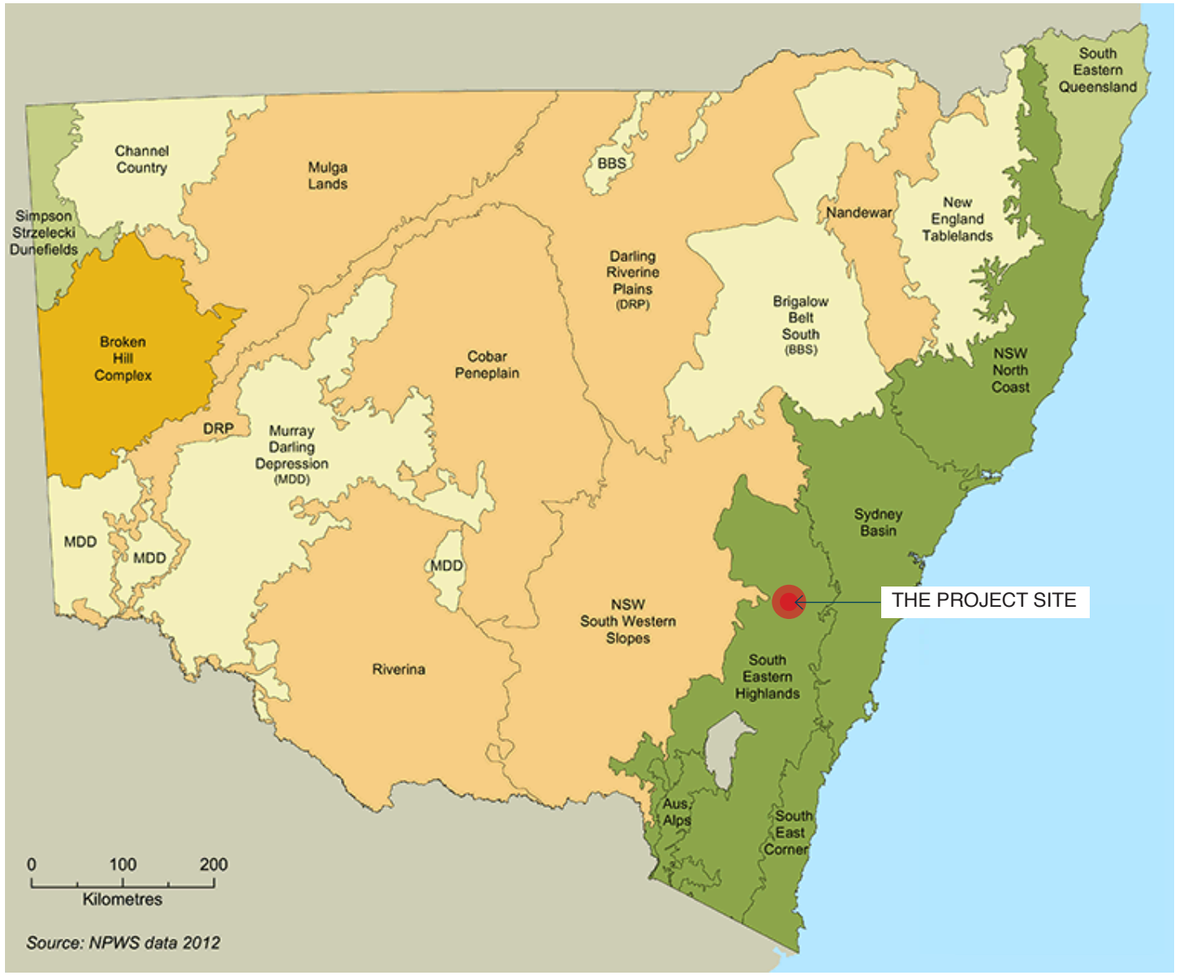
Table 5 Visual Baseline Study Inputs

5.2 Bioregion Context

Of the 17 bioregions of NSW, the Project Site lies within the South Western Slopes Bioregion (refer to **Figure 9**). Located at the foothills of the Great Dividing Range, it also consists of isolated ranges and inland slopes.

The bioregion's topography, especially around the region of the Project Site is characterized by steep, rocky granite slopes with inland streams, creeks and rivers that are confined to valleys with terraces and local sedimentation areas. Overall, the soils are shallow and stony, and found on the tops of ridges and hills. Soil profiles around the Project Site showcase limited abilities to adapt to different uses and the soil inherently has very low fertility.

Hilly terrains towards the north and the east are dominated by open woodlands of Grey Box (*Eucalyptus microcarpa*) and White Cypress Pine (*Callitris glaucophylla*). Vegetation communities around valley flats and stream / river banks includes Rough-Barked Apple (*Angophora floribunda*) and River Oak (*Casuarina cunninghammia*).



LEGEND

Project Location

Figure 9 South Western Slopes Bioregion

(Source: NPWS, 2003)

5.3 Land Use

The following provides an overview of the land use within the Study Area and its immediate surrounds as shown in **Figure 10**.

5.3.1 Nature Conservation and minimal use

Large areas of land to the north and east of Lake Burrendong are devoted to conserving the existing character of the area. These areas are zoned as E3 Environmental Management. An E3 zoning objective of Wellington LEP is 'to protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values', and to 'provide for a limited range of development that does not have an adverse effect on those values.'

5.3.2 Water

The Macquarie, Meroo and Cudgegong Rivers all feed into Lake Burrendong. Immediately to the west of the Project Site, recreational activities including boating and water sports, fishing, swimming, picnics, camping and holiday activities revolve around the man-made water body, providng a valuable cool destination for surrounding communities. A number of creeks and gullies drain the terrain and these include Oakey Creek, Black Willow Creek (which further breaks into gullies), Gundowda Creek, and Smiths Creek amidst others.

5.3.3 Grazing pastures and agricultural land uses

Soil fertility is inherently low in most land parcels around the Project Site. Cleared valleys and gentle slopes that are devoted to agricultural grazing are centred around the areas that lie east of the Project Site. These lands are dominated by introduced pasture species dominating the ground plain, interspersed with remnant vegetation. Native vegetation still tends to cover steeper slopes and ridges where stock access is limited.

5.3.4 Urban, intensive uses and rural residential settlements

The Project Site sits in close proximity to towns such as Yarrabin, Yarragal and Worlds End. Other towns in the vicinity include Wellington, Mumbil and Stuart Town. These towns and settlements have a population of about 400 - 500 people. These towns are mostly associated with the predominant agricultural activity in its surrounds or, as in the case of Mumbil, it was established in 1950 for the construction of the Burrendong Dam.

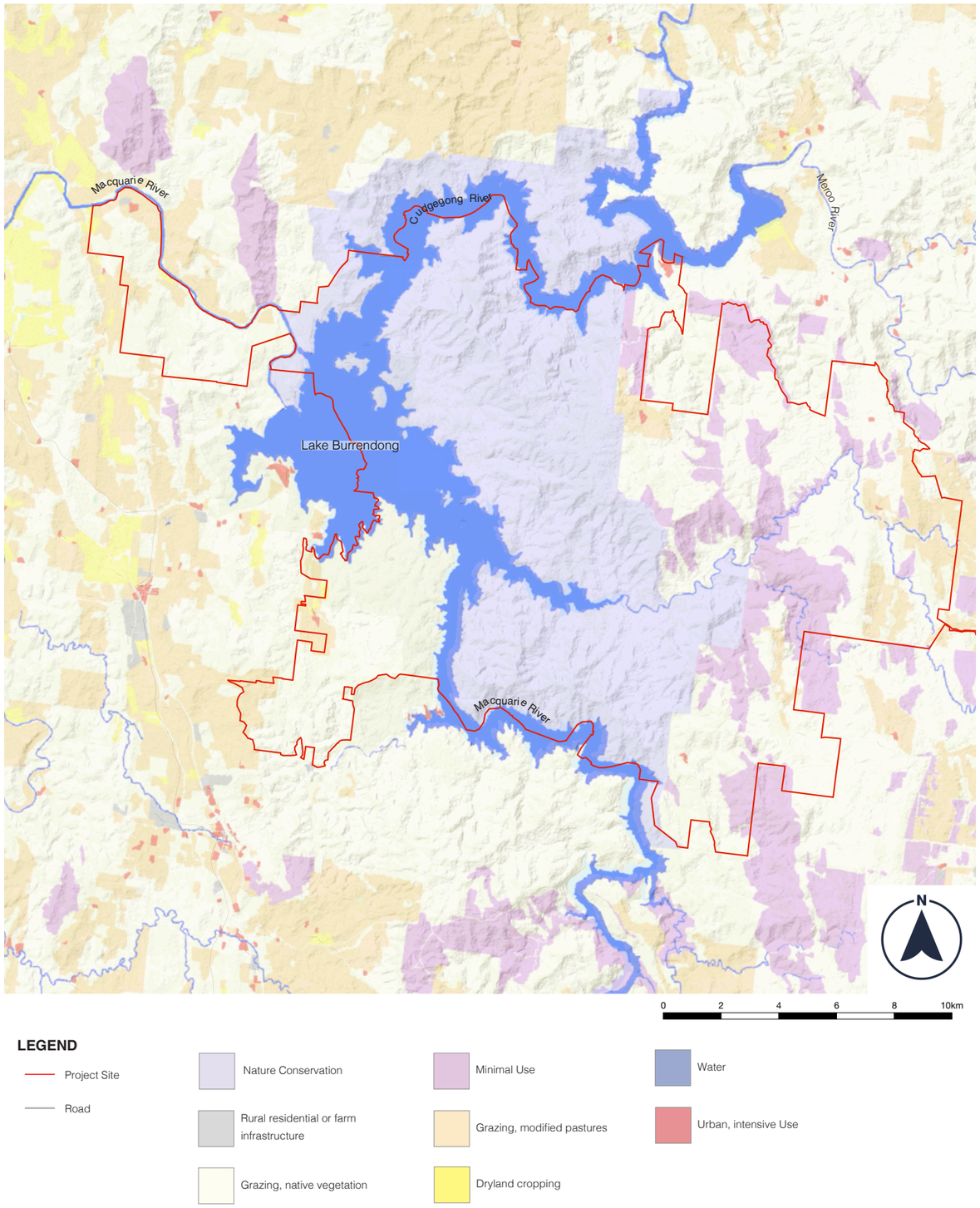


Figure 10: Land Use Designations within the Study Area

5.4 Sensitive Land Use Designations

The Project Site spans across both the Dubbo Regional and the Mid-Western Regional Council LGAs, with the LGA boundary dividing the Project Site into two halves. The following provides an overview of land zoning within the Project Site and its immediate surrounds as shown in **Figure 11**.

5.4.1 RU1 Primary Production Zoning

A large portion of the land surrounding the Project Site is zoned RU1 - Primary Production. An objective of the RU1 zoning relevant to landscape and visual impact within the Mid-Western Regional LEP is to 'maintain the visual amenity and landscape quality of Mid-Western Region by preserving the area's open rural landscapes and environmental and cultural heritage values.'

5.4.2 E3 Environmental Management

To the west of the Project Site lies the other predominant land zoning classification of a large tract of E3 Environmental Management. This landscape spans across Burrendong State Park and is a major inland water tourism/recreation destination. A relevant zoning objective of the Wellington LEP is to 'allow for a range of low impact recreational activities and ancillary land uses in the Burrendong State Park that protect and enhance the environmental and scenic qualities of the park and the water quality of Lake Burrendong.'

The Wellington LEP restricts the following types of development within the E3 zoning: 'Bee keeping; Dairies (pasture-based); Industries; Multi dwelling housing; Residential flat buildings; Retail premises; Seniors housing; Service stations; Warehouse or distribution centres'.

5.4.3 SP2 Infrastructure: Water Supply Systems

Immediately north of the Project Site is an area dedicated to water supply infrastructure.

5.4.4 Other land zoning designations

Surrounding areas include other land zoning designations such as RE2-Private Recreation which co-relates to the private holiday park in the area.

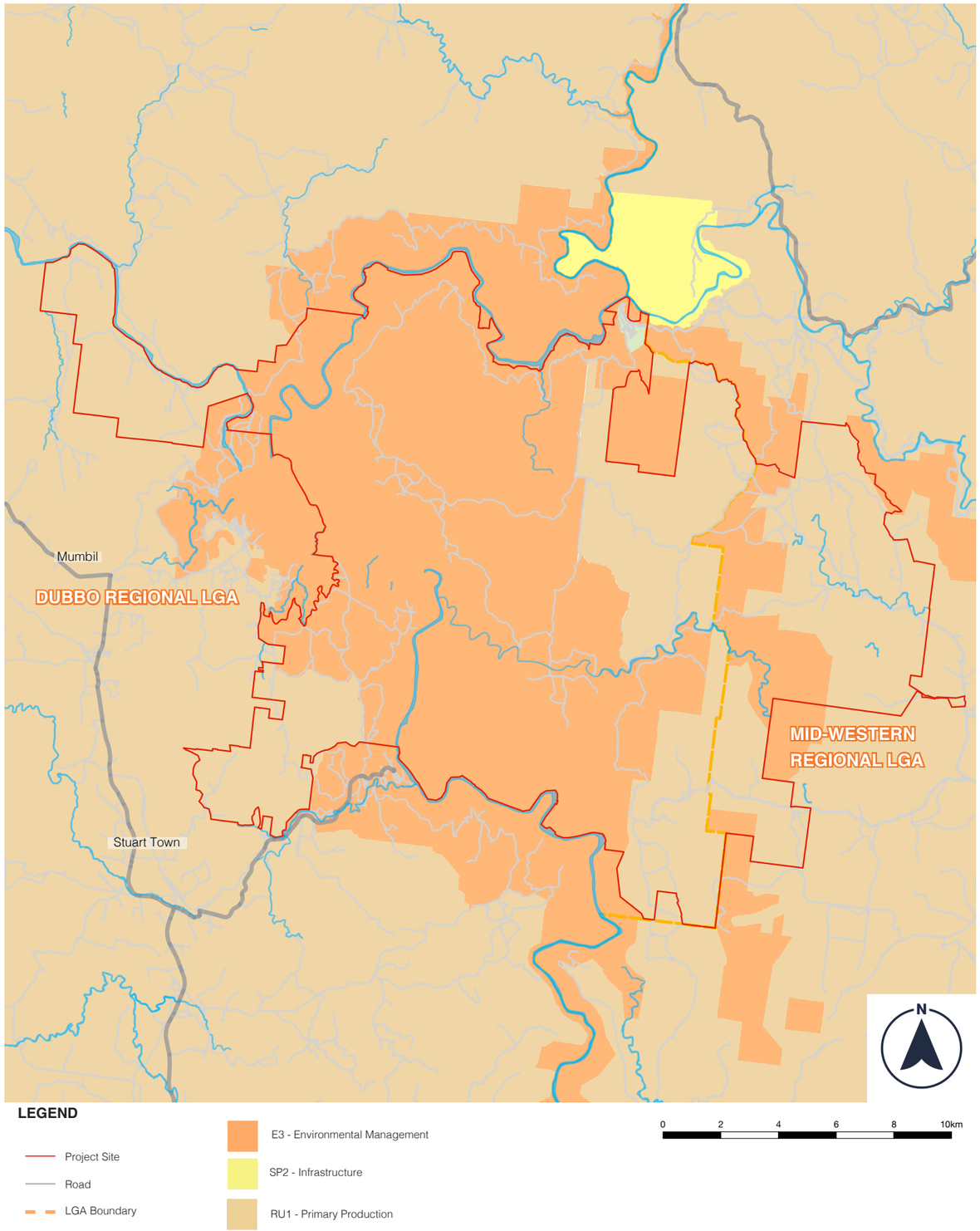


Figure 11 Land Zoning Designations within the Study Area (Map Source: Dubbo Regional LEP & Mid-Western LEP)

5.5 Existing Landscape Character

Identification and mapping of existing landscape characteristics of the Project Site as well as its surroundings is one of the first steps of carrying out an LVIA. The following section of this report discusses the typical character of the Study Area (refer to **Figure 13**).

5.5.1 Nearby towns and villages

The Project Site spans across both Dubbo Regional and the Mid-Western Regional Council LGAs, with the LGA boundary dividing the Project Site into two halves. It is located about 30 km southeast of Wellington and 25 km south west of Mudgee. The character of some of the rural towns and settlements that are within a 20km radius of the Project Site has been discussed below.

Yarrabin, Yarragal and Worlds End

To to northeast, east and west of the Project Site are the towns of Yarrabin, Yarragal and Worlds End respectively. They are small settlements which were established upon the discovery of gold in the area in 1951. They also hosted the construction workers that were engaged in building Burrendong dam. Currently the settlement has about 87 residents and the 2,500 acres of forests and open paddocks. The region's significance revolves around equestrian activity, which is also the major contributor towards the settlement's economic survival.

Mookerawa

The settlement is located on the banks of Macquarie River about 10km south of the Lake Burrendong reservoir. It's most famous of the holiday park and camping grounds located along the river which allows access to recreational activities such as boating, fishing, camping, bush walking and the likes.

Stuart Town and Mumbil

Formerly known as Ironbarks, after the trees in the area, Stuart Town is a small town which serves as a service centre for travellers commuting between Wellington and Orange on Burrendong Way. Mumbil is another town located on Burrendong Way and like Stuart Town it was established to house the dam workforce that was engaged in the construction of Burrendong Dam in 1951. Current population of Mumbil is 289 people.

5.5.2 Accessibility

Major highways and roads that provide access to the Project Site and other towns are Mitchell Highway and Castlereagh Highway. They bifurcate further into major roads which includes Burrendong Way, Yarrabin Road and Worlds End Road. These roads play an important role in providing access to some of private lanes and roads that lead to dwellings of Yarrabin, Worlds End, Yarragal and Mookerawa. Most of these lanes and private roads are situated on steep slopes with very limited accessibility.

Holiday parks and campgrounds located along riverfronts are accessed via 4WD tracks and other minor roads which lead from Mookerawa Road, Burrendong Dam Road and Endacott Road to name a few. Some of the important roads that run within the extents of the Project Site are Wallawaugh Road, Black Willow Road and Bonds Road which are used to access the dwellings located off these roads.

5.5.3 Landform

The Project Site and its surrounds are primarily characterized by undulating, rolling hills to steep, rocky slopes with a gradient ranging from 20-50%. General elevations range from 40-200m. River and lake valleys are dominated by these rocky cliff edges with shallow soils which are prone to erosion and are severely limited for land uses other than grazing activity over native pastures. Other parts of the Project Site are gently undulating with rolling hills that are 50-140m in elevation. These areas are moderately prone to erosion and are currently used for grazing over extensively cleared lands. Traces of very gently undulating hills that are used for grazing over native pastures can be found south-southeast of the Project Site.

5.5.4 Vegetation

Native vegetation is largely restricted to the steep, rocky hills which are not suitable for other land uses. These areas, therefore, are dominated by remnant native vegetation which includes dry sclerophyll forests with grass /shrub understorey. Prominent species include white box, yellow box, Blakely's Red Gum, Red Stringybark, Broad-leaved Peppermint, Red Box and Black Cypress Pine. Rocky cliffs are dominated by Broad-leaved Peppermints and Scribbly Gum communities. Tumbledown Red Gums, Grey Box and Yellow Box can be found on upper slopes.

5.5.5 Water bodies

The most prominent water feature is the Burrendong Dam which many inland sports and recreational activities associated with it. The dam's main purpose was to assist with irrigation, livestock and household needs in the Macquarie Valley and to manage flows within the Macquarie Marshes. It is situated on the Macquarie River where it meets Cudgegong River.

Cudgegong River flows northwards where it meets Meroo River at Yarrabin. These waterways play an important role in serving the needs for towns such as Yarrabin and Worlds End. Other gullies and creeks that flow in the basin are Black Willow Creek, Oakley Creek and Spring Creek.

Image 6 Bonds Road

Image 7 Yarrabin Road

Image 8 Endacott Road

Image 9 Black Willow Road

Image 10 Worlds End Road

Image 11 Mt. Aquila Road

Landscape Features
Burrendong Wind Farm

LEGEND:

- Project Boundary
- Proposed 250 m WTG Location
- Involved Dwelling
- Non-involved Dwelling (within 4,950 m of nearest turbine)
- Non-involved Dwelling (in excess of 4,950 m from nearest turbine)
- 8000 m from WTG
- Road
- Indicative ridgeline
- High points
- Parks and lookouts
- Points of interest
- Rivers & creeks
- Town / Village / Settlement

N

0 2 4 6 8 10km

Figure 12: Existing Landscape Character and Key Features (Map Source: ESRI Topographic Maps)

Image 12. Cudgegong River from Holiday Reflections Parks - Cudgegong

Image 13. Lake Burrendong

Image 14. Overlooking the floodplain the Meroo River snakes through. The vegetated riparian corridor can be seen in the distance, before the topography starts to slope upwards.

5.6 Key Landscape Features

The Bulletin states: Key landscape features should be identified and shown on the baseline study map for further reference. Key landscape features may include natural features such as a distinctive mountain peak or hill top, a large rock outcrop or cliff, a waterfall, a visually distinctive stand of trees, or even a single large tree that stands out visually in the scene.

The following provides an overview of the key features identified within the Study Area and its surrounds which contribute to the visual character of the landscape (refer to **Figure 12**).

5.6.1 Lake Burrendong & Burrendong State Recreation Area

Burrendong State Recreation Area surrounds Lake Burrendong with vegetated, elevated ridges to the south. Burrendong State Park is zoned as E3 Environmental Management to allow for a range of low impact recreational activities and ancillary land uses in the Burrendong State Park that protect and enhance the environmental and scenic qualities of the park and the water quality of Lake Burrendong. The land to the south of Lake Burrendong is densely vegetated and access is contained to a small number of roads. The waters of the Macquarie and Cudgegong rivers and Meroo Creek flow into the man-made Lake Burrendong. Lake Burrendong is a popular recreation area for fishing and tourism.

5.6.2 Burrendong Hill and other highpoints

The Project Site sits in the Hill End Trough physio-graphic unit which comprises of volcanic rocky outcrops. The elevations of these prominent ridgelines ranges from 680 - 970m and they predominantly run northwest to southeast. The steep, rocky outcrops have poor soil fertility which limits its use to light grazing and restricted clearing of native vegetation. These uninhabited vegetated hills have with very limited access but visually they play an important role in contributing towards the scenic quality of the region.

5.6.3 Farmland character

Another prominent landscape character is that of the farmlands that span across gentle undulations in the landscape. These land parcels have been extensively cleared for grazing and pastoral activity. Most of these areas are accessible and are nestled between the prominent ridgelines that lie to the east of Lake Burrendong.

5.6.4 Recreational associations with water

The banks of Lake Burrendong, Cudgegong River and Macquarie River are utilised for passive recreational activities such as camping, bushwalking, fishing and boating. These landscape features act as the biggest tourist draw-card for the region and in many ways shape the identity of the region.

5.7 Landscape Character Unit Classification

Due to the large scale of the Study Area and varying landscape character the Study Area has been categorised into seven (7), LCUs to assist in the assessment.

The LCUs are classified by slight variations in the landscapes geology, topography, land use and vegetation which create distinct character areas within the Study Area. The LCUs have been informed by land use patterns, vegetation coverage, topographical maps, site images and site inspection.

The general extent of the LCUs are shown on **Figure 14** on the following page and detailed description of each LCU has been included in **Appendix A** of this report.

The Scenic Quality 'frame of reference' has been applied to each LCU (refer to **Section 5.8** for methodology).

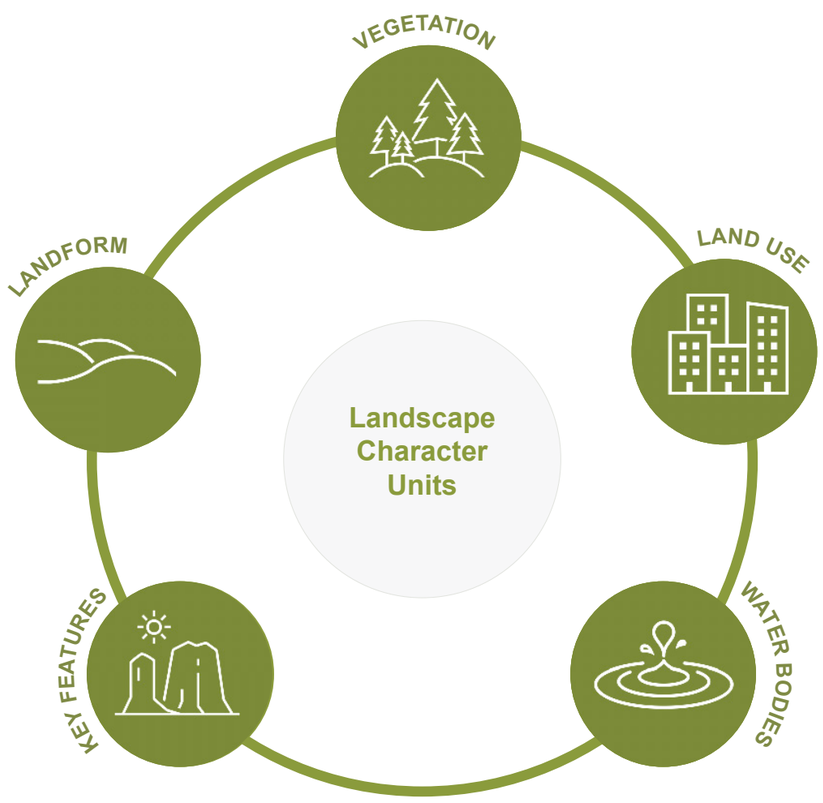
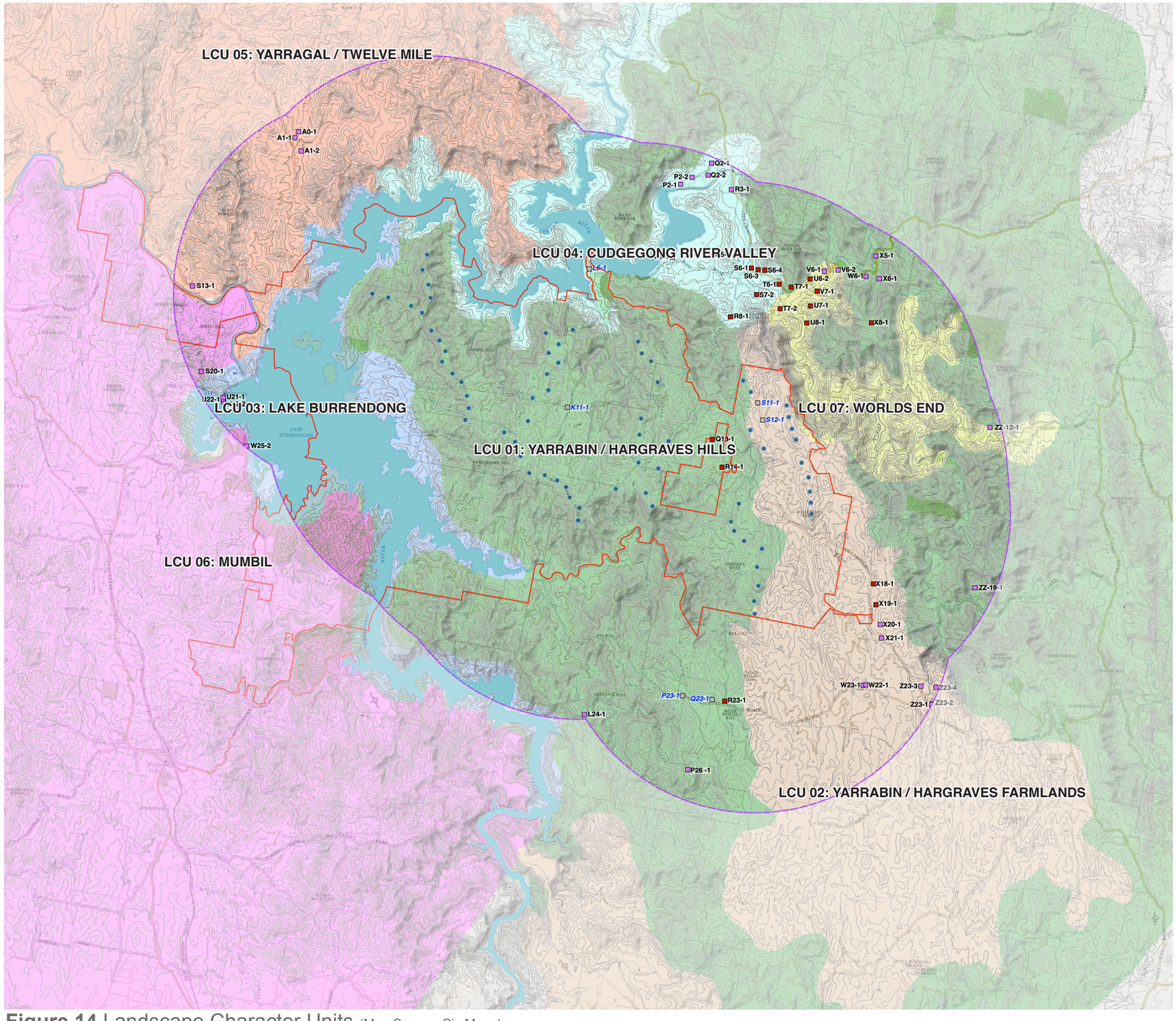


Figure 13 Defining Landscape Character Units

Overview of Landscape Character Units

LCU:	Overview:	Scenic Quality Rating:
LCU01 Yarrabin / Hargrave Hills	Steep ridgelines with vegetated hill slopes that span across the Study Area associated with Yarrabin and Hargraves. The Project Site is located within this LCU.	**Moderate** *Refer to Appendix B1*
LCU02 Yarrabin / Hargrave Farmlands	Gently undulating landscapes associated with Yarrabin and Hargraves that have been cleared for grazing pastures and other agricultural activity.	**Low - Moderate** *Refer to Appendix B2*
LCU03 Lake Burrendong	Lake Burrendong LCU is defined as the waterway and foreshore associated with Lake Burrendong.	**Moderate** *Refer to Appendix B3*
LCU04 Cudgegong River Valley	Cudgeong River Valley includes the Cudgegong River and associated valley, typically to the north of Lake Burrendong.	**Moderate** *Refer to Appendix B4*
LCU05 Yarragal / Twelve Mile	Yarragal / Twleve Mile is generally defined as the largely uninhabited hills to the north of the Project Site associated with Yarragal and Twelve Mile. Land in this area is associated within the visual catchment of the Approved Uungula Wind Farm Project.	**Moderate** *Refer to Appendix B5*
LCU06 Mumbil	Typically the vegetated hills to the west of Lake Burrendong. Land is largely uninhabited with the exception of small settlement at Mumbil.	**Low** *Refer to Appendix B6*
LCU07 Worlds End	Worlds End is a small LCU defined by the valley defined as Worlds End. Land is typically characterised by a valley floor with dwelling utilised as weekenders.	**Moderate** *Refer to Appendix B7*

Table 6 Overview of Landscape Character Units



Landscape Character Units

Burrendong Wind Farm

LEGEND:

- Project Boundary
- Proposed 250 m WTG Location
- Involved Dwelling
- Non-involved Dwelling (within 4,950 m of nearest turbine)
- Non-involved Dwelling (in excess of 4,950 m from nearest turbine)
- 8000 m from turbine
- LCU 01: Yarrabin / Hargraves Hills
- LCU 02: Yarrabin / Hargraves Farmlands
- LCU 03: Lake Burrendong
- LCU 04: Cudgegong River Valley
- LCU 05: Yarragal / Twelve Mile
- LCU 06: Mumbil
- LCU 07: Worlds End
- 10m Contour

Figure 14 Landscape Character Units (Map Source: Six Maps)

5.8 Scenic Quality Class Rating

The Bulletin states: *the baseline study inputs, including key landscape features and sensitive land use designations, should lead to the identification of Scenic Quality Classes. Scenic quality refers to the relative scenic or aesthetic value of the landscape based on the relative presence or absence of key landscape features known to be associated with community perceptions of high, moderate or low scenic quality. It is both a subjective and complex process undertaken by experts in visual impact assessment, taking into account community values identified in early community consultation.*

In accordance with the Bulletin, a Scenic Quality 'frame of reference' has been formulated by Moir LA (**Table 7**) utilising *An approach to landscape sensitivity assessment by Natural England*. The frame of reference developed for the Project is in keeping with the example frame of reference provided in the Bulletin.

Each category of the 'frame of reference' has been quantified for each LCU (overviews of each LCU is provided in **Appendix B**) to determine a Scenic Quality Rating of **low**, **moderate** or **high.** The resulting Scenic Quality Rating is used to assist in defining the Visual Influence Zones in accordance with the Bulletin (refer to matrix in **Appendix A**).

Additionally, DPEs visual reference for scenic quality values prepared for the Large scale Solar Energy Guideline has been utilised to verify the scenic quality ratings (**Table 8**).

SCENIC QUALITY RATING		
Description	***LOW*** ← ***MODERATE*** → ***HIGH***	
Landform	- Flat Topography - Absence of Landscape Features - Open, broad extents of spaces	- Diversity in Topographical Range - Unique Landscape Features - Intimate spaces
Waterforms	- Absence of Water	- Presence of Water - Visually prominent lakes, reservoirs, rivers streams and swamps.
Vegetation	- Absence of vegetation - Lack of diversity - Land cleared of endemic vegetation - Low level of connection between vegetation and landscape / topography	- Abundant vegetation - High diversity - High retention of endemic vegetation. - High level of connectivity between natural landscape and landforms.
Human Influence	- High population. - High density in settlement - High presence of Infrastructure - High levels of landscape modification	- Low / dispersed population - No settlement - Absence of infrastructure - Landscape in natural state
Activity	- High levels of traffic movement - Presence of freight and passenger transport networks - Presence of production or industry.	- Low traffic movement - Absence of freight and passenger transport - Absence of production or industry
Rarity	- Typical landscape within a local and regional context	- Unique combination of landscape features in a local and regional context
Relationship with Adjoining Landscapes	- Low visible connection with adjoining landscapes - Low variability between adjoining landscapes. - Landscape features do not contribute to amenity from adjoining landscapes	- High visibility with adjoining landscapes. - High variability and contrast with adjoining landscapes - Landscape features contribute significantly to amenity of adjoining landscapes

Table 7 Scenic Quality Rating Frame of Reference

VISUAL REFERENCE FOR SCENIC VALUES

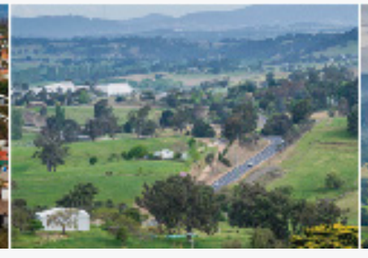
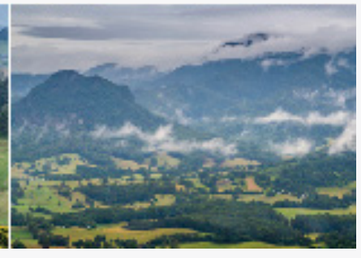
	LOW SCENIC QUALITY	MODERATE SCENIC QUALITY	HIGH SCENIC QUALITY
LANDFORM			
VEGETATION			
WATER BODIES			
SOCIAL / CULTURAL			
HUMAN PRESENCE			

Table 8 Visual Reference for Scenic Quality Values (Source: DPE 2022)

06

Preliminary Assessment Tools

6.0 Preliminary Assessment Tools

6.1 Overview of Preliminary Assessment Tools

To assist in defining the visual catchment, preliminary assessment tools have been developed in the Bulletin. In accordance with the Bulletin, the purpose of the preliminary assessment tools are: to provide an early indication of where turbines require careful consideration because of potential visual impacts. The tools apply to both dwellings and key public viewpoints in the study area. The tools provide an early indication of where placement of turbines will require further assessment and justification, and where consultation with potentially affected landowners needs to be focused – including discussions for landholder agreements.

The preliminary assessment tools involve analysis of two key visual parameters:

1. Visual Magnitude (**Refer to Section 6.2**)
2. Multiple Wind Turbine Tool (**Refer to Section 6.4**)

Once defined, the Bulletin states: Further assessment and justification for placement of turbines located in these sensitive areas in the EIS will be required, along with a description of mitigation and management measures being employed to reduce impacts. This assessment may identify that factors such as topography, relative distance and existing vegetation may minimise or eliminate the impacts of the project.

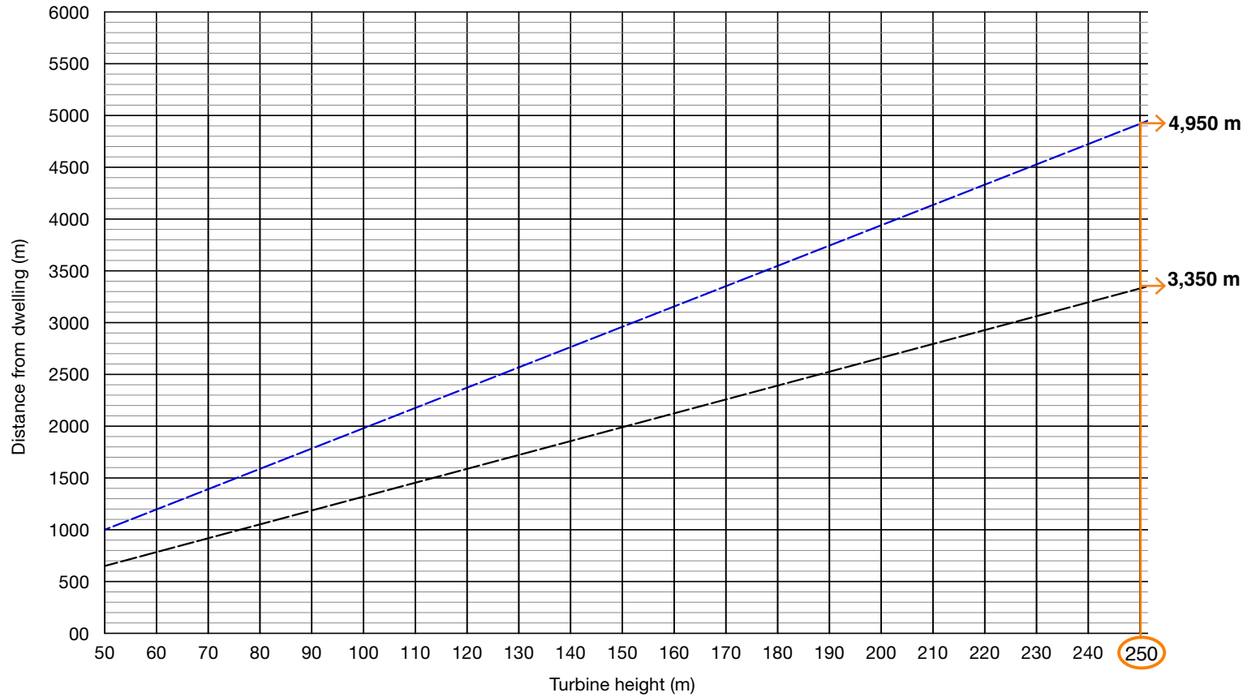
Dwellings identified through the application of the Preliminary Assessment tools have been assessed in detail in **Appendix D** of this LVIA.

6.2 Preliminary Assessment Tool 1: Visual Magnitude

The Visual Magnitude Threshold is based on the height of the proposed WTG to the tip of the blade and distance from dwellings or key public viewpoints as shown in **Figure 15.**

In accordance with the Bulletin: *proposed turbines below the black line must be identified along with the dwellings or key public viewpoints as part of the request for SEARs.* The proposed WTGs are based on a worst case scenario with a tip height of *250 metres*. The 'black line 'intersects at a distance of *3,350 metres* and the 'blue line' intersects at *4,950 metres*.

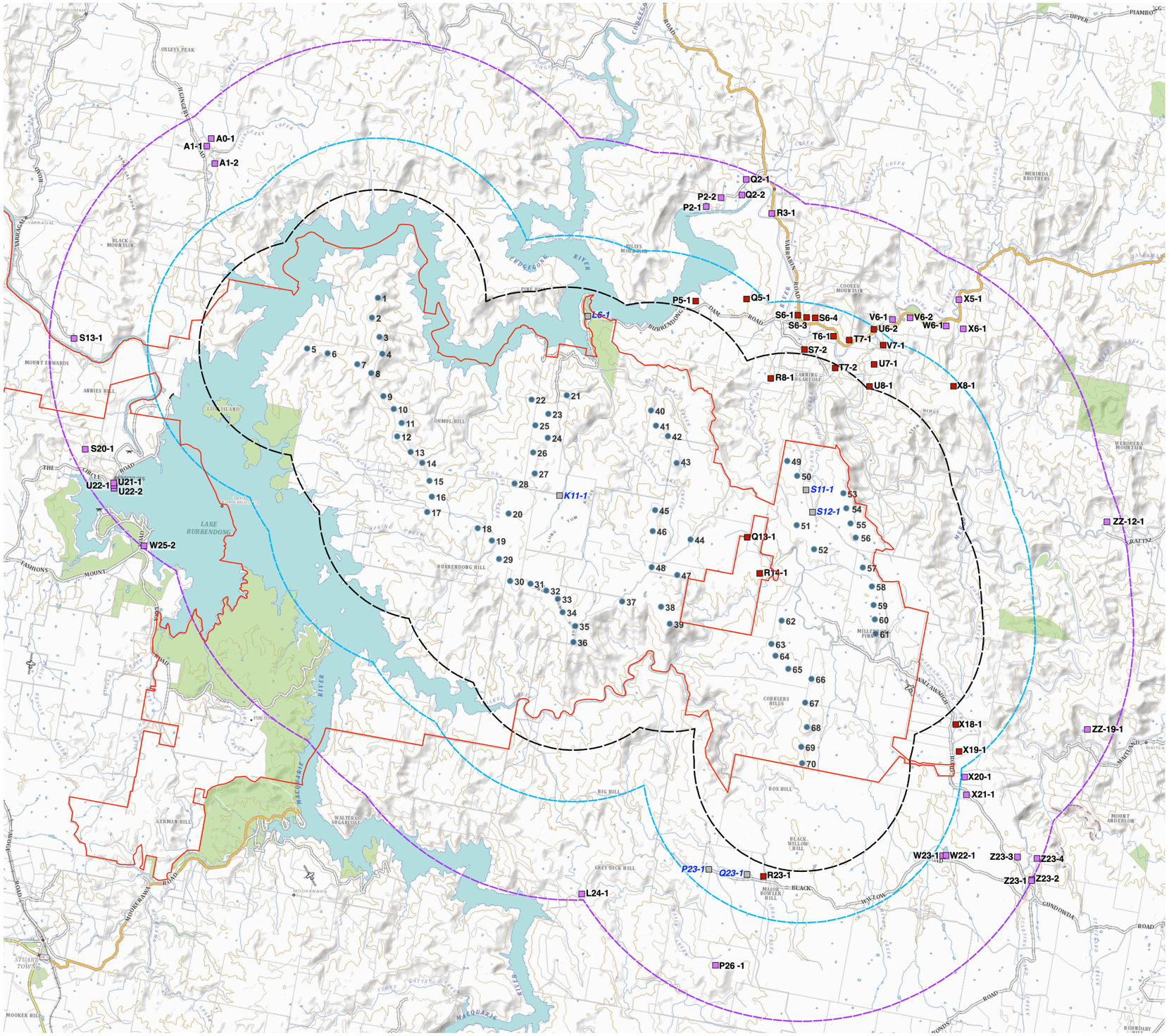
For the purpose of the Preliminary Assessment, the Visual Magnitude thresholds are based on a 2D assessment of the Project alone. Further assessment indicates factors such as topography, relative distance and existing vegetation may minimise or eliminate the impacts of the Project from residences.



-------- Black Line of Visual Magnitude = 3,350 m

-------- Blue Line of Visual Magnitude = 4,950 m

Figure 15 Preliminary Assessment Tool 1: Visual Magnitude thresholds for Project Layout
(Source: Visual Assessment Bulletin)



Visual Magnitude
Burrendong Wind Farm

LEGEND:

- Project Boundary
- Proposed 250 m WTG Location
- Involved Dwelling
- Non-involved Dwelling (within 4,950 m of nearest turbine)
- Non-involved Dwelling (in excess of 4,950 m from nearest turbine)
- 3,350 m from WTG (Black Line of Visual Magnitude)
- 4,950 m from WTG (Blue Line of Visual Magnitude)
- 8,000 m from WTG

Note:

Preliminary Assessment Tool 1: Visual Magnitude is based on a 2D Assessment alone and does not take into account topography, vegetation or other screening factors which may reduce the potential for viewing WTGs.

For detailed assessment of Non-involved Dwellings identified refer to **Appendix D.**

Figure 16 Preliminary Assessment Tool 1: Visual Magnitude - Burrendong Wind Farm (Map Source: Six Maps)

6.3 Results of Preliminary Assessment Tool 1: Visual Magnitude

Application of the Preliminary Assessment Tools to the Project identified dwellings which require further assessment in accordance with the Bulletin. Non-involved dwellings identified within 3,350 metres and between 3,350 - 4,950 metres of the nearest proposed WTG are shown on **Figure 16** and outlined in **Section 10.0** of this report.

Non-involved dwellings within 3,350 m (Black Line of Visual Magnitude):

- Four (4) *non-involved dwellings* have been identified within 3,350 metres of a proposed WTG location (within the black line of visual magnitude). Detailed assessments of all non-involved dwellings within the black line of visual magnitude have been summarised in **Table 12, Section 10.0** and detailed assessments have been provided in **Appendix D.**

Non-involved dwellings between 3,350 - 4,950 m (Blue Line of Visual Magnitude):

- 16 non-involved dwellings are located within 3,350 - 4,950 metres of a proposed WTG (between the black and the blue line of visual magnitude). Assessments of all dwellings between the black and blue line of visual magnitude have been provided in **Appendix D** and summarised in **Table 13, Section 10.0.**

6.4 Preliminary Assessment Tool 2: Multiple Wind Turbine Tool

The Multiple Wind Turbine Tool provides a preliminary indication of potential cumulative impacts arising from the Project. To establish whether the degree to which dwellings or key public viewpoints may be impacted by multiple wind turbines, the Proponent must map into six sectors of 60° any proposed WTGs, and any existing or approved WTG within eight kilometres of each dwelling or key public viewpoint. **Figure 16** below provides examples of where a dwelling or key public viewpoint may have views to WTGs in multiple 60° sectors.

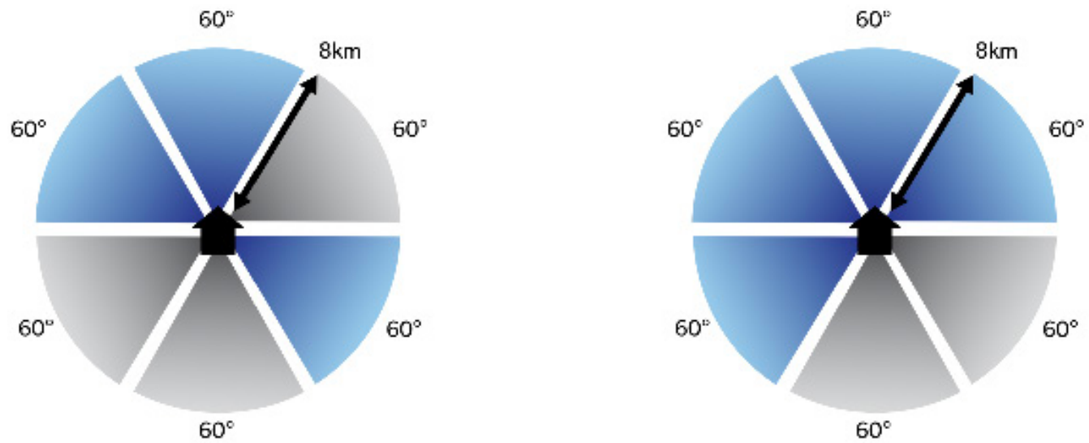


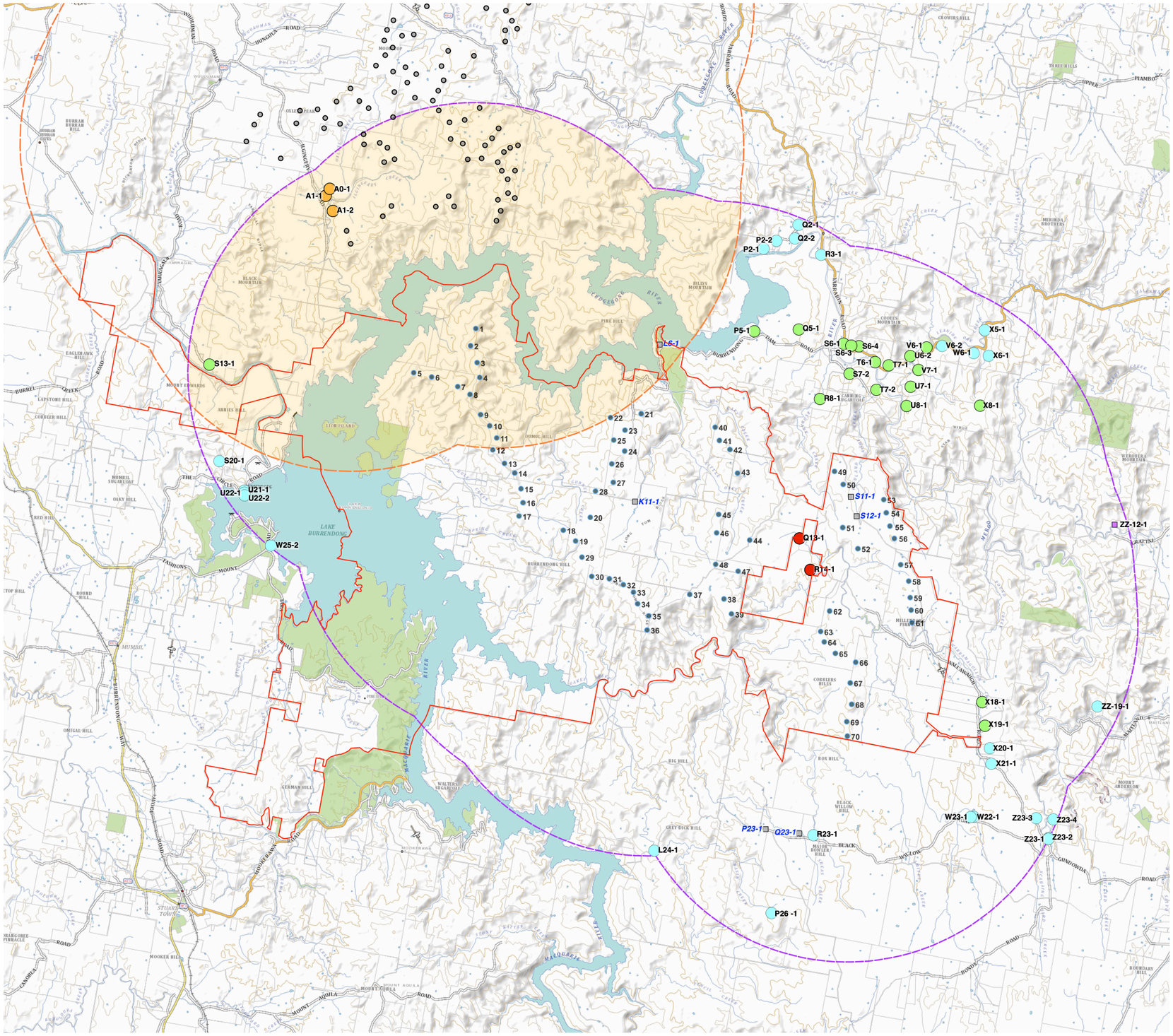
Figure 17 Preliminary Assessment Tool: Multiple Wind Turbines

(Source: Visual Assessment Bulletin)

In accordance with the Bulletin: *"Where wind turbines are visible within the horizontal views of the dwelling or key public viewpoints in three or more 60° sectors, the proponents must identify the turbines, relative dwelling and key public viewpoint, along with the relative distance and submit these to the Department as part of the request for SEARs. These WTGs will become a focus for assessment in the EIS."*

Figure 17 provides an overview of the number of 60º sectors visible from each of the dwellings identified within eight kilometres.

Multiple Wind Turbine Tool
Burrendong Wind Farm



LEGEND:

- Project Boundary
- 27 Proposed 250 m WTG Location
- 8,000 m from Burrendong Wind Farm (BWF) WTGs
- Approved Uungula Wind Farm (UWF) WTG Location (250 m)
- 8,000 m from Approved Uungula Wind Farm WTG
- Involved Dwelling

MWTT LEGEND:

- One 60° Sector (60°)
- Up to two (2) 60° Sectors (120°)
- Up to three (3) 60° Sectors (180°)
- Up to four (4) 60° Sectors (240°)
- Up to five (5) 60° Sectors (300°)
- Up to six (6) 60° Sectors (360°)

Dwellings within 8,000 m of UWF and the Project

(Refer to Cumulative Visual Impact Assessment - Section 11.0)

Note:

Preliminary Assessment Tool 2: Multiple Wind Turbine Tool is based on a 2D Assessment alone and does not take into account topography, vegetation or other screening factors which may reduce the potential for viewing multiple WTGs.

Figure 18 Preliminary Assessment Tool 2: Multiple Wind Turbine Tool (Map Source: Six Maps)

6.5 Results of Preliminary Assessment Tool 2: Multiple Wind Turbine Tool

When applied to the Project, the 2D Multiple Wind Turbine Tool (see **Figure 17**) identified six (6) non-involved dwellings with WTGs located in more than two (2) 60 degree sectors (see **Table 8**). The assessment is based on a 2D assessment and takes into account turbines associated with the Approved Uungula Wind Farm (UWF).

- Three (3) non-involved dwellings had WTGs located within up to four (4) 60 degree sectors (Note: all three (3) take into account turbines associated with UWF).

- Two (2) dwellings had WTGs located within up to five (5) 60 degree sectors. 3D assessment identified this would be reduced to three (3) 60 degree sectors for both dwellings.

Detailed assessment of dwellings with WTGs in multiple 60 degree sectors associated with the Project has been undertaken in **Appendix D**. Assessment of the cumulative visual impact resulting from views to WTGs associated with the Project and UWF has been undertaken in **Section 11.0**.

ID	Distance to nearest WTG	Number of 60º Sectors (3D Assessment)	Notes:
Non-involved dwellings with WTGs in up to four (4) 60º Sectors (up to 240º) (Based on 2D Assessment)			
A1-2	**6.43 km**	**Three (3)**	* Note: Takes into account UWF WTGs **Refer to Section 11.0 - Cumulative Impact Assessment**
A0-1	**7.15 km**	**Three (3)**	* Note: Takes into account UWF WTGs **Refer to Section 11.0 - Cumulative Impact Assessment**
A1-1	**6.99 km**	**Three (3)**	* Note: Takes into account UWF WTGs **Refer to Section 11.0 - Cumulative Impact Assessment**
Non-involved dwellings with WTGs in up to five (5) 60º Sectors (up to 360º) (Based on 2D Assessment)			
Q13-1	**1.58 km**	**Five (5)**	Detailed assessment indicates turbines will be screened by vegetation. **Refer to detailed assessment - Appendix D**
R14-1	**1.61 km**	**Five (5)**	Detailed assessment indicates turbines will be screened by vegetation. **Refer to detailed assessment - Appendix D**

Table 8 Non-involved dwellings identified as having WTGs in multiple 60º sectors by Multiple Wind Turbine Tool

07

Zone of Visual Influence

7.1 Overview of Zone of Visual Influence

The Bulletin states 'the use of Geographic Information Systems (GIS) to facilitate the application of the tools will streamline the evaluation phase of the evaluation phase of a project during the pre-lodgement stage. This can also assist in refining the number of turbines and viewpoints that will ultimately need more detailed assessment.'

Two (2) ZVI diagrams have been prepared for the Project to illustrate the theoretical visibility of the Project, one from blade tip height (250m) and one from a nominal hub height (160m).

- **Figure 19** depicts the areas of land from which the proposed development may be visible and provides an indicative number of WTGs based on the blade tip height of 250 metres.
- **Figure 20** illustrates the areas of land from which the proposed development would be visible at a hub height of 160 metres.

The ZVI (also known as a Zone of Theoretical Visibility Model) represents the area over which a development can theoretically be seen, and is based on a Digital Terrain Model (DTM). The ZVI usually presents a bare ground scenario - ie. A landscape without screening, structures or vegetation, and is usually presented on a base map (Scottish Natural Heritage, 2017)

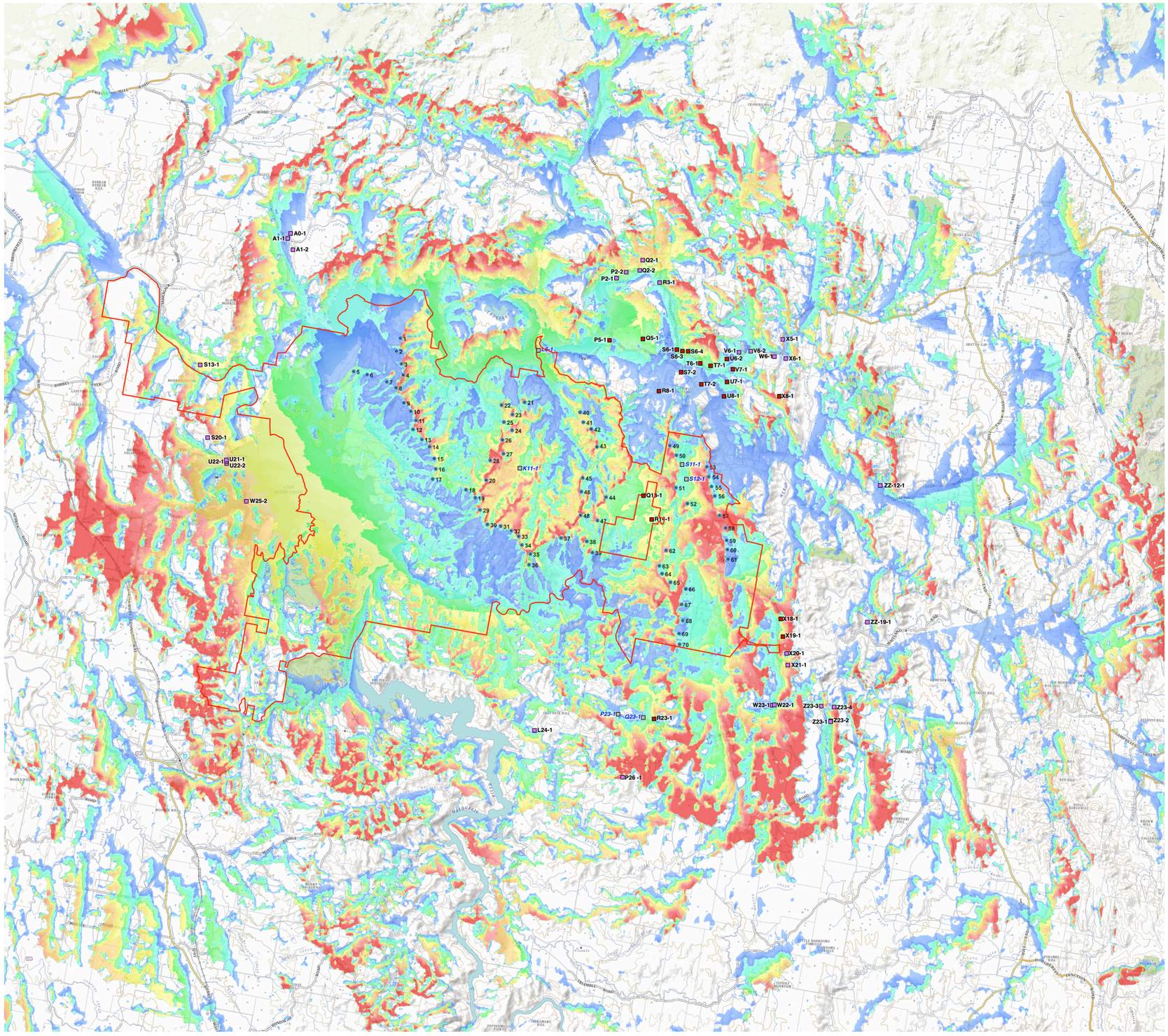
The ZVI has been determined through the use of digital topographic information and 3D modelling software WindPro. The ZVI has been assessed to approximately 15 - 20 km from the Project. Although it is possible for the development to be visible from further than 15 - 20 km away, it is generally accepted that beyond this distance visibility is diminished.

7.2 Summary of Zone of Visual Influence Analysis

The results of the ZVI are as follows:

- Due to the undulating topography that characterises the landscape, the ZVI illustrates there are limited opportunities to view the Project in its entirety. Areas that have been identified as having potential to view the Project in its entirety are generally isolated, and it is likely intervening vegetation would reduce the potential to view all of the WTGs.
- No non-involved dwellings have the potential to view the Project in its entirety.
- The most densely populated area is located to the north east of the Project associated with Yarrabin Road and Meroo River. The ZVI indicates views of the Project from dwellings in this area are limited to between 1 - 24 WTGs.
- The ZVI indicates views to the Project are limited from areas in excess of eight kilometres due to topography.

It is important to reiterate the ZVI is based on a worst case scenario assessment with no vegetation or structures. Ground truthing during field work will ascertain potential visibility taking into account structures and vegetation.



Zone of Visual Influence (ZVI)
Blade Tip Height 250m
Burrendong Wind Farm

LEGEND

- Project Boundary
- Proposed 250 m WTG Location
- Involved Dwelling
- Non-involved Dwelling (within 4,950 m of nearest turbine)
- Non-involved Dwelling (in excess of 4,950 m from nearest turbine)

Number of turbines visible:

- 1 - 11
- 12 - 23
- 24 - 35
- 36 - 47
- 48 - 60
- 61 - 70

Note:

The ZVI is a preliminary assessment tool that represents a bare ground scenario - i.e. a landscape without screening, structures or vegetation. As accurate information on the height and coverage of vegetation and buildings is unavailable, it is important to note the ZVI is based solely on topographic information. Therefore this form of mapping should be acknowledged as representing the worst case scenario.

N

0 2 4 6 8 10km

Figure 19 Zone of Visual Influence - Blade Tip Height 250 m (Map Source: Six Maps)

Zone of Visual Influence (ZVI)
Hub Height 160m
Burrendong Wind Farm

LEGEND

- Project Boundary
- Proposed 250 m WTG Location
- Involved Dwelling
- Non-involved Dwelling (within 4,950 m of nearest turbine)
- Non-involved Dwelling (in excess of 4,950 m from nearest turbine)

Number of turbines visible:

- 1 - 11
- 12 - 23
- 24 - 35
- 36 - 47
- 48 - 60
- 61 - 70

Note:

The ZVI is a preliminary assessment tool that represents a bare ground scenario - ie. a landscape without screening, structures or vegetation. As accurate information on the height and coverage of vegetation and buildings is unavailable, it is important to note the ZVI is based solely on topographic information. Therefore this form of mapping should be acknowledged as representing the worst case scenario.

N

0 2 4 6 8 10km

Figure 20 Zone of Visual Influence - Hub Height 160 m (Map Source: Six Maps)

08

Viewpoint Analysis

8.0 Public Viewpoint Analysis

8.1 Overview of Public Viewpoint Analysis

In accordance with the Bulletin: 'all key public viewpoints and individual dwellings within the 'visual catchment' should be identified and assessed'.

A total of 24 viewpoints were taken from public locations. Viewpoints have been carefully selected to be representative of the range of views within the Study Area. Selected viewpoint assessment locations are shown on **Figure 21**.

Public Viewpoint Selection Process

The selection of public viewpoints is generally informed by the results of the ZVI, topographical maps, field work observations and other relevant influences such as access, nearby representative residences, landscape character and the popularity of vantage points.

Public viewpoints are selected to illustrate a combination of the following;

- viewpoints identified by the community in community consultation phase of scoping paper,
- present landscape character types,
- areas of potentially high landscape or scenic value,
- range of distances,
- varying aspects and elevations,
- varying extent of wind farm visibility (full and partial visibility), and
- sequential views along specific routes.

It is important to note that viewpoints for this LVIA study have been taken predominantly accessible public land (typically walking tracks, roads and lookouts) which were identified as having a potentially high visual impact through the desktop review process. The viewpoint locations assessed for the Project have included key viewpoints identified through the extensive community engagement throughout the development, most of which were recorded in the PVIA prepared by Moir LA.

The Bulletin states: where relatively close clustering of houses belonging to different landowners or occupants occur, representative viewpoints may be selected and assessed in lieu of every single dwelling in the following types of areas:

• rural residential clusters;
• rural villages; and
• urban residential and commercial areas.

8.2 Viewpoint Analysis Methodology

Once the viewpoints had been selected, panoramic photographs are taken in accordance with the standards outlined in the Scottish Natural Heritage Visual Representation of Wind Farms Guidance Version 2.2.

Photographs used for viewpoints are taken on a level tripod at a height of 150cm (to represent eye level). Photographs were taken with a Canon EOS 5D Mark III Full Frame digital SLR through a 50mm fixed focal lens which closely represents the central field of vision of the human eye. Parameters for the photography is provided in **Table 9.**

The visual impact of the viewpoint was assessed both on site and through a desktop assessment utilising with the topographic and aerial information to ensure accuracy.

The locations of the viewpoints have been identified in **Figure 20** and the general viewing direction of each viewpoint is identified on the map on each viewpoint.

Viewpoint inventory prepared for the Project has been included as Appendix B.

Photography Specifications:	
Camera Make and Model:	**Canon EOS 5D Mark IV Full Frame Digital SLR**
Lens:	**EF50mm f/1.2L USM**
Focal Length:	**50mm f/0**
Aperture Setting:	**f/6.3 - 10**
Tripod Height:	**150cm (to represent eye level)**

Table 9 Photography Specifications

Public Viewpoint Analysis Locations

Burrendong Wind Farm

LEGEND:

- Project Boundary
- Proposed 250 m WTG Location
- Involved Dwelling
- Non-involved Dwelling (within 4,950 m of nearest turbine)
- Non-involved Dwelling (in excess of 4,950 m from nearest turbine)
- Viewpoint Analysis Location (Public Location)

Refer to Appendix C

N

0 2 4 6 8 10km

Figure 21 Viewpoint Analysis Locations (Map Source: Six Maps)

8.3 Visual Influence Zone (VIZ)

In accordance with the Bulletin, Visual Influence Zones (VIZ) have been established from the Project Site from dwellings and key viewpoints. This establishes the relative landscape significance against which the potential impacts of WTGs may be assessed. The Visibility Distance Zone, Viewer Sensitivity Level and Scenic Quality Class of each viewpoint have been assessed which, when combined, result in an overall VIZ (see **Figure 22** below and refer to tables in **Appendix A**). An evaluation using the corresponding visual performance objectives (see Table 2 of the Visual Assessment Bulletin) has been included for each viewpoint.

For each viewpoint, the potential visual impact was analysed through the use of a combination of the 3D terrain modelling, topographic maps and on site analysis.

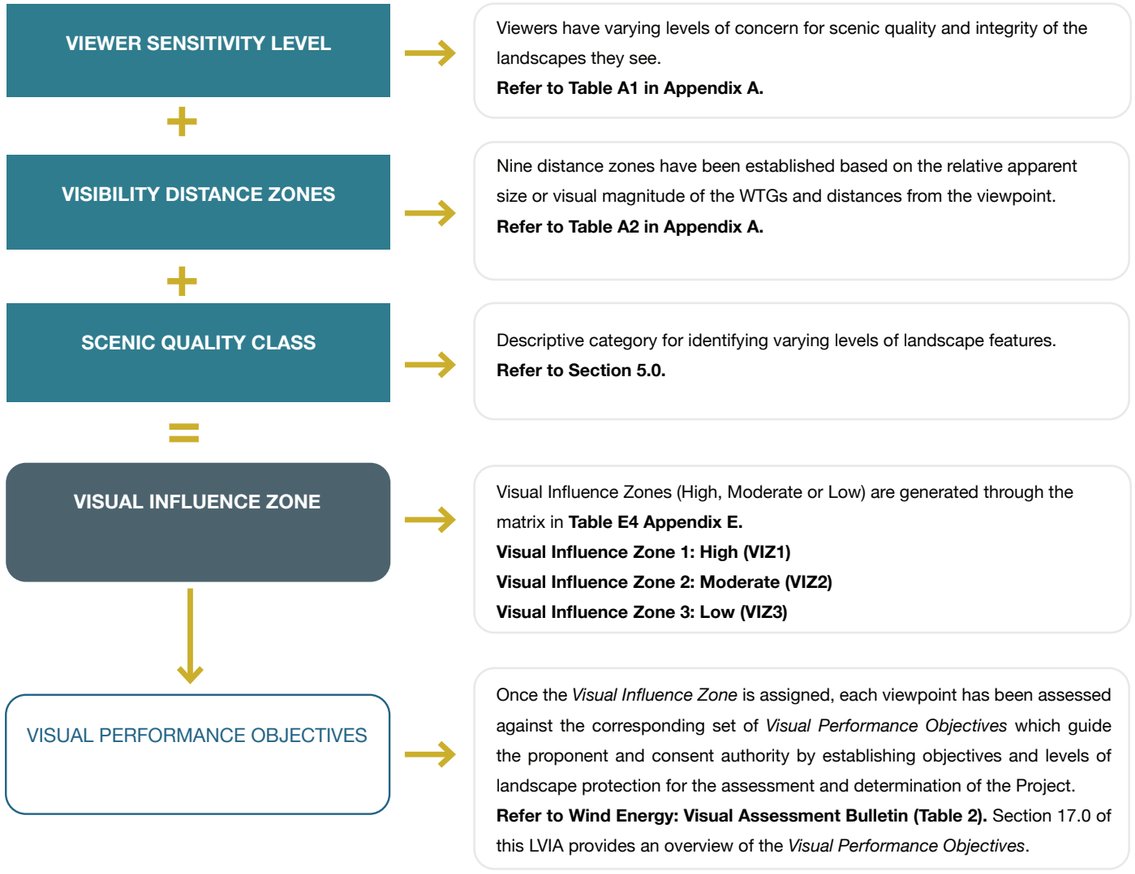


Figure 22 Summary of Methodology for Determining VIZ (Source: Visual Assessment Bulletin)

8.4 Summary of Viewpoint Analysis

The **24** viewpoints assessed for the purpose of this LVIA were taken from varying distances and locations surrounding the Project. Each viewpoint was assigned a VIZ based on their view sensitivity level, distance zone and scenic quality class combinations (refer to the methodology in **Section 8.3** and **Appendix A**). In accordance with the objectives of the Bulletin, each viewpoint was assessed against the objectives for the VIZ. The following provides a brief overview of the viewpoint analysis which is located in **Appendix B**. Photomontages have been undertaken from selected public viewpoints to illustrate the potential visual impacts refer to **Section 9.0** and **Appendix E**.

Visual Influence Zone 1 (VIZ1):
In accordance with the methodology, there are no publicly accessible viewpoints identified as VIZ1.

Visual Influence Zone 2 (VIZ2):
One (1) viewpoint was rated as VIZ2. This viewpoint was taken from Cudgegong River Park (BWF09) generally rated as VIZ2 due to the moderate viewer sensitivity (Level 2) and close proximity to the Project (3.04 km). The viewpoint location was assessed against the performance objectives outlined in the Bulletin. It was assessed that the Project was likely to be visible from each of the viewpoints, however the visual performance objectives were met for each viewpoint.

Visual Influence Zone 3 (VIZ3):
23 viewpoints were rated as VIZ3 in accordance with the methodology in the Bulletin. This is generally due to the low landscape sensitivity and / or distance to the Project. There are no performance objectives for VIZ3 receptors.

09

Photomontages and Wire Frame Diagrams

9.0 Photomontages and Wire Frame Diagrams

9.1 Overview of Photomontages and Wire Frame Diagrams

The Bulletin states: *Photomontages shall be prepared in accordance with the Scottish Natural Heritage Visual Representation of Wind Farms, Version 2.1 December 2014 guidelines, noting they are generally consistent with the Land and Environment Court's Photomontage Policy. The visual assessment needs to include a concise description of the complete methodology used to create any photomontages presented in the visual assessment.*

9.1.1 Photomontages

A photomontage combines a photograph of an existing view with a computer-rendered image of a proposed development. Photomontages are used to illustrate the likely view of a proposed development as it would be seen in a photograph (not as it would appear to the human eye in the field).

Although photomontages are based on a photograph of the existing landscape, it is important to stress that they are not a substitute to visiting a viewpoint in the field. They are only one tool to aid assessment. They provide a two-dimensional image that can be compared with an actual view of the landscape to provide information, such as the scale and potential appearance of a proposed development.

9.1.2 Wire Frame Diagrams

A wire frame is a computed generated image based on a digital terrain model, that indicate the 3D shape of the landscape in combination with additional elements. They are a valuable tool in the wind farm LVIA process as they allow the assessor to compare the position and scale of the WTGs to the existing view of a landscape (Scottish Natural Heritage, 2017). Wire frame images can be seen as a worst case scenario as they do not take into account factors such as vegetation, building structures.

Wire frame diagrams have been utilised in this LVIA to assist in the assessment of the Project from inaccessible locations. In instances where access to a private property was not granted, wire frame diagrams have been utilised as an assessment tool to provide a worst case scenario view of the proposal.

Wire frame images have also been utilised as a substitute for photomontages in areas where intervening factors limit the capacity to align photographs accurately (ie. due to dense vegetation).

9.2 Photomontage Selection Process

Viewpoints have been selected for the preparation of photomontages to best illustrate the potential appearance of the Project from varying distances and locations with differing views (refer to **Figure 23**).

Public Photomontage Locations:

A total of **six (6)** public viewpoint locations selected for the preparation of visual photomontages are based on feedback received from the community. Exact photomontage locations were selected on site to represent a worst case scenario for the viewpoint location. Localised screening factors such as vegetation were avoided (where possible) to ensure maximum exposure to the Project. The public viewpoint locations selected for the preparation of photomontages are consistent with viewpoints identified in the Preliminary Visual Impact Assessment and locations identified during ongoing community consultation.

Photomontages from public viewpoint locations have been provided in Appendix E.

Private Photomontage Locations:

Eight (8) photomontages have been prepared from private properties. The locations selected were based on those within close proximity to the Project where access to private property was available. Although effort was made to undertake site assessments from all dwellings within 4,950 metres, access to some properties was not available. Where access was not available, wire frame diagrams have been utilised to illustrate potential visual impacts from dwellings.

Photomontages prepared for the Project from private Dwellings have been included in Appendix D.

Photomontage Locations
Burrendong Wind Farm

LEGEND:

- Project Boundary
- Proposed 250 m WTG Location
- Involved Dwelling
- Non-involved Dwelling (within 4,950 m of nearest turbine)
- Non-involved Dwelling (in excess of 4,950 m from nearest turbine)
- Photomontage from Public Location (**Refer to Appendix E** - Public Photomontages)
- Photomontage from Private Location (**Refer to Appendix D** - Detailed Dwelling Assessment)

N

0 2 4 6 8 10km

Figure 23 Photomontage Locations (Map Source: Six Maps)

9.3 Photomontage Development Methodology

The process for generating the photomontages involves computer generation of a wire frame perspective view of the WTGs and the topography from each viewpoint. As per the requirements of the Wind Energy: Visual Assessment Bulletin, photomontages have been prepared in accordance with the Scottish Natural Heritage Visual Representation of Wind Farms, Version 2.2 February 2017. The process for photomontage development is demonstrated in ***Figure 24***.

The photomontages are based on a worst case scenario of a maximum turbine height dimension of 250 m with a hub height of 160 m and rotor diameter of 180 m, without the inclusion of the proposed mitigation methods.

Moir LA have prepared the photomontages using the most current available version of Wind Pro software using the following process:

Step 1: Develop 3D Model

Detailed 3D model of the Site is developed in Wind Pro. The WTGs and associated infrastructure (substations, transmission lines, wind masts etc.) are modelled and sited in the 3D model to scale.

Step 2: Align Photograph and Model

The digital panorama is imported into Wind Pro and EXIF properties of the file are inserted automatically defining all relevant visualization information as e.g. type of camera lens used, field of view for panoramas, the position and direction. Topography, control points, obstacle objects, existing wind masts can be used as reference to calibrate the camera model very precisely.

Step 3: Render Photomontage

The software calculates the position of the sun based on the time and date of photograph and renders the WTGs in accordance with the specific weather conditions and position of the sun. Once rendered, detailed removal of intervening elements (such as vegetation) is undertaken to provide an accurate representation of the Project.

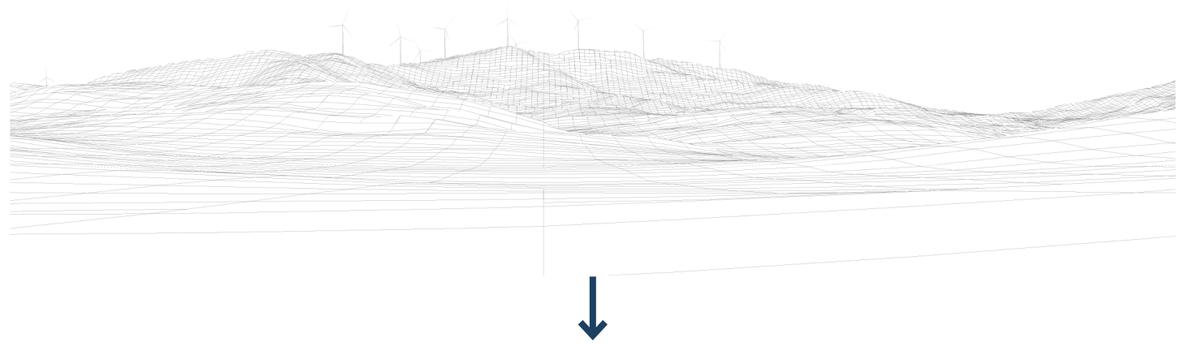


Figure 24 Photomontage Development Process

9.4 Photomontage Limitations

Visualisations in themselves can never provide the full picture in terms of potential impacts; they only inform the assessment process by which judgements are made. Visualisations of wind farms have a number of limitations which you should be aware of when using them to form a judgement on a wind farm proposal. These include:

- The images provided give a reasonable impression of the scale of the WTGs and the distance to the WTGs, but can never be 100% accurate;
- A static image cannot convey turbine movement, or flicker or reflection from the sun on the turbine blades as they move;
- A visualisation can never show exactly what the wind farm will look like in reality due to factors such as: different lighting, weather and seasonal conditions which vary through time and the resolution of the image.

Source: Scottish Natural Heritage Visual Representation of Wind Farms, Version 2.2 February 2017.

The Scottish Natural Heritage Guidelines state: One of the most significant difficulties of photographing wind farms, in contrast to other types of development, is that they often appear on the skyline where there can be little contrast between the light-coloured turbines and a light-coloured sky. It is therefore essential that all baseline photographs are taken in good visibility. This will generally mean clear skies, in suitably clear air to allow sufficient contrast between the different elements within the landscape. This is particularly important for long-range views where poor light and atmospheric conditions such as haze or cloud can reduce the clarity of the view, or for views where the turbines are predominantly viewed against the sky.

Moir LA undertook base photography over a series of three (3) site visits. Great effort was made to ensure clear sky conditions for each trip to Site, however some variations to the sky conditions may appear in the viewpoints and photomontages.

Images 15 - 17 have been included to illustrate the variations to WTGs based on differing times of the day and sky conditions.

Image 15. Photo of Gullen Range Wind Farm at dusk, looking in a east direction with sun on WTGs

Image 16. Photo of Gullen Range Wind Farm at dusk, looking in a west direction with sun on WTGs

Image 17. Photo of Crudine Ridge Wind Farm at midday, looking in a north direction

10
Dwelling Assessments

10.0 Dwelling Assessments

10.1 Overview of Dwelling Assessment

The Bulletin states: *"all key public viewpoints and individual dwellings within the 'visual catchment' should be identified and assessed" and "the black and blue lines are not determinative of acceptability. Instead, they provide a basis for the assessment to be undertaken. There may be reasons why the proposed turbine will not have the impact as identified by (the visual magnitude thresholds) and detailed justification can be provided for proposed turbines... for example ground truthing may identify that existing vegetation or topography will screen views to a proposed turbine".*

The Preliminary Assessment Tools (**Section 6.0**) defined the visual catchment and identified non-involved residences within the Study Area which require further assessment. These include:

- **Four (4)** non-involved dwellings within 3,350 metres of the nearest WTG.
- **16** non-involved dwellings within 3,350 - 4,950 metres.
- **Three (3)** non-involved dwellings in excess of 4,950 metres with potential view WTGs in three (3) or more 60º sectors. Note: as the sectors include WTGs associated with the UWF Project, assessment of these dwellings has been undertaken. Refer to **Section 11.0 Cumulative Visual Impact Assessment.**

10.2 Study Method for Dwelling Assessment

Table 10 provides an overview of the study method for undertaking the dwelling assessment for each dwelling identified within the visual catchment.

10.2.1 Dwellings within 3,350 metres of the nearest WTG (Black Line of Visual Magnitude)

With the advice of Moir LA, the proponent offered on-site visual assessments to most private properties within 4,950 metres of the Project. Access was granted by eight (8) of the landowners, and Moir LA attended these properties between *3rd - 5th March 2021, 27th September 2021* and *March 2023* to undertake a detailed site inspections.

The purpose of the site inspection was to undertake photographic assessments from areas of potential concern identified by the landowner. While on Site, Moir LA's team ground truthed information identified through the desktop assessment. Where access was not granted to the property, Moir LA have undertaken a desktop assessment utilising 3D modelling and the most current available aerial imagery. Assumptions have been made on the height of vegetation based on character assessments.

An overview of the visual assessment for each of these dwellings has been outlined in **Table 12** and detailed assessments have been included in **Appendix D** and summarised in **Section 10.4.**

10.2.2 Dwellings within 3,350 - 4,950 metres of the nearest WTG

A total of 16 non-involved dwellings were identified within 4,950 metres of a proposed turbine. An overview of the visual assessment for each of these dwellings has been outlined in **Table 13** detailed desktop assessments have been included in **Appendix D** and summarised in **Section 10.4.**

An assessment has been undertaken with the use of a combination of desktop assessment tools (ZVI, wire frame diagrams and aerial imagery).

10.2.3 Dwellings in excess of 4,950 metres of the nearest WTG

Where possible, Moir LA have provided representative viewpoints near dwellings located in excess of 4,950 m. The Bulletin states: where relatively close clustering of houses belonging to different landowners or occupants occur, representative viewpoints may be selected and assessed in lieu of every single dwelling in the following types of areas:

- rural residential clusters;
- rural villages; and
- urban residential and commercial areas.

In addition to the detailed assessment of dwellings identified within the visual catchment, Moir LA undertook an extensive Viewpoint Analysis which provides representative visual assessments from dwellings in excess of 4,950 metres of the Project (refer to **Appendix B**).

Study Method	Process
Step 1: Application of Preliminary Assessment Tools	Preliminary Assessment Tools were applied in accordance with the Bulletin from each dwelling to assess the following two parameters: - Visual Magnitude (identify the number of WTGs within blue and black lines) - Multiple 60º Sector Assessment (identify the number of 60º sectors based on a 2D assessment).
Step 2. 3D Assessment (based on topography alone)	Using 3D modelling, Moir LA identified WTGs which will not be visible from the dwelling due to topography. As a result the extent of visibility is generally decreased when compared to the 2D assessment. The application of the Preliminary Assessment Tools are updated to account for 3D modelling.
Step 3. Aerial Imagery	Information on the extent of visibility extracted from the 3D model is then overlaid onto a recent aerial image of the dwelling and its surrounds. This provides a detailed assessment of the direction and extent of potentially visible WTGs and identifies any intervening elements (such as structures, wind break planting or vegetation) which may reduce the potential visibility.
Step 4. Site Inspection	Where access was granted, Moir LA attended the property to undertake a site inspection to ground truth potential screening factors that were identified on aerial imagery. This included photographic assessment from the dwelling. During the site inspection Moir LA identified potential intervening elements including vegetation and structures.
Step 5: Photomontage / Wireframe	Where potential impacts were identified, photomontages or wireframes were prepared from dwellings to represent those with potential impacts or to best represent the appearance of the Project from each dwelling.
Step 6. Evaluation of VIZ Objectives	In accordance with the Bulletin, the VIZ was defined and the relevant objectives were evaluated for each dwelling based on the assessment.
Step 7. Visual Effect Rating	A visual impact rating is applied to each dwelling with regards to the parameters outlined in **Section 10.3.**
Step 8. Consideration of mitigation methods	For non-involved dwellings where by the Project has the potential to cause visual impact, mitigation methods have been suggested. **Refer to Section 16.**

Table 10 Dwelling Assessment Process

10.3 Visual Impact Rating Methodology

The Bulletin states: The Department adopts the widely accepted and commonly utilised approach that visual impact can be determined from a combination of receiver sensitivity and the magnitude of visual effect. This approach is documented in numerous Australian and international guidelines, and is considered to be industry best practice.

In addition to assessing against the visual performance objectives outlined in the Bulletin, Moir LA have developed a framework for defining and rating the level of visual effect from each dwelling.

The framework in **Table 11** has been prepared with regards to the third edition of the Guidelines for Landscape and Visual Impact Assessment (GLVIA3), Residential Visual Amenity Assessment (RVAA) and Moir LA's extensive professional experience in undertaking LVIA's for wind energy projects.

Published in 2013, the GLVIA3 is well established as providing 'best practice guidance' when undertaking LVIA's. RVAA is a stage beyond LVIA and focusses exclusively on private views and private visual amenity. Considerations outlined in the RVVA which provide a framework for describing and evaluating the predicted magnitude of visual change and related visual amenity effects include:

- Distance of property from the proposed development having regard to its size / scale and location relative to the property (e.g. on higher or lower ground);
- Type and nature of the available views (e.g. panoramic, open, framed, enclosed, focused etc.) and how they may be affected, having regard to seasonal and diurnal variations;
- Direction of view / aspect of property affected, having regard to both the main / primary and peripheral / secondary views from the property;
- Extent to which development / landscape changes would be visible from the property (or parts of) having regard to views from principal rooms, the domestic curtilage (i.e. garden) and the private access route, taking into account seasonal and diurnal variations;
- Scale of change in views having regard to such factors as the loss or addition of features and compositional changes including the proportion of view occupied by the development, taking account of seasonal and diurnal variations;
- Degree of contrast or integration of new features or changes in the landscape compared to the existing situation in terms of form, scale and mass, line, height, colour and texture, having regard to seasonal and diurnal variations;
- Duration and nature of the changes, whether temporary or permanent, intermittent or continuous, reversible or irreversible etc.; and
- Mitigation opportunities – consider implications of both embedded and potential further mitigation.

(Source: RVVA, 2019).

VISUAL IMPACT RATING - RESIDENCES

	NEGLIGIBLE	LOW	MODERATE	HIGH
Distance	The project may be partially visible but very difficult to discern due to distance and / or intervening elements.	Turbines may be visible in distance or very partially visible in the foreground.	Turbines maybe visible in the middle ground or a small number may be visible in the near ground.	Turbines are highly visible in the foreground.
Type of views		Views from the dwelling are not focused on the Project.	Views from the dwelling are not focused entirely on the Project.	Views are focused directly towards the Project.
Direction of view		The Project may be visible in peripheral views or form a very minor element in primary views.	The Project may be visible from, yet will not dominate primary views.	The Project will be highly visible and has the potential to be a dominant element in primary views from the property.
Extent of visibility		The Project may be partially visible or fragmented.	The Project may be visible from the dwelling yet will not significantly alter the existing visual character.	The Project has the potential to significantly alter the existing visual character when viewed from the dwelling.
Scale of change		The Project may be visible yet will not change to the existing visual character.	The Project has the potential to become a noticeable element in the view, yet will not overly diminish the existing visual character.	The Project has the potential to alter the existing visual character.
Degree of contrast		The Project will have a low level of contrast with the existing landscape.	The Project will result in a moderate level of contrast with the existing landscape.	The scale of the Project will result in a high level of contrast with the existing landscape.
Duration of change		Changes are temporary.	Changes to the landscape have the potential to be reduced over time (with the employment of. mitigation methods).	Changes to the landscape are continuous and / or irreversible.
Mitigation Options		Existing screening factors contribute to reducing the potential visibility.	Some existing screening factors may contribute to fragmenting the Project or there is opportunity to screen the Project.	Limited opportunities to screen the Project.

Table 11 Visual Impact Rating Methodology - Residences

Non-involved dwellings within Black Line of Visual Magnitude (3,350m)

Dwelling ID:	Distance to nearest Turbine:	Nearest Turbine:	Number of turbines within 3,350 m	Turbines within 3,350 m:	Number of turbines within 4,950 m:	Turbines within 4,950 m:	Theoretical number of 60º sectors (Based on 2D Assessment):	Number of 60º sectors (Based on 3D Assessment)	Number of potentially visible turbines:	Shadow Flicker:	Visual Impact Rating:	Assessment Notes:
Q13-1	**1.58 km**	**51**	**14**	**43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 62**	**15**	**40, 41, 42, 37, 38, 39, 56, 57, 58, 59, 60, 63, 64, 65, 66**	**Five (5)**	**Three (3)**	**27 turbines** 23 at hub 4 at blade tip	**26:16 hours per year**	**High**	**Refer to Appendix D.1** **Mitigation measures proposed, refer to Appendix G.1**
R14-1	**1.61 km**	**62**	**14**	**38, 39, 44, 47, 50, 51, 52, 55, 56, 57, 62, 63, 64, 65**	**14**	**37, 48, 46, 45, 43, 49, 53, 54, 58, 59, 60, 61, 66, 67**	**Five (5)**	**Five (5)**	**37** 34 at hub 3 at blade tip	**17:40 hours per year**	**High**	**Refer to Appendix D.2** **Mitigation measures proposed, refer to Appendix G.2**
R8-1	**2.61 km**	**49**	**2**	**49, 50**	**7**	**40, 41, 42, 43, 51, 53, 54**	**Two (2)**	**Two (2)**	**2 turbines** 0 at hub 2 at blade tip	**Nil**	**Very Low**	**Refer to Appendix D.3**
T7-2	**3.25 km**	**49**	**1**	**49**	**4**	**50, 53, 54, 55**	**Two (2)**	**One (1)**	**2 turbines** 1 at hub 1 at blade tip	**Nil**	**Very Low**	**Refer to Appendix D.4**

Table 12 Summary of Non-involved Dwelling Assessment within 3,350 m of nearest turbine

Non-involved dwellings within Blue Line of Visual Magnitude (Between 3,350 - 4,950 m)

Dwelling ID:	Distance to nearest Turbine:	Nearest Turbine:	Number of turbines within 3,350 m	Turbines within 3,350 m:	Number of turbines within 4,950 m:	Turbines within 4,950 m:	Theoretical number of 60º sectors (Based on 2D Assessment):	Number of 60º sectors (Based on 3D Assessment)	Number of potentially visible turbines:	Shadow Flicker:	Visual Impact Rating:	Assessment Notes:
U8-1	3.40 km	53	0	-	7	49, 50, 51, 53, 54, 55, 56	Two (2)	One (1)	8 turbines 5 at hub 4 at blade tip	Nil	Low	Refer to Appendix D.5
S7-2	3.50 km	49	0	-	3	49, 50, 53	Two (2)	Nil	Nil	Nil	Nil	Refer to Appendix D.6
P5-1	3.67 km	40	0	-	3	40, 41, 42	Two (2)	One (1)	14 turbines 8 at hub Height 6 at blade tip	Nil	Nil	Refer to Appendix D.7
R23-1	3.69 km	70	0	-	3	70, 69, 68	One (1)	One (1)	32 turbines 15 at hub Height 17 at blade tip	Nil	Low	Refer to Appendix D.8
X18-1	3.76 km	61	0	-	8	61, 60, 59, 66, 67, 68, 69, 70	Two (2)	Two (2)	17 turbines 16 at hub Height 1 at blade tip	Nil	Nil	Refer to Appendix D.9
U7-1	3.39 km	49	0	-	4	49, 50, 53, 54	Two (2)	One (1)	31 turbines 21 at hub Height 10 at blade tip	Nil	Moderate	Refer to Appendix D.10 Mitigation measures proposed, refer to Appendix G.3
T6-1	4.13 km	49	0	-	3	49, 50, 53	Two (2)	One (1)	21 turbines 13 at hub Height 8 at blade tip	Nil	Low	Refer to Appendix D.11
T7-1	4.22 km	49	0	-	3	49, 50, 53	Two (2)	One (1)	27 turbines 18 at hub Height 9 at blade tip	Nil	Low	Refer to Appendix D.12
X19-1	4.48 km	61	0	-	5	60, 61, 68, 69, 70	Two (2)	Two (2)	31 turbines 19 at hub Height 12 at blade tip	Nil	Nil	Refer to Appendix D.13
S6-3	4.50 km	49	0	-	2	49, 50	Two (2)	Two (2)	29 turbines 20 at hub Height 9 at blade tip	Nil	Low	Refer to Appendix D.14
S6-4	4.52 km	49	0	-	2	49,50	Two (2)	Two (2)	30 turbines 17 at hub Height 13 at blade tip	Nil	Low	Refer to Appendix D.15
S6-1	4.09 km	49	0	-	1	49	Two (2)	Two (2)	29 turbines 19 at hub Height 10 at blade tip	Nil	Low	Refer to Appendix D.16
Q5-1	4.55 km	40	0	-	3	40, 41, 42	Two (2)	Two (2)	34 turbines 28 at hub Height 6 at blade tip	Nil	Low	Refer to Appendix D.17
V7-1	4.67 km	49	0	-	3	49, 50, 53	Two (2)	One (1)	6 turbines 3 at hub Height 3 at blade tip	Nil	Nil	Refer to Appendix D.18
X8-1	4.76 km	53	0	-	1	53	One (1)	One (1)	62 turbines 57 at hub Height 5 at blade tip	Nil	Moderate	Refer to Appendix D.19 Mitigation measures proposed, refer to Appendix G.4
U6-2	4.89 km	49	0	-	1	49	One (1)	One (1)	13 turbines 9 at hub 4 blades	Nil	Low	Refer to Appendix D.20

Table 13 Summary of Non-involved Dwelling Assessment between 3,350 - 4,950m of nearest turbine

10.4 Summary of Dwelling Assessment

An overview of the visual assessment for each of the representative dwellings and detailed assessments have been included in **Appendix D**. The following provides a summary of the assessment and proposed recommendations in accordance with the Bulletin.

10.4.1 Dwellings within 3,350 metres of the nearest turbine (Black Line of Visual Magnitude)

A total of four (4) non-involved dwellings were identified within 3,350 metres of a proposed turbine. Detailed dwelling assessments have been undertaken for all four (4) of these non-involved dwellings.

Of the four (4) non-involved dwellings within 3,350 m the assessment found:

- Two (2) were assessed as having a high visual impact rating (R14-1 and Q13-1)
- Two (2) were assessed as having a very low visual impact rating (R8-1 and T7-2)

Two (2) non-involved dwellings located within 3,350 m of the nearest turbine were assessed as being Visual Influence Zone 1 (VIZ1) (R14-1 and Q13-1). In accordance with the Bulletin, objectives for VIZ1 receptors within the black line (3,350 m) of the nearest turbine are to: *Avoid turbines or provide detailed justification of turbines below the blue line.* Practical and feasible mitigation measures have been recommended for the two (2) dwellings rated as VIZ1. These two (2) dwellings have the potential for a high visual impact rating due to the close proximity of turbines. Proposed mitigation measures would significantly reduce the level of visual impact. Once established, it is anticipated the residual impacts would be acceptable. The mitigation measures have been provided in **Appendix G**.

Two (2) non-involved dwellings located within 3,350 m of the nearest turbine were assessed as being Visual Influence Zone 2 (VIZ2) (R8-1 and T7-2). In accordance with the Bulletin, objectives for VIZ2 receptors within the black line (3,350 m) of the nearest turbine are to: *Manage impacts as far as practicable, justify residual impacts.* The detailed assessment of these two (2) non-involved dwellings identified a very low visual impact resulting from the Project and therefore the impact is deemed acceptable.

10.4.2 Dwellings within 3,350 - 4,590 metres of the nearest turbine

A total of 16 non-involved dwellings were identified between the black and blue line of visual magnitude (between 3,350 - 4,950 metres of a proposed turbine). Detailed dwelling assessments have been undertaken for all 16 of these non-involved dwellings (refer to **Appendix D**).

Of the 16 non-involved dwellings between 3,350 - 4,950 m the assessment found:

- Two (2) non-involved dwellings were assessed as having a moderate visual impact rating (U7-1 and X8-1)
- Nine (9) non-involved dwellings were assessed as having a low visual impact rating (U8-1, R23-1, T6-1, T7-1, S6-3, S6-4, S6-1, U6-2 and Q5-1)
- Five (5) were assessed as having no visual impact (S7-2, P5-1, X18-1, X19-1 and V7-1)

All non-involved dwellings located between 3,350 m - 4,950 m of the nearest turbine were assessed as being Visual Influence Zone 2 (VIZ2). In accordance with the Bulletin, objectives for VIZ2 receptors between the black line (3,350 m) and blue line (4,950 m) of the nearest turbine are to: *Consider screening between the blue line and the black line.* In accordance with the Bulletin, screen planting has been proposed for the two (2) non-involved dwellings with a moderate visual impact rating. These have been provided in **Appendix G**.

10.5 Lots with Dwelling Entitlements

SEARs issued for the Project state the LVIA must include: *"detailed consideration of potential visual impacts on local residences (including approved developments, lodged development applications and dwelling entitlements)".*

The expression 'dwelling entitlement' has been interpreted as the potential for a landowner to obtain a development approval for a dwelling consistent with the applicable environmental planning instrument. Ark Energy provided Moir LA with lots within the blue line of visual magnitude. A total of 35 lots were identified as having a dwelling entitlement. Based on an assessment of zoning, lot size and the minimum lot size required for a dwelling, a total of 35 lots were identified within 5 kilometres of a proposed turbine location as having a potential dwelling entitlement. Development standards (for example the suitability of the site and access to a formed road) may render the grant of consent for a dwelling unlikely.

As a methodology for the assessment of lots with dwelling entitlements is not provided in the Bulletin, Moir LA have approached the assessment of dwelling entitlements as a desktop assessment. A Zone of Visual Influence (ZVI) diagram has been analysed for each lot and judgements have been made as to whether a dwelling could be site on the lot with minimal visual impacts. The desktop assessment does not take into account factors such as accessibility, bushfire risk, biodiversity which may limit opportunities to site a dwelling. In addition to the analysis of a ZVI data, commentary on the landscape character, topography, density of vegetation and potential orientation of a dwelling has been provided for each of the lots.

The assessment concluded that there are opportunities to position a dwelling on the majority of lots while ensuring minimal visibility of the Project. As the details of the Project are publicly available, a dwelling can be sited and orientated with well informed consideration of the potential visual impacts resulting from the Project.

An overview of the assessment is provided in **Appendix F.**

11

Cumulative Visual Impacts

11.0 Cumulative Visual Impact Assessment

11.1 Overview of Cumulative Visual Impacts

The Bulletin states: *The visual assessment must assess, in accordance with the SEARs, the overall and broader landscape impacts of the proposed wind energy project. It will also address potential cumulative impacts of wind energy projects in the region (the proposed wind energy project, as well as existing and approved projects).*

Cumulative landscape and visual impact result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it) or actions that occurred in the past, present or are likely to occur in the foreseeable future (Landscape Institute et al, 2008).

DPE has adopted the *Cumulative Impact Assessment Guidelines for State Significant Projects* (October 2022). These require an assessment of 'relevant future projects' during the process of preparing the EIS including:

- projects that have received SEARs but have not yet been submitted for assessment
- projects undergoing pre-SEARs consultation with the Department
- projects where there is market interest and the project has been publicly announced, but no formal application steps have been taken
- projects identified in a government plan or strategy (e.g. project identified in the State Infrastructure Strategy).

11.2 Central-West Orana Renewable Energy Zone

The Project is located within the Central-West Orana Renewable Energy Zone (REZ). The REZ has been identified by the NSW Government following a detailed statewide geospatial mapping exercise undertaken by the NSW Government in 2018. This initial analysis sought to identify optimal locations to host renewable energy generation around the State, including areas with strong renewable energy resource potential, proximity to the existing electricity network, and consideration of potential interactions with existing land uses, including agricultural lands and biodiversity conservation (Energy Co, 2023).

Due to the location within the Central-West Orana Renewable Energy Zone (REZ) there are a number of proposed renewable projects at varying stages of development (refer to Figure 23). There are ten (10) proposed, approved and constructed wind farms within the Central-West Orana REZ (including Crudine Ridge Wind Farm which is located outside of the REZ). These are listed in **Table 15** and shown on **Figure 25.**

Project	Distance to Project (Approximate):	Project Size: *Estimated	Planning Status
Operational Wind Farms:			
***Crudine Ridge Wind Farm** (Outside of the CWO REZ)	36 km (SE)	37 WTGs	Operational
Bodangora Wind Farm	24 km (N)	33 WTGs	Operational
Approved Wind Farms:			
Uungula Wind Farm	3.84 km (N)	* 97 WTGs	Consent granted: May 2021
Liverpool Range Wind Farm	94 km (NE)	* 267 WTGs	Modification to consent
Proposed Wind Farms:			
Barneys Reef Wind Farm	49 km (NNE)	* 65 WTGs	SEARs issued: September 2021
Valley of the Winds Wind Farm	70 km (NNE)	* 140 WTGs	EIS lodged: February 2022
Kerrs Creek Wind Farm	Approx. 22 km (SW)	Unknown	No SEARS issued as of July 2023
Spicers Creek Wind Farm	Approx. 25 km (N)	*117 WTGs	SEARS received May 2022
Aquila Wind Farm	Unknown (E)	Unknown	No SEARS issued as of July 2023

Table 15 Overview of Nearby Wind Energy Projects

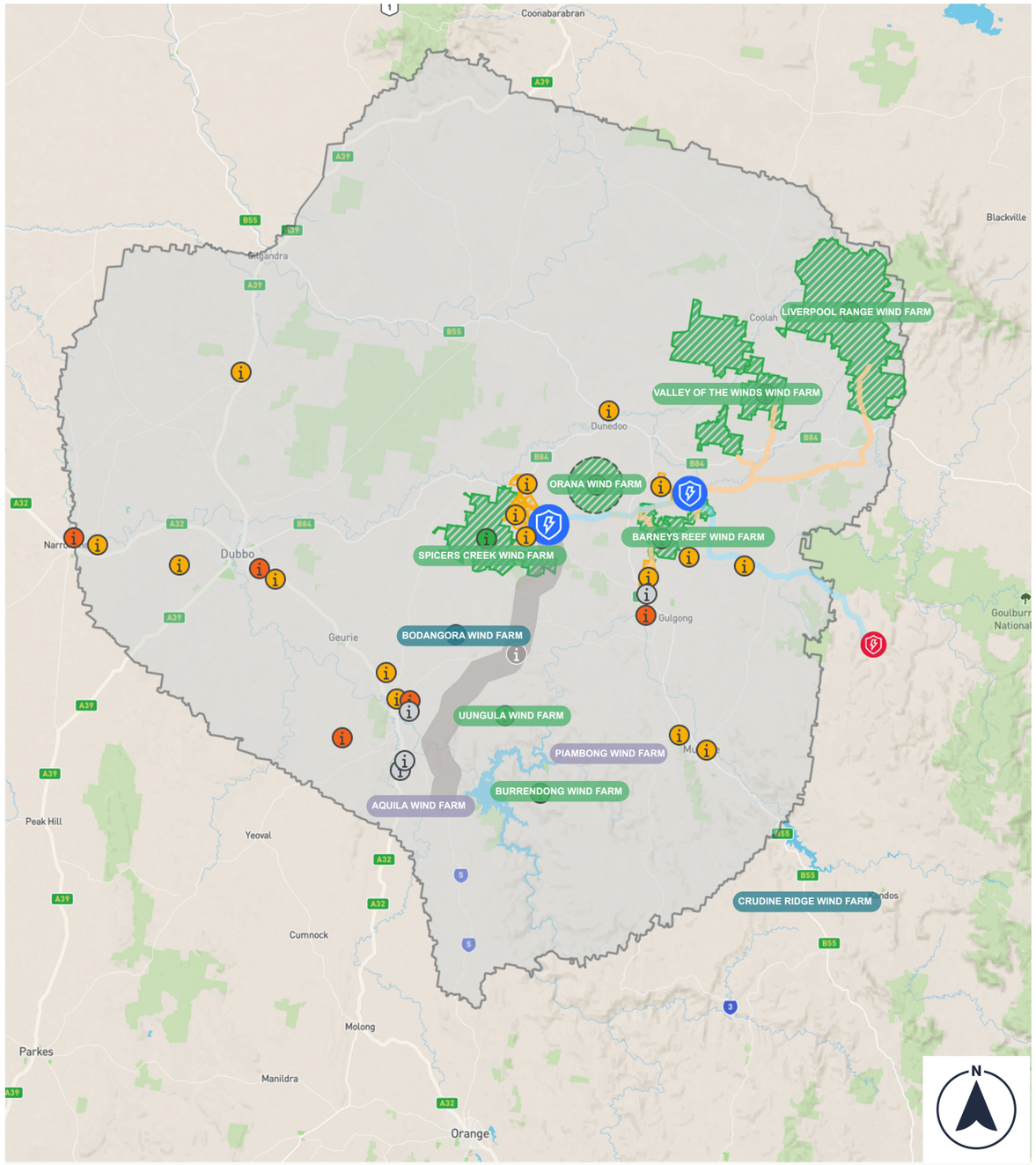


Figure 25 Central-West Orana Renewable Energy Zone **(Source: https://www.energyco.nsw.gov.au)**

11.3 Cumulative Impact with Nearby Wind Energy Projects

Uungula Wind Farm

The Uungula Wind Farm (UWF Project) gained development consent in May 2021, for 97 WTGs with a blade tip height of up to 250 metres. The UWF Project is sited north of the Cudgegong River, the nearest WTG is 3.84 kilometres north of the Projects northern most turbine (Turbine 1). Due to the relatively close proximity of the approved UWF to the Project, a detailed assessment of the potential cumulative visual impact has been undertaken.

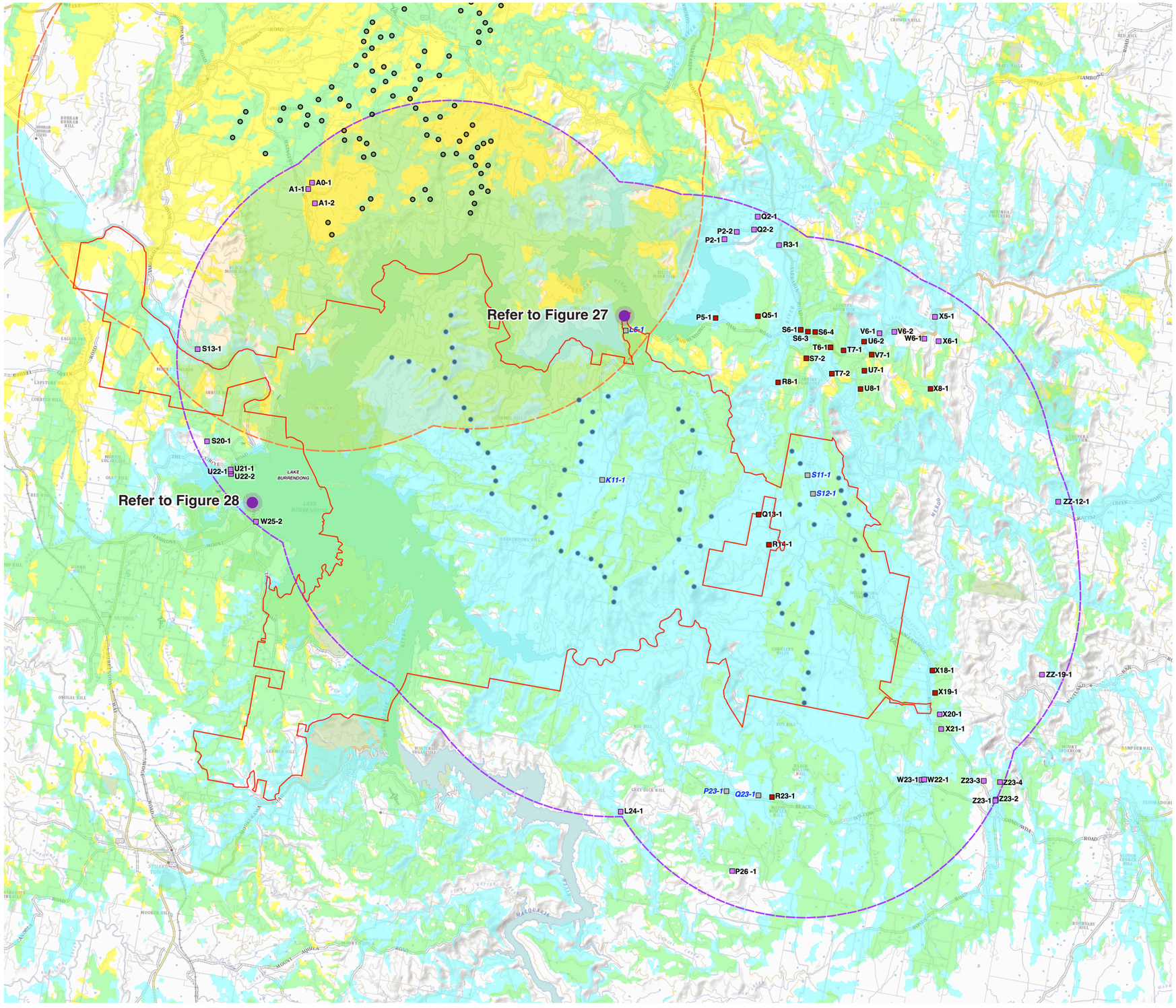
To assist in the cumulative visual impact assessment, a ZVI has been prepared to illustrate areas from which there is the potential to view both Projects (based on topography alone). The ZVI demonstrates areas of land from which WTGs associated with the UWF Project and the Project or potential to view both Projects simultaneously. Refer to **Figure 26.**

Aquila Wind Farm

Aquila Wind is being proposed by ACEN Australia and involves the proposed development of a wind project located near Mount Aquila, south-east of the township of Stuart Town in Dubbo Regional Council. The Aquila Wind Farm project is in the early stages of planning. The Project has been made public with consultation undertaken, however information regarding the project layout was unavailable as of July 2023 (Source: https://aquilawind.com.au). As the Project is still in the early planning phase, detailed assessment of the cumulative visual impacts resulting from the two projects will be required in the Aquila Wind Farm submission.

Piambong Wind Farm

The Piambong Wind Farm development is located approximately about 20 kilometers north west of Mudgee and about 20 kilometers south east of Gulgong, in Central West New South Wales. The proposed project area covers approximately 13,500 hectares. The project will be constructed on freehold land within the Mid-Western Regional Local Government Area (Source: https://www.piambongwindfarm.com.au). As the Project is still in the early planning phase, detailed assessment of the cumulative visual impacts resulting from the two projects will be required in the Piambong Wind Farm submission.



Cumulative Zone of Visual Influence (ZVI)

Burrendong & Uungula Wind Farm

LEGEND

- Project Boundary
- Proposed Burrendong Turbine Location
- Proposed Uungula Turbine Location
- Involved Dwelling
- Non-involved Dwelling (within 4,950 m of nearest turbine)
- Non-involved Dwelling (in excess of 4,950 m from nearest turbine)
- 8,000 m from nearest Burrendong turbine
- 8,000 m from nearest Approved Uungula turbine

ZVI Legend:

- Approved Uungula turbine visible
- Proposed Burrendong turbine visible
- Turbines associated with Uungula Wind Farm (UWF) and Burrendong Wind Farm (BWF) visible.
- Location of representative cumulative wire frame diagram

Note:

The ZVI is a preliminary assessment tool that represents a bare ground scenario - ie. a landscape without screening, structures or vegetation. As accurate information on the height and coverage of vegetation and buildings is unavailable, it is important to note the ZVI is based solely on topographic information. Therefore this form of mapping should be acknowledged as representing the worst case scenario.

N

0 2 4 6 8 10km

Figure 26 Cumulative Zone of Visual Influence (CZVI) -- Burrendong and Uungula Wind Farms **(Map Source: Six Maps)**

11.3.1 Assessment of Non-involved Dwellings

In accordance with the *Preliminary Assessment Tool: 2 Multiple Wind Turbine Tool* (**Refer to Section 6.4**), an 8 kilometre radius has been applied to each Project to identify dwellings and viewpoints within 8 kilometres of both Projects. The area is shown on **Figure 26** (See also - **Figure 16, Section 6.4**). Four (4) non-involved dwellings have been identified within 8 kilometres of both Projects (A0-1, A1-1, A1-2 and S13-1).

A cumulative ZVI prepared to illustrate the theoretical visibility of both the UWF and BWF Project (refer to **Figure 26**) indicates that none of the four (4) non-involved dwellings will have the potential to view both Projects due to topography.

An overview of the potential visual impact from each of the four (4) non-involved dwellings has been provided in **Table 16.**

Overview of Cumulative Visual Impacts with Uungula Wind Farm on Dwellings:				
Distance to nearest BWF WTG:	**Distance to nearest UWF WTG:**	**Number of BWF WTGs visible:**	**Number of UWF WTGs visible:**	**Cumulative Visual Impact Rating:**
S13-1				
7.241 km	**6.555 km**	**Approx. 25**	**Nil**	**Nil**
Assessment Notes: The UWF Project will be screened by topography from this dwelling, there will be no opportunities to view both Projects simultaneously. An assessment based on topography alone identified approximately 25 turbines associated with the Project have the potential to be visible to the east.				
A1-2				
6.43 km	**877 m**	**Nil**	**Approx. 70**	**Nil**
Assessment Notes: The BWF Project will be screened by topography from this dwelling, there will be no opportunities to view both Projects simultaneously.				
A0-1				
7.15 km	**1.616 km**	**Nil**	**Approx. 70**	**Nil**
Assessment Notes: Turbines associated with BWF will be screened by topography from this dwelling, there will be no opportunities to view both Projects simultaneously.				
A1-1				
6.99 km	**1.449 km**	**Nil**	**Approx. 70**	**Nil**
Assessment Notes: Turbines associated with BWF will be screened by topography from this dwelling, there will be no opportunities to view both Projects simultaneously.				

Table 16 Summary of Cumulative Impacts on Non-involved Dwellings

11.4 Cumulative Impact on the Broader Landscape Character

The existing landscape character of the region allows for optimum harvest of wind energy due to elevated topography, expanses of uninhabited land and minimal obstructions in the landscape. These characteristics are beneficial to the output of wind energy and it is inevitable that overtime this will be utilised for the development of wind farm projects.

The re-occurrence of wind farms within a region has the potential to alter the perception of the overall landscape character irrespective of being viewed in a single viewshed. As wind farm developments prevail it is important to determine whether the effect of multiple wind farms and other major infrastructure within the region would combine to become the dominant visual element, altering the perception of the general landscape character.

Aside from the application of the MWTT the Bulletin does not provide a methodology for further consideration of the cumulative visual impacts on the broader landscape. The Scottish Natural Heritage, Guidance - Assessing the cumulative landscape and visual impact of onshore wind energy developments (Published March 2021) provides a methodology for the assessment of cumulative visual impacts resulting from nearby wind farm projects. There are two main types of cumulative visual impacts 'combined visibility' or 'sequential impacts'.

Combined Visibility:

> *Combined visibility occurs where the observer is able to see two or more developments from one viewpoint. Assessments should consider the combined effect of all wind farms which are (or would be) visible from relevant viewpoints. Combined visibility may either be in combination (where several wind farms are within the observer's arc of vision at the same time) or in succession (where the observer has to turn to see the various wind farms). (Scottish Natural Heritage, 2021).*

Due to the undulating landscape character, and relatively isolated location of the Project, there are limited opportunities to view both Projects simultaneously from publicly accessible locations. Where views to both project are available, they are limited to distant, elevated positions.

The ZVI indicates opportunities to view the Project from some locations within the Cudgegong River Park, and Lake Burrendong Holiday Park. A wire frame diagram has been prepared from each of these locations (Figures 25 and 26) to illustrate the extent of visibility of each project. The wire frame diagrams represent a worst case scenario to illustrate the extent of visibility without intervening elements such as vegetation and built form.

Figure 27 illustrates the potential visibility from Cudgegong River Holiday Park. At this location the UWF is at a distance in excess of 6 km from the viewpoint. The wire frame diagram indicates that a small extent of the UWF would be visible to the north west.

Figure 28 is prepared from the boat ramp associated with the Lake Burrendong Holiday Park. From this location, the nearest turbine associated with the Project is 7.3 km and the UWF is 10.4 km. At this distance the proposed turbines associated with the Project will be visible along the ridge to the north east. The turbines associated with the UWF will be visible in the distance to the north.

Generally, due to the consistent WTG height of both Projects (250 m), when viewed simultaneously it is anticipated viewers would identify the Project as one entity.

Sequential Visibility:

> *Sequential impacts occur when the observer has to move to another viewpoint to see different developments. Sequential impacts should be assessed for travel along regularly-used routes like major roads, railway lines, ferry routes, popular paths, etc. The magnitude of sequential effects will be affected by speed of travel and distance between viewpoints.*

The Project Site is located within a largely isolated area of land, setback from Major Travel Corridors. As there are limited opportunities to view the Project sequentially along a travel route, it is unlikely the perception of the regions broad landscape character will be altered as a result of the Project.

The cumulative ZVI prepared for both projects indicates views to both Projects would be available from Lake Burrendong and the Cudgegong River. Due to limited access by road, views will be limited to people travelling by boat. It is anticipated that the extent of visibility would change as they move through the landscape, and views to the Project would be limited in parts by topography.

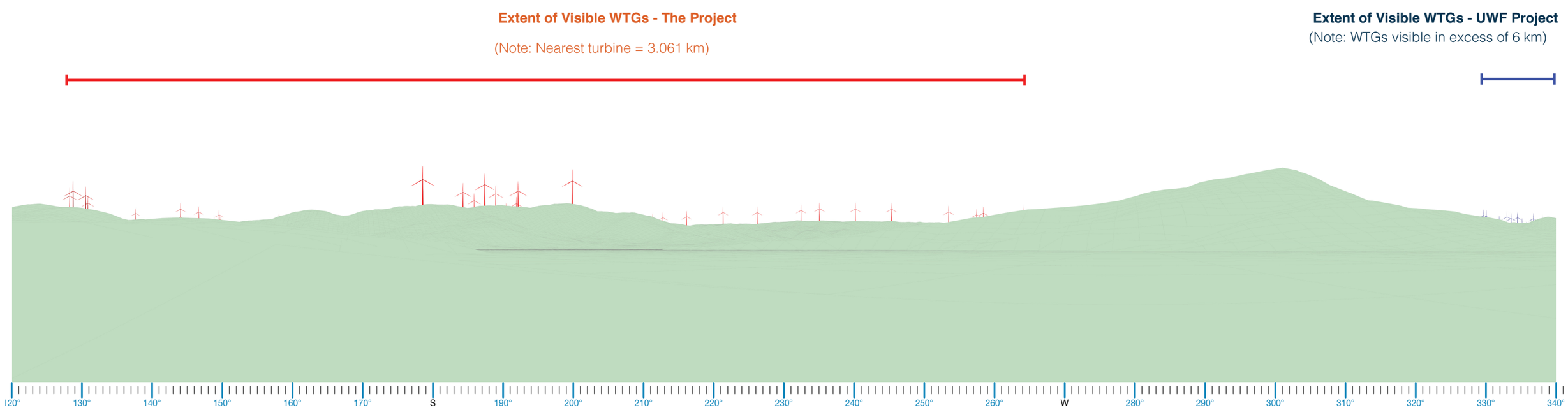


Figure 27 Wire Frame Diagram - Cudgegong River Park

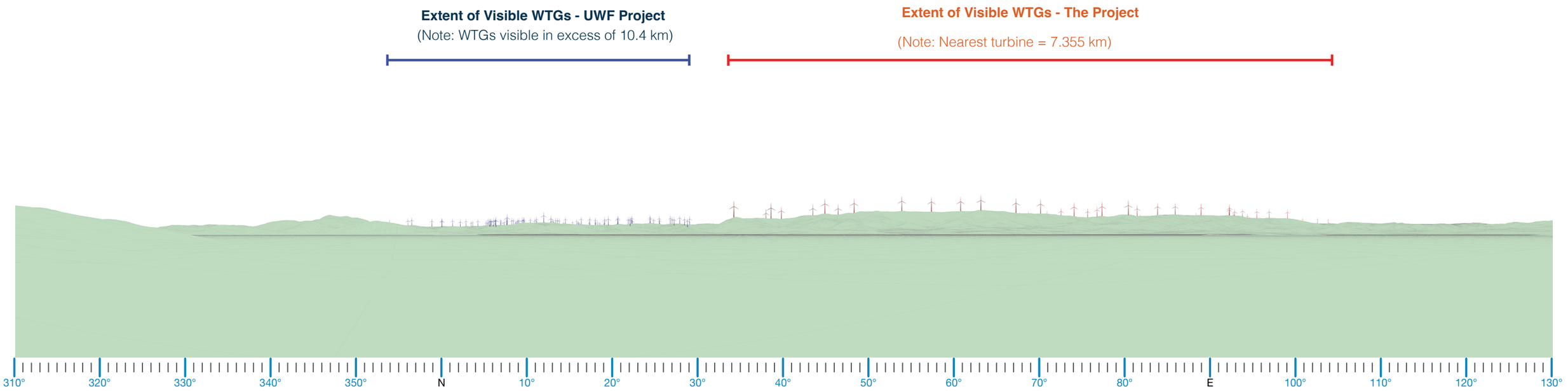


Figure 28 Wire Frame Diagram - Lake Burrendong Holiday Park - Burrendong and Uungula Wind Farm

12

Shadow Flicker & Blade Glint

12.0 Shadow Flicker and Blade Glint

12.1 Overview of Shadow Flicker

Shadow flicker is defined as the visual effect that occurs when rotating turbines cause moving shadows as the blades pass in front of the sun. The effect will occur under circumstances where the WTG is located such that at certain times of day the sun's rays pass through the swept area of the rotating blades, potentially affecting the viewpoint. The effect is diminished by the distance of the viewpoint from the turbine. Shadowing is also influenced by increased cloud cover, and is dependent on the angle of the sun's rays (Draft National Wind Farm Development Guidelines, 2016).

The Bulletin states: *The shadow flicker caused by certain sun angles in relation to the rotation of wind turbine blades on dwellings will be limited to 30 hours per year, and may require mitigation measures such as amended siting and design of turbines to minimise the amount of shadow flicker.*

12.2 Shadow Flicker Assessment Methodology

As there is no methodology for the assessment of shadow flicker in the Bulletin, Moir LA have referred to the *QLD State Code 23: Wind Farm Development* to define the parameters for the assessment.

Modelling of the shadow flicker was conducted using specialist industry software (Wind Pro), assessing the largest WTG (based on a 250m maximum tip height) proposed for the Project to represent the worst case impact scenario.

The parameters used for the Shadow Flicker Assessment are as follows:

Model Parameter	Setting Used:
Zone of Visual Influence of Shadows	265 x Maximum blade chord
Minimum angle of sun	3 degrees
Shape of the sun	Disk
Time and duration of modelling	One full year
Orientation of the rotor	The rotor plane is always perpendicular to the line from the WTG to the sun
Time step	1 minute
Effects of topography	Included
Receptor Height	1.7 meters (Glass house effect)
Grid size	1 meter

Table 17 Shadow Flicker Assessment Parameters

It is important to note the shadow flicker modelling undertaken for the Project is based on topography alone and therefore the extent of impact may be decreased by a number of variables including:

- the aspect of the residence relative to the WTGs (window locations, living area locations etc);
- the extent of natural or screening vegetation between the WTGs and the receptor;
- the existence of other screening elements (buildings, structures etc) between the WTG and the receptor;
- the time of year;
- the proportion of daylight hours in which the WTGs operate, and;
- the frequency of bright sunshine and cloudless skies (particularly at low elevations above the horizon).

Refer to **Figure 29.**

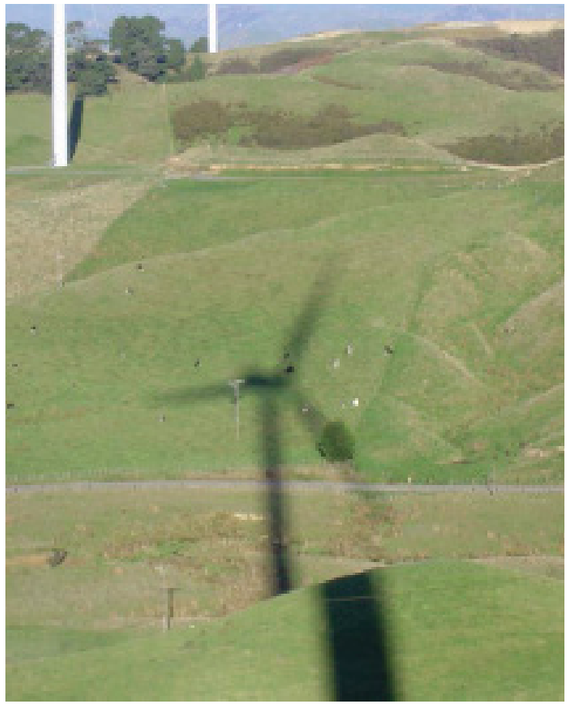


Image 18. Example of shadow intensity variation with distance.

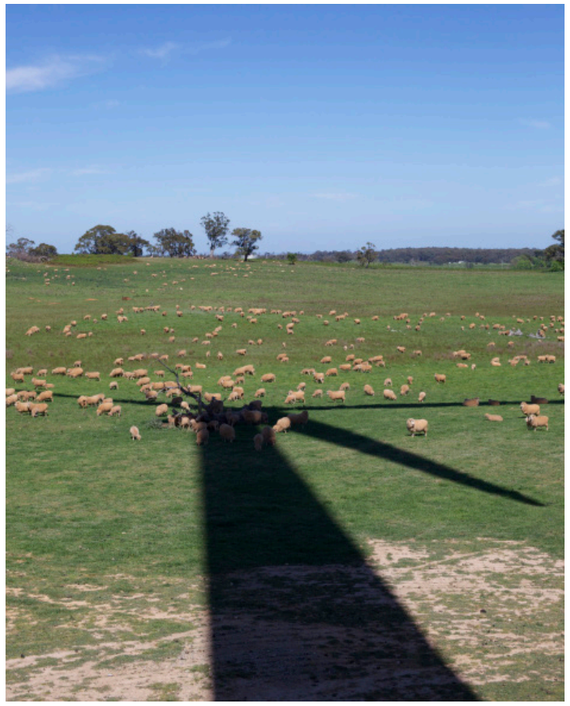
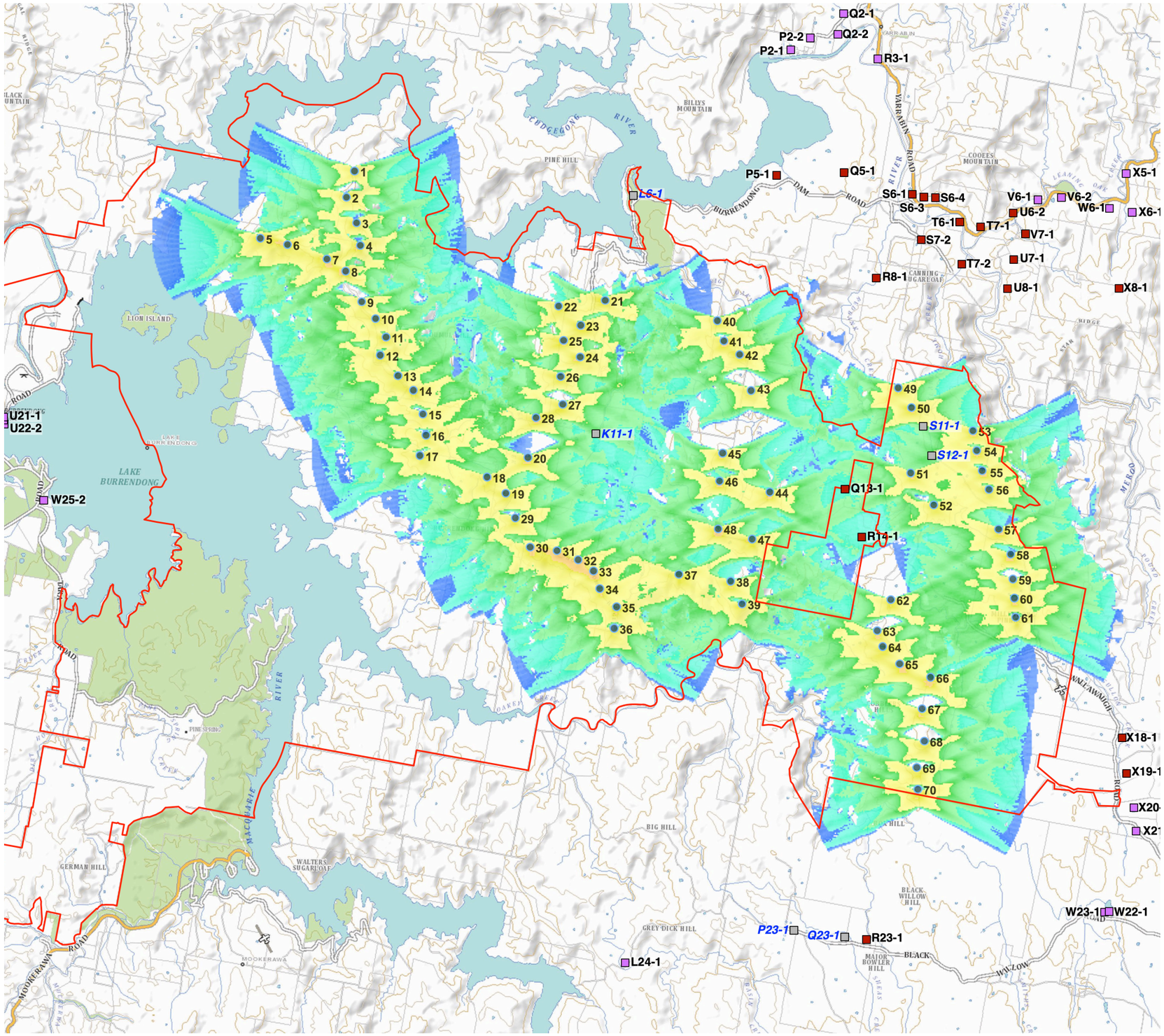


Image 19. Example of shadow flicker from base of a WTG.

Shadow Flicker Assessment
Burrendong Wind Farm



LEGEND

- Project Boundary
- Proposed WTG Location
- Involved Dwelling
- Non-involved Dwelling (within 4,950 m of nearest turbine)
- Non-involved Dwelling (in excess of 4,950 m from nearest turbine)

Number of Hours Per Year:

- 0.1-10 Hours
- 10 - 30 Hours
- 30 - < 100 Hours
- 100 - < 500 Hours
- 500 - < 1,000 Hours
- 1,000 - < 2,000 Hours

Assumptions for shadow calculations :

A ZVI (Zones of Visual Influence) calculation is performed before flicker calculation so non visible WTG do not contribute to calculated flicker values.

The calculated times are “worst case” given by the following assumptions:

- The sun is shining all the day, from sunrise to sunset.
- The rotor plane is always perpendicular to the line from the WTG to the sun.
- The WTG is always operating.

N

0 2 4 6 8 10km

Figure 29 Shadow Flicker Assessment Diagram

12.3 Results of Shadow Flicker Assessment - Dwellings

A total of two (2) non-involved dwellings were identified with potential shadow flicker hours (R14-1 and Q13-1). Refer to **Table 18.**

The Bulletin states: *the shadow flicker caused by certain sun angles in relation to the rotation of wind turbine blades on dwellings will be limited to 30 hours per year, and may require mitigation methods such as amend siting and design of turbines to minimise the amount of shadow flicker.*

The shadow flicker assessment found both dwellings (R14-1 and Q13-1) are likely to experience less than 30 hours per year of shadow flicker.

ID	Shadow Hours per year:	Shadow Days per year:	Max Shadow Hours per day:	Assessment Notes:
R23-1	17:40	38	0:39	Acceptable level.
Q13-1	26:16	79	0:32	Acceptable level.

Table 18 Non-involved Dwellings with potential to experience Shadow Flicker

12.3 Results of Shadow Flicker Assessment - Roads

Although there are no guidelines in the Bulletin relating to the acceptable level of shadow flicker on road users, shadow flicker has the potential to cause annoyance to road users. The shadow flicker assessment identified a small extent of Wallawaugh Road has the potential to experience shadow flicker. As the road has a low frequency of use and extensive roadside vegetation the potential impact is likely to be negligible.

12.5 Overview of Blade Glint

Blade Glint (also referred to as blade reflectivity) refers to the regular reflection off one or more rotating blades. This can be a temporary effect at any particular location, though the vast bulk of any glint occurs where the viewer is located above the altitude of the WTG hub.

The Bulletin recommends: turbine blades be finished with a low reflectivity surface treatment to ensure any actual or perceived blade glint impact is minimised.

All major wind turbine blade manufacturers currently finish their blades with a low reflectivity treatment. This prevents a potentially annoying reflective glint from the surface of the blades and the possibility of a strobing reflection when the turbine blades are spinning. Therefore the risk of blade glint from a new development is considered to be very low (Draft National Guidelines, 2010).

The WTGs selected for the Project will be finished with a low reflectivity surface treatment in accordance with the requirements of the Bulletin.

13

Associated Infrastructure

13.0 Associated Infrastructure

13.1 Overview of Associated Infrastructure

The Bulletin states: *the assessment of visual impacts from all ancillary facilities and infrastructure will be required.* In addition to the proposed WTGs, the associated infrastructure (as described in ***Section 3.4*** of this report) has the potential to contrast with the existing visual landscape and result in a level of change. An overview of the potential visual impact resulting from associated infrastructure and Project components is provided in this section of the report and provided on Figure 30..

13.2 Internal Access Roads & Hardstand Areas

Internal access tracks, turning heads and hardstands will be established within the Project Site for the construction, operation, repowering and/or decommissioning of the Project, from the public road access locations, WTGs, Substations, and other permanent and temporary facilities. This will be done using heavy earthworks machinery (generally early in the construction program) to excavate roads and hardstand areas to appropriate depths. Material excavated on-site for WTG and compound foundations and internal road alignments will be crushed on-site and used for road base or aggregate subject to meeting the relevant functional specifications.

Each WTG would require an access track and electrical cabling to the collection substations. Where possible, the access tracks will follow existing farm tracks, would have a trafficable width of 5.5 m (wider at bends and passing lanes) and be all weather graded gravel tracks. Hardstand areas are required beneath each WTG for delivery, storage, and assembly of WTG components, and for the safe operation of WTG installation cranes. Each hardstand area would be approximately 80 m x 40 m. The shape and exact size of the hardstand area is subject to final turbine selection and crane lifting requirements.

Generally, the internal roads have been sited to reduce potential vegetation loss and limit earth work requirements. Due to the existing agricultural land use of the Study Area, farm roads traversing the landscape are a common element in the existing landscape character. The proposed access roads are likely to be viewed as part of the existing character of the landscape and therefore visual impact would be considered ***negligible*** in the context of the existing landscape character. A summary of design principles for reducing residual visual impact resulting from the construction of internal access roads and hardstand areas include:

- Where possible utilise or upgrade existing roads, trails or tracks to provide access to the proposed turbines to reduce the need for new roads.
- Allow for the provision for down sizing roads or restoring roads to existing condition following construction where possible.
- Any new roads must minimise cut and fill and avoid the loss of vegetation.
- Utilise local materials where possible and practical.

13.3 Transmission Lines

13.3.1 Internal 33kV Transmission lines

Each of the WTGs will be connected to an onsite substation via a system comprising a network of underground and overhead electrical cables, reticulating power from each WTG to the substations. The proposed internal overhead 33kV transmission lines are in keeping with the scale and appearance of existing power lines which are a common element within the existing rural landscape. There are limited

13.3.2 External 330kV Transmission lines

A 330kV single circuit overhead transmission line connection is proposed to connect the on site substation to the existing overhead 330kV transmission line network to the western side of Lake Burrendong. Two (2) routes are under consideration. The preferred transmission line route runs to the south west and an alternate route to the north west (both routes have been presented on **Figure 30**).

The design of the proposed 330kV transmission line will be refined during the detailed design stage, however for the purpose of this report a worst case scenario of 50 metres has been assumed. A maximum 60 metre cleared easement will be required underneath the transmission line.

Generally the above ground transmission lines transverse an large area of uninhabited land surrounded by undulating topography. Opportunities to view the transmission lines are limited due to distance, topography and vegetation. There are no non-involved dwellings within 2,000 m of the preferred transmission line route. The preferred transmission line route will cross the Macquarie River in an isolated area. Views of the transmission line will be available to a very low number of marine vessels using the lake for recreation.

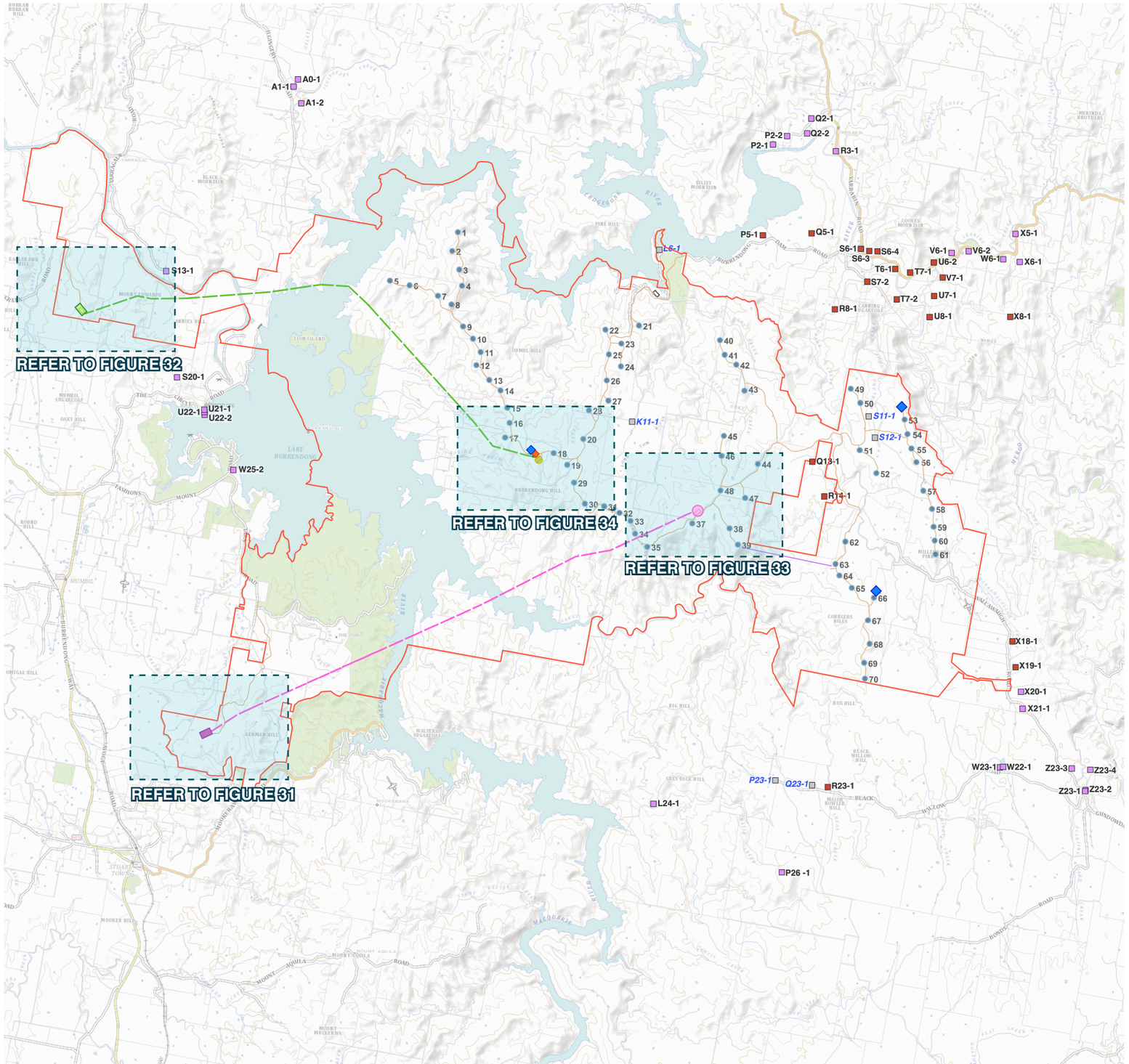
The following design principles have been considered to reduce the visual impacts:

- Where possible underground cabling is to be used to connect wind turbines to the electricity grid.
- Utilise existing transmission lines where possible.
- The route for any proposed overhead transmission lines should be chosen to reduce visibility from surrounding areas.
- Plan route to minimise vegetation loss.
- Use of subtle colours and a low reflectivity surface treatment on power poles to ensure that glint is minimised.

With these prinicples employed, the potential visibility of the transmission lines is anticipated to be ***negligible.***

Associated Infrastructure

Burrendong Wind Farm



LEGEND:

- Project Boundary
- Proposed 250m Turbine Location
- Preferred Overhead Transmission Line (Up to 330kV)
- Preferred Switch Yard Location
- Preferred Substation Location
- Alternative Overhead Transmission Line (Up to 330kV)
- Alternative Switch Yard Location
- Alternative Substation Location
- Permanent Met Mast Location
- O&M Facility
- Internal Access Road
- Internal Overhead Transmission (33kV)
- Involved Dwelling
- Non-involved Dwelling (within 4,950 m of nearest turbine)
- Non-involved Dwelling (in excess of 4,950 m from nearest turbine)

Figure 30 Associated Infrastructure

13.4 Switchyard

13.4.1 Preferred Location

The proposed switching station is located within the south western corner of the Project Site, approximately 4.5 kilometres north east of Stuart Town, connecting to the existing overhead transmission line network (see **Figure 30**). The switching station is located between Spring Creek and Carols Rocks Gully. Land surrounding the Site is uninhabited grazing land with native vegetation.

The switching station is located on low lying topography and surrounded by rises in the topography. The switching station will be screened by topography from a small pocket of non-involved dwellings associated with Spring Creek Road, Mookerawa.

Opportunities to view the switching station are limited to receptors travelling within the Project Site and therefore the potential visual impact has been rated as ***negligible***.

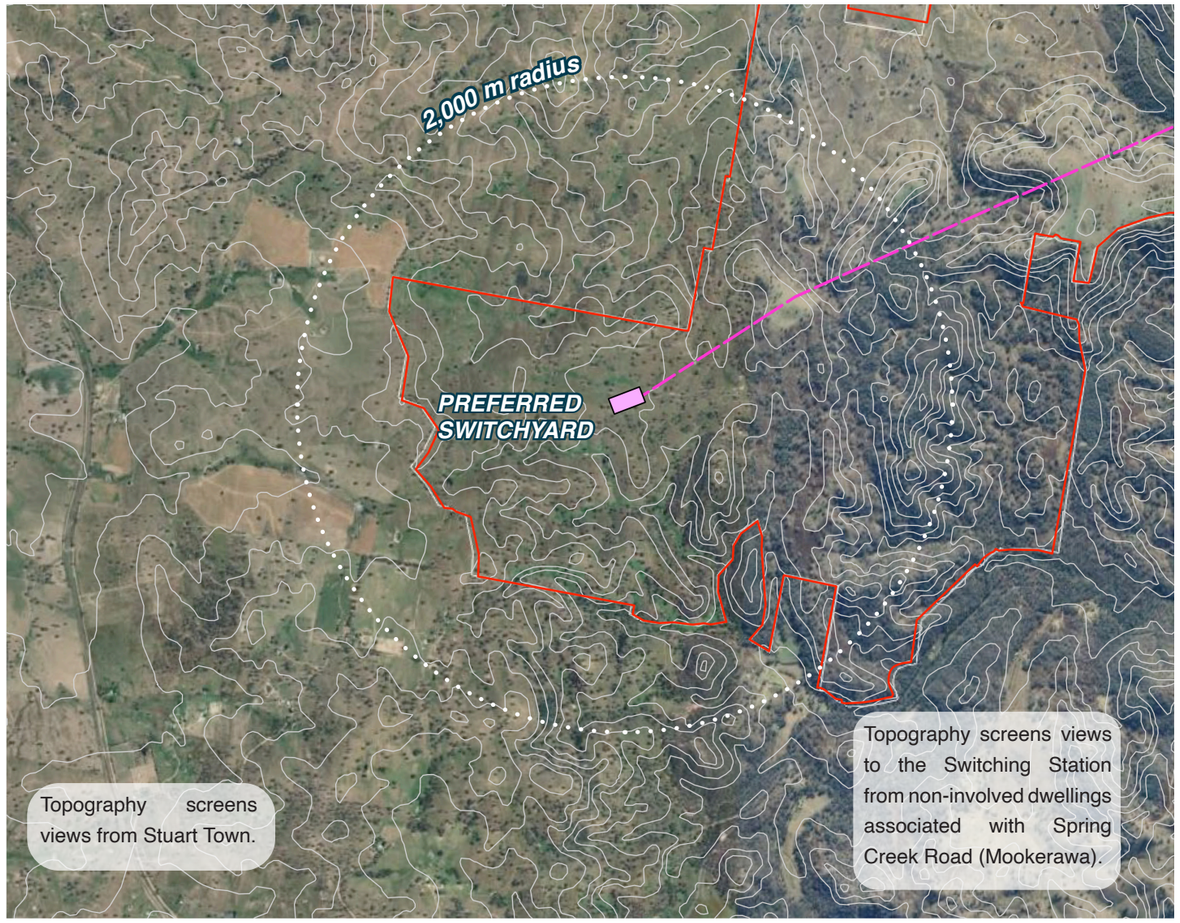


Figure 31 Preferred Switchyard Location

13.4.2 Alternate Location

The alternate switchyard location is situated within the north western corner of the Project Site, approximately 4.8 kilometres east of Dripstone. The switching station is located between Spring Creek and Carols Rocks Gully (see **Figure 32**). Land surrounding the Site is uninhabited grazing land with native vegetation.

The switching station is located on low lying topography and surrounded by rises in the topography. The switching station will be screened by topography from a small pocket of non-involved dwellings associated with Spring Creek Road, Mookerawa.

Opportunities to view the switching station are limited to receptors travelling within the Project Site and therefore the potential visual impact has been rated as ***negligible***.

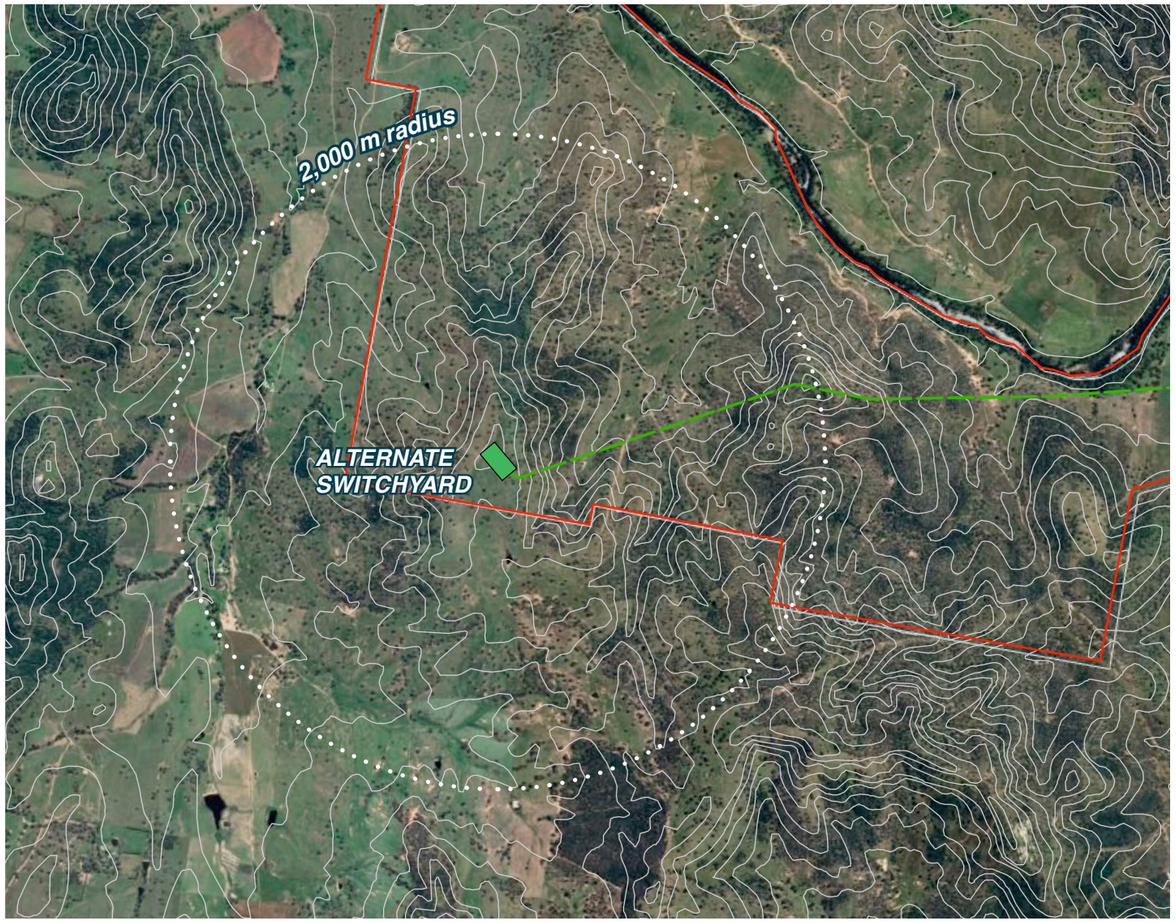


Figure 32 Alternate Switchyard Location

13.5 Ancillary Structures

13.5.1 Preferred Substation Location

The preferred collector substation is located in an area of cleared land near the centre of the Project Site (see **Figure 33**). Typically, the Substation would take up an area up to 100 m x 200 m. Existing vegetation and topography will screen views to the substation from surrounding areas of publicly accessible land. There are no non-involved dwellings within 2,000 m of the substation location.

Due to its isolated location, within the Project Site the potential visibility has been rated as ***negligible***. If deemed necessary during the detailed design phase, mitigation methods such as screen planting could be employed to reduce any potential visual impacts.

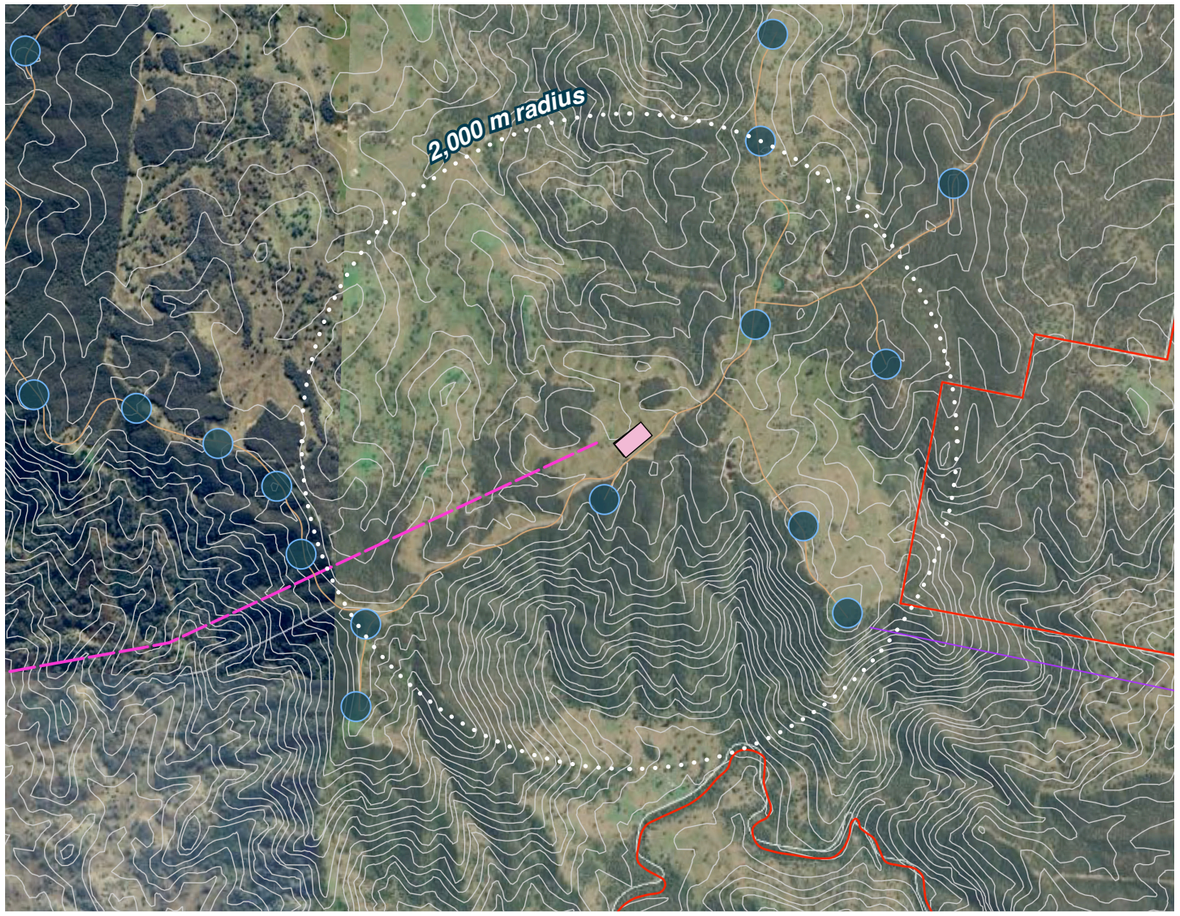


Figure 33 Preferred Substation Location

13.5.2 Operations and Maintenance Compound

A permanent O&M compound will be established for the day-to-day operation of the Project and would take up an area of approximately 100 m x 100 m or at the indicative location shown in (**Figure 34**). The O&M compound may include a lay down area, site operations facilities and a services building, workshop, storage, parking, and other facilities for operations staff. The building of the operation compound will house office space, toilet, kitchen, communications equipment, meeting room and routine maintenance stores.

A permanent site operations and maintenance (O&M) facility will be constructed to provide for all operations and maintenance activities associated with the Project. The O&M facility is proposed adjacent to the substation. It is unlikely the O&M facility would be visible from any nearby dwellings.

13.5.2 Alternate Substation Location

The alternate collector substation is located adjacent to the proposed O&M compound location within the centre of the Project Site (see **Figure 34**). Typically, the Substation would take up an area up to 100 m x 200 m. Existing vegetation and topography will screen views to the substation from surrounding areas of publicly accessible land. There are no non-involved dwellings within 2,000 m of the alternate substation location.

The smaller scale of ancillary structures including the proposed substation and site compound have the ability to be screened by topography, existing vegetation or proposed screening vegetation. The following mitigation measures would assist in reducing any residual visual impacts:

- Siting to ensure minimal vegetation loss.
- Consideration should be given to controlling the type and colour of building materials used. Where possible a recessive colour palette is to be used which blends into the existing landscape.
- Avoidance of unnecessary lighting, signage on fences, logos etc.
- Any proposed buildings to be sympathetic to existing architectural elements in the landscape.
- Minimise cut and fill and loss of existing vegetation throughout the construction process.
- Boundary screen planting is an effective mitigation method which could be utilised to ameliorate potential visual impacts resulting from the construction of ancillary structures with a small vertical scale such as collector substations, switching stations and the operations facilities building.

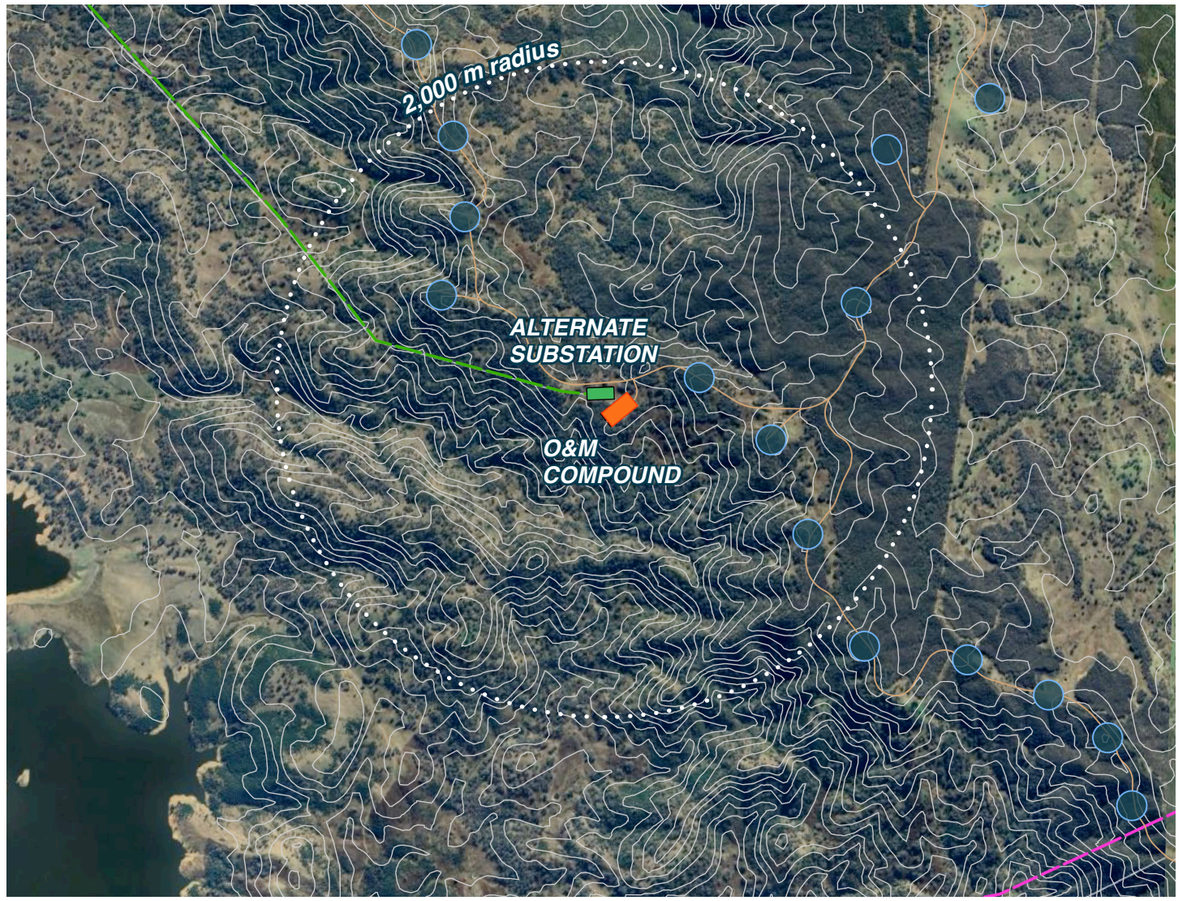


Figure 34 O&M Compound & Alternate Substation Location

13.5.3 Meteorological Monitoring Masts

The Proponent operates a temporary wind monitoring mast and several remote sensing SoDARs on the Project Site to assess wind speeds at or near proposed WTG locations. Following construction of the Project, up to three (3) permanent wind monitoring masts would be required to assist with the control and operation of the Project. These would be static guyed masts with remotely operated wind monitoring equipment installed at multiple heights on each mast. Each mast could require hub-height wind monitoring; therefore, masts are expected to be around 150 m tall.

Pending final WTG placements, it may be necessary to move or install additional permanent wind monitoring masts to verify wind speeds across the Project site. The temporary and permanent masts would be located within the Project site boundary. The Proponent will inform Civil Aviation Safety Authority (CASA) and the Department of Defence (DoD) of the location of any monitoring masts constructed.

The proposed masts may be visible from some public locations, however due to the narrow scale, they are generally indiscernible to viewers.

14

Night Lighting Assessment

14.0 Night Lighting Assessment

14.1 Overview of Night Lighting

The following section of the report provides an assessment of the visual impacts of potential night lighting of the Project. Night lighting has the potential to result in the alteration of the night time landscape character of the region. Potential light sources include:

- Aviation Hazard Lighting (AHL) on nacelle of WTGs (height of up to 160 metres AGL)
- Night lighting for safety and security on ancillary structures.

Aviation Projects has undertaken a safety risk assessment of the Project (August 2023) and concludes that WTGs and Wind Monitoring Masts will not require obstacle lighting to maintain an acceptable level of safety to aircraft.

14.1.1 Dark Sky Planning Guidelines

The Dark Sky Planning Guidelines have been developed by the Department of Planning and Environment (June, 2023) and provide guidelines for lighting practices that support the maintenance of a dark sky and improve lighting practice. The guidelines are related to projects within 200 kilometres of the Siding Spring Observatory, and provide relevant guidance to reduce potential light pollution. The Project is located 149.5 kilometres south of the Siding Spring Observatory (near Coonabarabran, NSW).

14.2 Overview of Aviation Hazard Lighting

CASA states: The presence of wind turbines, wind monitoring masts and other tall obstacles may create a risk to the safety of flight, due to the risk of collision. An entity that is proposing to introduce a hazard into navigable airspace, such as a wind farm, must mitigate the risk of the hazard on airspace users to ensure an acceptable level of safety is maintained.

The two primary options are the use of visibility meters to reduce light intensity during high visibility conditions and the use of a radar detection system to allow the lights to activate when an aircraft is in the vicinity of the wind farm.

CASA will consider the lighting intensity management and systems that achieve an acceptable level of aviation safety on a case-by-case basis during its assessment.

As the intensity and location of proposed obstacle lights are relatively unknown at this stage, representative photomontages of the proposed obstacle lighting of Project have not been included in this report.

Representative images of aviation lighting (installed in August 2020) on WTGs at Biala Wind Farm have been included to best illustrate the potential visual appearance of aviation lighting. Photographs of the aviation lighting at varying distances and times have been included in this report. Following consultation with NSW Department of Planning, Industry and Environment and other relevant authorities, the Biala Wind Farm aviation hazard lighting were turned off on 4th of June 2021, less than 12 months after installation.

Images 21 - 22 illustrate the effect of night lighting on a dark rural landscape at intervals after sunset.

Image 21. View towards Biala Wind Farm - 1.75 Kilometres from WTG at 6:35pm (45 minutes after sunset)

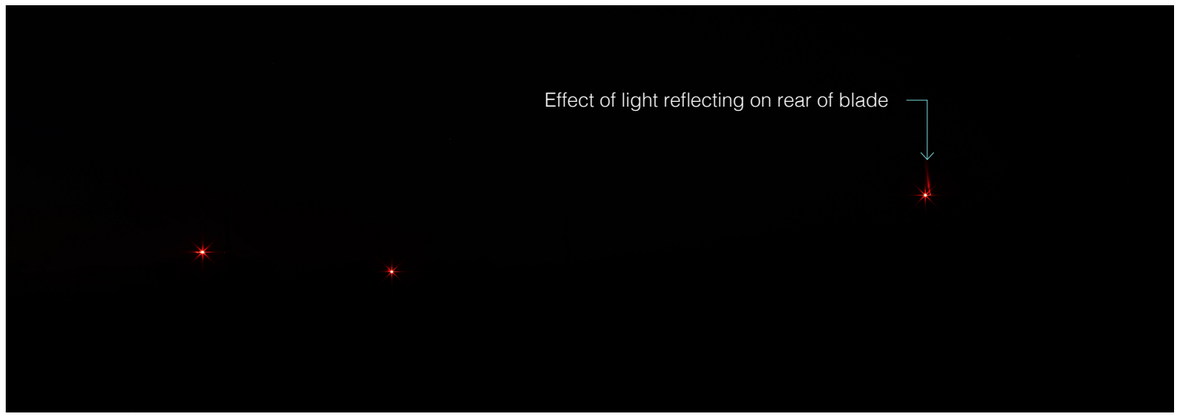


Image 22. View towards Biala Wind Farm - 1.85 Kilometres from WTG at 6:50pm (60 minutes after sunset)

Image 23. View towards Biala Wind Farm - 3.5 Kilometres from WTG

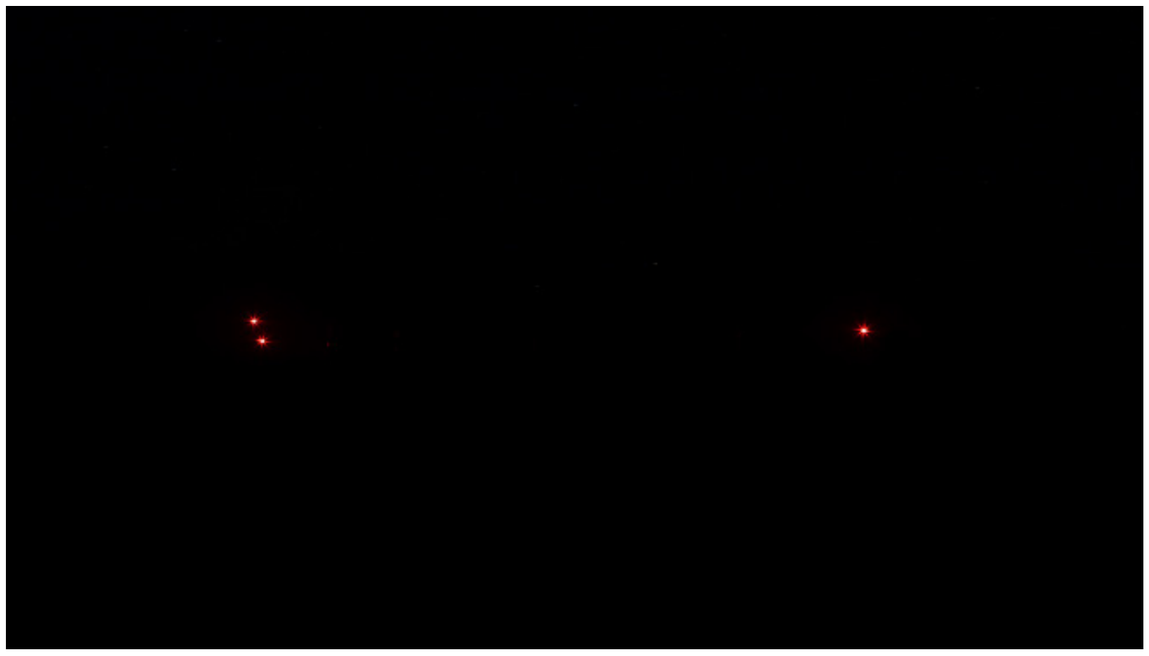


Image 24. View at night towards Biala Wind Farm - 3.5 Kilometres from WTG

Image 25. View towards Biala Wind Farm - 8.5 Kilometres from WTG

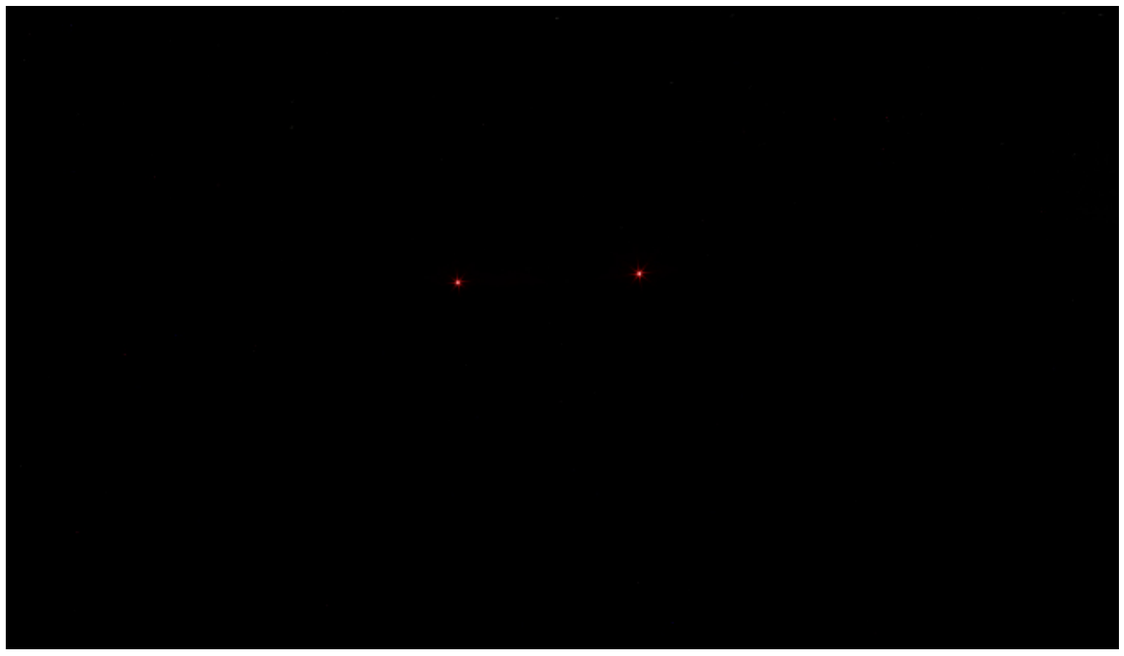


Image 26. View at night towards Biala Wind Farm - 8.5 Kilometres from WTG

14.2.1 Overview of potential visual impacts from AHL

Aviation Hazard Lighting (AHL) of the Project has the potential to extend the visual effect into the night time. AHL has the potential to be visible from distances in excess of 20 kilometres (Scottish Natural Heritage). However, the distance depends on a number of variables, including light intensity, topography, vegetation coverage and climatic conditions.

Due to the relatively isolated location of the Project, very little existing sources of lighting are present in the night time landscape of the Study Area. Some existing lighting associated with homesteads and motor vehicles is dispersed around the Study Area. Isolated receptors within the Study Area experience a dark night sky with minimal light sources. The impact of night lighting is unlikely to be experienced from inside of a dwelling as internal lights reflect on windows and limit views to the exterior at night time.

The highest visual impact is likely to be people who experience the night landscape outdoors. Dark sky is a valued quality of the rural landscape, due to the lack of light pollution. Aviation lighting has the potential to impact on receptors who view the landscape at night, in particular night-sky enthusiasts, photographers, star gazers, campers and some land owners with potential visibility of the turbines hub.

The Mudgee Observatory is located in excess of 14 kilometres to the east of the nearest turbine. Topography screens views to the turbines from the observatory and there is unlikely to be any impacts on the operations of the observatory as a result of aviation lighting associated with the Project.

The visual impact of potential aviation lighting could be reduced by employing mitigation methods outlined in ***Section 14.3***. Considering the high elevation of the WTGs and the implementation of shields, the source of visible light is likely to be reduced to ambient lighting as opposed to direct visibility of the light itself when viewed from a close proximity.

A CASA determination will consider the environmental setting when determining the need and level of lighting required on a wind farm or tall structure. This may include consideration of lower lighting intensities for obstacles away from an aerodrome. The back lighting of some locations is almost non-existent, meaning the risk of an aviation hazard light being compromised by background lighting from a rural and remote town is lower than would otherwise apply in a residential area closer to a city.

The nearby Uungula Wind Farm was approved in May 2021 with a recommendation to include low intensity aviation lighting (200 candela) which is considerably lower than the 2,000 candela required by international standards. In the 2021 Assessment Report, it stated “the Department consulted with the Observatory during its assessment, who confirmed it had no concerns regarding the project, including obstacle lighting”.

14.3 Recommendations to mitigate Aviation Hazard Lighting

The Bulletin states: If such lighting is required, the CASA guidelines recommend that to minimise visual impacts *“obstacle lights may be partially shielded, provided it does not compromise their operational effectiveness. Where obstacle lighting is provided, lights should operate at night, and at times of reduced visibility. All obstacle lights on a wind farm should be turned on simultaneously and off simultaneously.”* The lights should be fully shielded from the view of any dwelling within. As part of the assessment of visual impacts of wind energy projects, the Department will consider whether any obstacle lighting required is likely to result in any significant increase in visual impacts.

To assist in the amelioration of the effect of Aviation Hazards Lighting on WTGs the following should be applied:

- If used, aviation lights are generally required to be spaced over the array, particularly at the extremities. They are not required on every tower. Where possible, careful consideration of WTGs upon which aviation lighting is installed to avoid unnecessary impact upon residences.
- Treatment of the rear of blades with a non-reflective coating to reduce reflection off the rotating blade at night.
- Use of the lowest candela intensity allowed by CASA.
- Permanent light shielding is also an option to reduce impact on residences within six kilometres of the installation.

An example of how aviation lighting can effectively shield the emission of light has been provided from non-involved dwelling R8-1. Refer to **Figure 35.**

Overtime as wind farm development has occurred throughout New South Wales, there are precedents for the review of the requirement of aviation lightings on a number of wind farms post-construction. The Biala Wind Farm aviation lights were operational for less than 12 months (installed in August 2020 and switched off in June 2021). In the Upper Lachlan Shire, on November 1, 2010 Cullerin Wind Farm, owned by Origin Energy, switched off WTG AHL after guidelines set out by CASA were withdrawn. Requirement of aviation lighting for Crookwell 2 Wind Farm was reviewed by CASA in 2019 and allowed to be turned off (Crookwell Gazette, 2019).

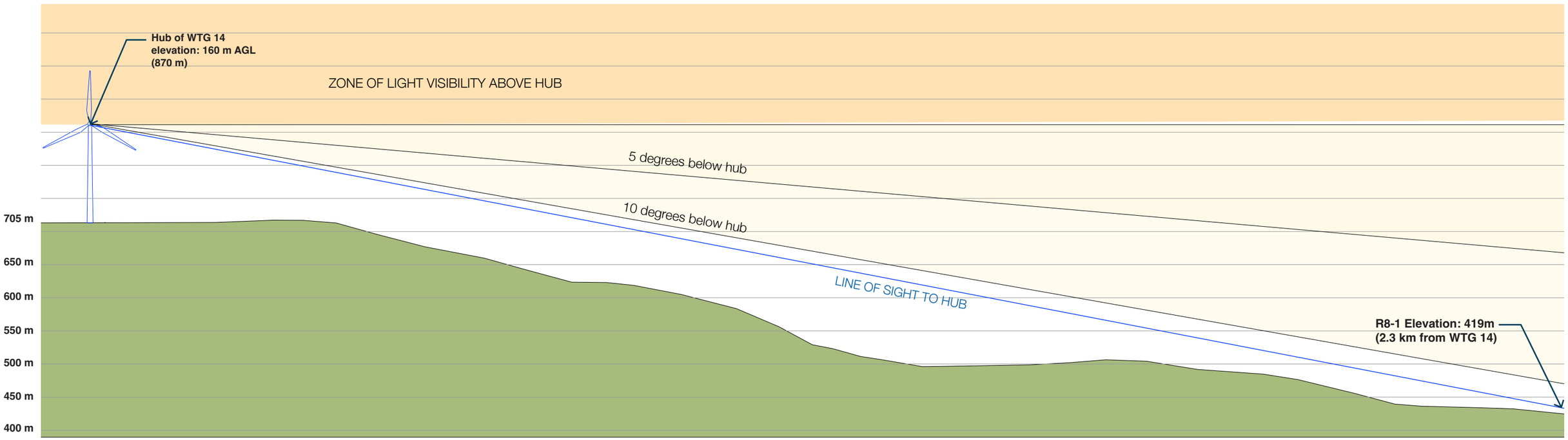


Figure 35 Example of effectiveness of Aviation Shielding

14.4 Potential Impacts of Lighting Associated with Ancillary Infrastructure

In addition to aviation hazard lighting on WTGs, night lighting is likely to be required on ancillary infrastructure including switching stations, collector substations and facilities buildings. At this stage of the Project, the location and type of lighting required on the proposed substations and facilities buildings is to be confirmed. The light sources are limited to low-level lighting for security, night time maintenance and emergency purposes. There will be no permanently illuminated lighting installed.

The proposed ancillary infrastructures have been carefully sited to minimise visibility from existing residences and publicly accessible viewpoints. It is unlikely the proposed night lighting associated with the ancillary infrastructure would create a noticeable impact on the existing night time landscape.

The following principles will be incorporated into lighting design during the detailed design phase of the switching station, substation, O&M Facility and any other structures requiring lighting. If design principles are incorporated into the night lighting for Ancillary Infrastructure, it is likely there will be no visual impacts resulting from night lighting of Ancillary Structures.

1. Control the level of lighting:

- Only use lighting for areas that require lighting ie. paths, building entry points.
- Reduce the duration of lighting:
    - Switch off lighting when not required
    - Consider the use of sensors to activate lighting and timers to switch off lighting

2. Lighting Design:

- Use the lowest intensity required for the job
- Use energy efficient bulbs and warm colours
- Direct light downwards
- Ensure lights are not directed at reflective surfaces
- Use non-reflective dark coloured surfaces to reduce reflection of lighting (**Figure 32**)
- Keep lights close to the ground and / or directed downwards (**Figure 33**)
- Use light shield fittings to avoid light spill (refer to **Figure 34**).

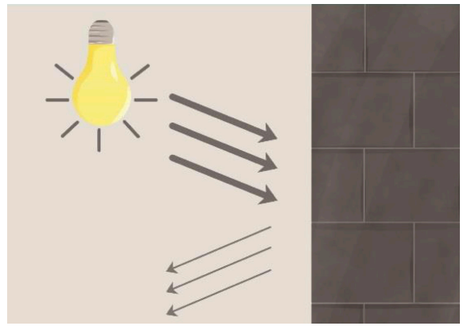


Figure 36. Surface Reflectivity

Source: Department of Environment and Energy National *Light Pollution Guidelines for Wildlife* (2020)

Non-reflective dark coloured surfaces:

In accordance with the recommendations of the LVIA, the O & M Building and any other structures are to be painted in a dark, non-reflective paint to reduce reflectivity from lighting and remain sympathetic to the surrounding landscape.

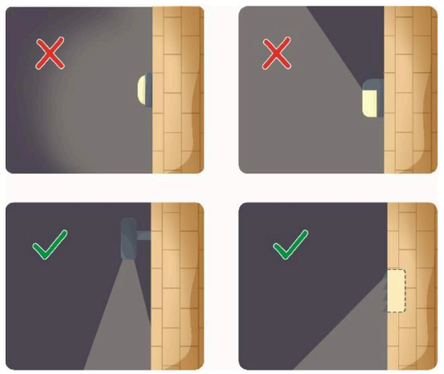


Figure 37. Downward Lighting

Source: Department of Environment and Energy National *Light Pollution Guidelines for Wildlife* (2020)

Downward lighting:

Where possible lights are to be directed downwards.

Use of Lighting Shields:

Where necessary for safety, lighting should be fully or partially shielded to prevent light spill into surrounding areas.

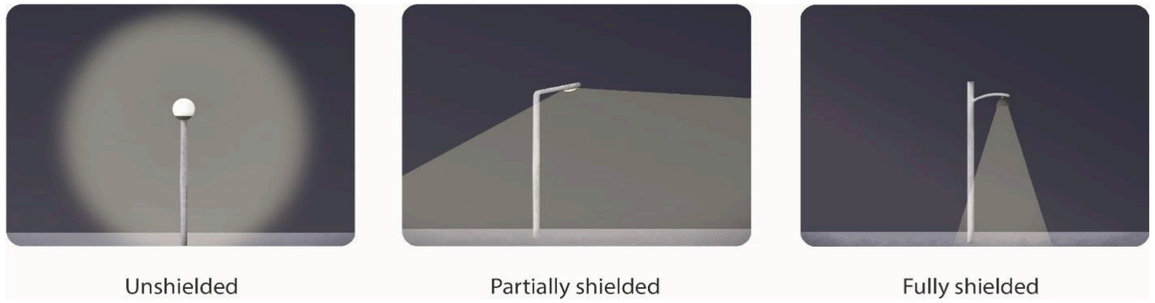


Figure 38. Light Shielding

Source: Department of Environment and Energy National *Light Pollution Guidelines for Wildlife* (2020)

14

Overview of Impact on Landscape Character

15.0 Visual Impacts on Landscape Character

15.1 Overview of Visual Impacts on Landscape Character

The Project is to be located within a predominantly rural landscape that has not been identified as significant or rare. The broad landscape character is dominated by established rural land which consists primarily of modified undulating hills. Generally, the Scenic Quality Classes of the LCU within the Study Area have been rated as moderate (refer to Section 5.0).

There is little doubt that the Project, regardless of how visible it actually is, would become a feature of the area. However, the degree to which the existing landscape character and significance is altered as a result of the Project is determined by the dominance of the Project in relation to the existing landscape features.

It is undeniable the Project would become a feature of the visual landscape. However, it is likely the character of areas which are valued for their high landscape quality and utilised for recreation and tourism will remain intact. Regionally, significant landscape features identified in the Visual Baseline Study (**Section 5.0** of this report), would remain dominant features of the landscape and it is unlikely the proposal would degrade the scenic value of these landscape features.

15.2 Overview of the Visual Impact on LCUs

Table 20 provides an overview of the assessment of the potential visual impacts on the existing landscape character of the local area for each LCU as characterised in **Section 5.0** of this report. An evaluation of the potential visual impacts has been undertaken using the visual performance objectives as outlined in the Bulletin.

Table 20 provides a brief summary of the findings.

Of the seven (7) LCU's identified and assessed, the Project is likely to be visible from all, to varying degrees. Due to the undulating topography surrounding the Project Site, there are limited opportunities to view the Project in its entirety.

Summary of Visual Impacts of Landscape Character Units				
LCU:	**Scenic Quality Rating:**	**Overview of Potential Visual Impact**	**Landscape Scenic Integrity:**	**Key Landscape Features:**
LCU01 Yarrabin / Hargraves Hills	**Moderate** **Refer to Appendix B1**	The Yarrabin / Hargraves Hills LCU is generally defined by the vegetated hills associated with Yarrabin and Hargraves. Generally, the hills are uninhabited and largely inaccessible to the public. The Project Site is located within the land defined as the Yarrabin / Hargraves Hills, and therefore views to the Project from within the LCU will be availably to varying degrees.	Land in this LCU is generally characterised by steep undulating hills which are largely uninhabited and inaccessible. The hills form a backdrop to views from surrounding areas, for example distant views across Lake Burrendong from Mumbil. As accessibility within the LCU itself is limited, there are limited opportunities to view the Project in its entirety. A handful of elevated properties within the LCU will have expansive views across the Project, however for the most part views will be limited to small extents of the Project.	The key landscape features of the LCU are the vegetated hills. The hills form a backdrop to views from surrounding areas, particularly across Lake Burrendong from Mumbil. Due to their siting on the elevated ridgelines, the Project is unlikely to disrupt views to these hills, rather forming an element on them.
LCU02 Yarrabin / Hargraves Farmlands	**Low - Moderate** **Refer to Appendix B2**	The Yarrabin / Hargraves Farmlands LCU is generally defined as the predominately cleared and undulating grazing land associated with localities of Yarrabin and Hargraves. Land in this area is accessible by low use roads which provide access to rural residential dwellings. Views to the Project will be available from the LCU to varying degrees, however existing screening factors including roadside vegetation, riparian vegetation and undulating topography limit views from some areas.	Land in this LCU is largely characterised by the cleared undulating topography with views to vegetated hills. The Project has the potential to be visible to varying degrees from some locations within the LCU, however the Project is likely to occupy a small portion of the view and it is unlikely to alter the scenic integrity of the LCU.	The key landscape features of the LCU include the undulating landscape, views to vegetated hills and riparian vegetation associated with rivers and creeklines.
LCU03 Lake Burrendong	**Moderate** **Refer to Appendix B3**	The Lake Burrendong LCU is defined as the water body of Lake Burrendong and surrounding foreshore. The Project Site extends into the LCU. Access to the LCU is generally limited to those using the Lake for recreation purposes (fishing, water skiing etc). The foreshore is largely inaccessible as it is private property. Views of the Project from within the LCU will be available, particularly to those using the Lake and some publicly accessible areas on the foreshore (ie. Burrendong Dam Wall).	The scenic integrity of the LCU is generally associated with the water body and views to surrounding vegetated hills that form a backdrop to views across the lake. The scenic integrity of the LCU is likely to remain intact. Although the turbines will be a noticeable element to those using the lake for recreational boating activities, viewers will have views in all directions and the Project will only be visible to the east.	The Key landscape features of the LCU are views across the water body to the vegetated ranges. The views across the lake to the vegetated ranges are likely to be altered by the addition of turbines, however the vegetated ranges and water body are likely to remain the dominant feature of the visual catchment.
LCU04 Cudgegong River Valley	**Moderate** **Refer to Appendix B4**	The Cudgegong River valley is generally defined as the land to the north of the Project Site associated with the Cudgegong River and surrounding valley. The extent of visibility of the Project varies depending on th viewing location within the LCU, however for the most part, views to the Project are limited by topography.	Land in the area is generally characterised by predominantly cleared farmlands surrounded by steep vegetated hills. The scenic integrity of the LCU is unlikely to be impacted as views to the Project will be limited.	Key features within the LCU include the Cudgegong River and associated riparian vegetation, views to vegetated hills surrounding the valley floor and views across cleared rural landscape. Although there is potential to views the Project from some areas of the LCU, the vegetated hills will remain the dominant landscape feature within the LCU.
LCU05 Yarragal / Twelve Mile	**Moderate** **Refer to Appendix B5**	The Yarragal / Twelve Mile LCU is generally defined as the land to the north of the Cudgegong River associated with Yarragal and Twelve Mile LCU. Land in this area is generally uninhabited, with the exception of some isolated dwellings along Ilgingery Road (Yarragal).	The proposed Uungula Wind Farm is located within the LCU to the north of the Project. Potential for cumulative visual impacts from dwellings has been assessed and the assessment determined there are minimal opportunities to view both projects due to topography. The Project is unlikely to alter the scenic integrity of this LCU.	Key features of the Yarragal / Twelve Mile LCU are the undulating topography and steep hills within the LCU. Views are generally contained within the LCU by the hills. The Project is unlikely to disrupt key landscape features of this LCU.
LCU06 Mumbil	**Low** **Refer to Appendix B6**	The Mumbil LCU is generally characterised by the land to the west of Lake Burrendong, associated with the locality of Mumbil. Views from within the LCU are generally contained by the undulating topography. Views to the Project will be available from elevated positions within the LCU and from areas to the west of Lake Burrendong.	Land within the LCU is largely uninhabited with the exception of some dwellings and recreation facilities on the western edge of Lake Burredong. Views across the Lake to vegetated hills associated with the Project add to the scenic quality of the LCU. The Project is likely to be visible in the distance and although noticeable is unlikely to have a detrimental impact on the scenic integrity of the LCU.	The key landscape features of this LCU are views across Lake Burrendong with the vegetated hills associated with LCU01 providing a vegetated backdrop. Although distant views to the Project will be available to the east of the LCU, the vegetated hills and views across the Lake will remain the dominant landscape feature.
LCU07 Worlds End	**Moderate** **Refer to Appendix B7**	The Worlds End LCU is a small area characterised by the valley floor associated with the Meroo River to the east of the Project Site. The LCU has a number of isolated weekenders and dwellings accessed via a locked gate on Worlds End Road. The Project is likely to be visible to varying degrees to the west of the LCU.	Land within the LCU is generally accessible to landowners with access via a locked gate on Worlds End Road. The LCU is characterised by the valley floor with steep, vegetated hills to the west generally containing views. Dwellings are generally located along the valley floor associated with the Meroo River, with dense riparian vegetation limiting views.	The key landscape features of this LCU are the steep vegetated hills to the west of the Meroo River (associated with Canning Sugarloaf). Views to the Project will be limited by the steep topography and vegetation typical of the LCU.

Table 20. Summary of Visual Impacts on Landscape Character Units

15.3 Overview of the Visual Impact on Public Viewing Locations

A number of public viewing locations were identified through the community consultation process and subsequent site visits. These public locations have been assessed in this LVIA. An overview of how locations identified by the community have been addressed is provided in ***Table 21.***

Community Consultation Public Viewpoint Locations	
Response:	**How this has been addressed in the LVIA:**
Likely the higher "tops" West of the village of Hargraves, Burrendong recreation / Arboretum areas and within the lake.	A number of recreation facilities including holiday parks have been assessed on the western side of Lake Burrendong.
Wilderness landscape without wind farms.	No specific location identified.
From the high country looking west and from the Dam looking east.	No specific location has been identified for the area defined as 'high country'. A viewpoint and photomontage has been prepared from Burrendong Dam.
Foreshores of Burrendong dam	Burrendong Dam has been assessed in the Viewpoint Analysis and a photomontage has been prepared (Refer to Appendix C and Appendix E).
My property. Local traffic. Users of the area.	Assessment has been undertaken from all dwellings, roads within the Study Area.
The scenic drives of Hill End Road, Black Willow Road, Wallawaugh Road and Gundowda Road.	Views will not be available to the Project from Hill End Road due to topography. Indicative viewpoint locations from each of the roads within the Study Area (up to 8km from the Project) have been assessed in the Viewpoint Analysis.
I do not feel that turbines negatively impact an environment. Care needs to be taken situating the access roads to prevent unnecessary loss of vegetation.	Areas of potential vegetation loss has been considered and addressed in this LVIA.

Table 21 Key Public Viewpoints identified by the community

16

Mitigation Measures

16.0 Mitigation Measures

16.1 Overview of Mitigation Methods

This section of the report provides recommendations which seek to achieve a better visual integration of the proposal and the existing visual character at both local and regional scales. The mitigation measures attempt to lessen the visual impact of the proposed wind farm whilst enhancing the visual character of the surrounding environment.

Mitigation measures are best considered as two separate phases. These include:

- Primary measures that form part of the development of the wind farm design through an interactive process;
- Secondary measures designed to specifically address the remaining (residual) negative (adverse) effects of the final development proposals (The Landscape Institute et al 2008).

It is important to note that the mitigation methods proposed in this report are made notwithstanding issues raised by other consultants (eg. engineering, ecology, geology etc.). During the planning and design phase of a wind farm mitigation strategies should also be considered to lessen the visual impact of the proposal. This is by no means an exhaustive list, however the adoption of these recommendations will assist considerably in ensuring the proposal contributes positively to the visual quality and character of the area.

Mitigation methods considered for associated infrastructure has been included in **Section 13.0.**

16.2 Project Layout and Design

The design of the Project is a primary measure of mitigation. The general principles employed through the project design phase can significantly reduce the visual impact. These include siting, access, layout and other principles which directly impact the appearance of the proposed development. General guidelines for the design development of the Project have been outlined in the following section.

16.2.1 Wind Farm Layout and Size

The layout and size of the wind farm is a significant factor in the visual impact on the landscape. According to Stanton (1995) the intrusiveness of a wind farm is not directly proportional to the number of turbines in an array, and instead, more a factor of design feature. For example, large wind farms may appear less dominating than a smaller project when the large wind farm is subdivided into several visually comprehensible units.

It is suggested that fewer and more widely spaced WTGs present a more pleasing appearance than tightly packed arrays (URBIS, 2009). The following principles should guide the design process of the wind farm:

- Controlling the location of different WTGs types, densities and layout geometry to minimise the visual impacts.
- The lines of WTGs should reflect the contours of the natural landscape as best as possible.
- Ensure the WTGs are evenly spaced to give a regular pattern creating a better balance within the landscape.

It is important to note that as a result of community consultation during the development period, the Project has undergone many changes. The above design principles have been considered in the siting of the proposed WTGs to provide a balanced appearance along the ridgelines.

16.2.2 WTGs Design and Colouring

WTGs design and colouring are an important factor. The WTGs will have a matte white finish and consist of three blades which is consistent with the current WTGs models being considered.

The important factors to achieving a visual consistency through the landscape include:

- Uniformity in the colour, design, rotational speed, height and rotor diameter.
- The use of simple muted colours and non-reflective materials to reduce distant visibility and avoid drawing the eye.
- Blades, nacelle and tower to appear as the same colour.
- Avoidance of unnecessary lighting, signage, logos etc.

16.3 Mitigation Methods - Residences

In accordance with the Bulletin, a detailed assessment of dwellings identified within the visual catchment has been undertaken and (where possible) mitigation methods have been recommended to assist in reducing any residual impacts.

Of the **19 non-involved dwellings** assessed within the blue line of visual magnitude (4,950 m from the nearest turbine) a total of **four (4) non-involved dwellings** were identified through the visual assessment as having a moderate or high visual impact rating. Proposed mitigation measures have been recommended for each of these non-involved dwellings. **Table 22** provides an overview of the potential mitigation options for these **four (4)** residences.

Proposed mitigation measures have been provided for each of these dwellings in Appendix G.

Screen planting was identified as a potential mitigation measure for all four (4) dwellings. The principles for screen planting have been provided in the following section.

Summary of Proposed Mitigation Measures: Dwellings within Black Line of Visual Magnitude				
Dwelling:	**Visual Impact Rating:**	**Proposed Mitigation Measure:**	**Estimated Time Frame:**	**Predicted Visual Impact Rating (with Mitigation Measures Implemented):**
Q13-1	HIGH	Screen Planting	5 - 10 Years	LOW
R14-1	HIGH	Screen Planting	5 - 10 Years	LOW
U7-1	MODERATE	Screen Planting	2 - 5 Years	LOW - NEGLIGIBLE
X8-1	MODERATE	Screen Planting	2 - 5 Years	LOW - NEGLIGIBLE

Table 22 Overview of mitigation measures identified for non-involved dwellings

16.3.1 Residence Screen Planting

In circumstances where residences are subject to a high level of visual impact, screen planting is an option proposed to assist in mitigating views of WTGs from residential properties. As the viewing location of the proposal would be generally fixed there is opportunity to significantly reduce potential visual impact from the Project.

In order to achieve visual screening planting between the intrusive element and the homestead, tree planting can be undertaken in consultation with the relevant landowners to ensure that desirable views are not inadvertently eroded or lost in the effort to mitigate views of the WTGs.

An example of how screen planting could be used to mitigate views towards visible WTGs from **R14-1** has been illustrated in **Figure 35**. Note this is an example only and a detailed analysis would be required to determine the extent of visibility, existing planting and orientation of the residence. **Refer to Appendix G.**

Figure 35 Example of screen planting at R14-1 (Refer to Appendix G)

16.4 Landscaping Principles

Visual screen planting is a beneficial mitigation method used to assist in reducing the visual impact of the WTGs and associated infrastructure. Landscaping and screen planting can also be utilised to significantly reduce the affect of shadow flicker on both roads and residences.

The existing character of the landscape allows for a variety of methods of landscaping and visual screening which will remain in keeping with the landscape character. General guidelines to adhere to when planning for landscaping and visual screening include:

- Planting is recommended post construction in consultation with the landowner.
- Planting should remain in keeping with existing landscape character.
- Species selection is to be typical of the area.
- Planting layout should avoid screening views of the broader landscape.
- Avoid the clearing of existing vegetation. Where appropriate reinstate any lost vegetation.
- Allow natural vegetation to regrow over any areas of disturbance.

Locally native plant species are preferred, as they will help assist and maintain the connectivity of the area and therefore. They help preserve the landscape character and scenic quality of the area as well as building habitat for local fauna. Native species are also well-suited to local conditions (ie. soil, climate, etc.) and will build on the existing vegetation assemblages in the area.

17

Visual Performance Objectives

17.0 Evaluation of Visual Performance Objectives

17.1 Overview of Visual Performance Objectives

In accordance with the Bulletin, *"the visual assessment requires an evaluation of the proposed wind energy project and its various components, turbines and ancillary facilities against the visual performance objectives of the Project (refer to Table 2 of the Bulletin), using a combination of desktop and field evaluations. The visual performance objectives are used as a framework for evaluation that enables potential impacts and management options to be considered objectively, against the varying levels of landscape significance established by the baseline study. Application of the visual performance objectives will allow for a transparent and robust assessment process."*

The following tables provides a brief summary of the evaluation of each of the visual performance objectives and identifies the relevant sections of the LVIA where detailed assessments are located.

Visual Magnitude - Visual Performance Objectives		
Visual Influence Zone 1 Objectives:	**Visual Influence Zone 2 Objectives:**	**Visual Influence Zone 3 Objectives:**
Avoid turbines or provide detailed justification of turbines below the blue line (4,950 m for Burrendong WF)	*Manage impacts as far as practicable, justify residual impacts, and describe proposed mitigation measures below the black line (3,350 m for Burrendong WF). Consider screening between the blue line and the black line.*	*Consider screening below the black line (within 3,350 m).*
Summary of LVIA Evaluation		
Refer to Section 6.0 - Visual Magnitude **Dwellings within 3,350 m (below the black line):** • Four (4) non-involved dwellings were identified within 3,350 metres of a proposed WTG • Detailed Assessment found the Project is likely to result in a very low visual impact from two (2) non-involved dwellings (R8-1 and T7-2) and a high visual impact from two (2) of the non-involved dwellings (R14-1 and Q13-1) refer to **Appendix D**. • Practical mitigation measures have been proposed for the dwellings will, over time, reduce impacts to an acceptable level (refer to **Appendix G**). **Dwellings between 3,350 m - 4,950 m (between the black and blue line):** • 15 non-involved dwellings were identified between 3,350 - 4,950 metres of the nearest proposed WTG (between the black and blue line of visual magnitude). • Further Detailed Assessment found the Project is likely to be screened by a combination of topography and / or vegetation from five (5) dwellings within the blue line and have been assessed as having nil visual impact. • Of the remaining 10 non-involved dwellings with potential visibility of the Project, the visual impact rating was assessed as follows: eight (8) rated as low and two (2) rated as moderate. Refer to **Appendix D**. • Practical mitigation measures have been proposed for the two (2) non-involved dwellings rated as having a moderate visual impact (U7-1 and X8-1). The proposed mitigation measures will, over time, reduce impacts to an acceptable level (refer to **Appendix G**).		

Table 23 Visual Magnitude - Evaluation of Visual Performance Objectives

Landscape Scenic Integrity

Visual Influence Zone 1 Objectives:	Visual Influence Zone 2 Objectives:	Visual Influence Zone 3 Objectives:
Wind turbines should not cause more than a low level modification of the visual catchment. Turbines are seen as either very small and/ or faint, or as of a size and colour contrast (under clear, haze-free atmospheric conditions) that they would not compete with major elements of the existing visual catchment.	Wind turbines should not cause more than a low level modification of the visual catchment. Turbines are seen as either very small and/ or faint, or as of a size and colour contrast (under clear, haze-free atmospheric conditions) that they would not compete with major elements of the existing visual catchment.	No Visual Performance objective applies.

Summary of LVIA Evaluation

Assessment Notes:

- The VIZ was identified for 24 key viewpoint locations within the Study Area, where relevant for viewpoints rated as VIZ1 and VIZ2 the objectives were evaluated.
  Refer to Section 8.0 and Appendix B: Viewpoint Analysis

- The potential for the project to affect the Scenic Integrity of the existing landscape character has been summarised for each LCU. **Refer to Section 15.0.**

- The LVIA concluded that whilst the Project will be a visible element in the landscape, the scenic integrity of the existing landscape character is likely to remain intact.

Table 24 Landscape Scenic Integrity - Evaluation of Visual Performance Objectives

Key Feature Disruption

Visual Influence Zone 1 Objectives:	Visual Influence Zone 2 Objectives:	Visual Influence Zone 3 Objectives:
Avoid wind turbines or ancillary facilities that result in the removal or visual alteration/disruption of identified key landscape features. This includes any major or visually significant landform, waterform, vegetation or cultural features that have visual prominence or are focal points.	Minimise impact of wind turbines or ancillary facilities that result in the removal or visual alteration/disruption of identified key landscape features. This includes any major or visually significant landform, waterform, vegetation or cultural features that have visual prominence or are focal points.	No Visual Performance objective applies.

Summary of LVIA Evaluation

Assessment Notes:

- Key Landscape Features are identified in **Section 5.0**. The key features were identified through a combination of community consultation and landscape character assessment.
- The LVIA has assessed the key features of the area and it has been concluded that whilst the Project may impact views from some areas, key features identified through the landscape baseline study will remain the dominant features of the landscape. The Project is unlikely to result in major disruptions to the key landscape features.

Table 25 Key Feature Disruption - Evaluation of Visual Performance Objectives

Multiple Wind Turbine Effects

Objectives (Applies to all Visual Influence Zones)

- Avoid views to the proposed, existing and approved turbines within eight kilometres from Level 1 and Level 2 viewpoints, exceeding the following thresholds, or provide detailed justification:
- Level 1: (High Sensitivity) - Wind Turbines visible within the effective horizontal views of two or more 60º sectors.
- Level 2: (Moderate Sensitivity) - Wind Turbines visible within the effective horizontal views in three or more 60º sectors.

Summary of LVIA Evaluation

Assessment Notes:

- All viewers identified using the Multiple Wind Turbine Effect Tool (based on 2D plan assessment) are Level 2 Sensitivity (Rural Dwelling). The Bulletin recommends further assessment to Rural Dwellings (Level 2 Sensitivity) identified as having the potential to view more than two (2) 60º sectors when using the Multiple Effect Tool. The Multiple Wind Turbine Effect Tool takes into account the approved Uungula Wind Farm (UWF), located to the north of the Site.

Refer to Section 6.0: Preliminary Assessment Tools

Summary of Assessment:

- The preliminary 2D assessment identified a total of five (5) non-involved dwellings with WTGs in more than two (2) 60º sectors.
- Three (3) of the non-involved dwellings are included due to WTGs associated with the UWF Project (A1-2, A0-1 and A1-1). Further assessment of these non-involved dwellings identified no opportunities for turbines associated with the Project to result in cumulative visual impacts due to intervening topography (Refer to Section 11.0).
- Detailed assessment has been undertaken for the remaining two (2) non-involved dwellings with turbines located in multiple 60 degree sectors. R14-1 and Q13-1 and mitigation measures have been proposed where required. **Refer to Appendix D.**

Table 26 Multiple Wind Turbine Effects - Evaluation of Visual Performance Objectives

Shadow Flicker and Blade Glint - Visual Performance Objectives

Objectives (Applies to all Visual Influence Zones)

- Minimise shadow flicker to not more than 30 hours per year and utilise available mitigation options to minimise shadow flicker.
- Finish turbine blades with a low reflectivity surface treatment to ensure that blade glint is minimised.

Summary of LVIA Evaluation

Assessment Notes:

- No methodology is provided for the assessment of shadow flicker. Moir LA have utilised the *QLD State Code 23 – Appendix B* to assist in formulating a methodology for assessment.
- A total of two (2) non-involved dwellings were identified with potential shadow flicker hours (R14-1 and Q13-1).
- Of the two (2) non-involved dwelling with potential shadow flicker, the potential for shadow flicker does not exceed 30 hours per year.
- The assessment is based on a worst case scenario considering topography alone.

Refer to Section 12.0 Shadow Flicker

Blade Glint:

- WTGs will be finished with a low reflectivity surface treatment to ensure blade glint is minimised.

Refer to Section 12.4 Blade Glint

Table 27 Shadow Flicker and Blade Glint- Evaluation of Visual Performance Objectives

Aviation Hazard Lighting

Objectives (Applies to all Visual Influence Zones):

- Aviation Hazard Lighting (AHL) must meet the requirements of Australian Standard AS 4282 - 1997 and any prescribed or notified CASA requirement. Shield all AHL within 2 kilometres of any dwellings. Avoid strobe lighting.

Summary of LVIA Evaluation

Assessment Notes:

- AHL is generally required on obstacles 150 m above the ground in accordance with advice from the CASA. The Aviation Impact Assessment prepared for the Project (Aviation Projects - August, 2023) assessed the requirement for obstacle lighting and concluded that obstacle lighting was not required to maintain an acceptable level of safety to aircraft. CASA has advised that it will only review assessments referred to it by a planning authority or agency.
- If deemed necessary by CASA, mitigation methods for AHL have been outlined in **Section 14.4.**
- Shielding will be installed on all turbines with aviation lighting to reduce impact for dwellings within 2 kilometres.

Refer to Section 14.0 Night Lighting Assessment

Table 29 Aviation Hazard lighting- Evaluation of Visual Performance Objectives

18.0 Conclusion

It is inevitable that the placement of wind turbines in a rural landscape will alter the existing landscape character of the area to some degree. The Project contrasts with the existing landscape character of the region which is typically rural, land with large expanses of vegetation.

With all visual impact assessments the objective is not to determine whether the proposed impact is visible or not visible, but to determine how the Project will impact on the existing visual amenity, landscape character and scenic quality. If there is potential for negative impact, this impact, and any mitigation methods must be investigated in order to reduce the impact to an acceptable level.

Although this LVIA quantifies the visual impact of the proposed turbines and associated infrastructure, the overall visual impact of the Project will vary greatly depending on the individual viewer's sensitivity to and acceptance of change. The sensitivity towards change varies greatly depending on the user's connection with the landscape. For example visitors to the area may perceive the Project as an interesting feature of the landscape. This may contrast with a resident who passes the wind farm daily who may have a more critical perception of the visual presence of the Project.

The visual impact of the Project is lessened as the distance of the vantage point from the Project Site is lengthened. The undulating topography surrounding the Project significantly alters the visibility of the Project from many vantage points. Within the local setting, a combination of the topography and local influences such as existing natural and introduced vegetation significantly reduce visibility towards the Project.

The greatest potential for visual impact is most likely to be felt by a small number of dwelling receptors in the immediate vicinity of the Project. The LVIA concludes there are limited opportunities to view the Project from non-involved dwellings within 4,950 m of the Project. Of the 20 non-involved dwellings assessed, 15 are likely to have a no views to the Project or a negligible - low visual impact. Two (2) non-involved dwellings are likely to have a moderate visual impact, and two (2) non-involved dwellings have been assessed as having a high visual impact rating.

Mitigation methods incorporated into the design process in conjunction with landscape and visual screening will have a positive effect on reducing any visual impact of the Project. Through the implementation of mitigation methods described in this report, it will be possible to significantly reduce the visual impact to an acceptable level at all non-involved dwellings.

On evaluation, it is the professional opinion of Moir LA that with mitigation measures implemented, the Project is compliant with the performance objectives as per the Visual Assessment Bulletin. It is the professional opinion of Moir LA that the social, environmental and economical benefits of the proposed wind farm far outweigh the identified visual impacts associated with the Project.

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