Landscape and Visual Impact Assessment

Winterbourne Wind Farm

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Executive Summary

Moir Landscape Architecture (Moir LA) have been commissioned by ERM to prepare a Landscape and Visual Impact Assessment (LVIA) for the proposed Winterbourne Wind Farm (the Project). The Project is being developed by WinterbourneWind Pty Ltd (WinterbourneWind).

The Project is located in the New England region of New South Wales (NSW), approximately 6.5 kilometres (km) to the north east of Walcha and 25 km south east of Uralla. An application for the construction, operation and decommissioning of a wind farm on the 9th of September 2020. SEARs were issued by the Department of Planning and Environment (DPE) on the 17th September 2020. The Project will have a combined installed capacity of approximately 700 megawatts (MW). This LVIA relates to the installation, operation, maintenance and decommissioning of up to 119 Wind Turbine Generators (WTGs), each with a maximum height of 230 metres.

In addition to the WTGs, this LVIA assesses the potential visual impacts associated with ancillary infrastructure including: access roads, underground and above ground cables, 2 x on-site substations, large scale battery storage, and associated operational facilities. The Project also includes the construction of 50 km of new 330kV overhead transmission line to a new TransGrid switch yard which is proposed to be constructed approximately 7 km south of Uralla, NSW.

Moir Landscape Architecture (Moir LA) have utilised a quantitative study methodology for the assessment developed with regards to the relevant requirements of the *Wind Energy: Visual Assessment Bulletin for State significant wind energy development, December 2016* (referred to as 'the Visual Assessment Bulletin'). In addition to the Visual Assessment Bulletin, Moir LA have considered relevant literature and guidelines relating to large energy projects to inform the study method.

The LVIA includes a comprehensive assessment of the existing landscape character, scenic quality and visibility of the Project. Extensive photography was undertaken by Moir LA during multiple site visits to develop a visual baseline against which the Project has been assessed. The assessment determined the regional landscape character is typical of the New England region characterised by agricultural land predominately utilised for grazing, with some areas of remnant vegetation.

The landscape was categorised into nine (9) 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 Visual Performance Objectives outlined in the Visual Assessment Bulletin.

The Visual Assessment Bulletin states that 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. 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, grazing paddocks, undulating topography, roadside vegetation and riparian vegetation associated with creek lines and rivers. The assessment found the Project could be undertaken whilst maintaining the key visual features of the landscape.

Specific assessment was undertaken on the potential for impact on the nearby Gondawana Rainforest of Australia World Heritage Area. This assessment was undertaken in the consideration of the UNESCO World Heritage and Wind Planning document and the specific SEARS relating to locations within the World Heritage Area.

In accordance with the Visual Assessment Bulletin, Moir LA applied the Preliminary Assessment Tools to the Project Layout to determine residences requiring detailed assessment. The assessment identified a total of **43 non-involved dwellings within the blue line of visual magnitude** (4,550 m of the nearest turbine), of which **20** non-involved dwellings are located within the black line of visual magnitude (3,100 m of nearest turbine) and the remaining **23** non-involved dwellings are located within the blue line of visual magnitude (3,100 m - 4,550 m of nearest turbine). Assessments were undertaken to determine the level of visual impact for all 43 representative non-involved dwellings within 4,550 m. The assessment identified:

- **Twenty six (26) non-involved dwellings** within the blue line of visual magnitude would have **nil, negligible or low visual impact**. This is mainly due to intervening topography or vegetation.
- **Twelve (12) non-involved dwellings** within the blue line of visual magnitude were assessed as having the potential to have **moderate visual impacts**.
- **Five (5) non-involved dwellings** within the blue line of visual magnitude were assessed as having the potential for a **high visual impact**.

Practical and feasible mitigation measures have been proposed for each of the non-involved dwellings with a moderate or high visual impact rating. The proposed mitigation measures would assist in significantly reducing negative 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, with the proposed mitigation measures implemented, the Project can be developed in compliance with the performance objectives as per the Visual Assessment Bulletin.

1.0 Introduction

1.1 Introduction

Moir LA have been commissioned by ERM to prepare a Landscape and Visual Impact Assessment (LVIA) for the proposed Winterbourne Wind Farm (referred to hereafter as the Project).

The Project includes the construction, operation and decommissioning of a wind farm with a combined installed capacity of approximately 700 megawatts (MW). The Project generally comprises of up to 119 Wind Turbine Generators (WTGs), access roads, underground and above ground cables, 2 x on-site substations, one (1) large scale battery storage system (BESS), and associated operational facilities. The Project will also require the construction of 50 km of 330kV overhead transmission lines to a new switchyard which would be constructed approximately 7 km south of Uralla, NSW.

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 Project.

This LVIA has been prepared in accordance with the *Wind Energy: Visual Assessment Bulletin December 2016* (the Visual Assessment Bulletin). This LVIA forms a part of the Environmental Impact Statement (EIS) to be submitted to NSW 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 Visual Assessment 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 Landscape Architecture Pty Ltd (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.

Our team has extensive experience in undertaking Landscape and Visual Impact Assessments for wind energy projects. Relevant experience includes the preparation of Landscape and Visual Impact Assessments for the following Wind Energy Projects:

- *Crudine Ridge Wind Farm LVIA* (Crudine, New South Wales)
- *Bodangora Wind Farm LVIA* (Bodangora, New South Wales)
- *Capital II Wind Farm LVIA* (Bungendore, New South Wales)
- *Uungula Wind Farm LVIA* (Wellington, New South Wales)
- *Hills of Gold Wind Farm LVIA* (Nundle, New South Wales)
- *Liverpool Range Wind Farm Modification VIA* (Coolah, New South Wales)
- *Thunderbolt Energy Hub Stage 1 LVIA* (Kentucky, New South Wales)

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.

2.0 Study Method

2.1 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 in September 2020 for the Project state:

> *the EIS must include a detailed assessment of the visual impacts of all components of the project (including turbines, transmission lines, substations, and any other ancillary infrastructure and (if required) night lighting) in accordance with the NSW Wind Energy: Visual Assessment Bulletin (DPE, 2016), including detailed consideration of potential visual impacts on local residences and the amenity values of the Oxley Wild Rivers National Park, Gondwana Rainforest of Australia World Heritage Area and areas of declared wilderness under the NSW Wilderness Act 1987).*

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

2.2 Wind Energy: Visual Assessment Bulletin

The *Wind Energy: Visual Assessment Bulletin for State Significant Wind Energy Development* (referred to in this report as the 'Visual Assessment Bulletin') was adopted by the 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.

Table 1 provides an overview of where specific requirements of the Visual Assessment Bulletin are addressed within this LVIA report.

The visual assessment process is broken into two main stages:
Stage 1: Preliminary Environmental Assessment and;
Stage 2: EIS

The Preliminary LVIA prepared for Stage 1: Preliminary Environmental Assessment was prepared by Green Bean Design Pty Ltd (GBD) in September 2020. The findings of the assessment undertaken by GBD 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 visual influences 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 Landscape Architecture 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 by Moir LA in March and June 2020 from public and private property and prior to this by others involved in the Project.

2.4 Report Structure

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.

2.0 Study Method

2.5 Landscape and Visual Impact Assessment (LVIA) Process

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 ASPECTS

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

SUMMARY AND RECOMMENDATIONS

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

2.0 Study Method

	Landscape and Visual Impact Assessment Report Structure	
VISUAL BASELINE STUDY	***Section 3.0: Project Overview***	***Visual Bulletin Requirements Addressed:***
	• Detailed Project Description • Wind Turbine Design • 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.
	Section 4.0: Community Consultation	***Visual Bulletin Requirements Addressed:***
	• 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	***Visual Bulletin Requirements Addressed:***
	• Detailed assessment of Landscape Character and Key Features of the Region • Landscape Character Unit Classification • Application of Scenic Quality Class Ratings	• 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***	***Visual Bulletin Requirements Addressed:***

	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	***Visual Bulletin Requirements Addressed:***
	• 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 VIEWPOINT ASSESSMENT	***Section 8.0: Public Viewpoint Analysis***	***Visual Bulletin Requirements Addressed:***
	Assessment of viewpoints from areas identified within the visual catchment. ***Refer to Appendix C - Viewpoint Analysis***	• All key public viewpoints and individual dwellings within the 'visual catchment' should be identified and assessed. • The visual performance objectives form the principle framework and guide for assessing the proposed wind energy project when applied to individual viewpoints.
	Section 9.0: Dwelling Assessments	***Visual Bulletin Requirements Addressed:***
	• Summary of impact on Dwellings ***Refer to Appendix E - Dwelling Assessment***	• All key public viewpoints and individual dwellings within the 'visual catchment' should be identified and assessed.
VISUALISATIONS	***Section 10.0: Photomontage & WIre Frame Diagrams***	***Visual Bulletin Requirements Addressed:***
	• Photomontage selection process • Photomontage development process ***Refer to Appendix D - 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.
OTHER ASPECTS	***Section 11.0 Shadow Flicker & Blade Glint***	***Visual Bulletin Requirements Addressed:***
	• Shadow Flicker Assessment (Section 10.1) • Blade Glint Assessment (Section 10.5)	• An assessment of the number of hours of potential 'shadow flicker' • Blade Glint
	Section 12.0 Night Lighting	***Visual Bulletin Requirements Addressed:***
	• Night Lighting Assessment	• Consider whether any obstacle lighting required is likely to result in any significant increase in visual impacts.
	Section 13.0 Cumulative Visual Impacts	***Visual Bulletin Requirements Addressed:***
	• 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 14.0 Associated Infrastructure	***Visual Bulletin Requirements Addressed:***
	• Overview of impact resulting from Associated infrastructure	• the assessment of visual impacts from all ancillary facilities and infrastructure will be required.
SUMMARY AND RECOMMENDATIONS	***Section 15.0 Visual Impact on Landscape Character***	***Visual Bulletin Requirements Addressed:***
	• Overview of Landscape Character Units (LCU's) with regards to Visual Performance Objectives • Summary of impact on Landscape Character	• Assess the Project using visual performance objectives.
	Section 16.0 Mitigation Methods	***Visual Bulletin Requirements Addressed:***
	• Wind Farm Design • Mitigation Methods for Residences	• 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	***Visual Bulletin Requirements Addressed:***
	• Evaluation of Visual Performance Objectives	• 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.

Table 1: Landscape and Visual Impact Assessment Report Structure

2.0 Study Method

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 - Good Practice Guidance (February, 2017)*
- *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 proposal is considered a State Significant Development and will be assessed as such by the NSW DPE, however relevant local government policies have also been considered. The Project spans across two Local Government Areas (LGAs) including the Walcha Council and Uralla Shire 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 10.0*** of this LVIA.

2.7.3 Civil Aviation Safety Authority

The LVIA includes an assessment of potential visual impact associated with night lighting in accordance with the Civil Aviation Safety Authority (CASA). Refer to ***Section 11.0*** of this LVIA.

2.7.4 National Parks and Wildlife Services

The Project is located within close proximity to significant conservation areas including the Oxley Wild River National Park, Gondwana Rainforest of Australia World Heritage Area and areas of declared wilderness under the NSW Wilderness Act 1987.

As Lot 145 and Lot 148 in DP755822 are located close to the northern boundary of the proposed development area and are lands managed by the NPWS which are currently going through the gazettal process, the EIS must assess the impacts of the proposal on these lands as if they are part of the NPWS estate. The LVIA will consider the interactions of the wind turbine infrastructure on the amenity and function of the nearby NSW National Parks and Wildlife Services Estate in accordance with the *Guidelines for developments adjoining land managed by the Office of Environment and Heritage, 2020.*

SEARs issued for the Project state:

The EIS must include an assessment of potential... visual impacts, at each of the following visitor areas of the Oxley Wild Rivers National Park:
a. Budds Mare campground.
b. Apsley Falls and associated walking tracks
c. Tia falls and associated walking tracks
d. The Rocks lookout and Green Gully track

3.0 Project Overview

3.1 The Project Site

The Project is situated approximately 425 kilometres (by road) from Sydney and 180 kilometres north-west of Port Macquarie. It is located approximately 75 kilometres north-east of Tamworth and approximately 35 kilometres south-south-west of Armidale within both Walcha Council and Uralla Shire Council Local Government Areas (LGAs). The Project Site is roughly bounded by Thunderbolts Way to the west, the Oxley Highway to the south, the Oxley Wild Rivers National Park to the east, and the Salisbury Plains to the north.

The Project Site extends around an area of approximately 22,285 hectares and is at an elevation of approximately 1,100 to 1,300 metres (above sea level), comprised of hills and ridgelines rising out of the Walcha Plateau. ***Figure 2*** provide the regional context of the Project Site.

3.2 The Study Area

For the purpose of this report, the Study Area is generally referring to the land surrounding the Project Site. The Study Area and surrounding area is generally used for grazing operations. In accordance with the Bulletin, residences and key viewpoints within 8 kilometres of the Project have been identified and assessed. *Figure 1* provides a bird eye view of the Study Area.

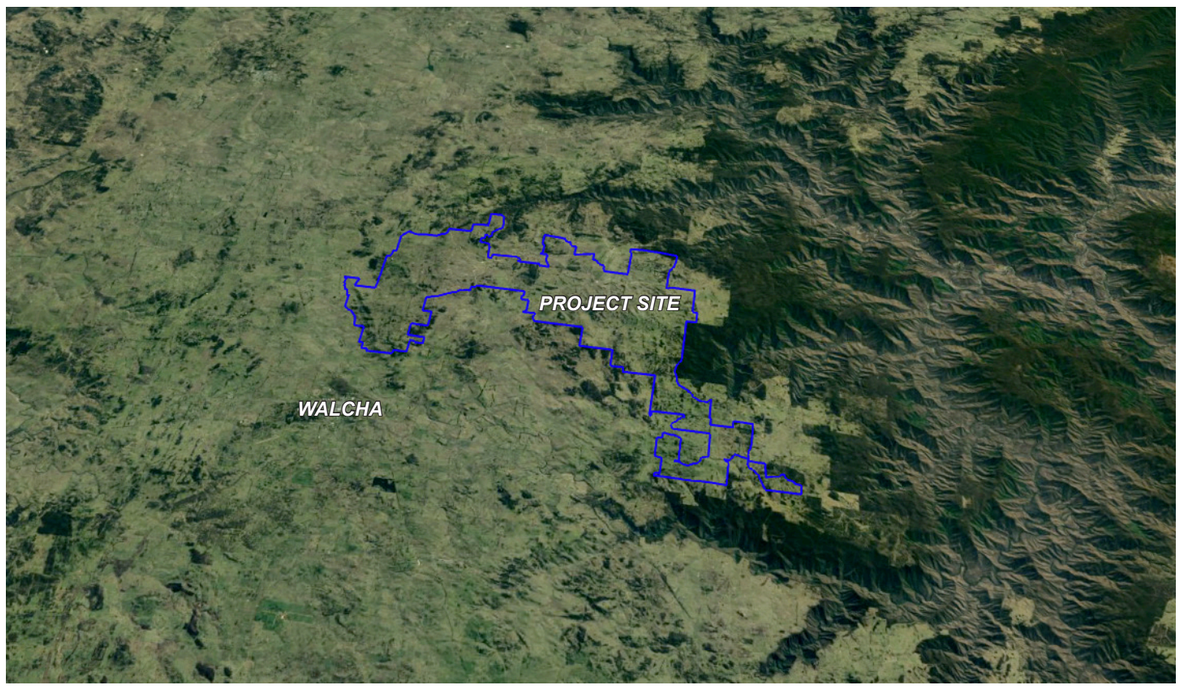


Figure 1: Birds Eye View of the Project Site (Map Source: Google Earth)

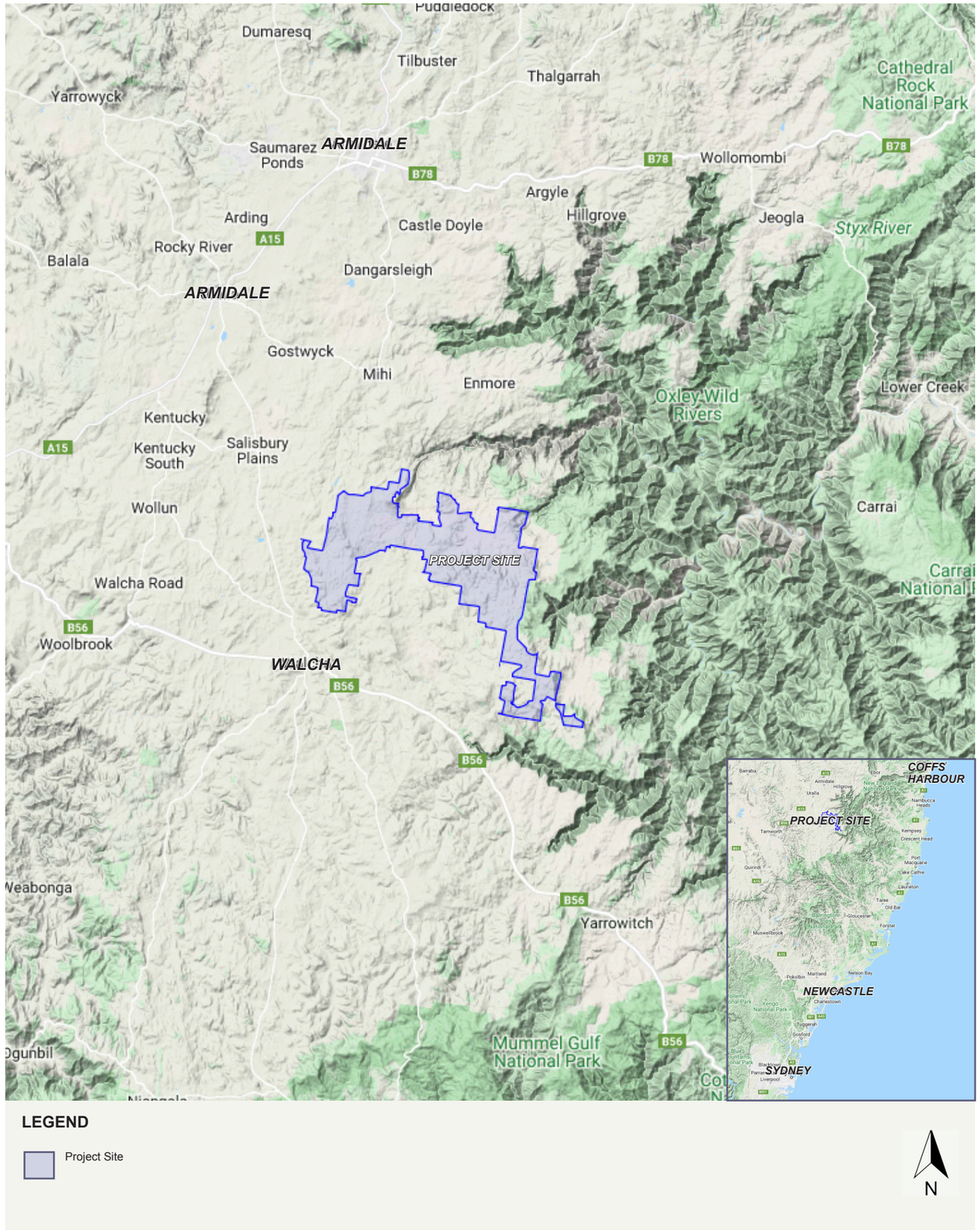


Figure 2: Project Site Context (Map Source: Google Maps)

3.0 Project Overview

3.3 The Project

The Project would consist of up to 119 wind turbine generators (WTG) with 6.2 megawatt (MW) capacity.

The proposal would also include:

- An internal electrical reticulation network (both overhead and underground);
- Two (2) 33/330 kV electrical substations;
- New and upgraded access roads;
- Four (4) temporary and 2 permanent Meteorological monitoring masts;
- Temporary construction facilities (including concrete batching plants); and
- Operation and maintenance buildings.

Large-scale battery storage is also proposed for the proposal to support stabilising the supply of electricity to the National Electricity Market (NEM).

The proposal is also proposed to include approximately 50 km of new 330kV overhead transmission line running through the wind farm and continuing north-west from the Project Site. This new transmission line would connect to the existing grid network operated by TransGrid at a new switchyard which would be constructed approximately 7 km south of Uralla, NSW.

The following provides an overview of all aspects of the proposal to be considered in this LVIA.

3.4 Wind Turbine Design

The WTG model selected for the Project (V162 - 6.2MW) would have an output capacity of 6.2 MW per WTG. The proposed turbines under consideration has a maximum blade tip height of 230 metres.

- A generating capacity of 6.2 MW;
- three blades mounted to a rotor hub on a tubular steel tower, with a combined height of blade and tower limited to a maximum tip height of 230m AGL;
- a gearbox and generator assembly housed in a nacelle; and
- adjacent hardstands for use as crane pads and assembly and laydown areas.

Table 2 provides an overview of dimensions of the turbine components that have been used for this assessment. To best represent a worst case scenario, the maximum hub height of 149 metres has been used for modelling and visualisation purposes in this report.

Figure 3 illustrates the turbine parameters utilised for this report. ***Image 1*** shows the appearance of a typical wind turbine.

Wind Turbine Components		
Project Component	**Dimensions used in LVIA:**	**Quantity**
Make / Model / Power	Vestas / V162 / 6.2 MW	**119**
Uppermost Blade Tip	230 metres AGL	
Tower (hub) height	149 metres	
Blade length	81 metres (including hub)	

Table 2: Wind Turbine Dimensions for Visual Assessment

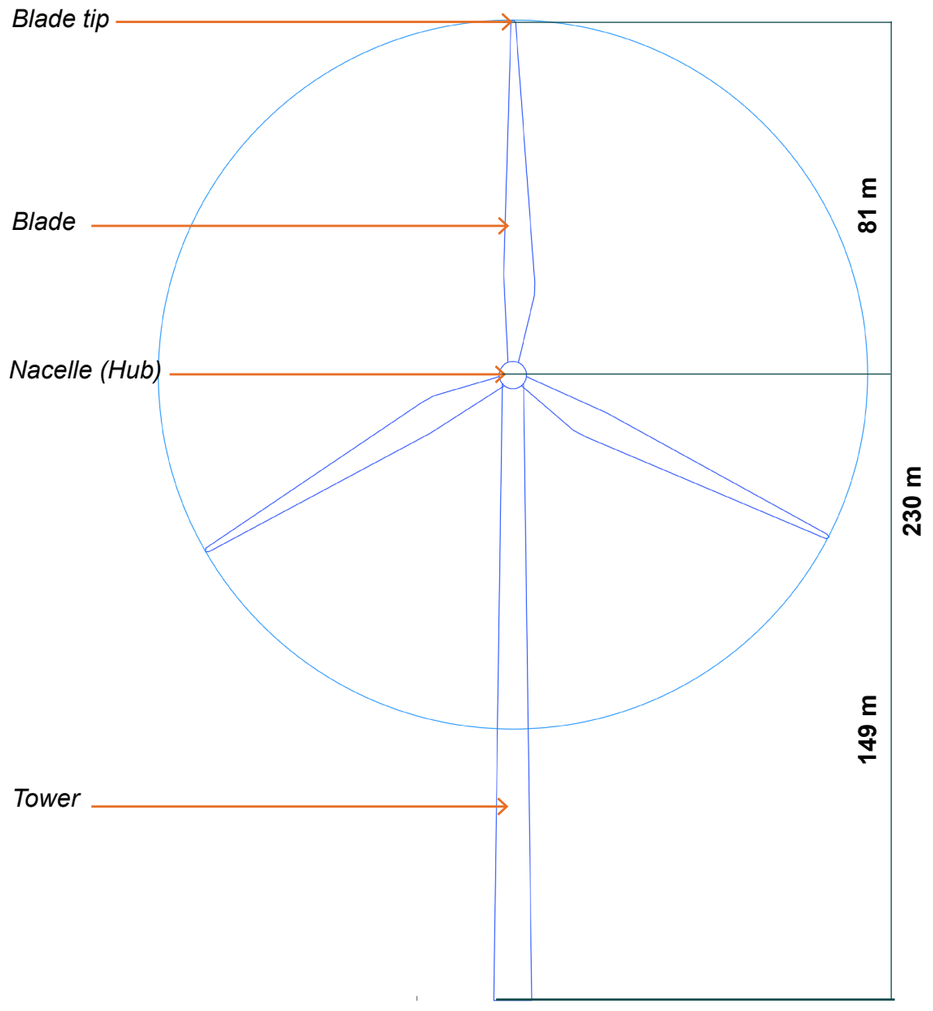
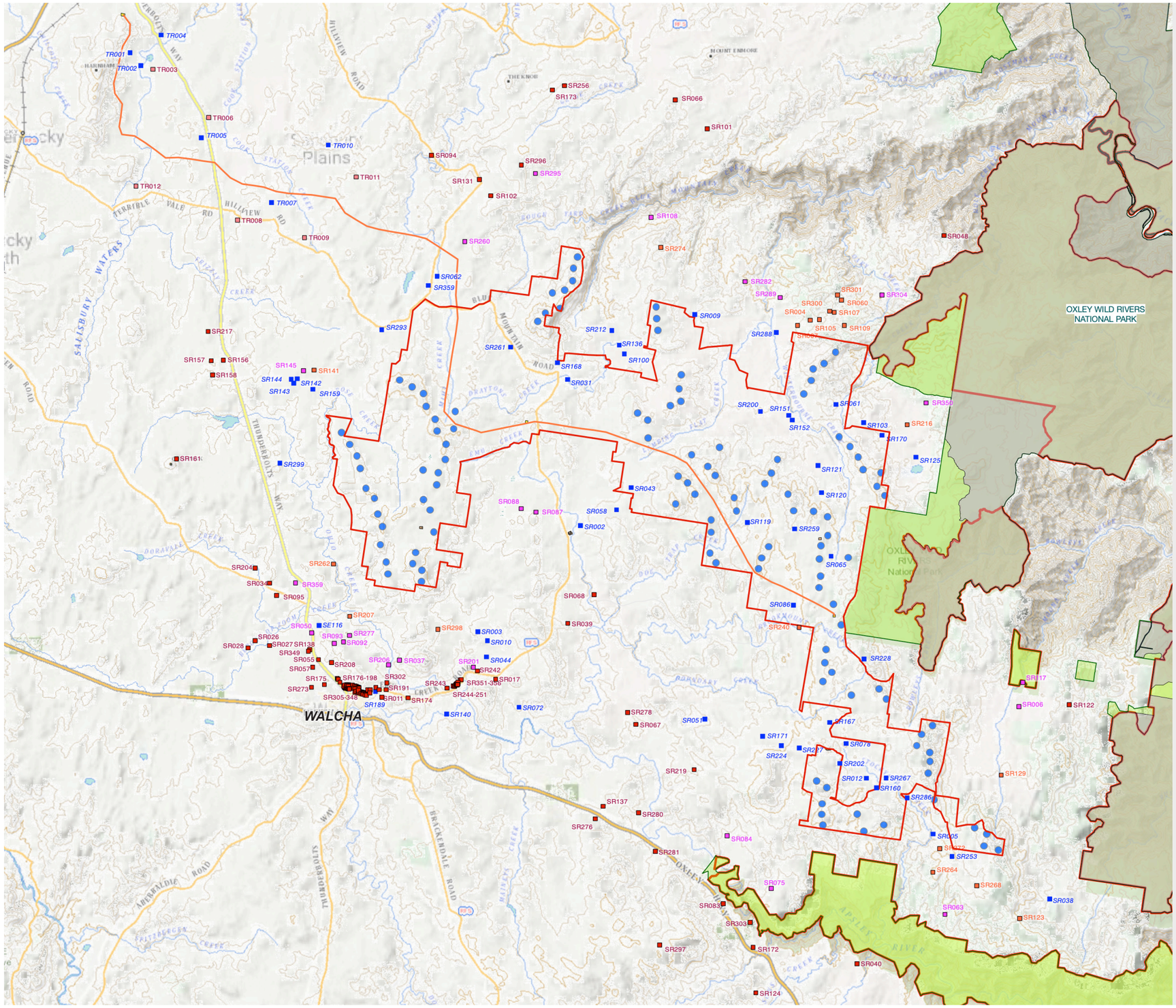


Figure 3: Turbine Dimensions used for Visual Assessment

3.0 Project Overview



The Project
Winterbourne Wind Farm

LEGEND

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Involved Residences
- Non-Involved Residences within 3,100 m
- Non-Involved Residences within 4,550 m
- Non-Involved Residences beyond 4,550 m
- Non-Involved Residences beyond 4,550 m (Within 2,000 m of Transmission Line)
- Proposed Transmission Line
- Switchyard
- Overlapping areas of World Heritage Area, Oxley Wild Rivers National Park, Wilderness Winterbourne
- Oxley River National Park

***Figure 4:** The Project (Map Source: Six Maps)*

3.0 Project Overview

3.5 Associated Infrastructure

In addition to the turbines, the following provides an overview of the permanent associated infrastructure components proposed for Winterbourne Wind Farm 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.

Associated Infrastructure	
Project Component:	**Description:**
Switchyard	160 m x 120 m switchyard to connect the Project transmission line to the adjacent 330 kV transmission line. ***Refer to Image 2***
Transmission Lines	50 kms of 330 kV overhead transmission line running through the wind farm and continuing northwest from the Project Site, connecting the Project to a new switchyard near Uralla, NSW. Main transmission line will be above ground with approximately 40 m high single or dual circuit lattice steel tower spaced approximately 500 m apart or monopoles approximately 50 m high, spaced approximately 250 m (subject to terrain). ***Refer to Image 3***
Meteorological monitoring masts	Four meteorological monitoring masts (met mast) for power testing and installation of up to two permanent met masts of max. 149m AGL in height***. Refer to Image 7***
On-site substations x 2	It is expected that each substation would occupy an area approximately 100 m x 100 m and will contain transformers, associated high voltage switchgear and control and protection equipment as well as a communication tower, and drainage and oil containment system. ***Refer to Image 4***
Permanant Operations and Maintenance Facility	A permanent site operations and maintenance (O&M) facility, approximately 50 m by 40 m, will be constructed to provide for all operations and maintenance activities associated with the Project. The buildings of the O&M facility will contain the control room, switch room, storage shed and carpark. ***Refer to Image 5***
Battery Energy Storage Facility	A fenced area of 100 m x 100 m with 80 cabinets of 100 MW/200 MWh Battery energy storage system. ***Refer to Image 6***
Internal private access road network	Approximately 113km of new private access track providing access to WTG's and connecting to existing Council roads.
Lighting	Maintenance and security lighting will be installed at the substations and at the O&M building for night work including emergency operations.
Public Road Upgrades	The upgrades to existing roads including intersection widening, trimming and removal of vegetation, removable signs and infrastructure, and the relocation of overhead wires may be required to facilitate the Project. The specific upgrade areas remain subject to further assessment.

Table 3: Associated Infrastructure

The following temporary elements will be required during construction of the Project:

- Temporary site buildings and facilities for construction contractors / equipment, including site offices, car parking and amenities for the construction workforce;
- Up to four temporary meteorological monitoring masts. The temporary monitoring masts will be located close to a WTG location with a maximum height of approximately 149 m AGL;
- Up to three (3) temporary mobile concrete batching plant/s to supply concrete for WTG footings and substation construction works;
- Earthworks for access tracks, WTG platforms and foundations, potentially including controlled blasting in certain areas;
- Potential rock crushing facilities for the generation of suitable aggregates for concrete batching and/ or for access track and hardstand construction;
- Hardstand laydown areas for the storage of construction materials, plant, and equipment;
- Up to four temporary meteorological monitoring masts. The temporary monitoring masts will be located close to a WTG location with a maximum height of approximately 149 m AGL (refer image 7);
- External water supply and storage for concrete batching and construction activities;
- The transport, storage and handling of fuels, oils and other hazardous materials for construction and operation of wind farm infrastructure; and
- Beneficial reuse of materials won from within the development footprint during cut and fill and WTG foundation excavation works for use in access track, hardstands and foundation material.

3.0 Project Overview

Image 1: Typical Wind Turbine (Source: Moir LA)

Image 2: Switchyard (Source: ERM)

Image 3: Transmission Line (Source: Vestas)

Image 4: Typical Substation (Source: Vestas)

Image 5: Operations and Maintenance Facility (Source: Vestas)

Image 6: Typical Battery Energy Storage System (BESS) (Source: Tesla)

Image 7: Meteorological monitoring masts (Source: Vestas)

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 was reflected in the PVIA prepared by Green Bean.

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 an objective frame of reference (*refer to Scenic Quality Rating - Section 5.5*) 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 intrinsic component of the Landscape and Visual Impact Assessment process.

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.

Generally, community consultation undertaken to date for the Winterbourne Wind Farm indicates a positive response to the proposal. Based on a survey undertaken by 41 community members in 2020, 63% of respondents had no concerns, and less than 20% identified visual amenity, noise during construction and traffic during construction.

The results indicate that 73.1% of those surveyed believe the most significant benefit of the wind energy project would be clean energy for future generations, and 60.3% of those surveyed identified local economic opportunities as a benefit.

4.3 Community Landscape Values

Landscape values are highly subjective and can differ depending on location, local context and place attachment. In accordance with the Bulletin, extensive ongoing community consultation has been undertaken by the proponent to establish an understanding of the landscape values held by the local and boarder community.

Specific questions were to developed to gain an understanding of the key landscape features, areas of scenic quality and key public viewpoints valued by the community.

The results of specific questions assisted in the identifying key areas of concern and ensuring the LVIA provided comprehensive assessment taking into account the results of questionnaires.

When asked *'what do you value most about the local area?'*, the majority of responses (up to 78% of responses) identified community and family ties, views and landscape were second most important. Other values identified included family, quality of farming land and climatic conditions (see **Figure 5**).

Question 2: What do you value most about the local area?

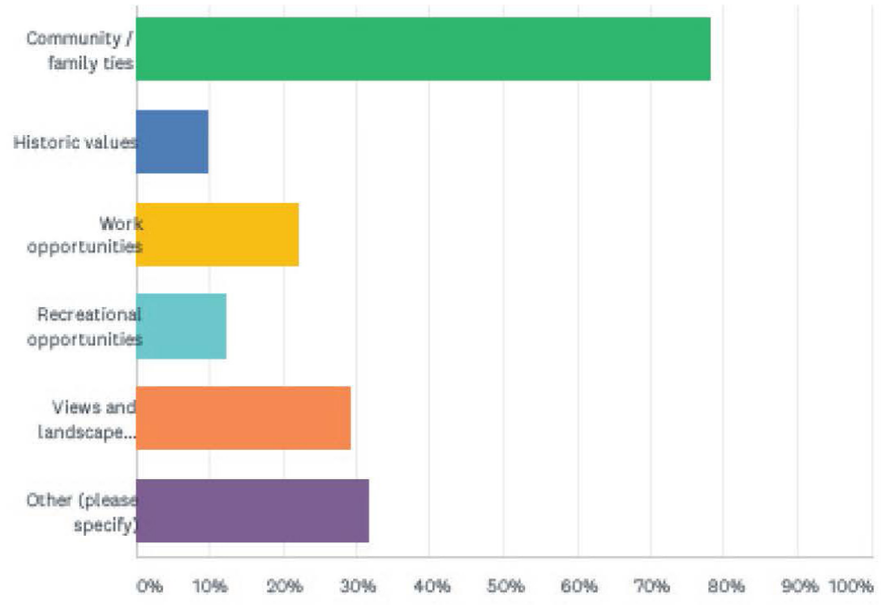


Figure 5: Results of Landscape Values Questionnaire Question 2

4.0 Community Consultation

To assist in the visual baseline study the proponent questioned the landscape characteristics of most importance to the community, the results (provided in **Figure 6** indicate prominent hills and ridgelines to be of highest value, followed by river corridors and water bodies.

Are any of the following landscape characteristics in the area important to you? Tick one or more.

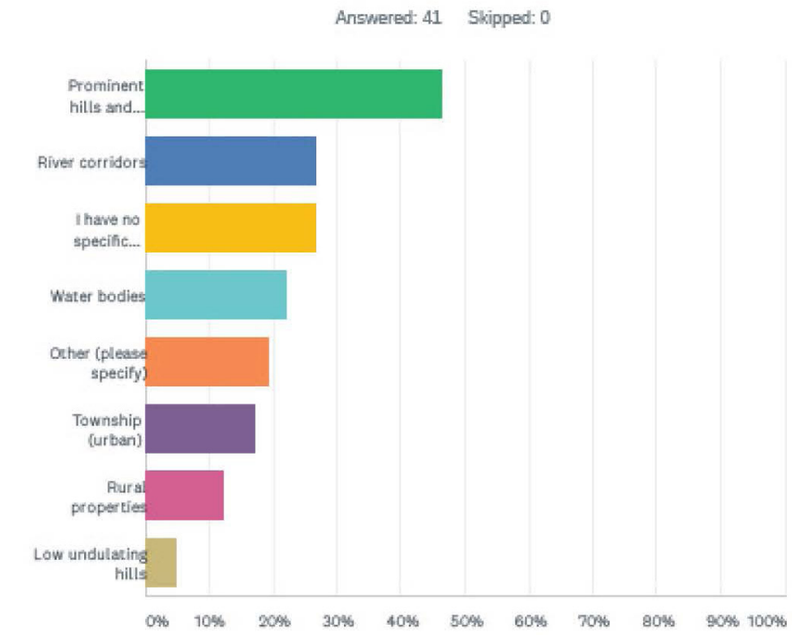


Figure 6: Results of Landscape Values Question 5

Other characteristics specified include:

- *Bush*
- *Influence on art in Walcha*
- *Forests*
- *Road corridors*
- *Landscape in general*
- *General view*
- *Green grass*
- *Open space*
- *I love the look of wind turbines*

The proponent asked *'What public lookout points or other places do you visit to view the landscape?'* Of the 41 responses, six (6) answered:

- *None*
- *Keen to have a public lookout to see the turbines*
- *Apsley falls*
- *There aren't any lookout points*
- *Steep Drop Falls and Apsley Falls and Riverside Camping Ground*
- *Apsley falls and Budds Mare*

Key features and lookout points have been included in the visual baseline study and considered in the assessment. The proponent asked '*What specific landscape features are important to you?'* Key landscape features may include items such as specific hills, rock outcrops or water features. Landscape features may also buildings such as churches, public buildings or heritage items.

Of the 41 questionnaires completed, only 10 respondents answered. Of the ten responses, four gave 'nothing' as a response, six referred to specific landscape features:

- *Apsley Falls (identified by 3 respondents)*
- *Tourist attractions*
- *Blue Mountain*
- *Water views and Apsley Falls*

The public lookouts and landscape features have been identified in the visual baseline study and where possible, visual assessments have been undertaken from each location.

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 Preliminary Landscape and Visual Impact Assessment was undertaken by Green Bean Design (2020) 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 baseline 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 A of the Bulletin* where relevant and in conjunction with previous experience on large scale wind energy projects.

Table 4 provides an overview of the methodology used to establish a quantitative approach to defining and assessing the landscape character.

Visual Baseline Study Inputs:	
Sensitive Land Use Designations	
• *Map Layer identifying National and State Sensitive Land use Designations and LEP Zones.*	***Refer to Section 5.2***
Landscape Character Type	
• *Describe the broad area of land in which the wind energy project is located.*	***Refer to Section 5.3***
Key Landscape Features	
• *Identify areas of visual interest or quality that stand out visually in the landscape.*	***Refer to Section 5.4***
Landscape Character Unit Classification	
• *Landscape is categorised into Landscape Character Units (LCU) and Scenic Quality Ratings are applied to each LCU.*	***Refer to Section 5.5 and 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***
Visibility Distance Zones	
• *Undertake visibility or view shed mapping when assessing what may be visible from a given viewpoint looking in all directions.*	***Refer to Section 7.0***

Table 4: Visual Baseline Study Inputs

5.0 Visual Baseline Study

5.2 Sensitive Land Zoning Designations

The proposal is located across two LGAs, including the Walcha Council and Uralla Shire Council areas. The following provides an overview of the land use zoning within the Project and its immediate surrounds. Refer to *Figure 8*.

- RU1 - Primary Production
- E1 - National Parks and Nature Reserves
- RU4 - primary production small lots
- R5 - large lot residential
- R1 - general residential
- IN1 - general industrial

5.2.1 RU1 - Primary Production

The proposal site comprises land zoned RU1 – Primary Production, a rural zone primarily intended to promote sustainable primary industry production. There are currently no objectives of the RU1 zoning relevant to visual impact within the any of the LEPs.

5.2.2 E1 - National Parks and Nature Reserve

Land parcels located east the Project Site have been zoned as C1 - National Parks and Nature Reserves. These include:

- Oxley Wild Rivers National Park
- Apsley Gorge National Park

Land in these areas are reserved under the National Parks and Wildlife Act 1974 to protect their environmental significance. This LVIA has referred to the Guidelines for development adjoining NPWS lands for general information on NPWS's expectations in relation to development that has the potential to impact NPWS lands. All potential impacts on the conservation values of the surrounding National Parks and NPWS management of these parks should be avoided.

5.2.3 - Other

A mixture of land uses including RU4 - primary production small lots, R5 - large lot residential, R1 - general residential, IN1 - general industrial exist within the Walcha town centre, approximately 6 km from the closest edge of the proposal site.

5.3 Overview of Bioregion

5.3.1 New England Tableland Bioregion

The Project Site is located within the New England Tableland Bioregion (see **Figure 7**). The New England Tableland Bioregion lies between the North Coast and Nandewar bioregions in northeast NSW, extending north just into Queensland. This bioregion is one of the smaller bioregions in NSW, occupying 3.57% of the state. In NSW, the bioregional boundary extends from north of Tenterfield to south of Walcha and includes towns such as Armidale and Guyra.

The bioregion is characterised by a stepped plateau of hills and plains with elevations between 600 and 1500m. Vegetation is diverse with a high degree of endemism.

The site is situated within the Walcha Plateau sub region which is characterised by high central plateau capped by granite and basalts with undulating and rugged areas including the Great Escarpment with deep rugged gorges such as Apsley Gorge (NSW Office of Environment and Heritage 2003).

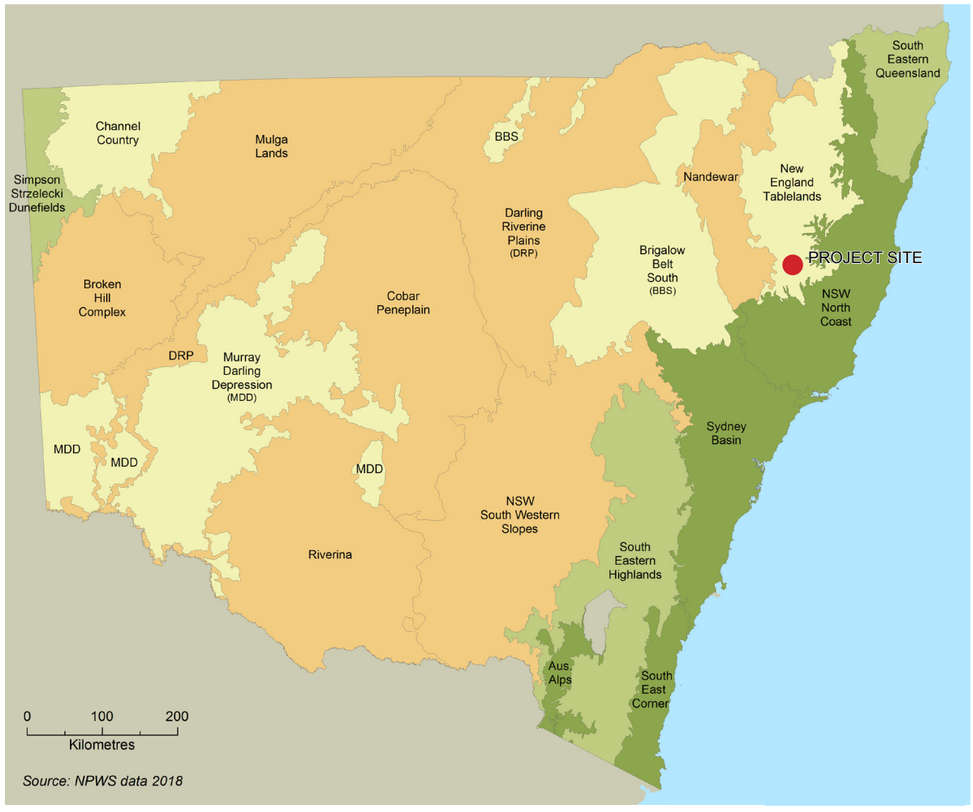
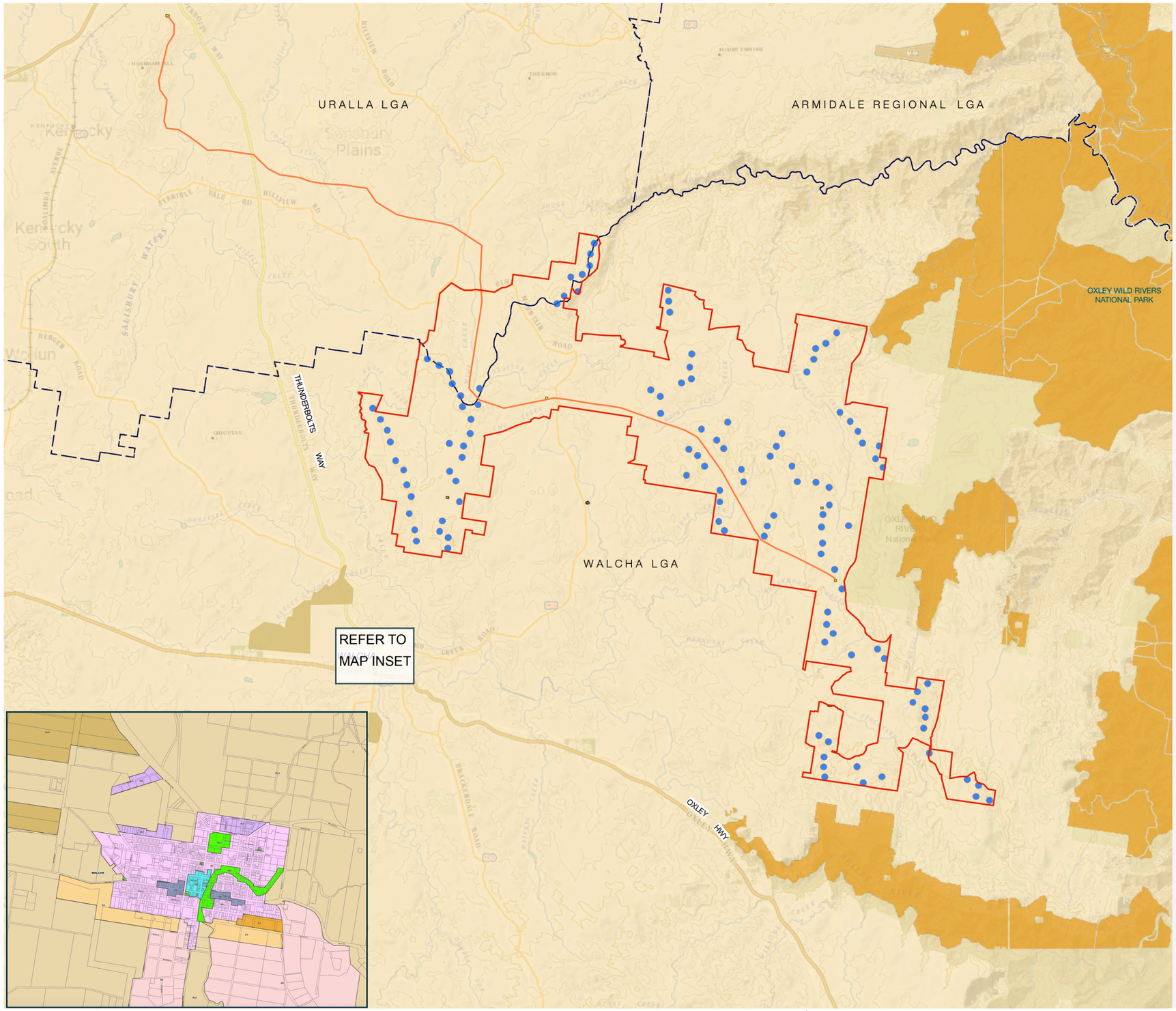


Figure 7: NSW Bioregion (Source: NPWS)

5.0 Visual Baseline Study



Land Zoning
Winterbourne Wind Farm

LEGEND

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Proposed Transmission Line

LAND USE:

- C1 - NATIONAL PARKS AND NATURE RESERVES
- RU1 - PRIMARY PRODUCTION
- RU4 - PRIMARY PRODUCTION SMALL LOTS
- R5 - LARGE LOT RESIDENTIAL
- R1 - GENERAL RESIDENTIAL
- IN1 - GENERAL INDUSTRIAL

N

0 2 4 6 8 10km

Figure 8: Land use Designations within the Study Area

5.0 Visual Baseline Study

5.4 Existing Landscape Character

Generally one of the first steps in carrying out a Landscape and Visual Impact Assessment (LVIA) is to identify and map the landscape character of the Project Site and its surrounding area (the Study Area, as defined in ***Section 3.2***). The following section of the LVIA describes the typical landscape character of the Study Area.

5.4.1 Nearby Towns

The proposal is located across two (2) Local Government Areas (LGAs), including the Walcha Council and Uralla Shire Council LGA. The nearest town is Walcha, located approximately 6 kilometres to the south west of the Project Site. The population of Walcha is 1,451 as of 2016 (ABS, 2016). Walcha generally consists of a mix of residential, rural residential and commercial land use with a industrial land on the northern edge. Walcha sits at the convergence of Thunderbolts Way and the Oxley Highway.

5.4.2 Accessibility

The Oxley Highway runs east-west through the Study Area, eventually meeting with Thunderbolts Way (which runs north-south) in Walcha. Both roads lead to the New England Highway, which is situated to the north west of Walcha. These major roads play an important role in linking Walcha to other towns in the region.

A number of low-use roads are serviced off Oxley Highway and Thunderbolts way and provide access to dwellings and National Park attractions. Emu Creek Road, Moona Plains Road and Winterbourne Road provide access via private driveways to homesteads located to the east of Walcha. Numerous unsealed roads run off Emu Creek Road, Moona Plains Road and Winterbourne Road, including Blue Mountain, Hazeldean Road and Old Brookmount Road to provide access to isolated dwellings.

Tia Falls Road and Aspley Falls Road (off the Oxley Highway) provide access to Aspley Falls campground. Whilst the unsealed Budd Mares Trail and Bark Hut Trail provide access to Budd Mare Campground.

Image 8: Walcha Township

Image 9: Entry to Walcha via Thunderbolts Way

Image 10: Entry into Oxley Wild Rivers National Park

Image 11: Entry to Walcha via Oxley Highway

5.0 Visual Baseline Study

5.4.3 Landform

The Study Area, in particular the area within Oxley Wild Rivers National Park, is characterised by steep, deep gorges. When running, fast flowing rivers occur within an area known as The Great Escarpment, east of the Great Dividing Range. The Great Escarpment runs along the eastern edge of the tablelands and extends from northern Queensland to southern Victoria. Westward erosion of the tablelands by the Macleay River system created the gorges of the Oxley Wild Rivers National Park area which in some areas approach 600 metres. Waterfalls or cascades are characteristic of many of the streams which plunge over the Great Escarpment. Drops exceeding 100 metres are common and the largest single drop is 240m at Wollomombi Falls. Elevation ranges from 200m above sea level at Georges Creek to 1,294m at Baynes Mountain.

Outside of the National Park the landscape is a combination of rolling to undulating hills and isolated peaks contrasted by productive flats that have agricultural associations.

5.4.4 Vegetation

The presence of Oxley Wild Rivers National Park has protected a number of species that are consistent with the Walcha Plateau sub Bioregion, including Snow Gum, Black Sallee, Ribbon Gum, Mountain Gum, Silvertop Stringybark, New England Blackbutt, Narrow-leaved Peppermint, in moist high areas and New England Stringybark, Ribbon Gum, and cool temperate rainforest elements in moist sheltered gullies (NSW Office of Environment and Heritage 2003).

The topography of the Study Area has resulted in the retention of stands of native vegetation along hilltops and gullies and windbreak vegetation. Accessible areas used for agriculture are generally cleared grasslands and are used support grazing.

5.4.5 Water Form - Rivers and Creeks

The Apsley River is the main waterform which traverses the Study Area. The river is a perennial stream of the Macleay River catchment. The river runs through Walcha and spills over the Apsley Falls, descending approximately 27 metres into the Apsley Gorge, towards its confluence with the Macleay River.

A number of creeks including Ohio Creek, Emu Creek and Rowleys Creek traverse through the Project Site and its immediate surrounds, connecting to the Apsley River. These creeks feed into a number of gullies and support agricultural farming activities.

Image 12: Cleared agricultural land

Image 13: Retention of stands of native vegetation along hilltops and gullies

Image 14: Windbreak vegetation typical in the area

Image 15: Apsley River

Image 16: Steep, deep gorges characteristic of the National Park

5.0 Visual Baseline Study

5.5 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 that contribute to the visual character of the landscape (refer to **Figure 9**).

5.5.1 High points within the landscape

The Project Site and its surrounds are characterised by undulating hills, dramatic gorges and steep elevations ranging from 200-1294 m above sea level. A number of high points exist within the Oxley Wild Rivers National Park. Some of these include Baynes Mountain and Table Top Mountain, however due to the topography, they are difficult to access.

Outside of the National Park, a number of isolated high points exist including:

- Winterbourne Mountain
- Blue Mountain
- The Knobs
- Bald Knob
- Ohio Peak
- Black Knob

5.5.2 Oxley Wild Rivers National Park

Oxley Wild Rivers National Park is included on the World Heritage List as part of the Central Eastern Rainforest Reserves of Australia (CERRA) World Heritage Area. CERRA was inscribed on the World Heritage List in 1986, and extended in 1994, because it satisfies three of the four criteria for natural values of outstanding universal significance. It contains:

- spectacular gorges, cliff lines and deep, steep sided valleys illustrating on-going geomorphological processes associated with the Great Escarpment;
- numerous high waterfalls;
- panoramic views from locations along the escarpment edge;
- attractive tall moist forests and rainforests and diverse vegetation types across the landscape.

It is a popular tourist area offering diverse recreational opportunities including:

- easily accessible lookouts and associated facilities at spectacular escarpment locations;
- a range of short to long day and overnight walks;
- self-reliant recreation in the extensive network of gorges and wilderness areas;
- swimming, canoeing, rafting and liloing along the creeks and rivers;
- extended horse riding, bicycling and walking on the Bicentennial National Trail
- isolated and easy to access camping and day use areas

A number of key areas include the following:

5.5.3 Apsley Falls and Camping Area

The Apsley Falls are located 20 kilometres south east of Walcha, and is accessed off the Oxley Highway. It is a popular attraction and provides visitors a view of the rugged gorges carved out by the Apsley and upper Macleay Rivers which meander through the park and the falls. The two falls are accessed via the Gorge Rim Walk and the Oxley Walk. The recreational area provides both picnic facilities and camping area for overnight stays.

5.5.4 Budds Mare Day Use and Campground

The Budds Mare campground is 44 kilometres east of Walcha via the Moona Plains Road. The route includes unsealed roads and as a result it is not accessible to some visitors. Budds Mare campground is generally situated within bushland with limited viewing opportunities out of the area. A number of informal look outs with extensive views across the national park are located nearby the campground. A number of challenging hikes suitable for experienced hikers depart from this campground.

5.5.5 Riverside Campground

Riverside Campground is an isolated yet popular camping area located within the Oxley Wild Rivers National Park. It is 4WD access only.

5.5.5 Tia Falls

Tia Falls is located 31km south east of Walcha, just off the Oxley Highway. It is a popular picnic and rest

5.0 Visual Baseline Study

area and offers visitors a variety of short walking trails which take visitors around the rim of Tia Falls and surrounding bushland. A number of formal and informal look out areas provide extensive views of the falls and surrounding gorges. A campground is also provided for visitors.

5.5.6 Green Gully Track and Rocks Lookout

Green Gully Track is an isolated and challenging 65km hike that generally takes 4-5 days to complete and is recommended for experiences bushwalkers. The walking track explores the Apsley-Maclaey gorges and includes both high elevation forests, ridgelines, fern lines gullies and streams. A number of informal look out areas, including the Rocks Lookout, provide views to the surrounding dramatic gorges and rocky outcrops. A number of small huts located along the trail provide visitors an area to rest along the way.

Image 17: Apsley Falls

Image 18: Walking trail at Apsley Falls

Image 19: Entry to Riverside Campground

Image 20: Oxley Wild Rivers National Park

Image 21: Lookout at Budds Mare Campground

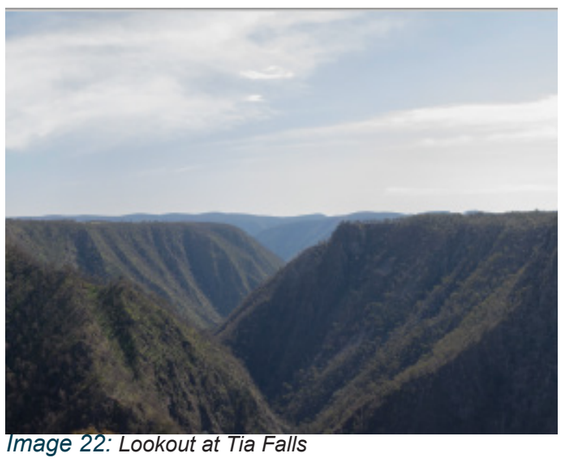
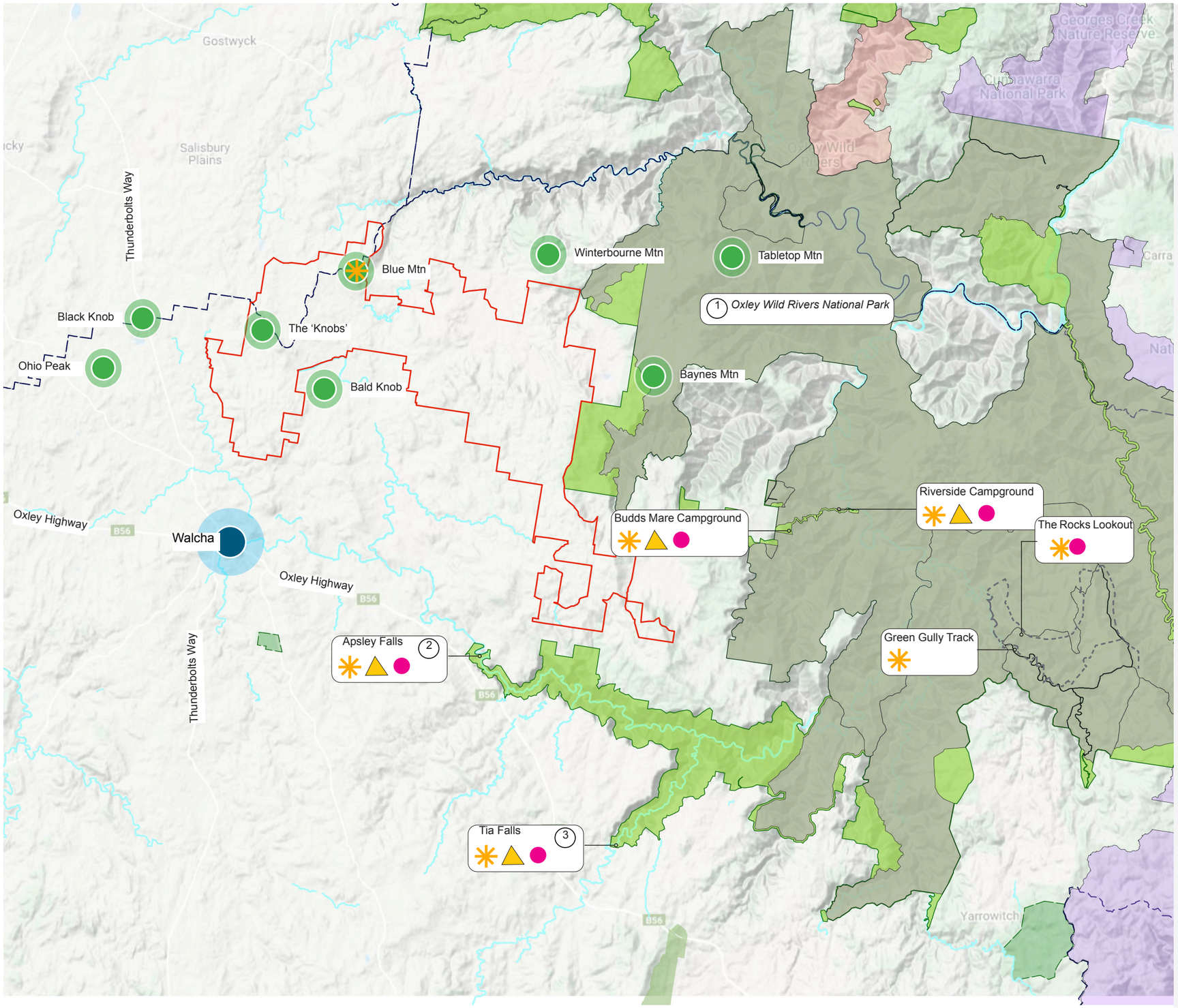


Image 22: Lookout at Tia Falls

5.0 Visual Baseline Study



Key Landscape Features
Winterbourne Wind Farm

LEGEND

- Project Site Boundary
- River / Creek
- Campground and Day Use Areas
- Look out
- LGA Boundary
- Walking Trails
- Key locations identified through community consultation
- National Park (Oxley Wild Rivers National Park)
- State Forest
- Highpoint / Mountain
- Town
- Overlapping areas of World Heritage Area, Oxley Wild Rivers National Park, Wilderness Winterbourne
- Wilderness Winterbourne Areas
- Oxley River State Conservation Area

KEY LANDSCAPE FEATURES

1. *Oxley Wild Rivers National Park*
2. *Apsley Falls and Gorge*
3. *Tia Falls*

N

0 4 8 12 16km

Figure 9: Existing Landscape Character and Key Features

5.0 Visual Baseline Study

5.6 Scenic Quality Class Rating

The Visual Assessment 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 Visual Assessment Bulletin, a Scenic Quality 'frame of reference' has been formulated by Moir LA (***Table 5***) utilising *An approach to landscape sensitivity assessment* by Natural England. The frame of reference developed for the Winterbourne Wind Farm 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 Landscape Character Unit (summarised in ***Section 5.7*** and overviews 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***).

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 5: Scenic Quality Class Rating Frame of Reference

5.0 Visual Baseline Study

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 nine (9), Landscape Character Units (LCU) 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 a combination of the *Preliminary Landscape and Visual Assessment* (prepared by Green Bean Design), land use patterns, vegetation coverage, topographical maps, site images and site inspection.

The general extent of the LCUs are shown on ***Figure 10*** on the following page and detailed description of each Landscape Character Unit has been included in ***Appendix B*** of this report.

The Scenic Quality 'frame of reference' has been applied to each LCU (refer to ***Appendix B*** and ***Table 6***).

Overview of Landscape Character Units

LCU:	Overview:	Scenic Quality Rating:
LCU 01 Oxley Wild Rivers	The LCU is defined by rivers, associated gorges and adjoining heavily timbered ridgelines and rocky crests that form part of the Great Dividing Range, located to the east of the Project Site. Areas associated with the World Heritage Area and Oxley Wild Rivers National Park also form part of this LCU.	**Moderate / High** *Refer to Appendix B1*
LCU 02 Walcha	Walcha Township and rural surrounds.	**Moderate** *Refer to Appendix B2*
LCU 03 Moona Plains	Defined by the gently undulating landform associated with the mostly cleared primary production land located to the west of the Project Site.	**Low / Moderate** *Refer to Appendix B3*
LCU 04 Oxley Highway	Flat land with isolated local rises to the west of the Project Site, generally associated with the entry into the village of Walcha from the east	**Low** *Refer to Appendix B4*
LCU 05 Thunderbolts Way Pastures	Thunderbolts Way Pastures LCU is defined by the cleared, generally flat grazing land located to the west of the Project Site.	**Low / Moderate** *Refer to Appendix B5*
LCU 06 Rowleys Creek Road	Defined by the undulating topography adjoining the heavily timbered hillsides and rocky crests that border the Oxley Wild Rivers LCU.	**Moderate** *Refer to Appendix B6*
LCU 07 Winterbourne	Flat to undulating topography adjoining the heavily timbered hillsides and rocky crests that border the Oxley Wild Rivers LCU and the Moona Plains to the west.	**Low / Moderate** *Refer to Appendix B7*
LCU 08 Apsley River	Flat to gently undulating and is intersected by Apsley River and small creeklines to the south of Walcha.	**Low / Moderate** *Refer to Appendix B8*
LCU 09 Sailsbury Plains	Flat land associated with the mostly cleared primary production land located to the north west of the Project Site.	**Low** *Refer to Appendix B9*

Table 6: Overview of Landscape Character Units

5.0 Visual Baseline Study

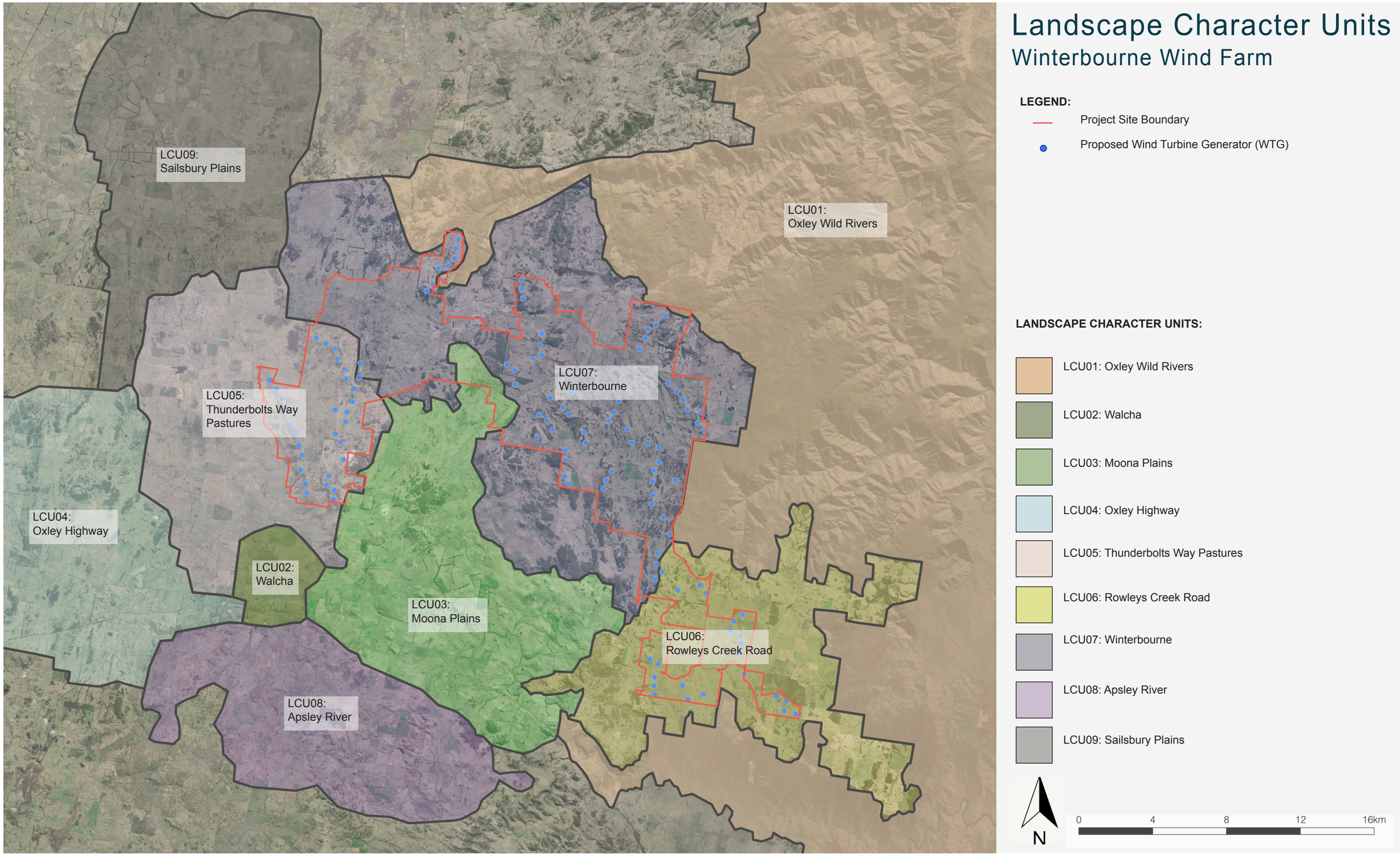


Figure 10: *Landscape Character Units*

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 Visual Assessment Bulletin. In accordance with the Visual Assessment 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 E*** of this LVIA.

6.2 Preliminary Assessment Tool 1: Visual Magnitude

The Visual Magnitude Threshold is based on the height of the proposed wind turbines to the tip of the blade and distance from dwellings or key public viewpoints as shown in ***Figure 11***.

The Visual Assessment Bulletin states: *The respective threshold lines on the graph indicate where turbines may potentially have significant visual magnitude impacts based on their relative height and their distance from viewpoints. For the visual assessment, an additional threshold distance line has been added to the visual magnitude graph which identifies potentially high visual magnitude impacts, to allow more detailed assessment as part of the EIS. However, the black and blue lines are not determinative of acceptability. Instead, they provide a basis for the assessment to be undertaken.*

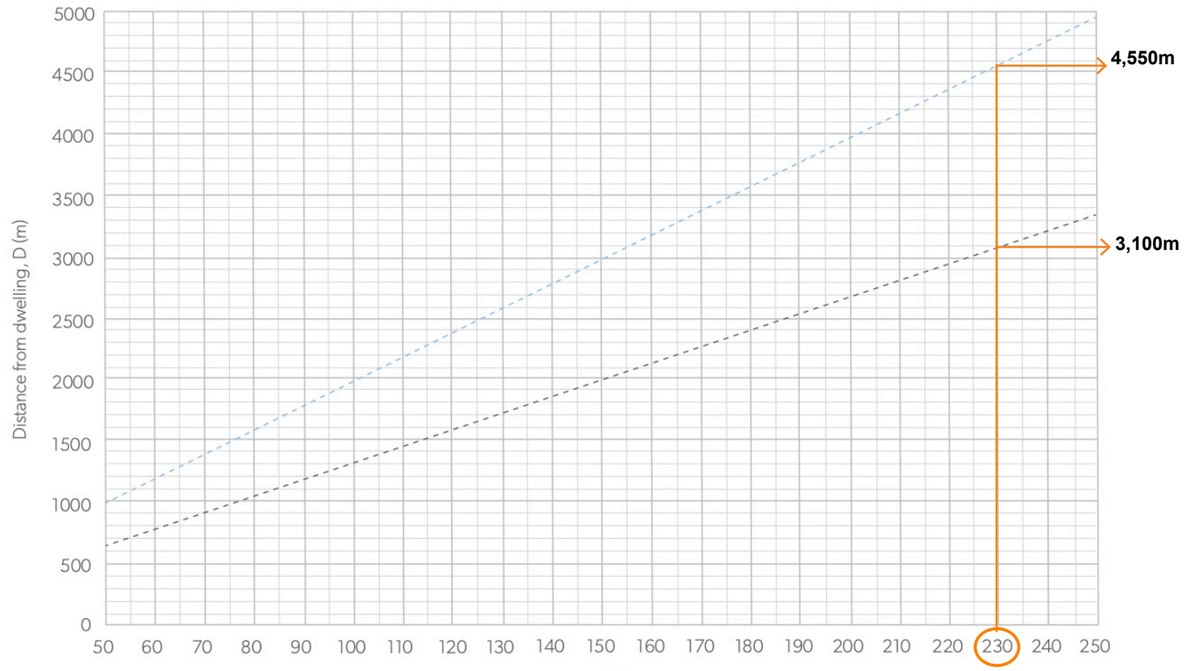
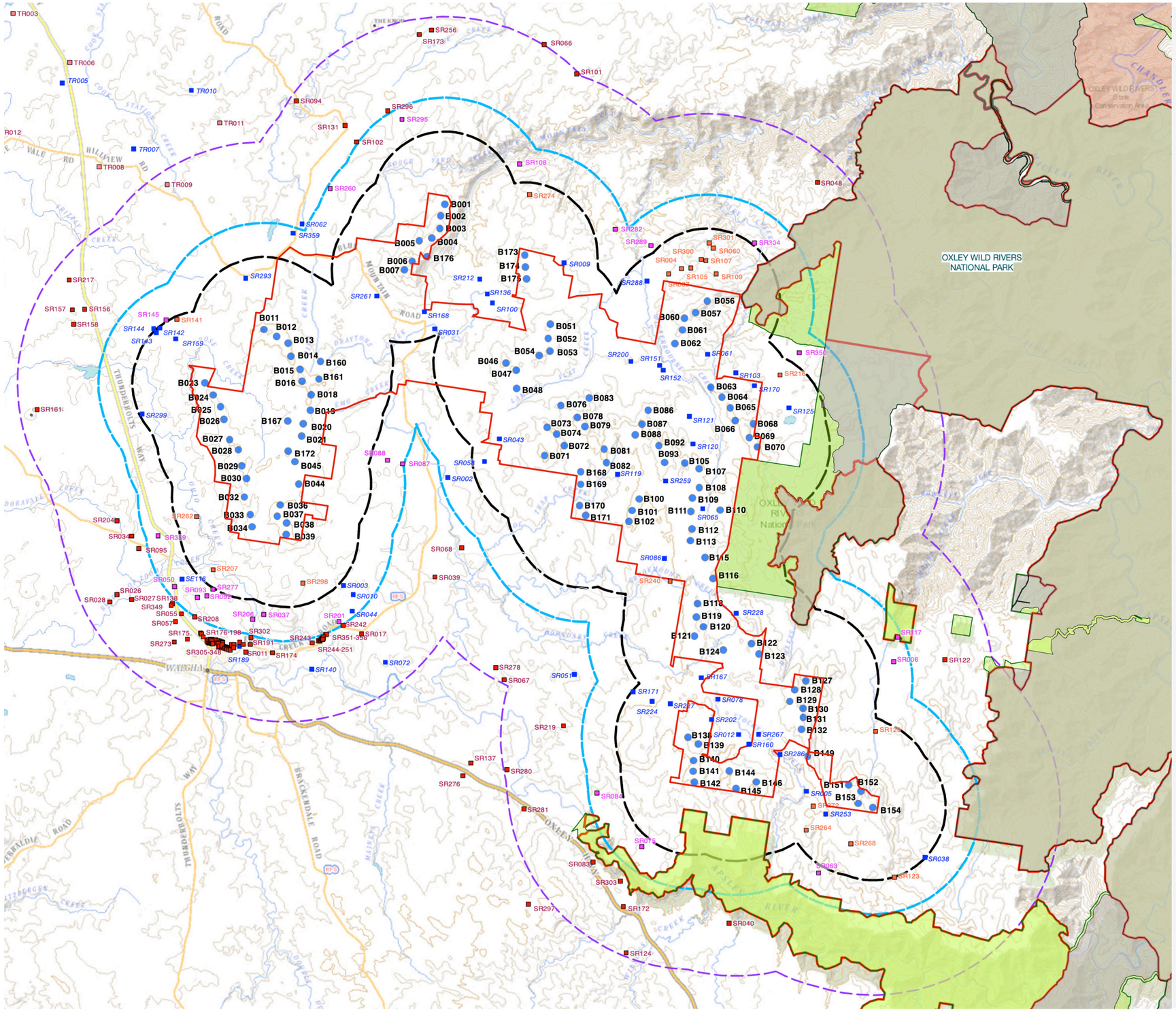


Figure 11: ***Visual Magnitude thresholds for Project Layouts***
(Source: Visual Assessment Bulletin)

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 wind turbines are based on a worst case scenario with a tip height of *230 metres*. The 'black line 'intersects at a distance of *3,100 metres* and the 'blue line' intersects at *4,550 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.

6.0 Preliminary Assessment Tools



Visual Magnitude
Winterbourne Wind Farm

Black Line: 3,100 m

Blue Line: 4,550 m

LEGEND

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Involved Residences
- Non-Involved Residences within 3,100 m
- Non-Involved Residences within 4,550 m
- Non-Involved Residences beyond 4,550 m
- Non-Involved Residences beyond 4,550 m (Within 2,000 m of Transmission Line)
- 3,100 m from nearest WTG (Black Line of Visual Magnitude)
- 4,550 m from nearest WTG (Blue Line of Visual Magnitude)
- 8,000 m from nearest WTG
- Overlapping areas of World Heritage Area, Oxley Wild Rivers National Park, Wilderness Winterbourne
- Wilderness Winterbourne Areas
- Oxley River State Conservation Area
- Oxley River National Park

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 turbines.

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

N

0 2 4 6 8 10km

Figure 12: Preliminary Assessment Tool 1: Visual Magnitude - Winterbourne Wind Farm (Map Source: Six Maps)

6.0 Preliminary Assessment Tools

6.3 Results of Preliminary Assessment Tool 1: Visual Magnitude

Application of the Preliminary Assessment Tools to the Winterbourne Wind Farm Project identified dwellings which require further assessment in accordance with the Bulletin. Non-involved dwellings identified within 3,100 metres (black line of visual magnitude) and between 3,100 - 4,550 metres (blue line of visual magnitude) of the nearest proposed turbine are shown on ***Figure 12*** and outlined in ***Section 17*** of the LVIA***.***

- **20 non-involved dwellings** have been identified within 3,100 metres of a proposed wind turbine location (within the black line).

- **23 non-involved dwellings** were identified within 3,100 - 4,550 metres of a proposed wind turbine (within the blue line of visual magnitude).

Detailed assessment from representative dwellings within the black line has been undertaken in **Appendix E**.

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 proposed wind energy 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 turbines, and any existing or approved turbines within eight kilometres of each dwelling or key public viewpoint. ***Figure 13*** below provides examples of where a dwelling or key public viewpoint may have views to turbines in multiple 60° sectors.

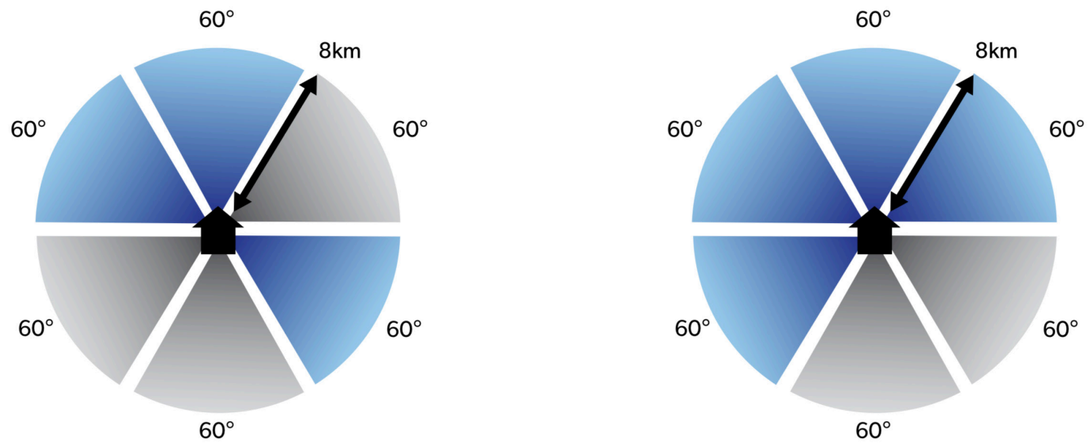


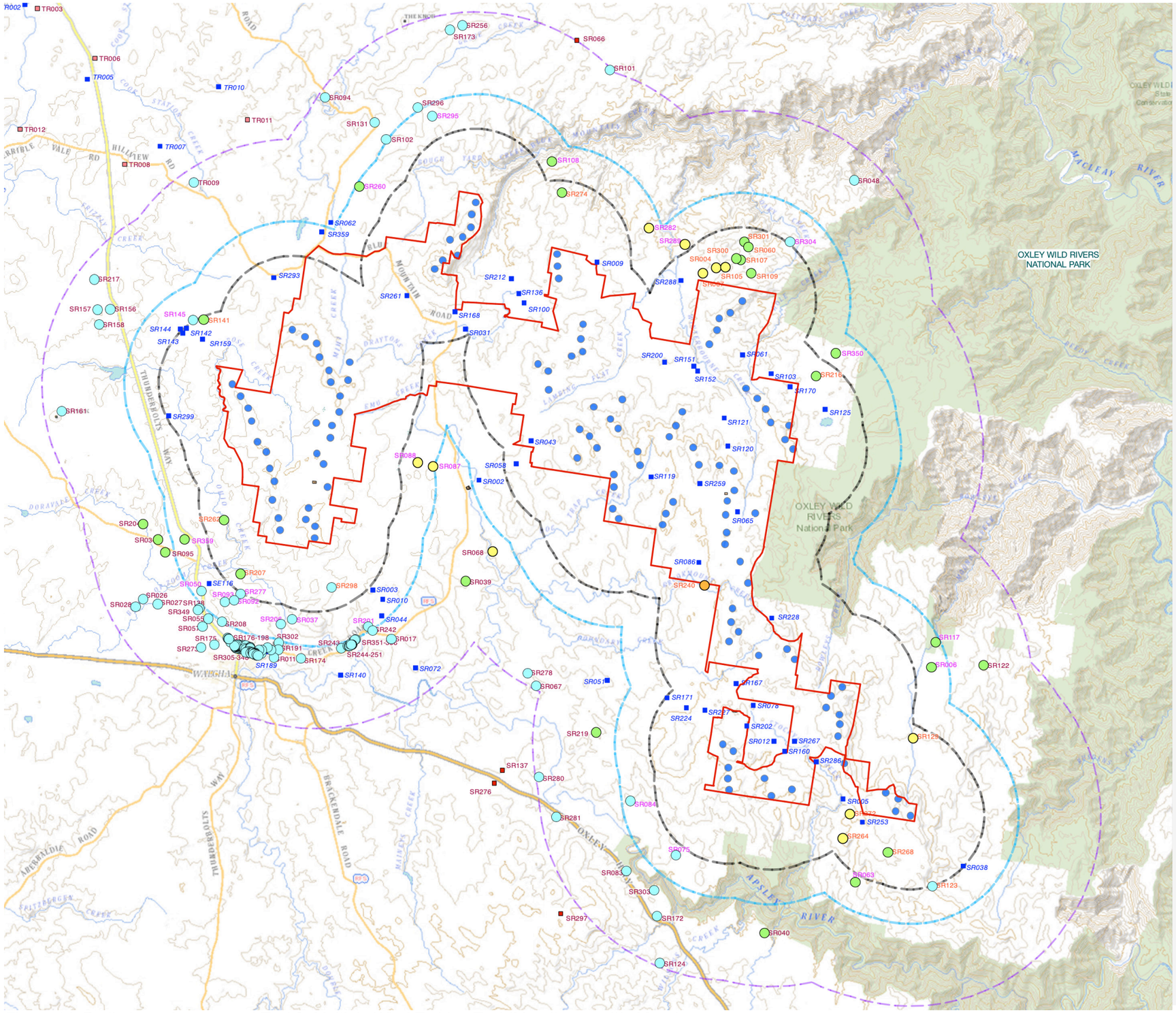
Figure 13: Preliminary Assessment Tool: Multiple Wind Turbines

(Source: Visual Assessment Bulletin)

In accordance with the Visual Assessment 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 turbines will become a focus for assessment in the EIS.

Figure 14 provides an overview of the number of 60º sectors visible from each of the non-involved dwellings identified within 8 kilometres.

6.0 Preliminary Assessment Tools



Multiple Wind Turbine Tool
Winterbourne Wind Farm

LEGEND

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Involved Residences
- 3,100 m from nearest WTG (Black Line of Visual Magnitude)
- 4,550 m from nearest WTG (Blue Line of Visual Magnitude)
- 8,000 m from nearest WTG

Number of Sectors - Based on a 2D Assessment:

(Non-involved Dwellings)

- One (1) 60º sector visible
- Two (2) 60º sectors visible (120º)
- Three (3) 60º sectors visible (180º)
- Four (4) 60º sectors visible (240º)
- Five (5) 60º sectors visible (300º)
- Six (6) 60º sectors visible (360º)

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 turbines.

For detailed assessment of Non-Involved Dwellings identified refer to ***Appendix E.***

N

0 2 4 6 8 10km

Figure 14: Preliminary Assessment Tool 2: Multiple Wind Turbine Tool (Map Source: Six Maps)

6.0 Preliminary Assessment Tools

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 14***) identified 12 non-involved dwellings with more than two (2) 60 degree sectors of turbines within 8,000 metres (see ***Table 7***). Of the 12 non-involved dwellings identified:

- Eleven (11) dwellings have turbines in up to three (3) 60º sectors (up to 180º)
- One (1) in up to four (4) 60º sectors (up to 240º).

The remaining dwellings within 8,000 m of the nearest turbine had two (2) or less 60 degree sectors. This is deemed acceptable in accordance with the Visual Assessment Bulletin.

Further assessment based on topography alone determined that views toward turbines would be reduced to an acceptable number of 60º sectors from two (2) dwellings (SR264 and SR282).

ID	Location	Distance to nearest WTG	Number of Sectors (2D Assessment)	Number of sectors (3D Assessment based on topography alone)
Non-involved dwellings with turbines in up to three (3) 60º Sectors (up to 180º)				
SR004	*'Antlers Rest' 1953 Winterbourne Road*	1.78 km	3	3
SR007	*'Arran Park' 1878 Winterbourne Road*	2.00km	3	3
SR068	*'Emu Creek' 247 Old Brookmount Road*	5.31km	3	3
SR087	*'Gleneagles 1' 91 Gill Road*	4.51km	3	3
SR088	*'Gleneagles 2' 91 Gill Road*	3.82km	3	3
SR105	*1995 Winterbourne Road*	1.60km	3	3
SR129	*'Moona Plains Station' 16 Brooklyn Road*	2.57km	3	3
SR264	*'Tangmalangmaloo' 100 Echo Point Road*	2.49km	3	1
SR272	*'Rivendell' 332 Chinnocks Road*	1.76km	3	3
SR282	*'Weenganimbee' 204 Weenganimbee Road*	4.02km	3	1
SR289	*'Wyobie' 443 Ohio Road*	3.40km	3	3
Non-involved dwellings with turbines in up to four (4) 60º Sectors (up to 240º)				
SR240	*'Straban' 784 Old Brookmount Road*	1.52km	4	4

Table 7: Multiple Wind Turbine Tool

7.0 Zone of Visual Influence

7.1 Zone of Visual Influence

The Visual Assessment Bulletin states: *'the use of Geographic Information Systems (GIS) to facilitate the application of the tools will streamline 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) Zone of Visual Influence (ZVI) diagrams have been prepared for the Winterbourne Wind Farm to illustrate the theoretical visibility of the Project:

- ***Figure 15*** depicts the areas of land from which the Project may be visible and provides an indicative number of wind turbines based on the blade tip height of 230 metres.
- ***Figure 16*** illustrates the areas of land from which the Project may be visible at hub height (maximum height of 149 metres for this Project).

The ZVI (also known as a Zone of Theoretical Influence Model) represents the area over which a development can theoretically be seen, and is based on a Digital Terrain Model (DTM). The ZVI 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).

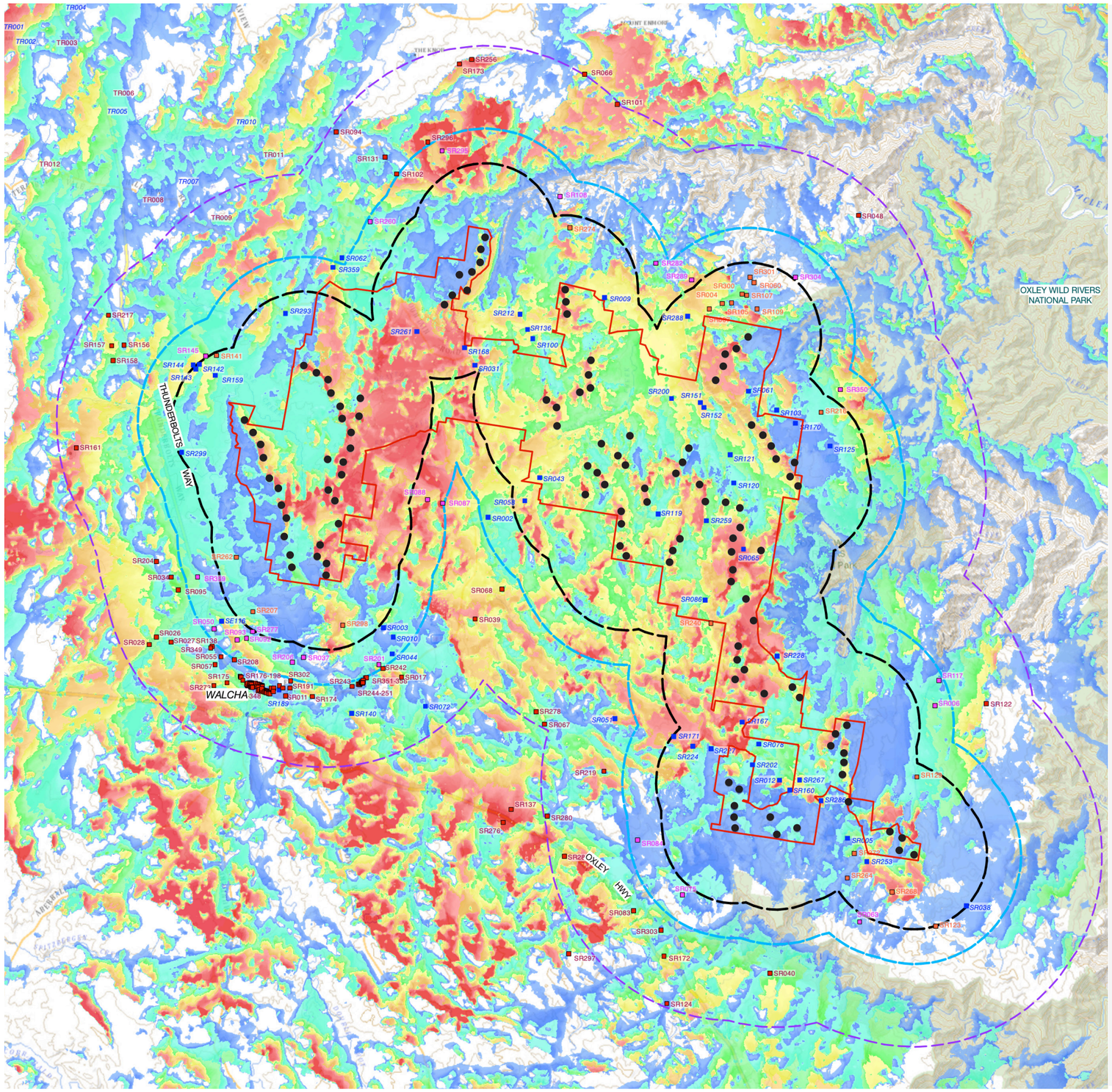
The ZVI has been determined through the use of digital topographic information and 3D modelling software *WindPro*. The ZVI has been assessed to approximately 10km from the project. Although it is possible for the development to be visible from further than 10km away, it is generally accepted that beyond 10km visibility is diminished.

7.2 Overview of Zone of Visual Influence

Due the elevated locations of the proposed wind turbines and the maximum blade tip height of 230m above ground level, the ZVI depicts a large percentage of land immediately surrounding the proposed development from which wind turbines would theoretically be visible (refer ***Figure 15 and 16***).

- The undulating topography that characterises the region results in large areas of land from which views of all or most of the Project would be obstructed by landform.
- The ZVI indicates the proposal will not be visible from large areas of land to the north and east of the proposal site, in particular land associated with Oxley Wild Rivers National Park.
- The ZVI indicates the highest level of visibility is likely to be experienced from elevated areas of land within the development site, to the south of Oxley Highway and to the west.
- The highest level of visibility is likely to be from within the Project Site.

7.0 Zone of Visual Influence



Zone of Visual Influence Blade Tip Height 230m

Winterbourne Wind Farm

LEGEND:

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Involved Residences
- Non-Involved Residences within 3,100 m
- Non-Involved Residences within 4,550 m
- Non-Involved Residences beyond 4,550 m
- Non-Involved Residences beyond 4,550 m (Within 2,000 m of Transmission Line)
- 3,100 m from nearest WTG (Black Line of Visual Magnitude)
- 4,550 m from nearest WTG (Blue Line of Visual Magnitude)
- 8,000 m from nearest WTG

ZVI LEGEND:

- **0**
- **1-19**
- **20-39**
- **40-59**
- **60-79**
- **80-99**
- **100-119**

Note:

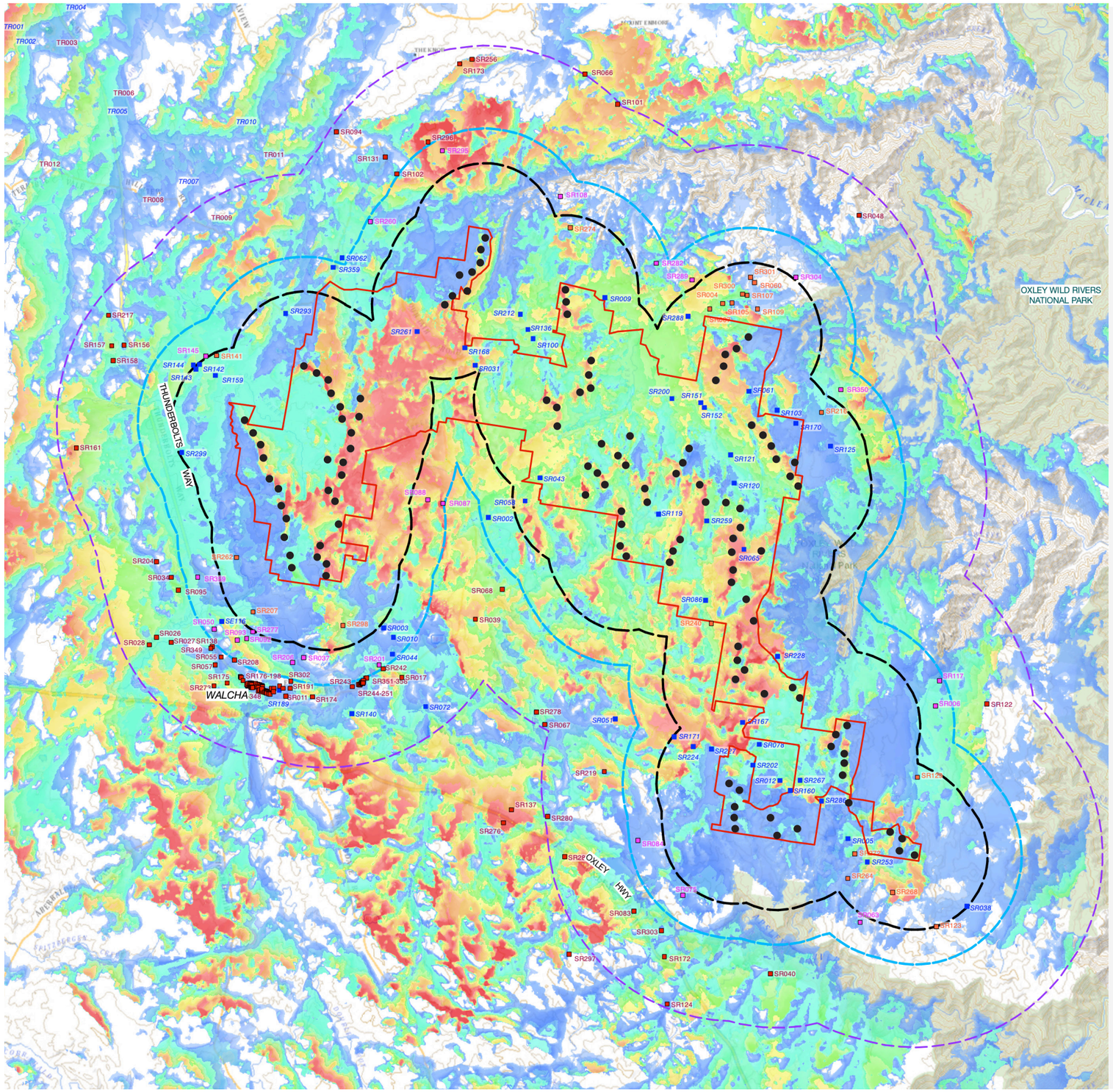
The ZVI is a preliminary assessment tool that represents a bare ground scenario - ie. a landscape without screening, structures or vegetation. As accurate information on the height and coverage of vegetation and buildings is unavailable, it is important to note the ZVI is based solely on topographic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

N

0 2 4 6 8 10km

Figure 15: Zone of Visual Influence - Blade tip (230 metres)

7.0 Zone of Visual Influence



Zone of Visual Influence Hub Height 149m

Winterbourne Wind Farm

LEGEND:

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Involved Residences
- Non-Involved Residences within 3,100 m
- Non-Involved Residences within 4,550 m
- Non-Involved Residences beyond 4,550 m
- Non-Involved Residences beyond 4,550 m (Within 2,000 m of Transmission Line)
- 3,100 m from nearest WTG (Black Line of Visual Magnitude)
- 4,550 m from nearest WTG (Blue Line of Visual Magnitude)
- 8,000 m from nearest WTG

ZVI LEGEND:

- **0**
- **1-19**
- **20-39**
- **40-59**
- **60-79**
- **80-99**
- **100-119**

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 16: Zone of Visual Influence - Hub Height (149m)

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 ***56*** viewpoints were taken during the field work process. Viewpoints have been carefully selected to be representative of the range of views within the Study Area. The selection of viewpoints is generally informed by the topographical maps, field work observations and other relevant influences such as access, residences, landscape character and the popularity of vantage points. 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 from accessible public land (typically walking tracks, roads and lookouts) which were identified as having a potentially high visual impact through the desktop review process. Some viewpoints were recorded from private property with consent from landowners.

The viewpoint locations assessed for the Winterbourne Wind Farm have included key viewpoints identified through the extensive community engagement throughout the development, most of which were recorded in the PVIA prepared in by Green Bean in 2020.

The Visual Assessment 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.

Selected viewpoint assessment locations are shown on ***Figure 17***.

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 8***.

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 17*** 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 C.

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**

Table 8: Photography Specifications

8.0 Public Viewpoint Analysis

Public Viewpoint Analysis Locations

Winterbourne Wind Farm

LEGEND:

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Involved Residences
- Non-Involved Residences within 3,100 m
- Non-Involved Residences within 4,550 m
- Non-Involved Residences beyond 4,550 m
- Non-Involved Residences beyond 4,550 m (Within 2,000 m of Transmission Line)
- 3,100 m from nearest WTG (Black Line of Visual Magnitude)
- 4,550 m from nearest WTG (Blue Line of Visual Magnitude)
- 8,000 m from nearest WTG
- Public Viewpoint Assessment Location
- Public Viewpoint Assessment Locations within World Heritage Area and Oxley Wild Rivers National Park

Note:

Refer to Appendix C for Viewpoint Analysis.

Detailed location plans are provided for each viewpoint.

N

Figure 17: Viewpoint Analysis Locations (Map Source: Six Maps)

8.0 Public Viewpoint Analysis

8.3 Visual Influence Zone (VIZ)

Visual Influence Zones have been established from the Project Site from dwellings and key viewpoints. This establishes the relative landscape significance against which the potential impacts of wind turbines 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 Visual Influence Zone (see ***Figure 18*** below and refer to tables in ***Appendix A***). An evaluation using the corresponding visual performance objectives *(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.

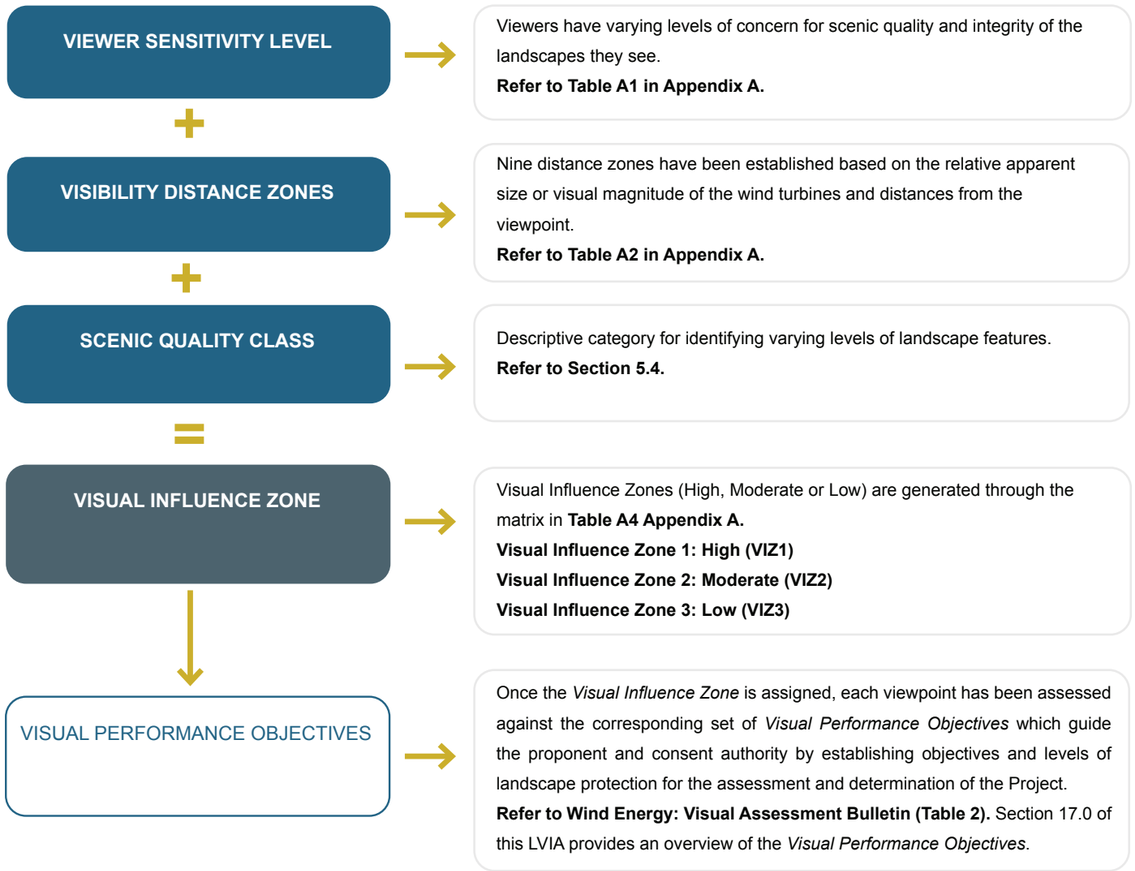


Figure 18: Methodology for determining Visual Influence Zone (VIZ)

8.4 Summary of Viewpoint Analysis

The 56 viewpoints assessed for the purpose of this LVIA were taken from varying distances and locations surrounding the Project. Each viewpoint was assigned a Visual Influence Zone (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 C***. Photomontages have been undertaken from eleven (11) public viewpoints to illustrate the potential visual impacts refer to ***Section 10.0*** and ***Appendix D***.

Visual Influence Zone 2 (VIZ1):
No viewpoints were rated as Visual Influence Zone 1 (VIZ1).

Visual Influence Zone 2 (VIZ2):
A total of 24 viewpoints were rated as Visual Influence Zone 2 (VIZ2). The visual performance objectives have been assessed for each of the viewpoints in accordance with the Visual Assessment Bulletin.

Visual Influence Zone 3 (VIZ3):
A total of 32 viewpoints were rated as VIZ3 in accordance with the methodology in the Visual Assessment Bulletin.

9.0 Dwelling Assessments

9.1 Overview of Dwelling Assessment

The Visual Assessment Bulletin states: *all key public viewpoints and individual dwellings within the 'visual catchment' should be identified and assessed.*

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:

- 20 non-involved dwellings have been identified within 3,100 metres of a proposed wind turbine location (within the black line).
- 23 non-involved dwellings were identified within 3,100 - 4,550 metres of a proposed wind turbine (within the blue line).
- 1 non-involved dwellings were identified beyond 4,550 metres of a proposed wind turbine with more than two sectors identified.

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.*

Of these non-involved dwellings within the blue and black lines the following VIZ ratings have been applied as per the Bulletin and are summarised below.

Visual Influence Zone 1 (VIZ1):
A total of 10 dwellings were rated as Visual Influence Zone 1 (VIZ1). The visual performance objectives have been assessed for each of the dwellings in accordance with the Visual Assessment Bulletin. Visual Influence Zone 1 (VIZ1).

Visual Influence Zone 2 (VIZ2):
A total of 33 dwellings were rated as Visual Influence Zone 2 (VIZ2). The visual performance objectives have been assessed for each of the dwellings in accordance with the Visual Assessment Bulletin.

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 turbines 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 turbines 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 turbines 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 clusters of dwellings.
Step 6. Evaluation of VIZ Objectives	In accordance with the Bulletin, the Visual Influence Zone was defined and the relevant objectives were evaluated for each dwelling based on the assessment.
Step 7. Visual Effect Rating	A visual effect rating is applied to each dwelling with regards to the parameters outlined in ***Section 9.3***.
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 12.: *Dwelling Assessment Process*

9.0 Dwelling Assessments

9.2 Study Method for Dwelling Assessment

The Bulletin states: *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'.*

Table 12 provides an overview of the study method for undertaking the dwelling assessment for each dwelling identified within the visual catchment.

With the advice of Moir LA, the proponent offered on-site visual assessments from private properties within 4,550 m metres of the proposed development and in consultation with a number of concerned landowners outside of the blue line.

With consent from landowners, Moir LA undertook detailed site inspection for a total of ***26 dwellings*** across several separate visits. These visits took place on the 28th and 29th of October 2021, the 6th November 2021 and 16th November 2021 and the 6th December 2021.

9.2.1 Dwellings within 3,100 metres of the nearest turbine

A total of ***twenty (20) non-involved dwellings*** were identified within 3,100 metres of a proposed turbine. Of these, access was granted to a total of 16 non-involved dwellings. The purpose of the site inspections was to undertake photographic assessments from areas identified by the landowner as having concern for visual impact and ground truth information identified through the desktop assessment. Where access was not granted to the property, Moir LA have undertaken a desktop assessment utilising 3D 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 14*** and detailed assessments have been included in ***Appendix E*** and summarised in ***Section 9.4***.

9.2.2 Dwellings within 4,550m of the nearest turbine

A total of ***twenty three (23)*** non-involved dwellings were identified within 3,100 - 4,550m of a proposed turbine. ERM offered on-site visual assessments from most of these dwellings with potential visual impacts identified. Access was granted by ***six (6)*** land owners and Moir LA attended these properties to undertake a detailed site inspection.

An overview of the visual assessment for each of these dwellings has been outlined in ***Table 15*** and detailed assessments have been included in ***Appendix E*** and summarised in ***Section 9.4***.

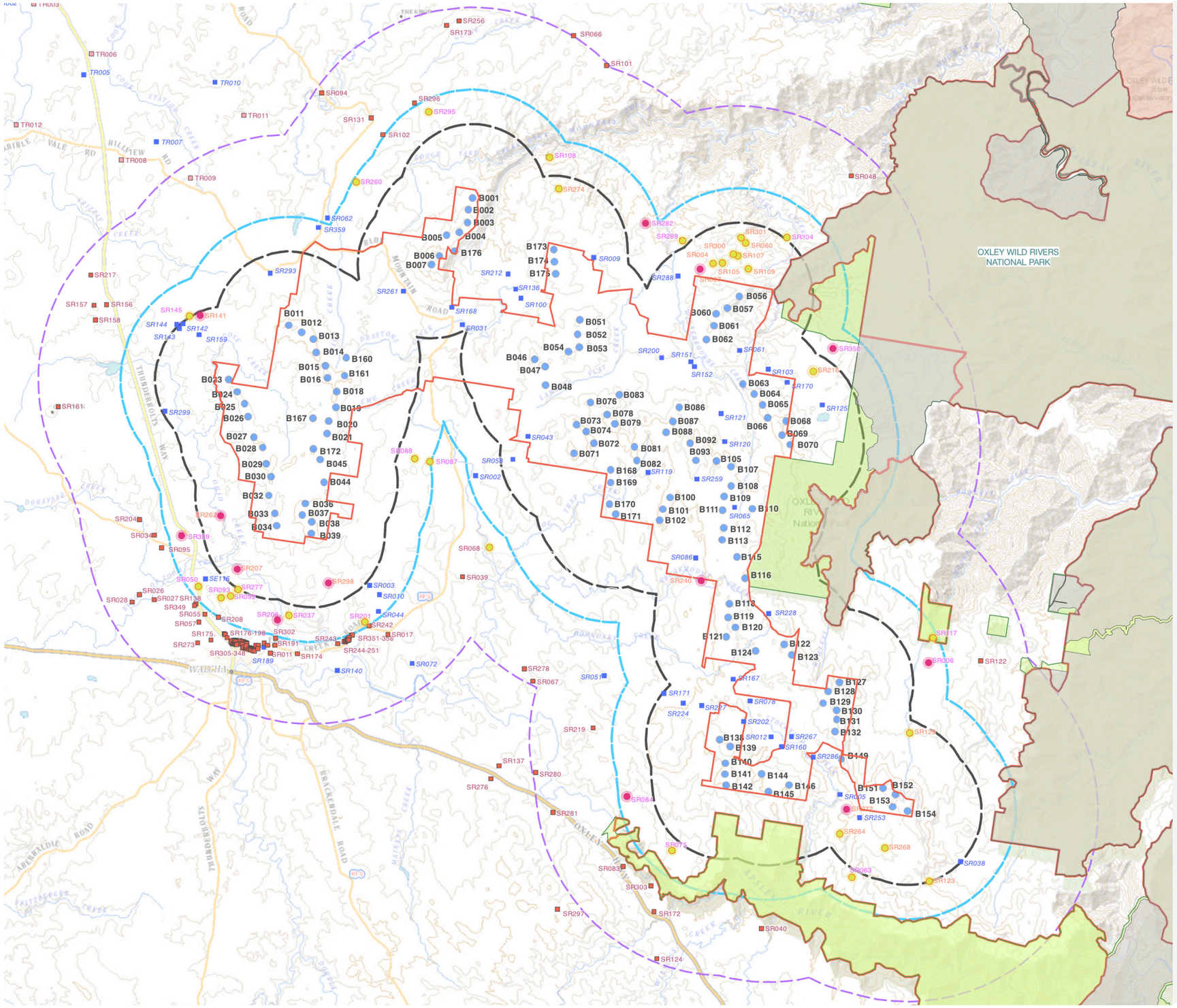
9.2.3 Dwellings in excess of 4,550m of the nearest turbine

Four (4) additional landowners with dwellings in excess of 4,550m requested a visual assessment due to concerns for visual impact. Moir LA undertook a site inspection on the 28th and 29th of October 2021. The outcomes of these demonstrated low visual impact and therefore were used for community consultation purposes only.

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 4,550m of the Project ***(refer to Section 7.0)***.

One (1) non-involved dwellings was identified beyond 4,550 metres of a proposed wind turbine with more than two sectors identified. A desktop assessment as been completed for this dwelling and included as part of ***Appendix E.***

9.0 Dwelling Assessments



Dwelling Assessment Locations

Winterbourne Wind Farm

LEGEND:

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Involved Residences
- Non-Involved Residences within 3,100 m
- Non-Involved Residences within 4,550 m
- Non-Involved Residences beyond 4,550 m
- Non-Involved Residences beyond 4,550 m (Within 2,000 m of Transmission Line)
- 3,100 m from nearest WTG (Black Line of Visual Magnitude)
- 4,550 m from nearest WTG (Blue Line of Visual Magnitude)
- 8,000 m from nearest WTG
- Photomontage from Dwelling *Refer to Appendix E*
- Desktop Assessment from Dwelling *Refer to Appendix E*

N

0 2 4 6 8 10km

Figure 19: Dwelling Assessment Locations

9.0 Dwelling Assessments

9.3 Visual Impact Rating

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 13** 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 Landscape and Visual Impact Assessment (LVIA). 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				
	NIL	LOW	MODERATE	HIGH
Distance		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 will not be visible.	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 13: Visual Impact Rating

9.0 Dwelling Assessments

Non-involved Dwellings located within 3,100 m of nearest turbine										
ID	**Distance to nearest turbine**	**Nearest turbine**	**Total number of turbines within 3100m**	**Turbines within 3100m:**	**Theoretical number of 60º Sectors**	**Number of 60º sectors**	**Number of visible turbines within 8000m of dwelling:**	**Visual Impact Rating**	**Shadow Flicker:**	**MLA Comments**
	Based on 2D Assessment:					**3D Assessment**				**Assessment:**
SR004	1.78 km	Turbine B056	4	*B056, B057, B060, B061*	3	3	14 turbines (14 at tip 11 at hub)	***Low***	***Nil***	***Refer to Appendix E.1***
SR007	2.00 km	Turbine B060	5	*B056, B057, B060, B061, B062*	3	3	23 turbines (23 at tip 20 at hub)	***Moderate***	***Nil***	***Refer to Appendix E.2***
SR060	2.28 km	Turbine B056	2	*B056, B057*	2	0	0 turbines (0 at tip 0 at hub)	***Nil***	***Nil***	***Refer to Appendix E.3***
SR105	1.60 km	Turbine B056	4	*B056, B057, B060, B061*	3	3	8 turbines (8 at tip 7 at hub)	***Nil***	***Nil***	***Refer to Appendix E.4***
SR107	1.74 km	Turbine B056	3	*B056, B057, B060*	2	2	10 turbines (10 at tip 7 at hub)	***Nil***	***Nil***	***Refer to Appendix E.5***
SR109	1.23 km	Turbine B056	4	*B056, B057, B060, B061*	2	1	1 turbines (1 at tip 0 at hub)	***Nil***	***Nil***	***Refer to Appendix E.6***
SR123	3.10 km	Turbine B154	1	*B0154*	1	1	4 turbines (4 at tip 4 at hub)	***Low***	***Nil***	***Refer to Appendix E.7***
SR129	2.57 km	Turbine B152	3	*B0149, B0151, B0152*	3	3	18 turbines (18 at tip 13 at hub)	***Low***	***Nil***	***Refer to Appendix E.8***
SR141	2.97 km	Turbine B023	1	*B023*	2	2	23 turbines (23 at tip 23 at hub)	***Nil***	***Nil***	***Refer to Appendix E.9***
SR207	2.48 km	B034	2	*B033, B034*	2	2	22 turbines (22 at tip 19 at hub)	***High***	***Nil***	***Refer to Appendix E.10***
SR216	2.44 km	B068	6	*B063, B064, B065, B066, B068, B069*	2	2	20 turbines (20 at tip 14 at hub)	***Low***	***Nil***	***Refer to Appendix E.11***
SR240	1.52 km	B118	10	*B0102, B0111, B0112, B0113, B0115, B0116, B0118, B0119, B0120, B0121*	4	4	37 turbines (37 at tip 33 at hub)	***Moderate***	***20:07 Hours / Year***	***Refer to Appendix E.12***
SR262	2.20 km	B032	5	*B029, B030, B032, B033, B034*	2	2	24 turbines (24 at tip 18 at hub)	***High***	***Nil***	***Refer to Appendix E.13***
SR264	2.49 km	B151	5	*B0146, B0151, B0152, B0153, B0154*	3	1	1 turbine (1 at tip 1 at hub)	***Nil***	***Nil***	***Refer to Appendix E.14***
SR268	1.77 km	B154	4	*B0151, B0152, B0153, B0154*	2	2	18 turbines (18 at tip 18 at hub)	***High***	***Nil***	***Refer to Appendix E.15***
SR272	1.76 km	B151	6	*B0146, B0149, B0151, B0152, B0153, B0154*	3	3	22 turbines (22 at tip 22 at hub)	***Moderate***	***29:34 Hours / Year***	***Refer to Appendix E.16***

***Table 14:* Overview of Non-involved Dwelling Assessments within 3,100 m**

Non-involved Dwellings located within 3,100 m of nearest turbine										
ID	**Distance to nearest turbine**	**Nearest turbine**	**Total number of turbines within 3100m**	**Turbines within 3100m:**	**Theoretical number of 60º Sectors**	**Number of 60º sectors**	**Number of visible turbines within 8000m of dwelling:**	**Visual Impact Rating**	**Shadow Flicker:**	**MLA Comments**
	Based on 2D Assessment:					**3D Assessment**				**Assessment:**
SR274	2.60 km	B173	2	*B0173, B0174*	2	2	17 turbines (17 at tip 17 at hub)	***Moderate***	***Nil***	***Refer to Appendix E.17***
SR298	2.20 km	B039	3	*B037, B038, B039*	1	1	19 turbines (19 at tip 12 at hub)	***Moderate***	***Nil***	***Refer to Appendix E.18***
SR300	1.80 km	B056	4	*B056, B057, B060, B061*	2	2	10 turbines (10 at tip 8 at hub)	***Low***	***Nil***	***Refer to Appendix E.19***
SR301	2.49 km	B056	2	*B056, B057*	2	2	3 turbines (3 at tip 1 at hub)	***Nil***	***Nil***	***Refer to Appendix E.20***

Table 14 (Continued): ***Overview of Non-involved Dwelling Assessments within 3,100 m***

9.0 Dwelling Assessments

Non-involved Dwellings located within 3,100 - 4,550m of the nearest turbine										
ID	**Distance to Nearest Turbine**	**Nearest turbine**	**Total number of turbines within 4550m**	**Turbines within 4550m:**	**Theoretical number of 60º Sectors**	**Number of 60º sectors**	**Number of visible turbines within 8000m of dwelling:**	**Visual Impact Rating**	**Shadow Flicker:**	**MLA Comments**
	Based on 2D Assessment:					**3D Assessment**				**Desktop Assessment:**
SR006	3.64 km	Turbine B127	3	*B127, B128, B130*	2	2	15 turbines (15 at tip 14 at hub)	***Moderate***	***Nil***	***Refer to Appendix E.21***
SR037	3.56 km	Turbine B039	5	*B033, B034, B037, B038, B039*	1	1	15 turbines (15 at tip 11 at hub)	***Nil***	***Nil***	***Refer to Appendix E.22***
SR050	4.19 km	Turbine B034	2	*B033, B034*	1	1	16 turbines (16 at tip 16 at hub)	***Moderate***	***Nil***	***Refer to Appendix E.23***
SR063	3.43 km	Turbine B153	4	*B151, B152, B153, B154*	2	2	12 turbines (12 at tip 08 at hub)	***Nil***	***Nil***	***Refer to Appendix E.24***
SR075	3.56 km	Turbine B142	3	*B140, B141, B142*	1	1	8 turbines (8 at tip 8 at hub)	***Moderate***	***Nil***	***Refer to Appendix E.25***
SR084	4.17 km	Turbine B142	3	*B140, B141, B142*	1	1	8 turbines (8 at tip 6 at hub)	***Nil***	***Nil***	***Refer to Appendix E.26***
SR087	4.51 km	Turbine B044	1	*B021*	3	3	42 turbines (42 at tip 42 at hub)	***High***	***Nil***	***Refer to Appendix E.27***
SR088	3.82km	Turbine B021	7	*B044, B045, B172, B021, B020, B019, B018*	3	3	39 turbines (39 at tip 39 at hub)	***High***	***Nil***	***Refer to Appendix E.28***
SR092	3.53 km	Turbine B034	3	*B033, B034, B039*	1	1	16 turbines (16 at tip 16 at hub)	***Low***	***Nil***	***Refer to Appendix E.29***
SR093	3.82 km	Turbine B034	2	*B033, B034*	1	1	15 turbines (15 at tip 15 at hub)	***Moderate***	***Nil***	***Refer to Appendix E.30***
SR108	3.63 km	Turbine B001	5	*B001, B002, B003, B173, B174*	2	1	5 turbines (5 at tip 0 at hub)	***Nil***	***Nil***	***Refer to Appendix E.31***
SR117	4.35 km	Turbine B127	1	*B127*	2	2	14 turbines (14 at tip 14 at hub)	***Low***	***Nil***	***Refer to Appendix E.32***
SR145	3.16 km	Turbine B023	3	*B023, B024, B025*	1	1	22 turbines (22 at tip at 22 hub)	***Low***	***Nil***	***Refer to Appendix E.33***

Table 15: ***Overview of Non-involved Dwelling Assessments within 3,100 - 4,550 m & with three of more segments within 8km of the nearest turbine***

9.0 Dwelling Assessments

Non-involved Dwellings located within 3,100 - 4,550m of the nearest turbine										
ID	**Distance to Nearest Turbine**	**Nearest turbine**	**Total number of turbines within 4550m**	**Turbines within 4550m:**	**Theoretical number of 60º Sectors**	**Number of 60º sectors**	**Number of visible turbines within 8000m of dwelling:**	**Visual Impact Rating**	**Shadow Flicker:**	**MLA Comments**
	Based on 2D Assessment:					**3D Assessment**				**Desktop Assessment:**
SR201	4.36 km	Turbine B039	1	*B039*	1	1	2 turbines (2 at tip at 0 hub)	***Nil***	***Nil***	***Refer to Appendix E.34***
SR206	4.00 km	Turbine B039	4	*B034, B033, B039, B038*	1	1	14 turbines (14 at tip at 12 hub)	***Low***	***Nil***	***Refer to Appendix E.35***
SR260	4.41 km	Turbine B005	1	*B005*	2	2	12 turbines (12 at tip at 09 hub)	***Low***	***Nil***	***Refer to Appendix E.36***
SR277	3.15 km	Turbine B034	6	*B034, B033, B032, B039, B038, B037*	1	1	4 turbines (4 at tip at 0 hub)	***Nil***	***Nil***	***Refer to Appendix E.37***
SR282	4.02 km	Turbine B173	3	*B173, B174, B175*	3	1	7 turbines (7 at tip 7 at hub)	***Nil***	***Nil***	***Refer to Appendix E.38***
SR289	3.40 km	Turbine B056	5	*B056, B057, B060, B061, B062*	3	3	22 turbines (22 at tip 22 at hub)	***Moderate***	***Nil***	***Refer to Appendix E.39***
SR295	4.07 km	Turbine B001	2	*B001, B002*	1	1	9 turbines (9 at tip at 9 hub)	***Low***	***Nil***	***Refer to Appendix E.40***
SR304	3.21 km	Turbine B056	3	*B056, B057, B060*	1	1	1 turbines (1 at tip at 0 hub)	***Nil***	***Nil***	***Refer to Appendix E.41***
SR350	3.63 km	Turbine B068	7	*B063, B064, B065, B066, B068, B069, B070*	2	2	22 turbines (22 at tip at 20 hub)	***Moderate***	***Nil***	***Refer to Appendix E.42***
SR359	4.03 km	Turbine B034	3	*B030, B032, B033, B034*	2	2	21 turbines (21 at tip at 21 hub)	***Moderate***	***Nil***	***Refer to Appendix E.43***

Non-involved Dwellings located outside 4,550m of the nearest turbine (more than 2 sectors)									
ID	**Distance to Nearest Turbine**	**Nearest turbine**	**Total number of turbines within 8000m**	**Theoretical number of 60º Sectors**	**Number of 60º sectors**	**Number of visible turbines within 8000m of dwelling:**	**Visual Impact Rating**	**Shadow Flicker:**	**MLA Comments**
	Based on 2D Assessment:				**3D Assessment**				**Desktop Assessment:**
SR068	5.30 km	B034	24	3	3	21 turbines (21 at tip at 21 hub)	***Low***	***Nil***	***Refer to Appendix E.44***

Table 15 (Continued): Overview of Non-involved Dwelling Assessments within 3,100 - 4,550 m & with three of more segments within 8km of the nearest turbine

9.0 Dwelling Assessments

9.4 Summary of Dwelling Assessment

9.4.1 Summary of non-involved dwellings within 3,100 metres (Black line of Visual Magnitude)

A total of **20 non-involved dwellings** were identified within 3,100 metres of a proposed turbine. Representative dwelling assessments have been undertaken for all non-involved dwellings within 3,100 metres of the nearest turbine.

Of those assessed:

- Seven (7) were rated as nil / negligible visual impact rating,
- Five (5) were rated as having a low visual impact rating,
- Five (5) were assessed as having a moderate visual impact rating,
- Three (3) were assessed as having a high visual impact rating.

An overview of the visual assessment for each of these dwellings and detailed assessments have been included in **Appendix E.**

9.4.2 Summary of non-involved dwellings between 3,100 - 4,550 metres (Blue line of Visual Magnitude)

A total of ***23 non-involved dwellings*** were identified within 3,100 - 4,550 metres of a proposed turbine. Representative dwelling assessment have been undertaken for all non-involved dwellings within the 3100 - 4550 metres of the nearest turbine.

Of those assessed:

- Eight (8) were assessed as having nil / negligible visual impact rating,
- Six (6) were assessed as having a low visual impact rating,
- Seven (7) were assessed as having a moderate visual impact rating,
- Two (2) were assessed as having a high visual impact rating.

An overview of the visual assessment for each of these representative dwellings has been provided in **Appendix E.**

9.4.3 Summary of non-involved dwellings in excess of 4,550 metres

One (1) non-involved dwelling (SR068) was identified in excess of 4,550 m with the potential to view turbines in three (3) or more 60 degree sectors. An assessment of this dwelling is provided in **Appendix E (E.44).** This assessment found this dwelling as having a low visual impact rating.

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 4,550 metres of the Project (refer to **Appendix C**).

The Visual Assessment 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.

Assessment from the township of Walcha has been provided in **Appendix F**.

10.0 Photomontages & Wire Frame Diagrams

10.1 Overview of Photomontages and Wire Frame Diagrams

10.1.1 Photomontages

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.*

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.

Photomontages prepared for the Project have been included as Appendix D.

10.1.2 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 turbines 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 or 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 dense vegetation limits the capacity to align photographs accurately.

10.2 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:

- 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;
- The images provided give a reasonable impression of the scale of the turbines and the distance to the turbines, 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.

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

10.3 Photomontage & Wire Frame Diagram Selection Process

A total of ***Twenty (20)*** viewpoints have been selected for the preparation of photomontages/wireframes to best illustrate the potential appearance of the proposed wind farm from varying distances and locations with differing views (refer to ***Figure 21***).

A total of ***eleven (11)*** public viewpoints (which includes **two (2)** photomontages prepared to demonstrate the visual impact of the Project on the Oxley Wild Rivers National Park and **two (2)** wireframes have been prepared to demonstrate the visual impact of the Project on the Gondwana Rainforest Area) and ***nine (9)*** private viewpoints locations have been selected for the preparation of visual photomontages 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.

10.3.1 Overview of Photomontages and Wireframes from World Heritage Area and Oxley Wild Rivers National Park

Of the four (4) viewpoint montage and wireframe locations selected within the World Heritage Area (WHA) and the Oxley Wild Rivers National Park (OWRNP), McMillan Lookout located approximately 4.36km (refer ***Appendix D Photomontage 17***) and Aspley Gorge Bridge located approximately 4.63km from nearest turbine (refer ***Appendix D Photomontage 18***). Intervening vegetation and topography

10.0 Photomontages & Wire Frame Diagrams

associated with the surrounding landscape will fragment views to the turbines from these locations. Two (2) wireframe diagrams prepared from Green Gully lookout (approximately 22.5km east) and The Rocks Lookout (approximately 21.6km east) have been prepared to indicate visual impact on the World Heritage Area adjoining the Project. Due to the distance between the Project and these location, the Project will be indiscernible from these locations. Additionally, intervening topography and vegetation will obscure views towards the Project from these locations.

10.4 Photomontage Development Methodology

The process for generating the photomontages involves computer generation of a wire frame perspective view of the Wind Turbines 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 20***.

The photomontages are based on a worst case scenario of a maximum turbine height dimension of 230m with a hub height of 149m and rotor diameter of 162m, without the inclusion of the proposed mitigation methods.

Moir Landscape Architecture 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 wind turbines and associated infrastructure (substations, transmission lines, wind masts etc.) are modelled and sited in the 3D model to scale.

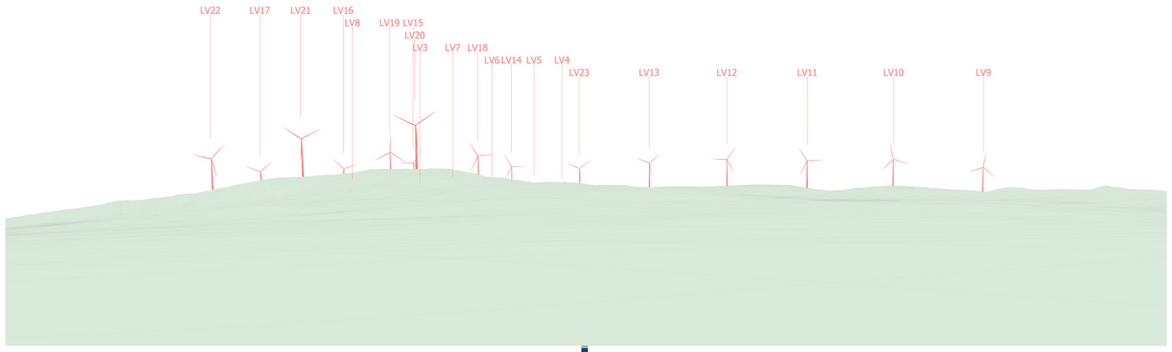
Step 2: Align Photograph and Model

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.

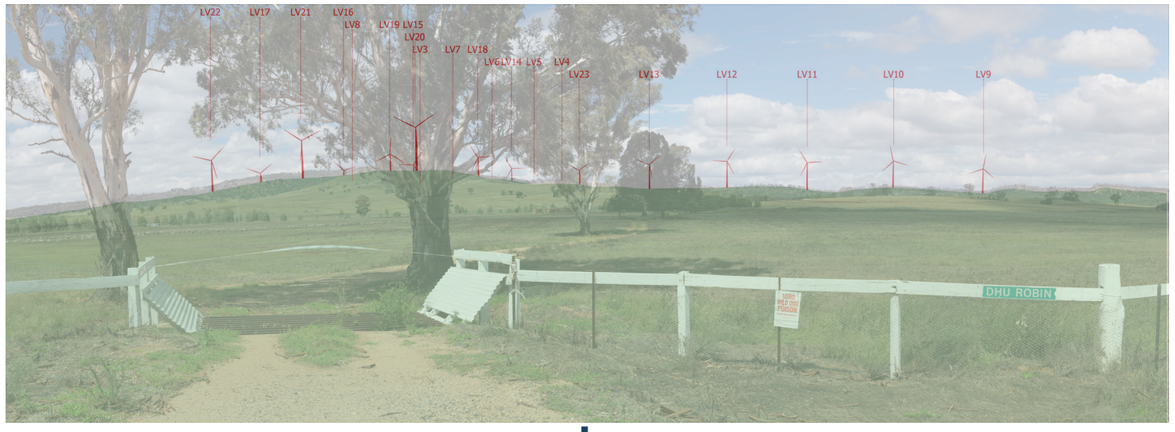
Step 3: Render Photomontage

The software calculates the position of the sun based on the time and date of photograph and renders the wind turbines 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.

Step 1: Develop 3D Model (Wire Frame Diagram)



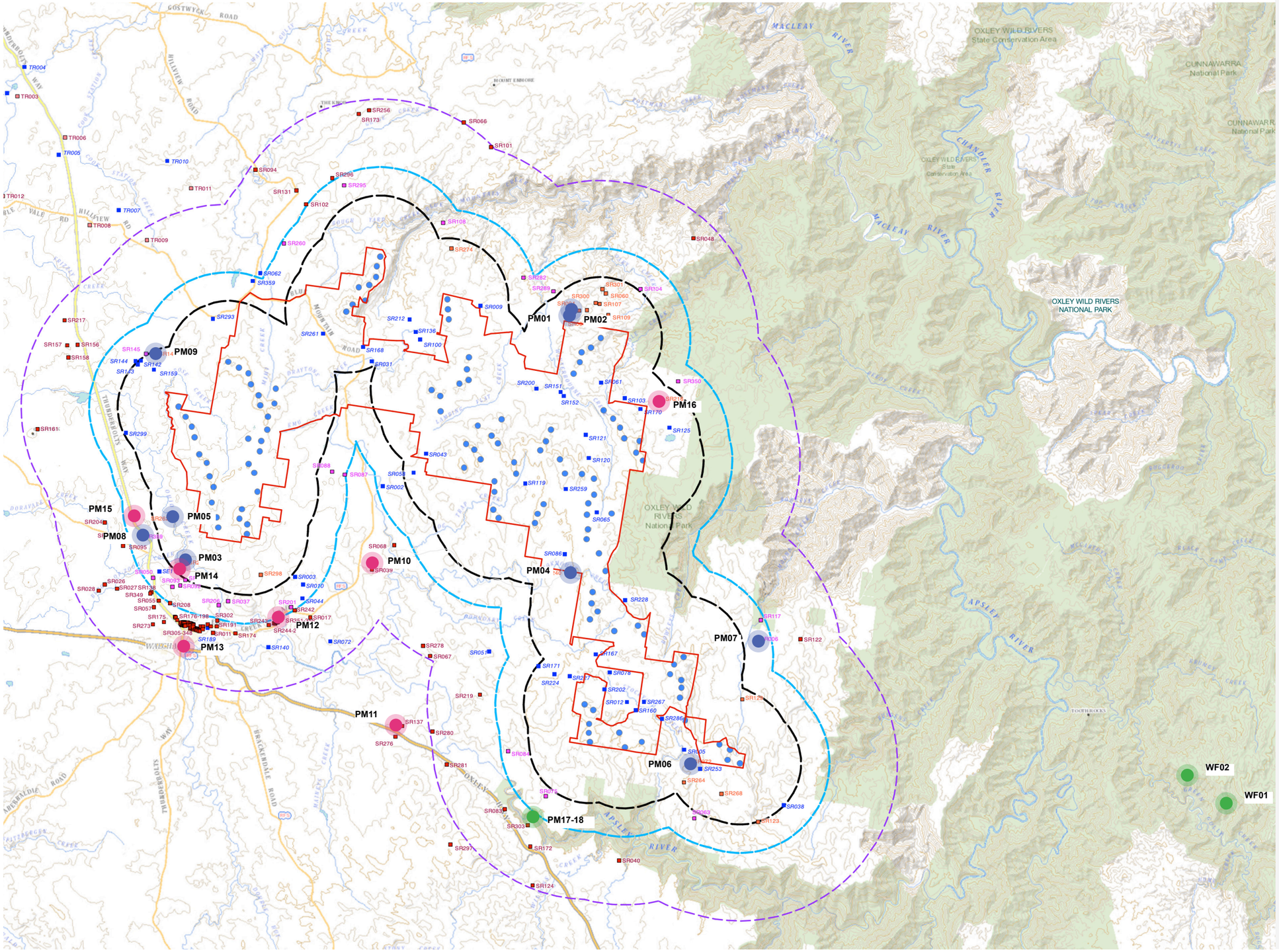
Step 2: Align photograph and model



Step 3: Render Photomontage

Figure 20: Photomontage Development Process

10.0 Photomontages & Wire Frame Diagrams



Public and Private Photomontage Locations

Winterbourne Wind Farm

LEGEND:

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Involved Residences
- Non-Involved Residences within 3,100 m
- Non-Involved Residences within 4,550 m
- Non-Involved Residences beyond 4,550 m
- Non-Involved Residences beyond 4,550 m (Within 2,000 m of Transmission Line)
- 3,100 m from nearest WTG (Black Line of Visual Magnitude)
- 4,550 m from nearest WTG (Blue Line of Visual Magnitude)
- 8,000 m from nearest WTG
- Public Viewpoint Montages *Refer to Appendix D*
- Private Viewpoint Montages *Refer to Appendix D and Appendix E*
- World Heritage Area / Oxley Wild Rivers National Parks Photomontage & Wireframes *Refer to Appendix D*

N

Note:

Refer to Appendix D for Photomontages

Detailed location plans are provided for each photomontage location.

Figure 21: Photomontage/Wireframe Locations (Map Source: Six Maps)

10.0 Photomontages & Wire Frame Diagrams

Representative Dwelling ID	Corresponding Photomontage / Wireframe
Dwellings and key Public Viewpoint locations within 4.55 km of the nearest turbine	
SR007	*Photomontage 01 , Photomontage 02*
SR207	*Photomontage 03*
SR240	*Photomontage 04*
SR262	*Photomontage 05*
SR272	*Photomontage 06*
SR006	*Photomontage 07*
SR359	*Photomontage 08*
SR141	*Photomontage 09*
SR250, SR251	*Photomontage 12*
SR207 and SR 277	*Photomontage 14*
SR204	*Photomontage 15*
SR216	*Photomontage 16*
Photomontages / Wireframes - World Heritage Area	
McMillan Lookout, Walcha	*Photomontage 17*
Dwellings and key Public Viewpoint locations exceeding 4.55 km of the nearest turbine	
SR039	*Photomontage 10*
SR137, SR276	*Photomontage 11*
Fitzroy Street, Walcha	*Photomontage 13*
Photomontages / Wireframes - World Heritage Area	
Aspley Gorge Bridge, Walcha	*Photomontage 18*
Green Gully Lookout	*Wireframe 01*
The Rocks Lookout	*Wireframe 02*

***Table 16:* Overview Photomontages and Wireframe Diagrams**

11.0 Shadow Flicker & Blade Glint Assessment

11.1 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 turbine 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.*

11.2 Shadow Flicker Assessment Methodology

As there is no methodology for the assessment of shadow flicker in the Bulletin, Moir LA have referred to the Draft National Wind Energy Guidelines (2010) to define the parameters for the assessment.

Modelling of the shadow flicker was conducted using specialist industry software (Wind Pro), assessing the largest turbine (based on a 230m 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
Grid size	1 meter

Table 17: Shadow Flicker Assessment Parameters

It is important to note the shadow flicker modelling undertaken for Winterbourne Wind Farm 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 turbine(s) (window locations, living area locations etc);
- the extent of natural or screening vegetation between the turbine(s) and the receptor;
- the existence of other screening elements (buildings, structures etc) between the turbine(s) and the receptor;
- the time of year;
- the proportion of daylight hours in which the turbines operate, and;
- the frequency of bright sunshine and cloudless skies (particularly at low elevations above the horizon).

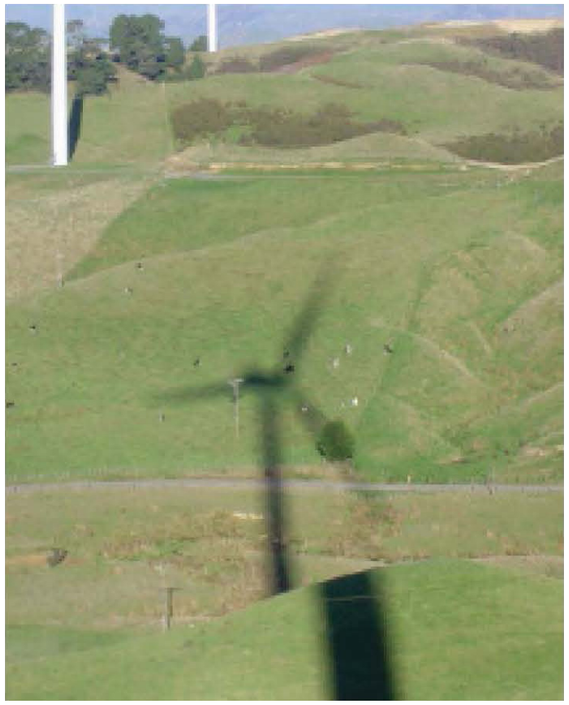


Image 23: Example of shadow intensity variation with distance.

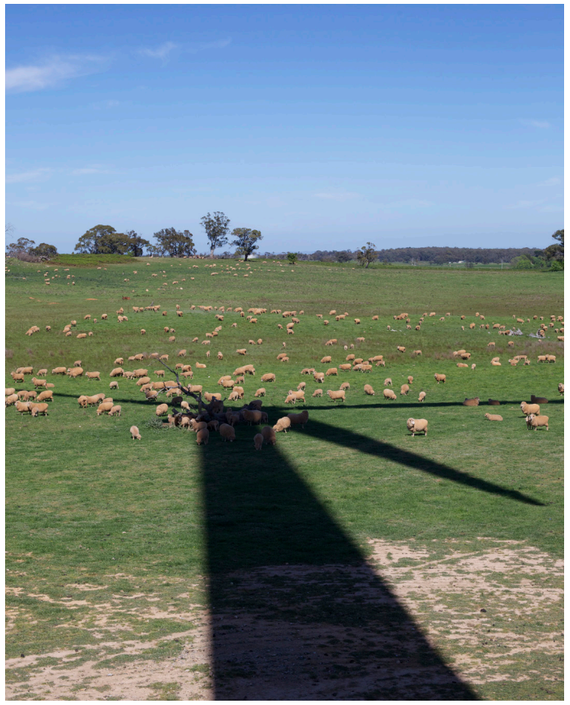
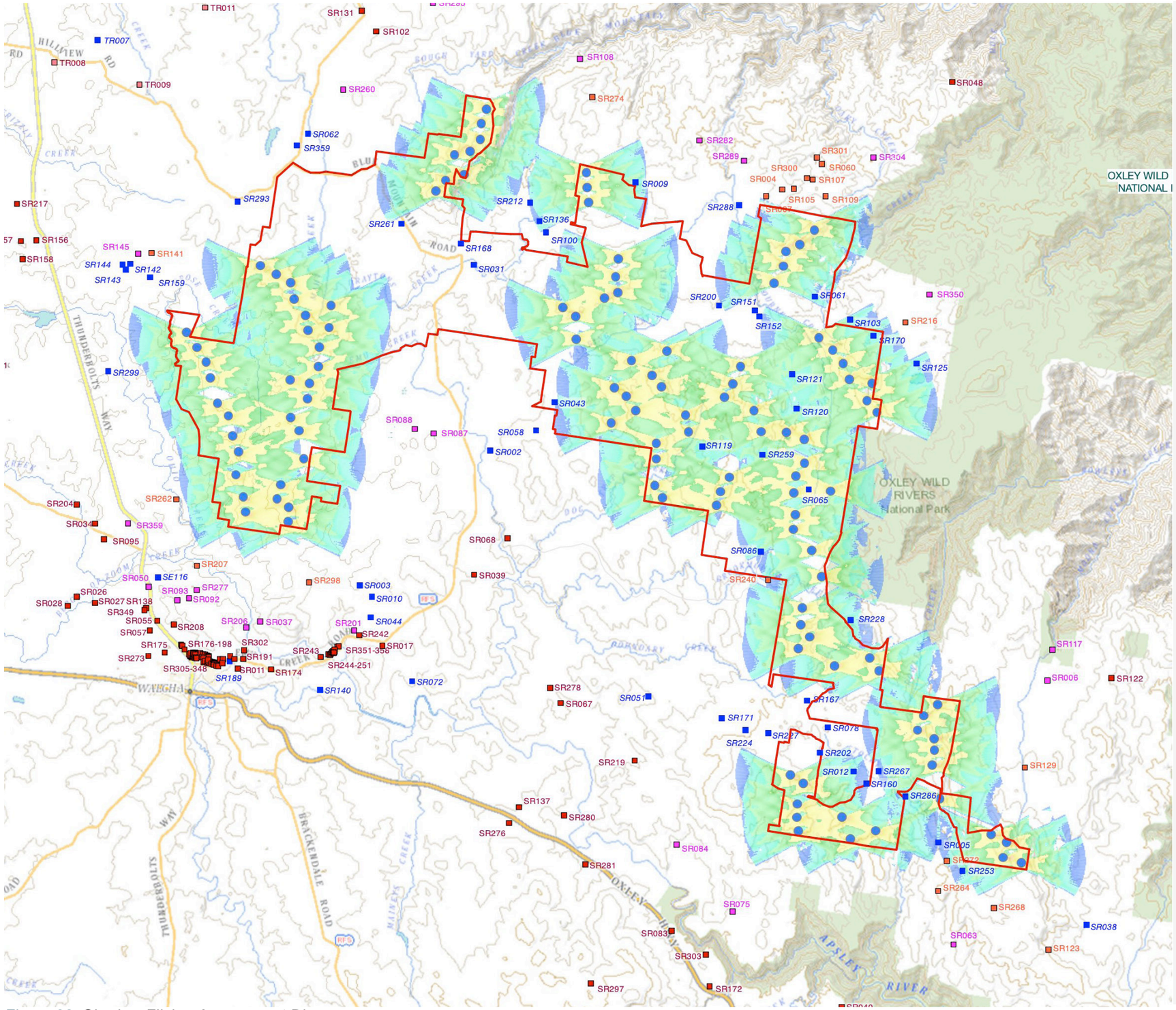


Image 24: Example of shadow flicker from base of turbine.

11.0 Shadow Flicker & Blade Glint Assessment



Shadow Flicker Assessment
Winterbourne Wind Farm

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Involved Residences
- Non-Involved Residences within 3,100 m
- Non-Involved Residences within 4,550 m
- Non-Involved Residences beyond 4,550 m
- Non-Involved Residences beyond 4,550 m (Within 2,000 m of Transmission Line)

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 22: Shadow Flicker Assessment Diagram

11.0 Shadow Flicker & Blade Glint Assessment

11.3 Results of Shadow Flicker Assessment

A total of two (2) non-involved dwellings were identified with potential shadow flicker hours. 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.*

Of the two (2) non-involved dwellings with potential shadow flicker, no dwellings have the potential to experience more than 30 hours per year. The assessment is based on a worst case scenario considering topography alone.

Detailed desktop assessment of all non-involved dwellings with potential to experience shadow flicker has been included in ***Appendix E***.

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 Winterbourne Road, Blue Mountain Road, Chinnocks Road and Table Top Road have potential to experience shadow flicker. As the roads have a low frequency of use the potential impact is likely to be low.

ID	Shadow Hours per year:	Shadow Days per year:	Max Shadow Hours per day:	Assessment Notes:
SR240	20:07	72	0:21	Acceptable level
SR272	29:34	103	0:23	Acceptable level

Table 18: Non-involved dwellings with potential to experience shadow flicker

11.0 Shadow Flicker & Blade Glint Assessment

11.4 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 turbine hub.

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

12.0 Night Lighting Assessment

12.1 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 wind turbines (height of up to 149 metres AGL)
- Night lighting for safety and security on ancillary structures.

12.2 Aviation Hazard Lighting

The requirement of aviation hazard lighting (AHL) on wind turbines for the proposed Winterbourne Wind Farm is subject to the advice of the Civil Aviation Safety Authority (CASA). It is noted that the turbines proposed for the Winterbourne Wind Farm will possibly be up to 230 m in height and CASA generally recommends night lighting if an obstacle exceeds 160 metres above ground level. However it is noted that the Aviation Impact Assessment for the project determined that WTGs will not require obstacle lighting to maintain an acceptable level of safety to aircraft

If determined to be required, potential CASA specifications for lighting could include:

- Two flashing red medium intensity obstacle lights should be provided per turbine where required.
- The light fixtures should be mounted sufficiently above the surface of the nacelle so that the lights are not obscured by the rotor hub, and are at a horizontal separation to ensure an unobstructed view of at least one of the lights by a pilot approaching from any direction.
- Sufficient individual wind turbines should be lit to indicate the extent of the group of turbines.
- The interval between obstacle lighted turbines should not exceed 900m, and the most prominent (highest for the terrain) turbine(s) should be lit. (CASA, 2004).

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

Representative images of aviation lighting (installed in August 2020) on turbines 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.

Images 25 - 31 illustrate the effect of night lighting on a dark rural landscape at intervals after sunset.

Image 25: View towards Biala Wind Farm - 2.0 Kilometres from turbine at 6:20pm (30 minutes after sunset)

Image 26: View towards Biala Wind Farm - 1.75 Kilometres from turbine at 6:35pm (45 minutes after sunset)

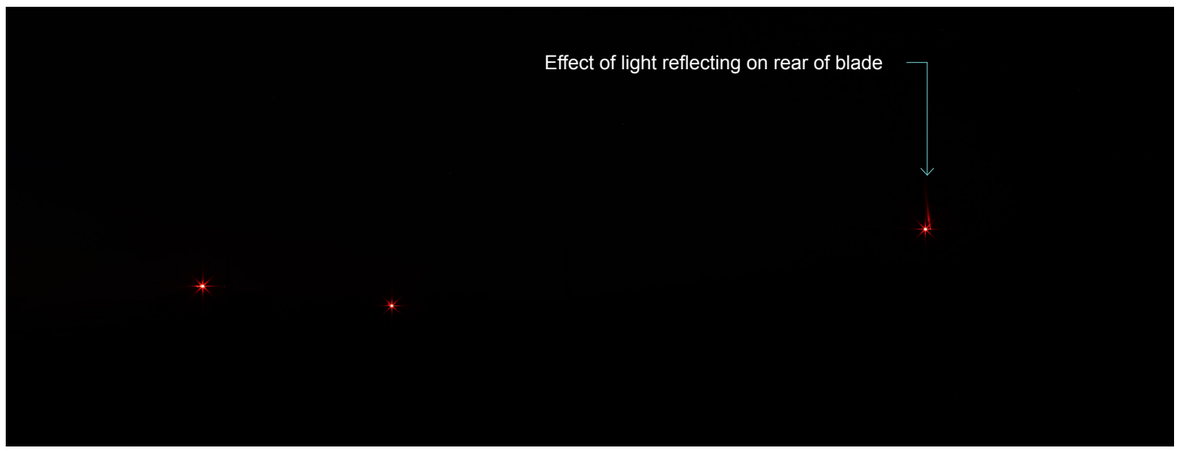


Image 27: View towards Biala Wind Farm - 1.85 Kilometres from turbine at 6:50pm (60 minutes after sunset)

12.0 Night Lighting Assessment

Image 28: View towards Biala Wind Farm - 3.5 Kilometres from turbine

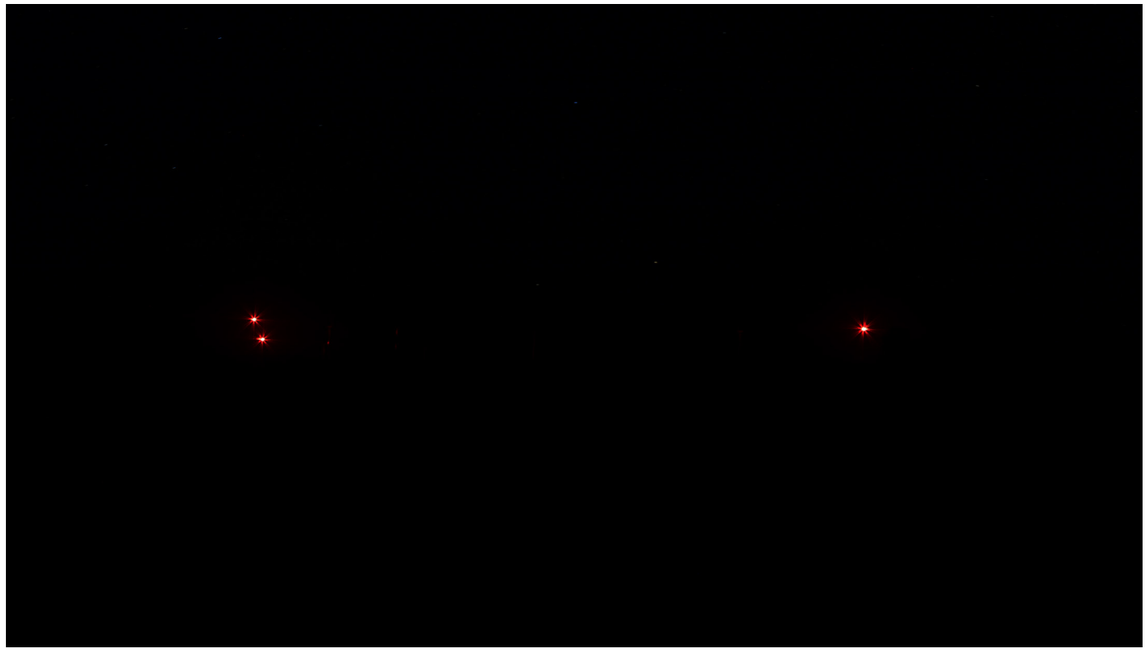


Image 29: View at night towards Biala Wind Farm - 3.5 Kilometres from turbine

Image 30: View towards Biala Wind Farm - 8.5 Kilometres from turbine

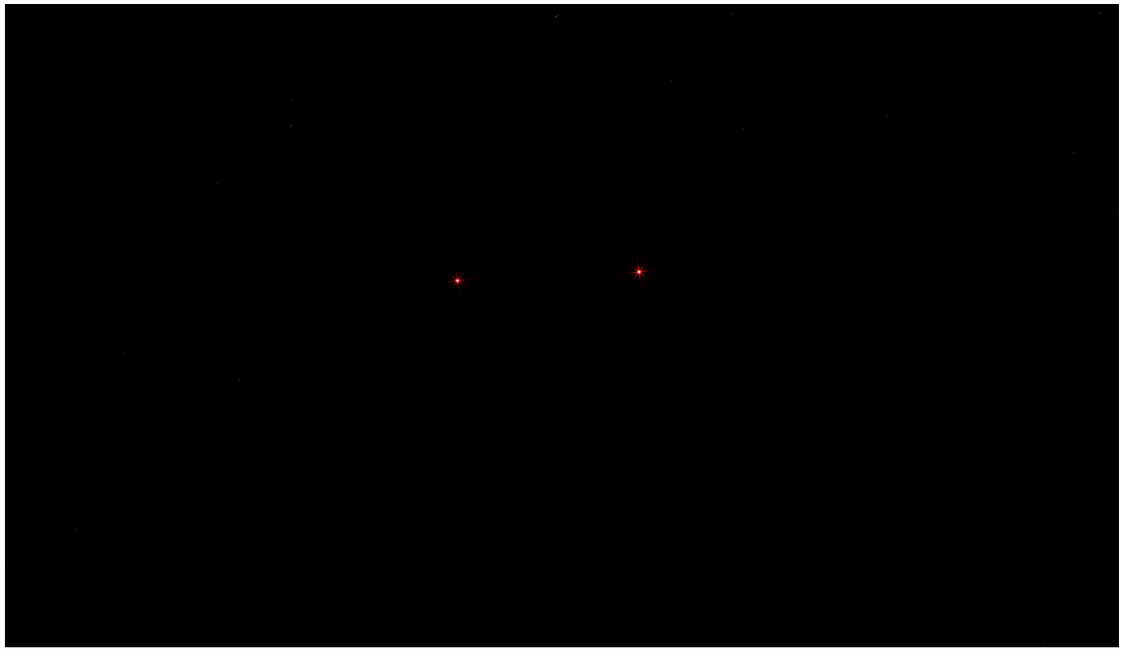


Image 31: View at night towards Biala Wind Farm - 8.5 Kilometres from turbine

12.0 Night Lighting Assessment

12.3 Overview of potential visual impacts from Night lighting

Night lighting of turbines and associated infrastructure has the potential to extend the visual effect into the night time. Aviation hazard lighting 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 few 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 visual impact of potential aviation lighting could be reduced by employing mitigation methods outlined in *Section 12.4.* Considering the high elevation of the turbines 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.

The Uungula Wind Farm (located to the east of Wellington in NSW) 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.

12.0 Night Lighting Assessment

12.4 Recommendations to reduce the potential visual impacts

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.*

Aviation Impact Assessment (prepared by Others) determined that WTGs will not require obstacle lighting to maintain an acceptable level of safety to aircraft. Additionally, if required, to assist in the amelioration of the effect of Aviation Hazards Lighting on wind turbines the following should be applied:

- If used, air navigation lighting should be spaced around the outer edges of the wind farm. Lights are not required on every tower. Where possible, careful consideration should be given to the selection of turbines requiring lighting 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.
- According to the CASA requirements, shielding may be provided to restrict the downward spill of light to the ground plane by ensuring that no more than 5% of the nominal light intensity should be emitted at or below 5° below horizontal (Refer to Figure 18).
- No light should be emitted at or below 10° below horizontal.

Technology in both aviation and wind farm development is constantly evolving. One example of evolving technology is Air Detection Lighting System (ADLS). Although these haven't been utilised in New South Wales, an ADLS has recently been installed at the Lal Lal Wind Farm just east of Ballarat in Victoria. An ADLS is an effective measure to reduce visual impacts, save electricity and improve aviation safety. Aviation lighting is activated when an aircraft approaches within four to six kilometres.

As this technology such as Air Detection Lighting Systems become more cost effective and readily available, it may become a viable option for the Project.

Over time 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. In the Upper Lachlan Shire, on November 1, 2010 Cullerin Wind Farm, owned by Origin Energy, switched off turbine aviation lighting 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).

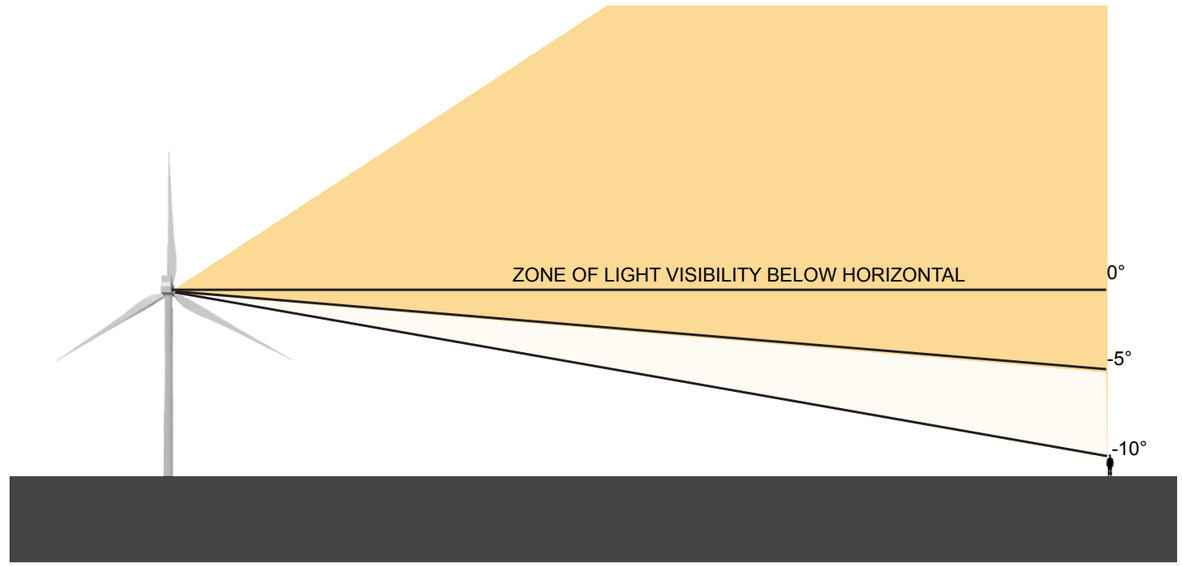


Figure 23: CASA Recommended Obstacle Lighting Spread (Image adapted from Urbis 2009)

12.0 Night Lighting Assessment

12.5 Potential Impacts of Lighting Associated with Ancillary Infrastructure

In addition to aviation hazard lighting on wind turbines, night lighting is likely to be required on ancillary infrastructure including switching stations, collector substations and facilities buildings.

Maintenance lighting will be installed at the substations and at the O&M building for night work including emergency operations. All maintenance lighting will be designed to reduce disturbance to neighbouring properties and will be used only when there are staff on-site or during emergencies.

Continuously operating security lighting would be installed on posts up to 3.5 m high adjacent to the security fencing and O&M buildings.

It is unlikely the proposed night lighting associated with the ancillary infrastructure would create a noticeable impact on the existing night time landscape.

To assist in the amelioration of the effect of night lighting on ancillary structures the following should be applied:

- Security lighting throughout the wind farm, switching station and the substation should be minimised to decrease the contrast between the wind farm and the night time landscape of the area.
- Motion detectors should be used to activate night time security lighting when required.
- Lighting is to be designed to ensure it does not spill onto nearby roads or residences.

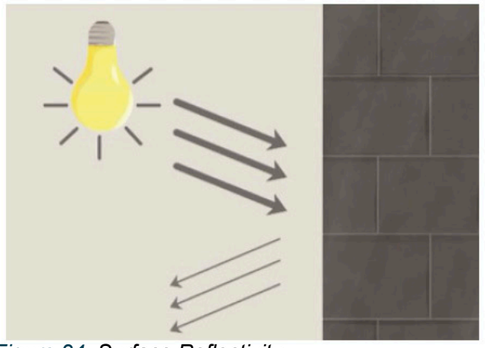
If design principles are incorporated into the night lighting for Ancillary Infrastructure, it is likely there will be no visual impacts resulting from night lighting of Ancillary Structures.

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:

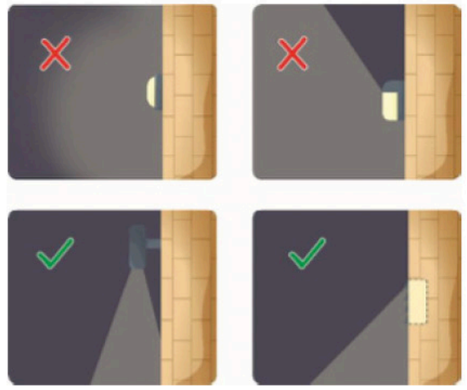
• Use the lowest intensity required for the job
• Use energy efficient bulbs and warm colours
• Direct light downwards
• Ensure lights are not directed at reflective surfaces
• Use non-reflective dark coloured surfaces to reduce reflection of lighting **(Figure 24)**
• Keep lights close to the ground and / or directed downwards **(Figure 25)**
• Use light shield fittings to avoid light spill (refer to **Figure 26**).



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



Downward lighting:

Where possible lights are to be directed downwards.

Figure 25: Downward Lighting
Source: Department of Environment and Energy National Light Pollution Guidelines for Wildlife (2020)

Use of Lighting Shields:

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

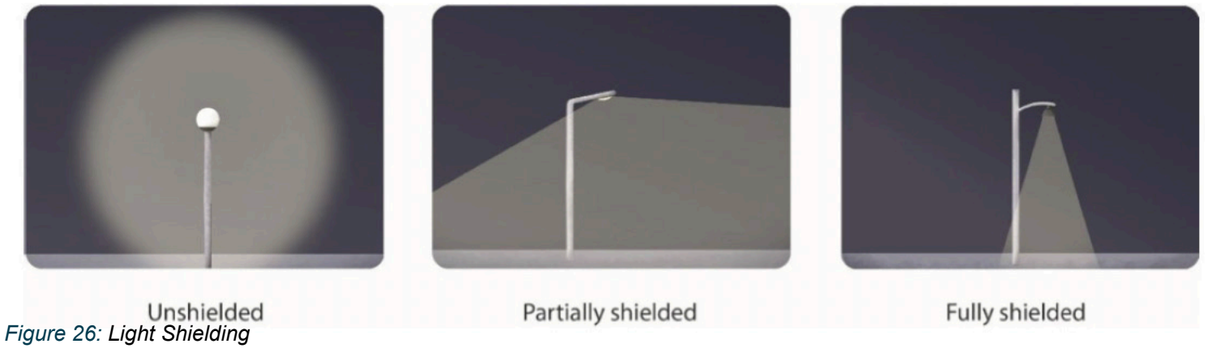


Figure 26: Light Shielding
Source: Department of Environment and Energy National Light Pollution Guidelines for Wildlife (2020)

13.0 Cumulative Visual Impact Assessment

13.1 Overview of Cumulative Visual Impacts

The Visual Assessment 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 effects 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). Cumulative effects may also affect the way a landscape is experienced and can be positive or negative. Where they comprise benefits, they may be considered to form part of the mitigation measures.

The Draft Planning NSW Guidelines state that “Cumulative impacts may result from a number of activities with similar impacts interacting with the environment in a region. They may also be caused by the synergistic and antagonistic effects of different individual impacts interacting with each other and may be due to temporal or spatial characteristics of the activities impacts.”

It is important the proposed Winterbourne Wind Farm considers the potential cumulative effects on the immediate and broader regional context it forms part of.

A cumulative impact assessment has several dimensions:

- The impact of the wind farm, when added to the combined impacts of all other existing developments and environmental characteristics of the area.
- The impact of this development in the context of the potential for development of wind energy developments in the local, regional and national context.
- The impact of developments which are ancillary to or otherwise associated with the proposed wind farm eg. the development of transmission lines.
- The potential for future development of wind farms in the region.

13.2 Nearby Wind Farm Projects

The nearest constructed and operating wind farm to the Project is the White Rock Wind Farm, which is located in excess of 115 kilometres north east from the Project Site. The nearest approved wind farm to the Project is the Liverpool Range Wind Farm which is located over 150 kilometres south east of the Winterbourne Project.

Due to distance there are no opportunities to view any additional wind farms simultaneously from a static viewpoint in the foreseeable future.

The potential cumulative visual impact must also be assessed in relation to the potential visual impact when viewed sequentially. If a number of wind farms are viewed in succession as a traveller moves through the landscape (eg. motorist travel routes or walking tracks) this may result in a change in the overall perception of the landscape character. The viewer may only see one wind farm at a time, but if each successive stretch of the road is dominated by views of a wind farm, then that can be argued to be a cumulative visual impact (EPHC, 2010).

Due to the relatively isolated location, the Project is set back from major travel routes which prevents any opportunities to view wind farms in succession along travel routes.

13.0 Cumulative Visual Impact Assessment

13.3 Visual Impact on the Broader Landscape Character

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 cumulative effect of 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.

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 over time this will be utilised.

The New South Wales Government have identified five key Renewable Energy Zones (REZ) in the Central-West, New England, South-West, Illawarra and Hunter-Central Coast regions. The Winterbourne Wind Farm Project is located within the New England REZ. The development of wind farms is likely to be focused in these key regions in the future.

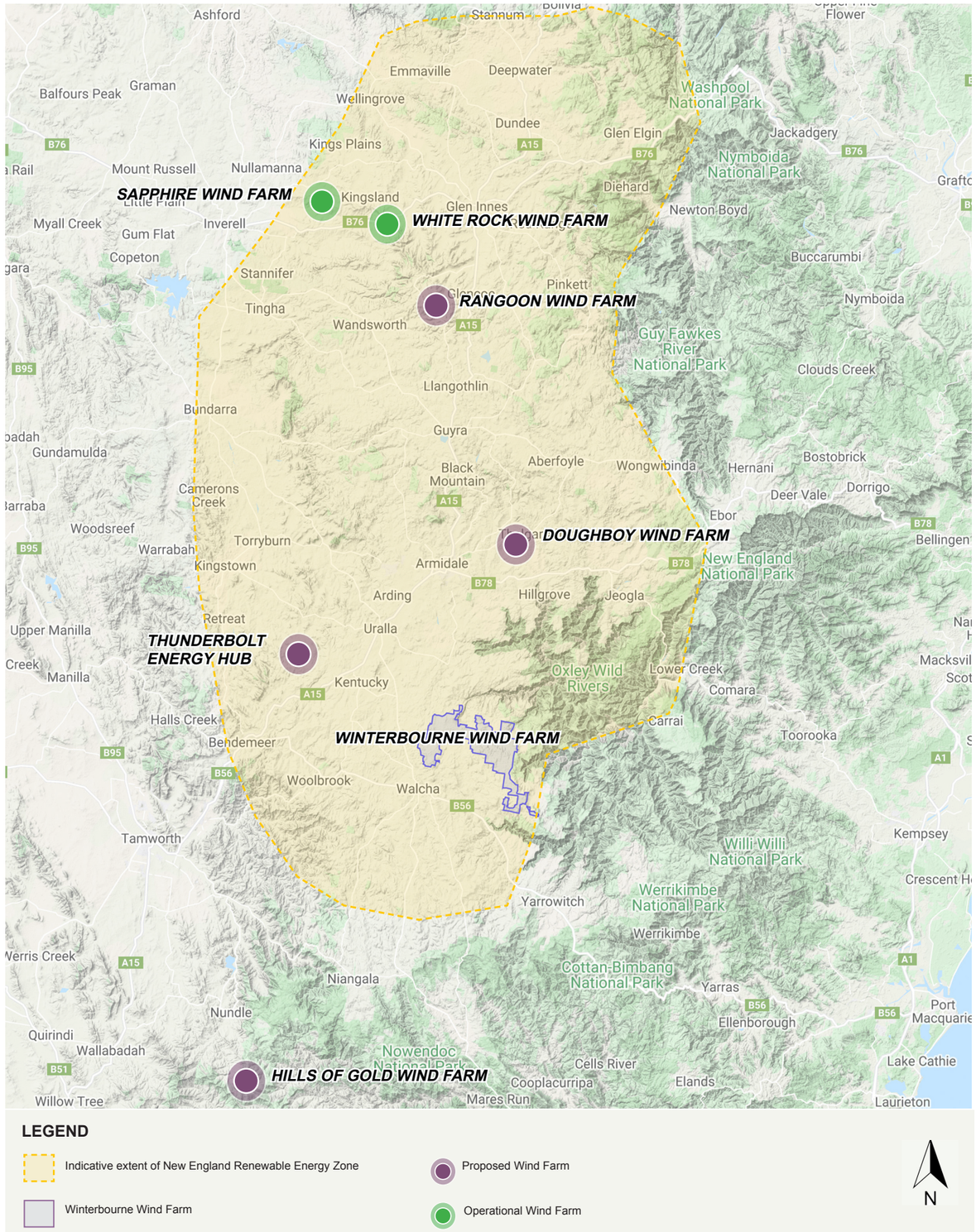


Figure 27: Nearby Wind Farms

14.0 Associated Infrastructure Assessment

14.1 Overview of Associated Infrastructure

In addition to the proposed wind turbines, the associated infrastructure (as described in ***Section 3.4*** of this report) is likely to contrast with the existing visual landscape. Due to the large scale and elevated siting of the proposed wind farm, access roads, transmission lines and other ancillary structures have the potential to alter the existing visual landscape. An overview of the potential visual impact resulting from associated infrastructure and project components is provided in this section of the report.

14.2 External Project Components

14.2.1 External 330kV Transmission lines

A 330kV single or dual circuit overhead transmission line connection is proposed to connect the on site substation to the existing overhead 330kV transmission line network to the north west of the Project Site. The proposed 330kV transmission line will include 40m high single circuit lattice steel tower spaced approximately 500m apart or monopoles approximately 50 m high, spaced approximately 250 m (subject to terrain) see ***Image 32.***

A 60 metre cleared easement will be required underneath the transmission line. ***Figure 28 and 29*** provide an overview of the potential visual impacts resulting from the construction of the 330kV transmission line external to for both the internal and external Project areas. Where they have been identified for individual dwellings, potential visual impacts have been discussed in further detail in ***Appendix E***.

Generally the aboveground transmission lines transverse a large area of uninhabited land surrounded by undulating topography. Opportunities to view the transmission lines are limited due to distance, topography and vegetation. The transmission line crosses Thunderbolts Way approximately 2 kilometres north of the Hillview Road / Terrible Vale Road intersection. As transmission lines are an existing infrastructure element in the landscape, the introduction of new transmission line would not be a significant or contrasting element in the landscape. The transmission line is generally consistent with existing infrastructure. It is our opinion that visual impact of the transmission lines will be low.

ID	Location	Distance to Transmission Line	Assessment	Visual Impact Rating:
	EXTERNAL			
TR003	*Thunderbolts Way*	*1.57 km*	Existing screen planting surrounding the dwelling is likely to screen view to the 330 kV transmission line.	Nil
TR006	*Thunderbolts Way*	*1.90 m*	Existing screen planting to the south and west of the dwelling is likely to screen views to the 330 kV transmission line.	Nil
TR008	*Thunderbolts Way*	*1.59 km*	The proposed 330 kV transmission line is 1.59 km to the north of the dwelling at its nearest point. A combination of trees to the north of the dwelling and vegetation to the north in the middle ground of the landscape would fragment views to the transmission line.	Nil / Low
TR009	*Hillview Road*	*1.86 km*	At its nearest point, the 330 kV transmission line is 1.86 kilometres to the north of the dwelling. A medium coverage of vegetation through the landscape to the north of the dwelling is likely to sufficiently screen views of the transmission line from this dwelling.	Nil
TR011	*Carlon Menzies Road*	*1.30 km*	The proposed transmission line is approximately 1.3 km south west of the dwelling at its nearest point. Intervening vegetation to the south of the dwelling is likely to fragment views of the transmission line to the south, however it may be visible in the distance to the south west.	Low
TR012	*Terriblevale Road*	*1.77 km*	The dwelling is located to the south of the transmission line. The nearest point is approximately 1.77 km to the NNE. Existing screen planting to the north of the dwelling and wind break planting through the landscape intervenes views from the dwelling.	Nil / Low
SR260	*Hillview Road*	*800 m*	At its nearest point, the 330kV transmission line is 800 m south west of SR260. Dense vegetation to the south west of the dwelling will screen views to the transmission line from this dwelling.	Nil
	INTERNAL			
SR240	*'Straban' 784 Old Brookmount Road*	*1.27 m*	A combination of topography and existing vegetation to the north of the dwelling will screen views to the transmission line from this dwelling.	Nil

Table 19: Overview of Potential Visual Impacts - External 300 kV Transmission Line

14.0 Associated Infrastructure Assessment

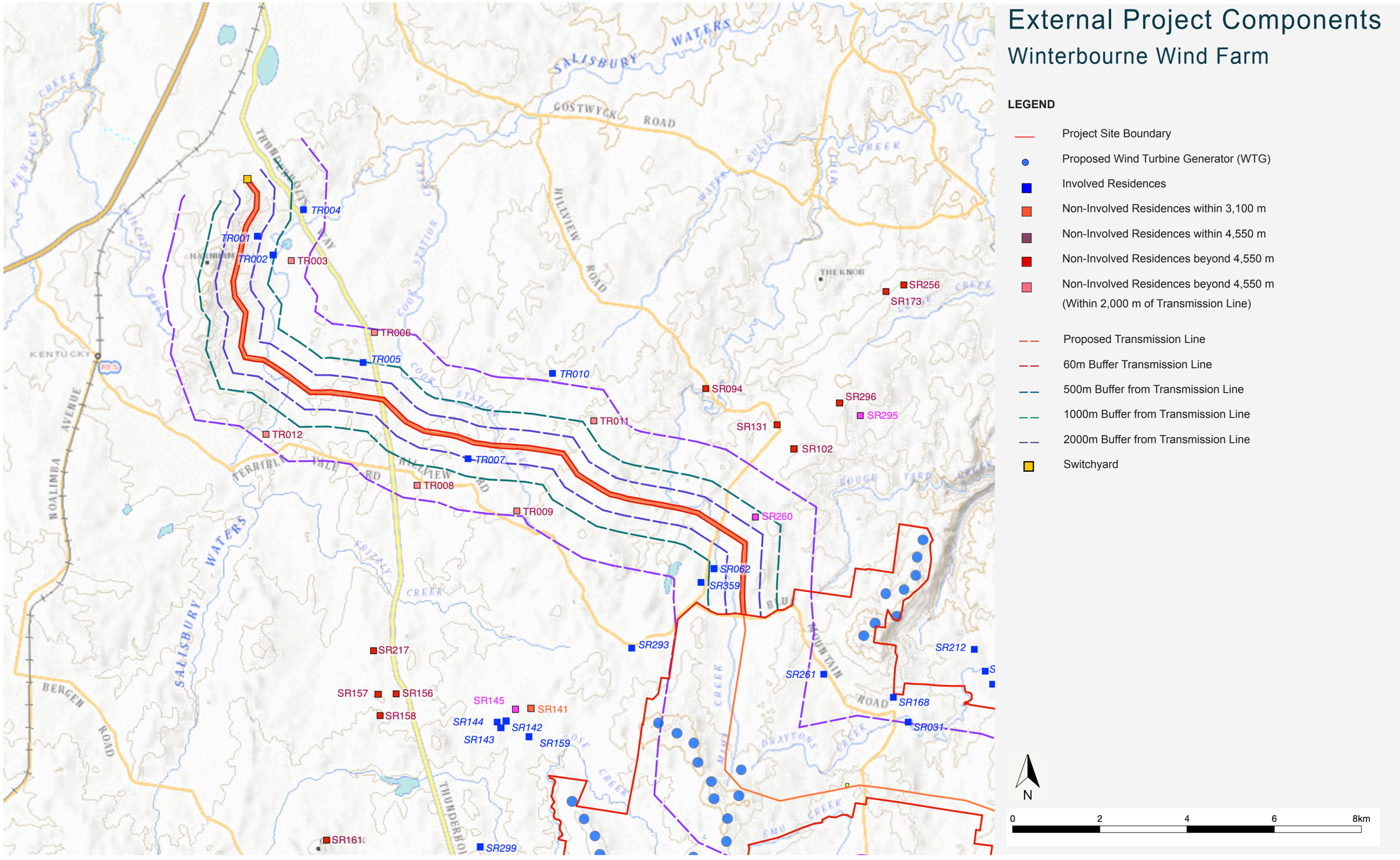
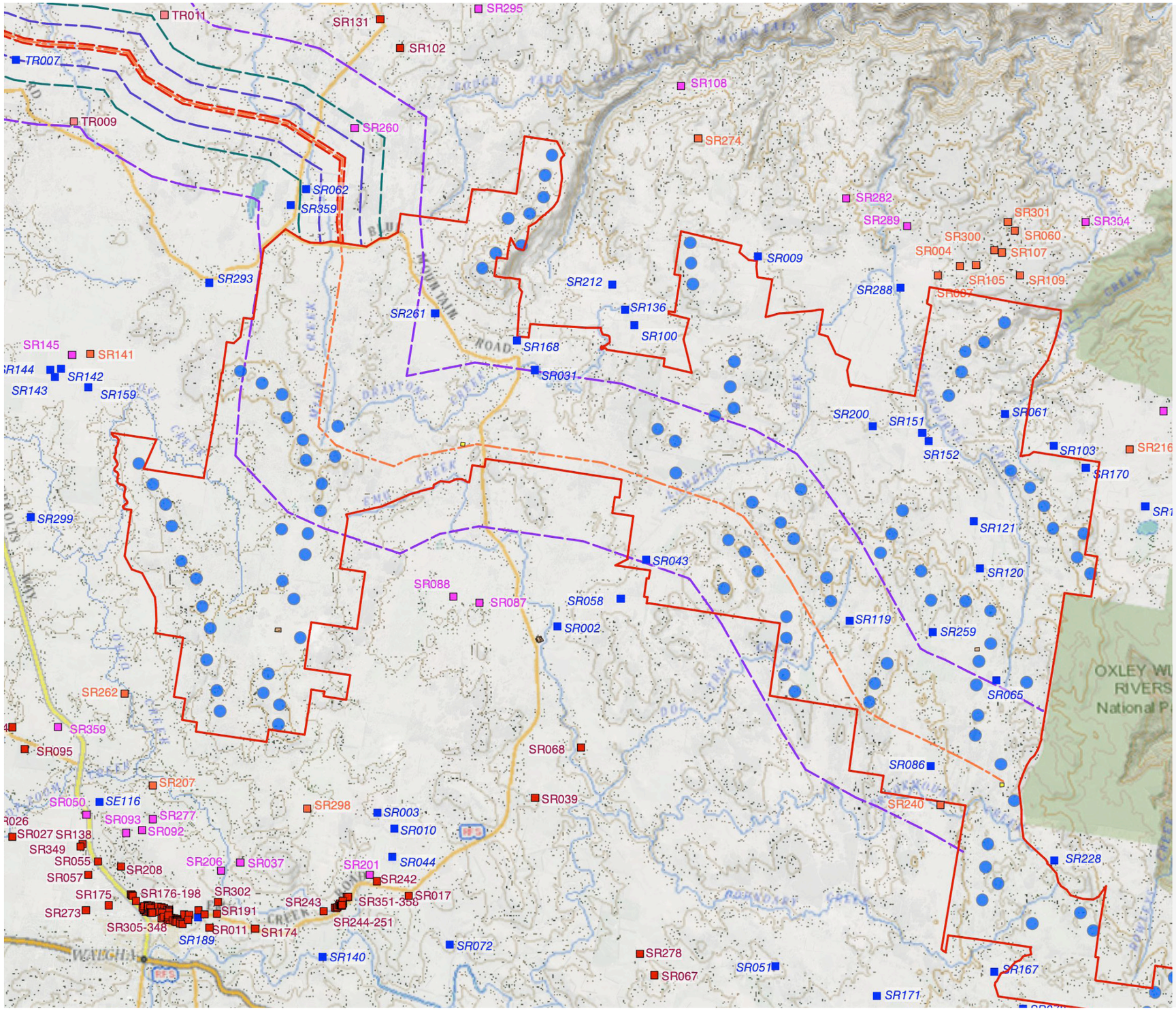


Figure 28: Overview of Potential Visual Impacts - External 330 kV Transmission Line

14.0 Associated Infrastructure Assessment



Internal Project Components
Winterbourne Wind Farm

LEGEND

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Involved Residences
- Non-Involved Residences within 3,100 m
- Non-Involved Residences within 4,550 m
- Non-Involved Residences beyond 4,550 m
- Non-Involved Residences beyond 4,550 m (Within 2,000 m of Transmission Line)
- Proposed Transmission Line
- 2000m Buffer from Transmission Line

Figure 29: Overview of Potential Visual Impacts - Internal 330 kV Transmission Line

14.0 Associated Infrastructure Assessment

14.2.2 Switchyard

The 330kV transmission line will connect to the existing grid network operated by TransGrid at a new switchyard which would be constructed approximately 7 km south of Uralla, NSW.

The switchyard is proposed to have the approximate dimensions of 160 m by 120 m for physical electrical components including required earth works will be located within a site with a maximum expected area of two ha. The switchyard will connect the Project transmission line to the adjacent 330 kV TransGrid Tamworth to Armidale overhead transmission line network. A 20 m APZ will surround the switchyard.

The switchyard is sited on a slight rise to the to the west of Thunderbolts Way. Existing roadside vegetation along the western side of Thunderbolts Way is likely to fragment views available to motorists travelling in a north and south direction along Thunderbolts Way. The nearest non-involved dwelling is to the north east of the switchyard approximately 830 metres to the north east. Views from this dwelling are likely to be mostly fragmented by roadside vegetation associated with Thunderbolts Way.

Image 32: Transmission Line (Source: Vestas)

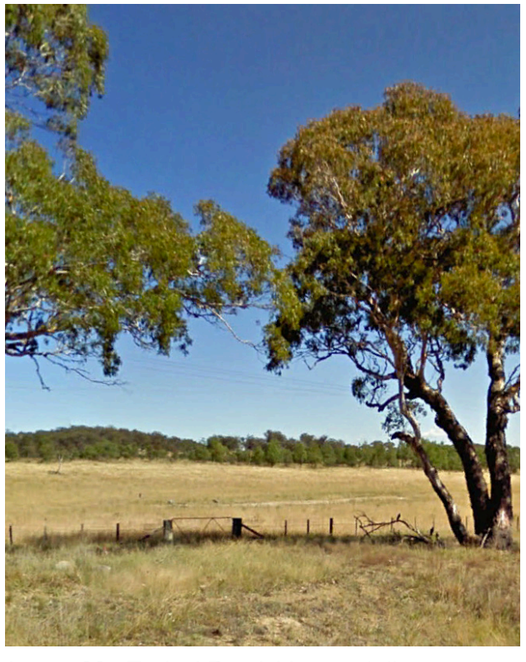


Image 33: Typical Roadside vegetation

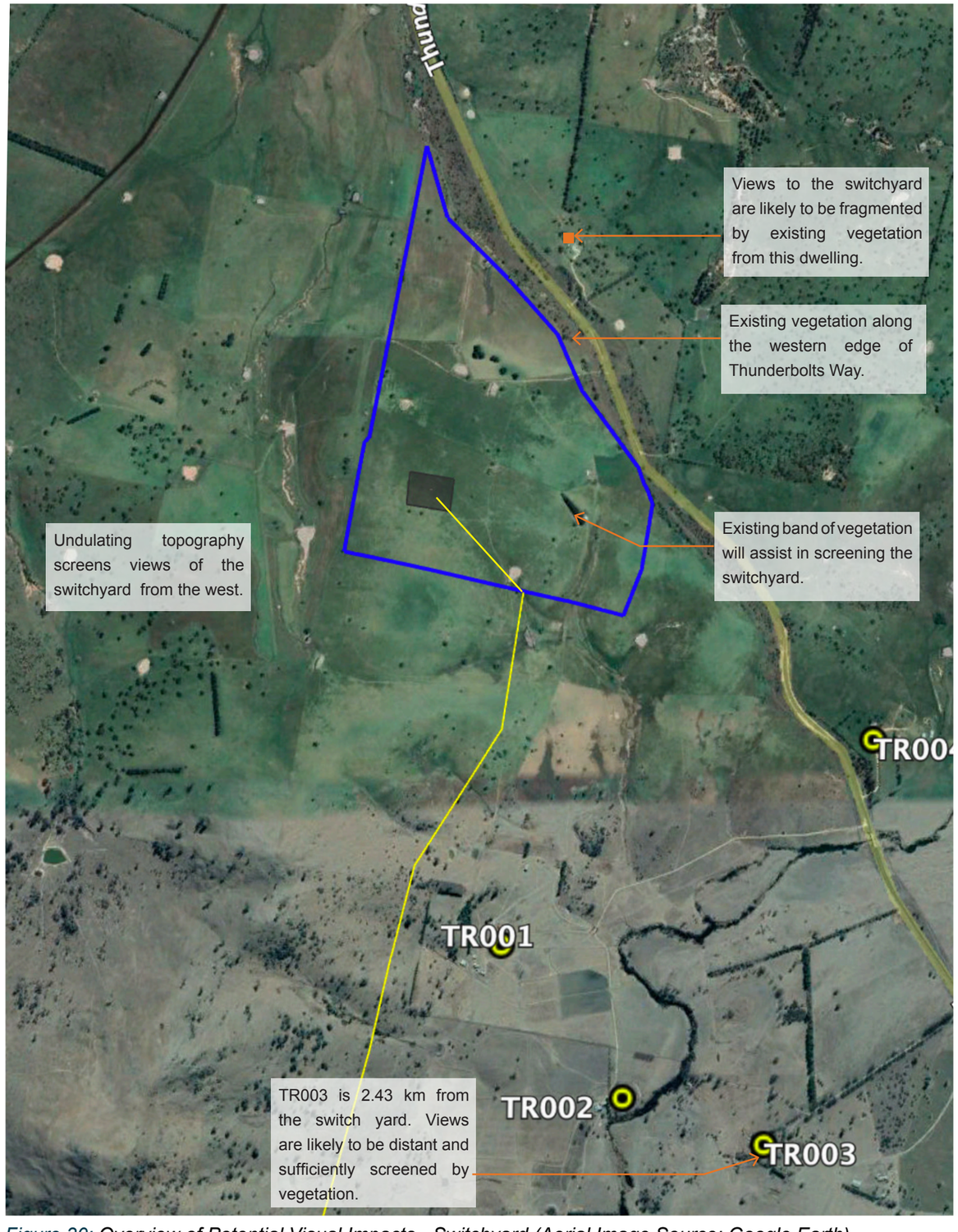


Figure 30: Overview of Potential Visual Impacts - Switchyard (Aerial Image Source: Google Earth)

14.0 Associated Infrastructure Assessment

14.3 Internal Electrical Reticulation Network

The internal electrical reticulation network, which connects the WTGs to the north and south onsite substations, will comprise approximately 324 km of underground and/or overhead 33 kV cables. Where possible the cabling will be located in underground trenches, which run parallel to the access track. Where deviation from the access track is required due to geotechnical or other constraints, or to reduce overall cable length, these deviations will be positioned to minimise impact to ecological and heritage areas of high significance.

The trenching for underground electrical cabling will be approximately 0.6 m wide per circuit by 1.0 m deep, located within a works area of approximately 5 m to accommodate the mobile plant and stockpiling of spoil and bedding sand. Trenches will be progressively backfilled during the course of the construction works.

Where ground conditions are not suitable for open cut trench installation, overhead single circuit electricity lines will be installed using concrete poles. The aboveground conductors may have orange balls for visual identification.

The Internal Electrical Reticulation Network is presented in **Figure 31**.

Generally, the internal 33kV cables will be located within underground trenches and therefore the visual impact would be negligible. Where the cables are required above ground, effort will be made to ensure the following principles are maintained through the design process:

- *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.*

14.4 Onsite Substations

Two (2) 33/330 kV substations will be constructed in the development footprint to transform the 33 kV received from the internal electrical reticulation network to the 330 kV transmission voltage.

While the design is yet to be finalised, it is expected that each substation would occupy an area approximately 100 m x 100 m (approximately 1 ha) and will contain transformers, associated high voltage switchgear and control and protection equipment as well as a communication tower, and drainage and oil containment system. A security fence will surround the substations. Gravel hardstand will be placed under and around the substation compounds to restrict vegetation growth and provide a safe working environment in accordance with the relevant Australian Standards.

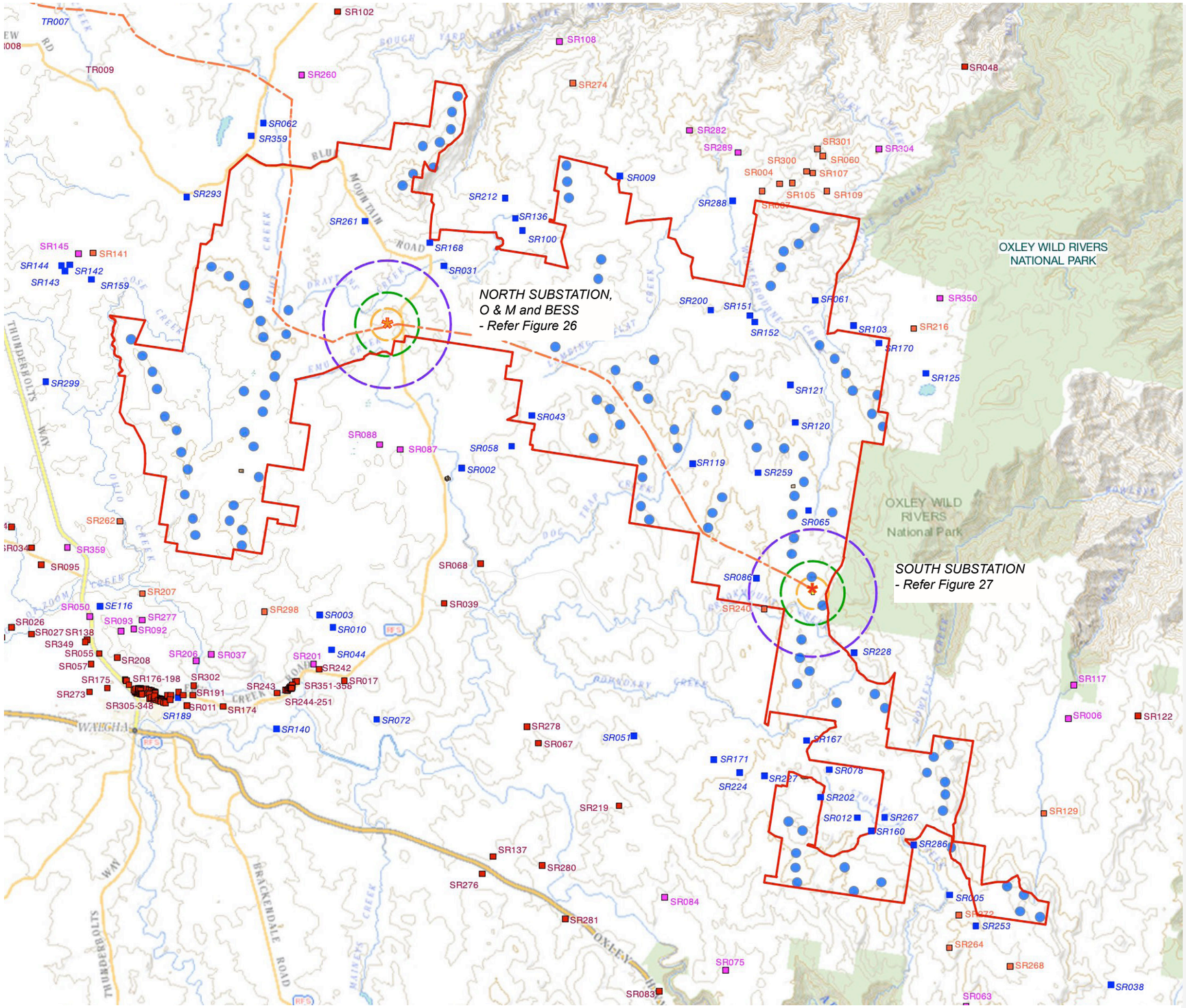
Internal structures within the fenced substation compounds will include:

- Control building / control room, switch room – height approx. 5 m;
- Two (2) 33 / 330 kV power transformers – height approximately 10 m;
- Approximately six (6) lightning protection masts – 25 m high;
- Associated high voltage switchgear including busbars, circuit breakers, disconnectors – approximately 10 m high; and
- A communication tower (up to 80 m high).
- A 20 m bushfire asset protection zone (APZ) will surround the substation.

The two (2) proposed locations for the substations have been presented in **Figure 32**.

An assessment of the potential visual impacts resulting from the North Substation has been provided in **Section 13.5**. An assessment of the South Substation has been provided in **Section 13.8**.

14.0 Associated Infrastructure Assessment



Internal Ancillary Structures
Winterbourne Wind Farm

LEGEND

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- Involved Residences
- Non-Involved Residences within 3,100 m
- Non-Involved Residences within 4,550 m
- Non-Involved Residences beyond 4,550 m
- Non-Involved Residences beyond 4,550 m (Within 2,000 m of Transmission Line)
- Proposed Internal 330kV Transmission Line
- 500 m Radius from Substation
- 1000 m Radius from Substation
- 2000 m Radius from Substation
- Onsite Substation Location

Figure 31: Overview of Internal Project Components

14.0 Associated Infrastructure Assessment

14.5 North Substation

The North Substation is located west of Blue Mountain Road and is situated within a relatively flat area surrounded by local vegetated rises. The nearest non-involved dwelling is SR088, located approximately 3.7 kilometres south of the substation. Views toward the substation from this dwelling are unlikely to be available due to topography and distance.

Views toward the substation are likely, though fleeting, when travelling south from a small section of Blue Mountain Road however, this area is located within the Project Boundary. Screen planting along the eastern boundary of the substation (as indicated on **Figure 32**) would assist in reducing the visibility of the sub-station to motorists travelling along Blue Mountain Road.

14.6 Site Operations and Maintenance Facility (O&M)

A permanent site operations and maintenance (O&M) facility, approximately 50 m by 40 m, will be constructed to provide for all operations and maintenance activities associated with the Project. The O&M compound will be located off Blue Mountain Road next to the north substation, BESS and laydown area. The buildings of the O&M facility will contain the control room, switch room, parking and storage shed.

Views toward the O&M are unlikely from the surrounding area due to topography. If deemed necessary during the detailed design phase, mitigation methods such as screen planting could be employed to reduce any potential visual impacts.

14.7 Battery Energy Storage System (BESS)

The proposed Battery Energy Storage System (BESS) will be located to the south of the north substation, occupying an area of approximately 100 m x 100 m. The BESS is likely to be screened by topography and vegetation.

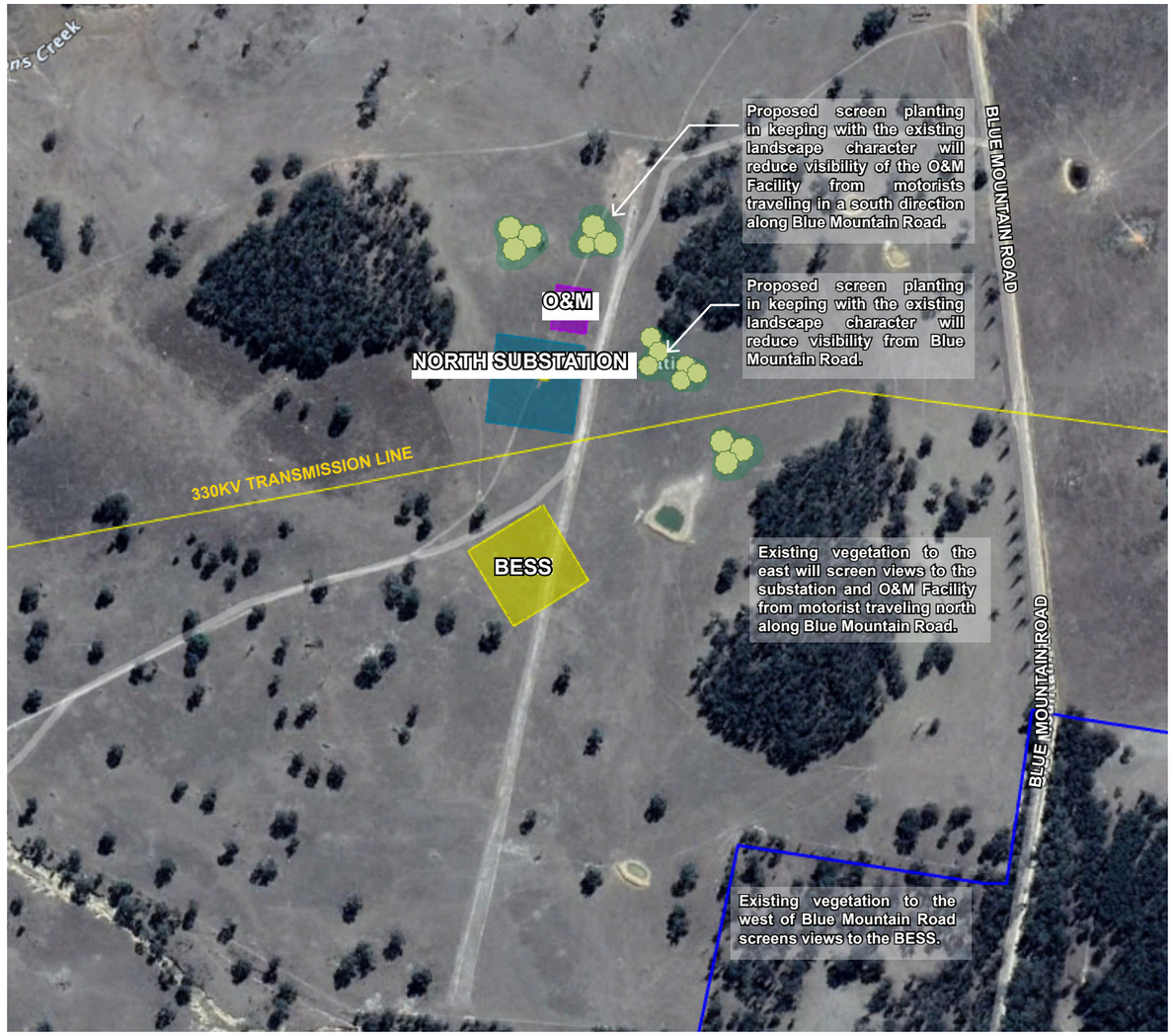


Figure 32: North Substation, BESS and O&M Facility

14.0 Associated Infrastructure Assessment

14.8 South Substation

The South Substation is located in an isolated and vegetated area north east of Old Brookmount Road within undulating landform, approximately 400m west of the boundary to Oxley Wild Rivers National Park. The nearest non-involved dwellings is SR240, approximately 1.5 kilometres south west of the substation. Views to the substation from SR240 are unavailable due to a combination of topography and the dense vegetation to the south west of the substation (as indicated on **Figure 33**).

The substation is also unlikely to be visible from Rowleys Gorge Boundary Trail, a low use fire access trail which follows the boundary of the Oxley Wild Rivers National Park. The existing vegetation along the eastern side of the substation is likely to provide visual screening toward the substation. The visual impact resulting from the south onsite substation is likely to be negligible.

Figure 33: South Onsite Substation

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.*
- *Screen planting to further reduce any residual visual impacts.*
- *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 (see example provided in **Image 34**).*
- *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. An example of the successful screening of a substation is provided in **Image 35**.*

Image 34: Example of a building colour palette sympathetic to the surroundings

Image 35: Example of landscape screening along the boundary of a substation - Rothbury NSW

14.0 Associated Infrastructure Assessment

14.9 Meteorological Monitoring Masts

The Project includes the commissioning and decommissioning of four temporary meteorological monitoring masts (met mast) for power testing and installation of up to two permanent met masts. The two monitoring masts will be located close to the WTG location and will have same height as the WTG hub height (149m). It is noted that masts are an existing element in the landscape.

The Permanent Mast 1 is located in the western boundary of the Project Site, nearby Turbine B034. The closest non-involved dwelling is SR262, located approximately 2.5 kilometres south west of the mast. Due to the elevated location and height, the mast is likely to be visible, although existing vegetation to the east is likely to fragment views to the mast and is likely to have a low visual impact.

The Permanent Mast 2 is located in the southern boundary of the Project Site, nearby Turbine B132. The closest non-involved dwelling is SR005, located approximately 2 kilometres south of the mast. Due to the elevated location and height, the mast is likely to be visible however it is likely to have a low visual impact.

14.10 Access Roads

Access roads are proposed off site connecting to existing arterial roads, and on site between the wind turbines. Access to the Project Site is proposed via existing roads. It is likely some upgrades to these roads would be completed to accommodate the Project.

The construction and maintenance of the Project will require construction of approximately 113 kilometres of new private access roads. Where possible, the internal road network will be aligned on the route of existing farm or other access roads. The internal roads will be up to 5.5 metres wide with localised widening where required to support transportation of the WTG components.

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 form a significant part of 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 low.

Mitigation measures for reducing residual visual impact resulting from the construction of access roads 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.*

15.0 Visual Impacts on Landscape Character

15.1 Overview of Visual Impacts on Landscape Character

The proposed development 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 Landscape Character Units (LCU) within the Study Area have been rated as low or moderate with one area defined as moderate to high (refer to ***Section 5.6***).

The fact that the proposed wind turbines are generally positioned within a landscape that has remained largely unchanged for decades means that the potential for contrast is significant. There is little doubt that the Winterbourne Wind Farm, 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 proposal, is determined by the dominance of the proposal in relation to the existing landscape features.

It is undeniable the proposed wind farm 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 ***Section 5.2*** 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

Appendix F provides an overview of the assessment of the potential visual impacts on the existing landscape character of the local area for each Landscape Character Unit (LCU) as characterised in ***Section 5.6*** 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 nine (9) 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.

15.0 Visual Impacts on Landscape Character

15.3 Summary of Visual Impacts on Landscape Character Units

Summary of Visual Impacts on Landscape Character Units (Refer to Appendix F)			
LCU:	**Scenic Quality Rating:**	**Landscape Scenic Integrity:**	**Key Landscape Features:**
LCU01: Oxley Wild Rivers	*Moderate / High*	The Project will form a minor element in the overall visual landscape. The landscape elements which contribute to the scenic quality of the LCU will remain unchanged as a result of the proposal.	The key features of this LCU include dramatic gorges, elevated, densely wooded and rugged ridgelines contrasted by waterfalls and rivers. These features will remain unchanged. The Project will form a minor element in the overall visual landscape and will not disrupt the key landscape features.
LCU02: Walcha Village	*Moderate*	Although the proposed wind turbines are likely to be discernible from some areas within the LCU, the Project will not dominate the visual catchment of the Walcha Village LCU. Due to the distance, the Project will form a minor element in the overall visual landscape. The landscape elements which contribute to the scenic quality of the LCU will remain intact as a result of the proposal.	Distant views toward the Project is likely to be visible from cleared, elevated positions within the LCU. The Project is unlikely to significantly alter or disrupt the identified key landscape features of the LCU.
LCU03: Moona Plains	*Low / Moderate*	Due a combination of factors including vegetation, topography, distance and speed of travel, the Project will form a minor element in the overall visual landscape. The current landscape character and scenic quality of the Moona Plains LCU is likely to be slightly altered in some locations due to the Project.	Although the proposed wind turbines are likely to slightly alter views within the LCU from some public locations to the north east and eastern areas of the LCU, the identified landscape features will remain the key features within the LCU area.
LCU04: Oxley Highway	*Low*	Due to the existing roadside vegetation, local topographical changes and distance, the Project will form a minor element in the overall visual landscape. The landscape elements which contribute to the scenic quality of the LCU will remain intact as a result of the proposal.	Although the Project is likely to slightly alter views from limited locations, the identified landscape features will remain the key features of the landscape within this LCU.
LCU05: Thunderbolts Way Pastures	*Low / Moderate*	The current landscape character and scenic quality of the Thunderbolts Way Pastures LCU is likely to be slightly altered in some locations, particularly sections of Mirana and Hillview Roads at close proximity to the Site, as a result of the Project.	Due to the proximity of some publicly accessible low use roads in this LCU, there is the possibility of the turbines being a dominant feature within the landscape. However, a combination of the orientation of these roads and the existing vegetation, generally these views make up a small portion of the views from within the LCU. Although the Project is likely to alter views from some limited locations, the identified landscape features will remain the key feature of the landscape within this LCU.
LCU06: Rowleys Creek Road	*Moderate*	The Project has the potential to be a dominant visual element when views from certain locations within this LCU due to the close proximity. However, the existing vegetation and topographical undulations are likely to fragment views, reducing the visibility of the Project from some locations. The current landscape character and scenic quality of the LCU is likely to be altered in some locations, particularly sections of at close proximity to the Project, as a result of the Project.	The proposed wind turbines have the potential to be a major feature within the LCU from some nearby locations. Views toward the ridgeline and undulating landform will remain a key feature, however the proposed turbines will also become a dominant visual element.
LCU07: Winterbourne Road	*Low / Moderate*	The Project has the potential to be a dominant visual element when views from certain locations within this LCU due to the close proximity. However, the existing vegetation and topographical undulations are likely to fragment views, reducing the visibility of the Project from some locations. Due to topographical variations, vegetation and the proximity to the Project typical of the LCU, views from some locations are likely to include a small portion of the Project at any one time. The current landscape character and scenic quality of the LCU is likely to be altered in some locations as a result of the Project.	The proposed wind turbines have the potential to be a major feature within the LCU from some nearby locations. Views toward the ridgeline and undulating landform will remain a key feature, however the proposed turbines will also become a dominant visual element.
LCU08: Apsley River	*Low / Moderate*	The Project will form a minor element in the overall visual landscape. The landscape elements which contribute to the scenic quality of the LCU will remain unchanged as a result of the Project.	The Project will form a minor element in the overall visual landscape and will not disrupt the key landscape features.
LCU09: Sailsbury Plains	*Low*	As a result the Project and associated infrastructure will form a minor element in the overall visual landscape. The scenic quality of the LCU will be slightly altered as a result of the proposal.	The Project is unlikely to significantly alter or disrupt the identified key landscape features of the LCU.

Table 20: Summary of Visual Impacts on Landscape Character Units

15.0 Visual Impacts on Landscape Character

15.4 Overview of Visual Impacts on Gondwana Rainforest of Australia World Heritage Area

The SEARS specifically requests for a detailed assessment of the visual impacts of the Project for the Gondwana Rainforest of Australia World Heritage Area (WHA).

The main publically accessible location within the Gondwana Rainforest is the Green Gully Track. The Green Gully Track is an isolated and challenging 65km hike that generally takes 4-5 days to complete and is recommended for experiences bushwalkers. The walking track explores the Apsley-Maclaey gorges and includes both high elevation forests, ridgelines, fern lines gullies and streams. A number of partially cleared, informal look out areas, including the Rocks Lookout, provide views to the surrounding dramatic gorges and rocky outcrops. A number of small huts located along the trail provide visitors an area to rest along the way. The trail itself is heavily wooded, with the exception of the surroundings to the huts and lookout areas.

A desktop assessment was undertaken using wireframes at both the Green Gully and 'Rocks' Lookout. These can be found within **Appendix D** of the report.

From these locations the turbines are located in excess of 20km of the viewpoints with the majority of the hike generally featuring dense vegetation. It was determined using the desktop assesment that due to a combination of distance and existing vegetation it will be unlikely to view the Project from either the Green Gully Lookout or 'Rocks' Lookout or from within the Gondwana Rainforest Area.

15.5 Potential Visual Impacts on Gondwana Rainforest of Australia World Heritage Area

In addition to what was requested in the SEARs, assessment was undertaken on the potential for impact on the entire WHA, in particular the areas directly to the east and south of the Project where, in some instances, the boundary of the WHA is within 2 km of the turbines. This assessment was undertaken in the context of the Unesco World Heritage and Wind Planning document which provides commentary on the assessment of wind energy projects in close proximity to listed World Heritage areas in Europe. Although the document focuses primarily on impacts on cultural heritage the concept of Outstanding Universal Value (OUV) is relevant in this case. The concept of OUV relates to the values of listed World Heritage Areas being representative of all the values of the World Heritage beyond the specific nature of each sites listing. The document states in explaining the concept of OUV that;

"*The value of a listed property is also universal and outstanding. To say that a World Heritage property is 'outstanding' means that it is the most representative example due to its status as a heritage type. 'Universal', for its part, means that the value of the property is recognizable to all of humanity, and not exclusively cultural, for instance, and that the property is representative of its culture of origin.*"

In relation to the Project, the concept of OUV is a relevant consideration in that the experience of the WHA, beyond the biodiversity values, should not be diminished or modified by change either inside or outside of the WHA boundary.

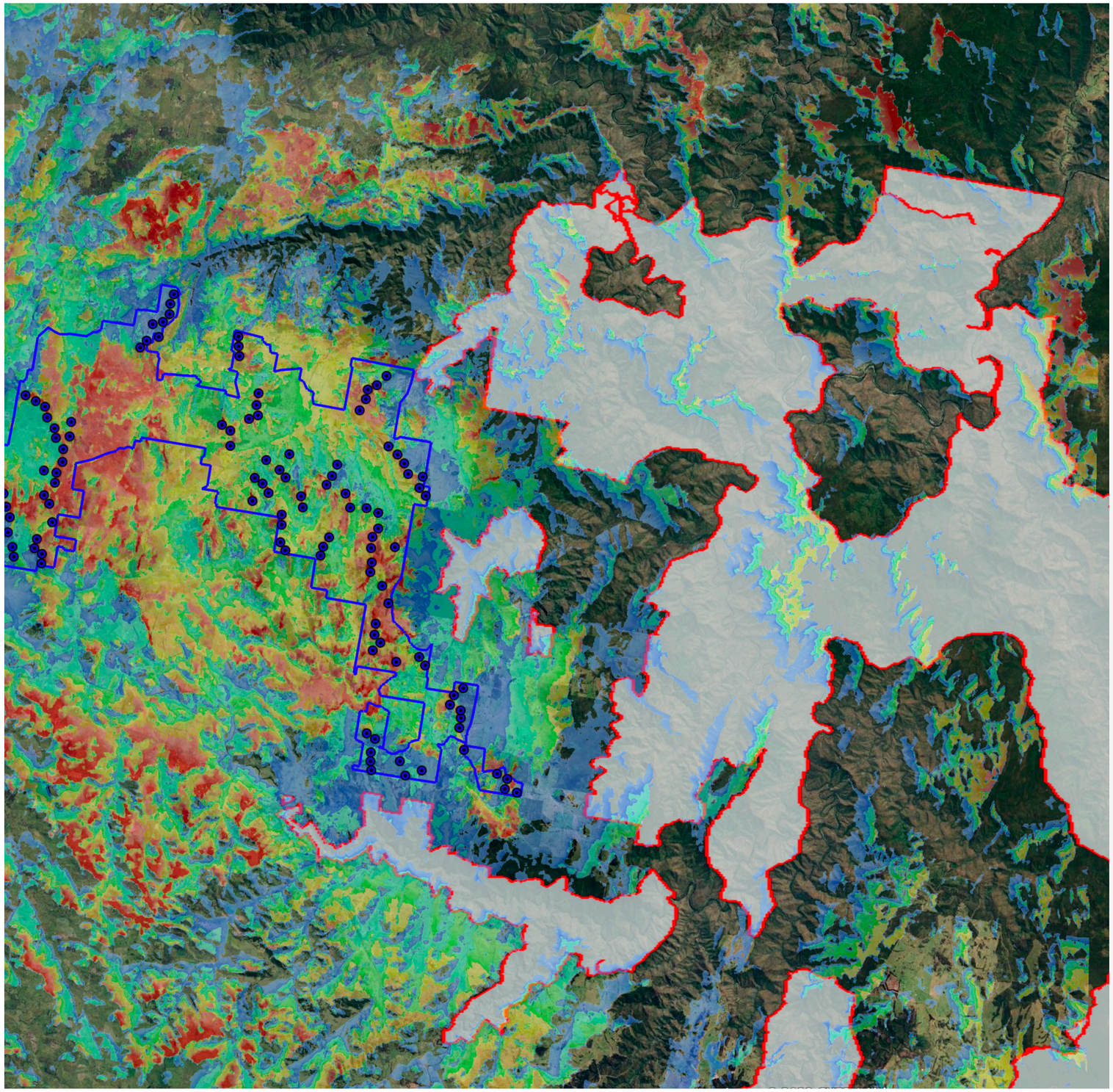
As part of the desktop assessment a ZVI was produced with a focus on theoretical visibility from the World Heritage Area and Oxley Wild Rivers National Park (Refer **Figure 34**). That ZVI demonstrated that the turbines would not be visible from the majority of the WHA however there is the potential for views from the eastern edge and from the southern edge. There is also the potential for views from high points within the WHA.

Considering the dense bushland character of the WHA it is likely that views from theoretically exposed locations would be either completely screened or fragmented by vegetation or, on potentially open ridgeline areas, be relatively brief and distant views in the context of the journey in and out of these locations. It is unlikely that the presence of the turbines in these views would impact on the existing landscape character or immersive experience of hiking to these locations.

From the identified walking trails assessed the ZVI demonstrated that views to the turbines from the walking trails within the WHA were either largely screened by topography or most likely to be significantly fragmented and diminished by vegetation and distance. Theoretical opportunities for views were also only identified in a few brief locations in the context of the broader journey of each trail (Refer to **Figures 35-40**).

The majority of the eastern and southern edge of the WHA is bounded by either National Park or private rural land. There are currently no identified walking trails in these areas and public access is also limited, excluding the Oxley Walking trail and the Aspley Falls Bridge assessed in VP29 and Photomontage 18A.

Due to distance and nature of the development, the construction of the Project will not have any physical impact on the values of the WHA as this is substantially tied to the relict Gondwana Rainforest that is an ancient natural environment. In regards to the Overall Outstanding Value of the WHA it is the conclusion that the Project will not negatively impact or diminish these values as the accessible experiences of the WHA either do not have views to the proposal due to topography or are so distant and densely vegetated that the presence of the turbines in any views would be insignificant in the context of the location and broader views.



Zone of Visual Influence National Parks Trails and World Heritage Area

Winterbourne Wind Farm

LEGEND:

- Project Site Boundary
- Proposed Wind Turbine Generator (WTG)
- World Heritage Area (WHA)

ZVI LEGEND:

- 0
- 1-19
- 20-39
- 40-59
- 60-79
- 80-99
- 100-119

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 34: Visual influence mapping on adjoining World Heritage Area and Oxley Wild Rivers National Park

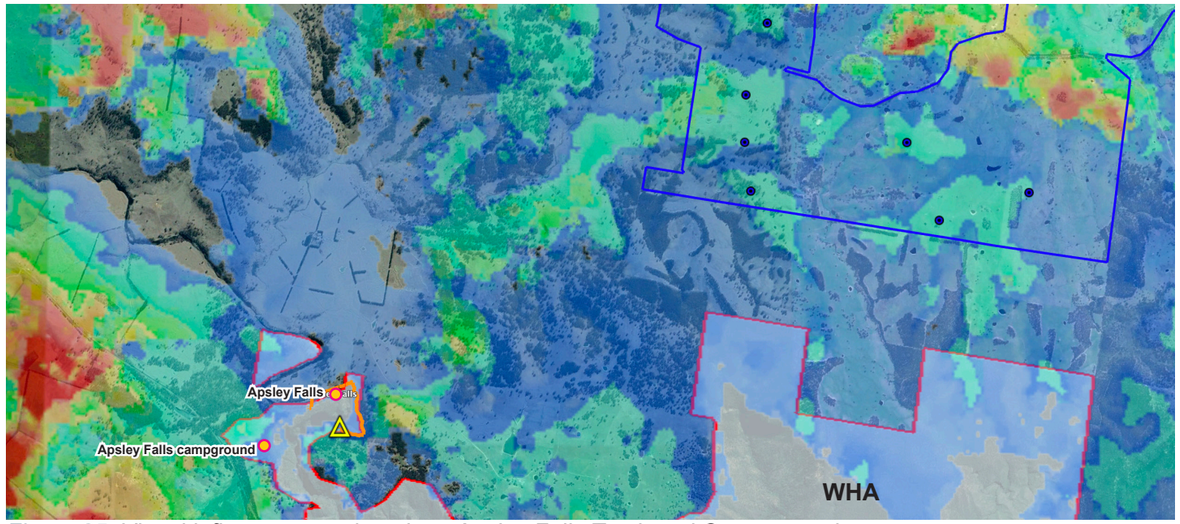


Figure 35: Visual influence mapping along Apsley Falls Track and Campground. Source: Google Earth 2021

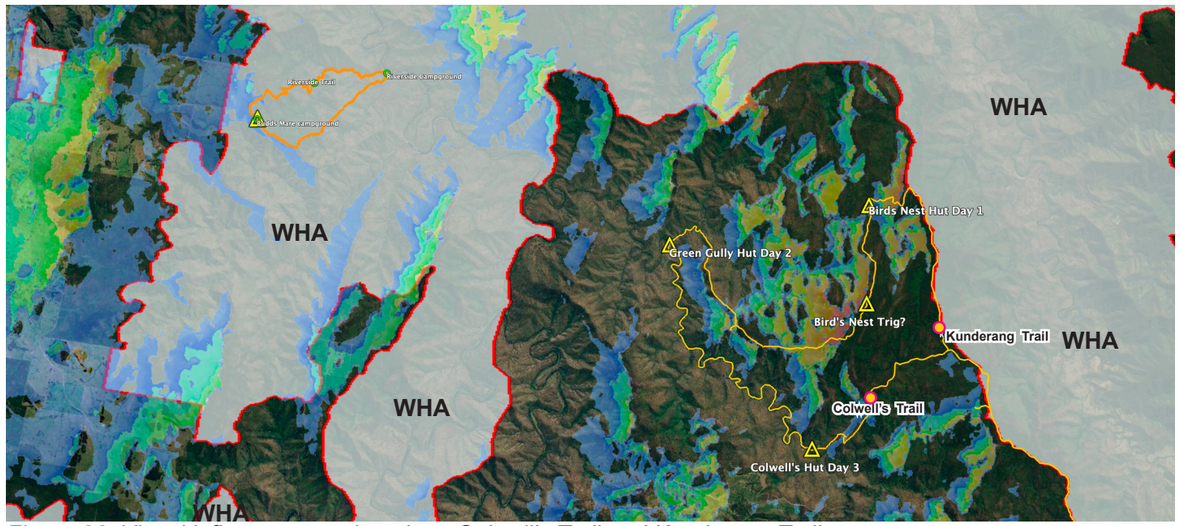


Figure 36: Visual influence mapping along Colwell's Trail and Kunderang Trail. Source: Google Earth 2021

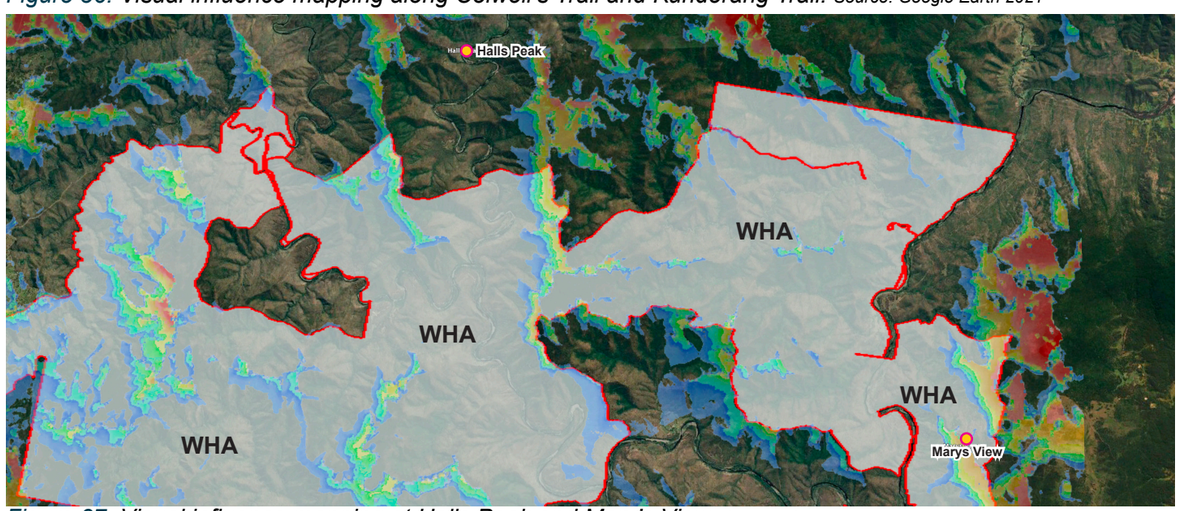


Figure 37: Visual influence mapping at Halls Peak and Mary's View. Source: Google Earth 2021

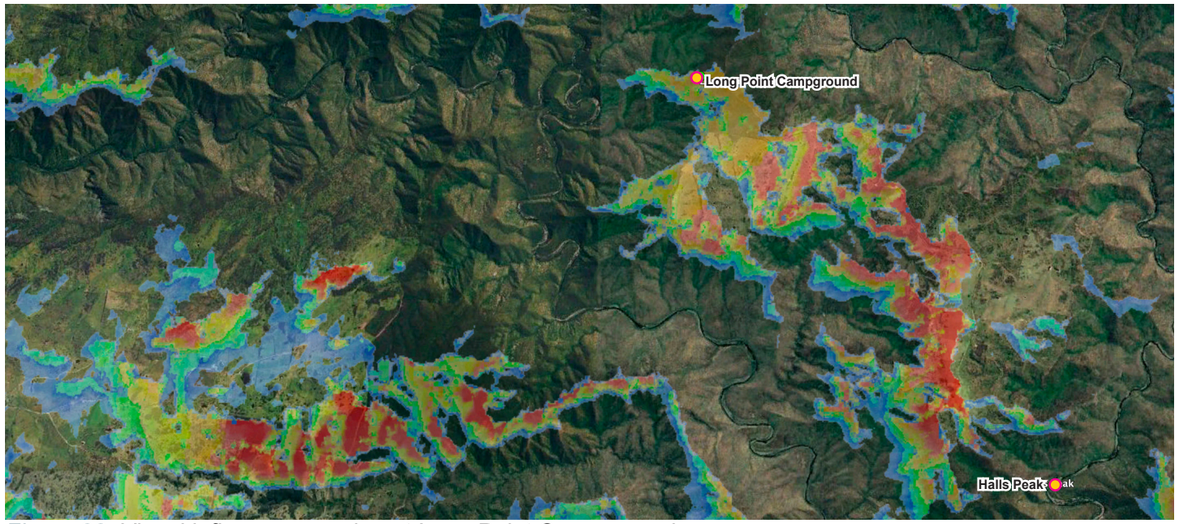


Figure 38: Visual influence mapping at Long Point Campground. Source: Google Earth 2021

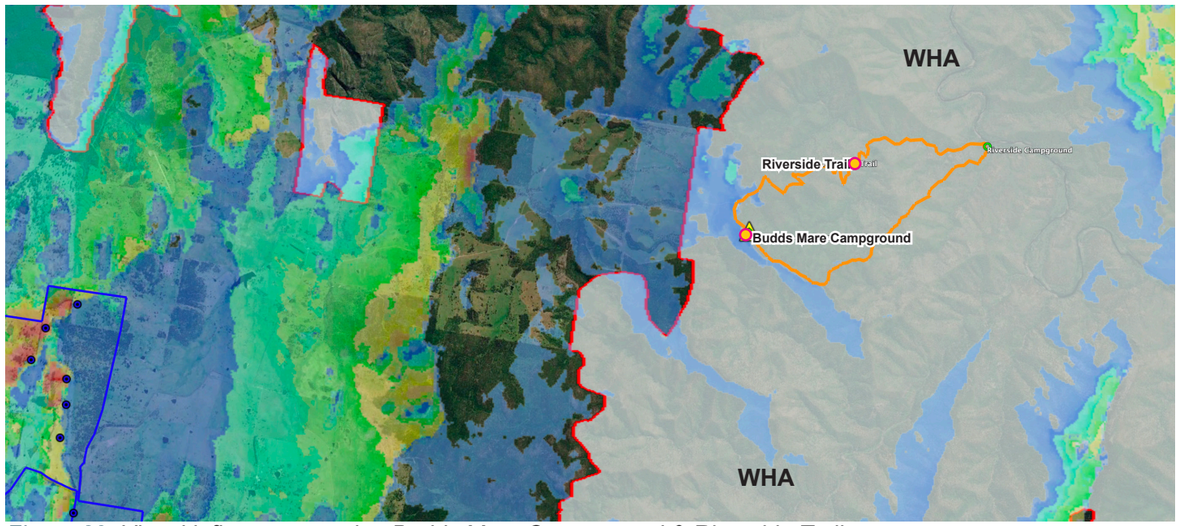


Figure 39: Visual influence mapping Budds Mare Campground & Riverside Trail. Source: Google Earth 2021

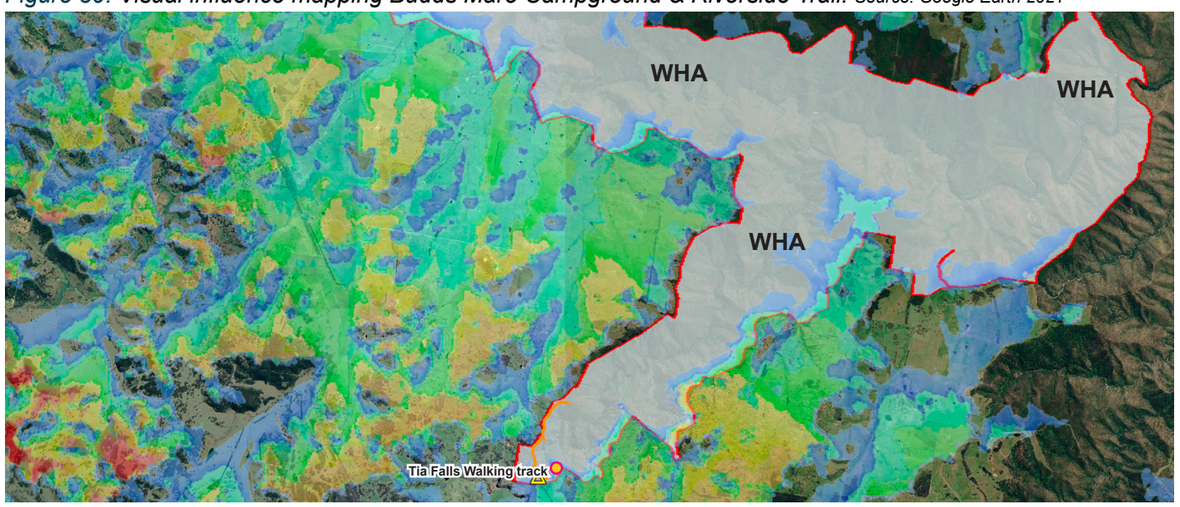


Figure 40: Visual influence mapping Tia Falls Walking Track. Source: Google Earth 2021

Points of interest within WHA — Publicly accessible walking trails

Points of interest within WHA — Publicly accessible walking trails

16.0 Mitigation Methods

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; and
- 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 proposed wind farm 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 turbines 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 turbine types, densities and layout geometry to minimise the visual impacts.
- The lines of turbines should reflect the contours of the natural landscape as best as possible.
- Ensure the turbines 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 resulting layout has a smaller development footprint to those previously considered. The above design principles have been considered in the siting of the proposed turbines to provide a balanced appearance within the landscape.

16.2.2 Wind Turbine Design and Colouring

Turbine design and colouring are an important factor. The turbines will have a matte white finish and consist of three blades which is consistent with the current turbine 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.

16.0 Mitigation Methods

16.3 Onsite Mitigation Methods - Non-involved Dwellings

The performance objectives of the Visual Assessment Bulletin state the proponent must: *Manage impacts as far as practicable, justify residual impacts, and describe proposed mitigation measures below the black line. Consider screening between the blue line and the black line.*

In accordance with the Visual Assessment Bulletin, the following provides a description of the proposed mitigation measures for each of the non-involved dwellings with a visual impact rating of moderate or high.

Further detail on Non-involved Dwelling Mitigation Measures has been included as part of ***Appendix G.***

16.3.1 Non-involved dwellings within 3,100 m

Of the **20 non-involved** dwellings assessed within the black line of visual magnitude (3,100 m from the nearest turbine) a total of **eight (8) non-involved dwellings** were identified through the visual assessment as having the potential for a moderate or high visual impact. Mitigation measures have been suggested for all nine (9) dwellings as per the objectives of the Visual Assessment Bulletin.

Application of mitigation methods as described in this section of the report could reduce the potential visual impact rating. ***Table 21*** provides an overview of the potential mitigation options for these dwellings.

Screen planting was identified as a potential mitigation measure for **four (4)** non-involved dwellings and supplementary planting has been suggested for **four (4)** dwellings.

Summary of Proposed Mitigation Measures: Dwellings within Black Line of Visual Magnitude

DWELLINGS	VISUAL IMPACT RATING (WITHOUT MITIGATION)	PROPOSED MITIGATION MEASURES	ESTIMATED TIME FRAME	VISUAL IMPACT RATING (WITH MITIGATION IMPLEMENTED)
SR207	*High*	Evergreen native planting may be added to supplement the existing deciduous vegetation on the north and north east of the dwelling.	2-5 years	*Low*
SR262	*High*	Screen planting to the east of the dwelling may assist in reducing the extent of visibility of the Project.	2-5 years	*Moderate*
SR268	*High*	Screen planting close to the northern side of the dwelling.	2-5 years	*Low*
SR007	*Moderate*	Screen planting to the south and west of the dwelling.	2-5 years	*Negligible*
SR240	*Moderate*	Screen planting close to the south eastern and northern side of the dwelling.	2-5 years	*Negligible*
SR272	*Moderate*	Supplementary planting to the north and north eastern side of the dwelling.	2-5 years	*Low*
SR274	*Moderate*	Supplementary planting near to the dwelling on the western and southern sides.	2-5 years	*Negligible*
SR298	*Moderate*	Supplementary planting near to the dwelling on the northern side of the dwelling.	2-5 years	*Negligible*

Table 21: Overview of mitigation measures identified for non-involved dwellings within 3100m

16.0 Mitigation Methods

16.3.2 Residences between 3,100 m - 4,550 m

Of the **23 non-involved dwellings** assessed between the black and blue line of visual magnitude (between 3,100 - 4550 m from the nearest turbine) a total of **nine (9) non-involved dwellings** were identified through the visual assessment as having the potential for a moderate or high visual impact. ***Table 22*** provides an overview of the potential mitigation options for these 11 dwellings.

Screen planting was identified as a potential mitigation measure for **four (4)** dwellings and supplementary planting has been suggested for **five (5)** dwellings. The principles of both methods have been outlined in the following sections.

Summary of Proposed Mitigation Measures: Dwellings between Black and Blue Lines of Visual Magnitude				
DWELLINGS	**VISUAL IMPACT RATING (WITHOUT MITIGATION)**	**PROPOSED MITIGATION MEASURES**	**ESTIMATED TIME FRAME**	**VISUAL IMPACT RATING (WITH MITIGATION MEASURES IMPLEMENTED)**
SR006	*Moderate*	Supplementary planting near to the dwelling on the south west side.	2-5 years	*Negligible*
SR050	*Moderate*	Supplementary planting near to the dwelling on the north east side.	2-5 years	*Negligible*
SR075	*Moderate*	Screen planting close to the north eastern side of the dwelling.	2-5 years	*Negligible*
SR087	*High*	Screen planting close to the west of the dwelling and east.	2-5 years	*Negligible*
SR088	*High*	Screen planting close to the west of the dwelling and east.	2-5 years	*Negligible*
SR093	*Moderate*	Supplementary planting to the north east of the dwelling.	2-5 years	*Negligible*
SR289	*Moderate*	Supplementary planting near to the dwelling on the southern side of the dwelling.	2-5 years	*Low*
SR350	*Moderate*	Supplementary planting to the foreground of the dwelling to the south west.	2-5 years	*Low*
SR359	*Moderate*	Screen planting to the north east of the dwelling	2-5 years	*Negligible*

Table 22: Overview of mitigation measures identified for non-involved dwellings between 3100m - 4550m

16.0 Mitigation Methods

16.4 Proposed Mitigation Methods

The Visual Assessment Bulletin states: *Vegetation screening, or the planting of trees and shrubs, to visually screen wind turbines or other potential visual impacts from view may be an option for selected viewpoints. Due to the great height of most wind turbines compared to that of surrounding trees, generally the vegetation must be relatively close to the viewer to be effective.*

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

The following provides examples of how visual screening can be implemented to reduce the visual impacts of the Project from non-involved dwellings. The examples have been provided to solely illustrate the effectiveness of on-site screen planting from a dwelling with a moderate or high visual impact rating. Visual screening location is indicative only and is proposed to be undertaken in consultation with the landowner post construction.

16.4.1 On site Screen Planting

In circumstances where residences are subject to a level of visual impact, screen planting is an option proposed to assist in mitigating views of turbines 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 proposal.

In order to achieve visual screening planting between the intrusive element and the homestead, tree planting could 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 turbines.

An example of successful screen planting employing principles outlined in this report has been provided in ***Figure 41*** and ***Figure 42a&b*** from SR262.

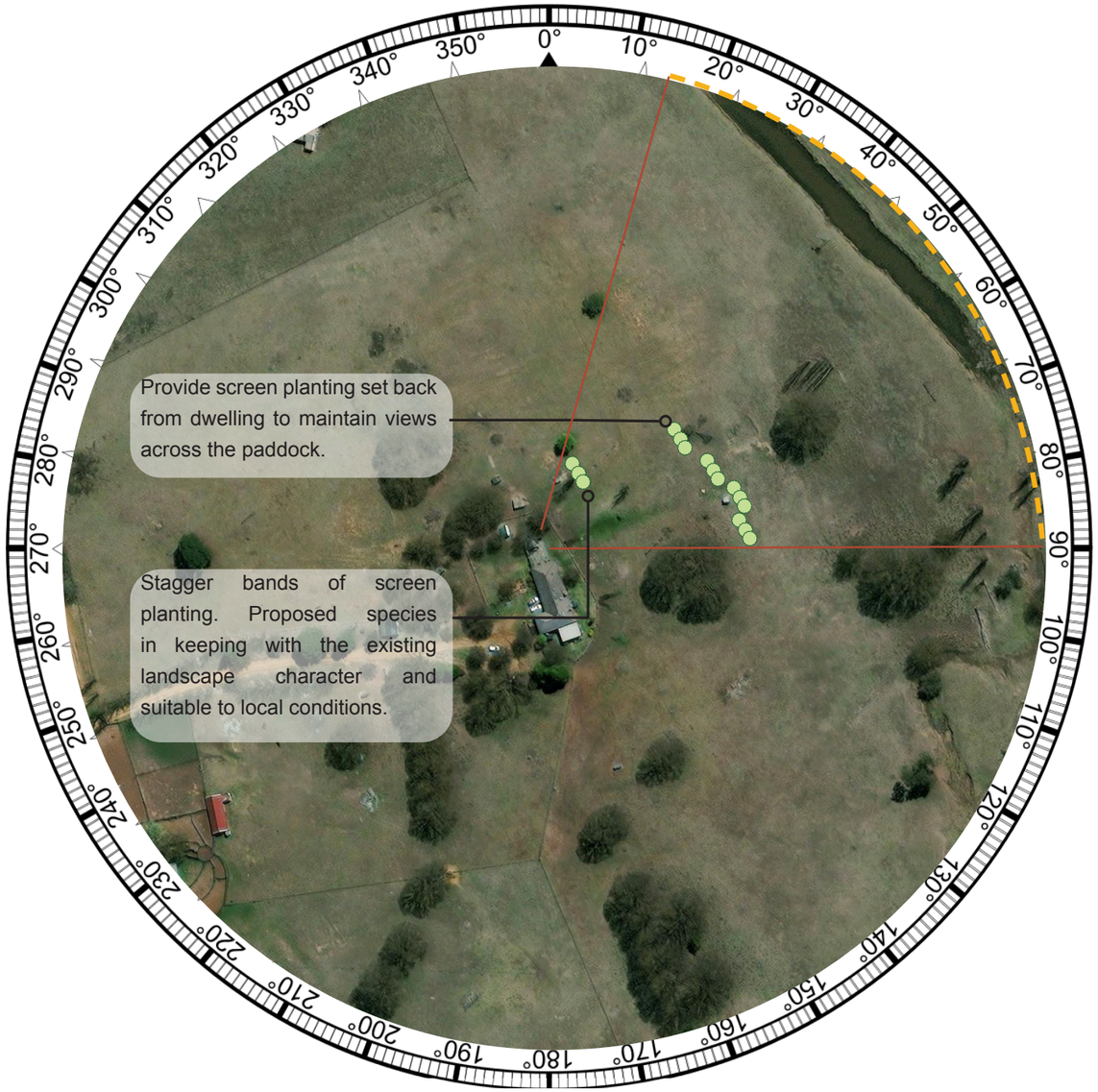


Figure 41: Example of screen planting principles (SR262) (Image Source: Six Maps 2021)

16.0 Mitigation Methods

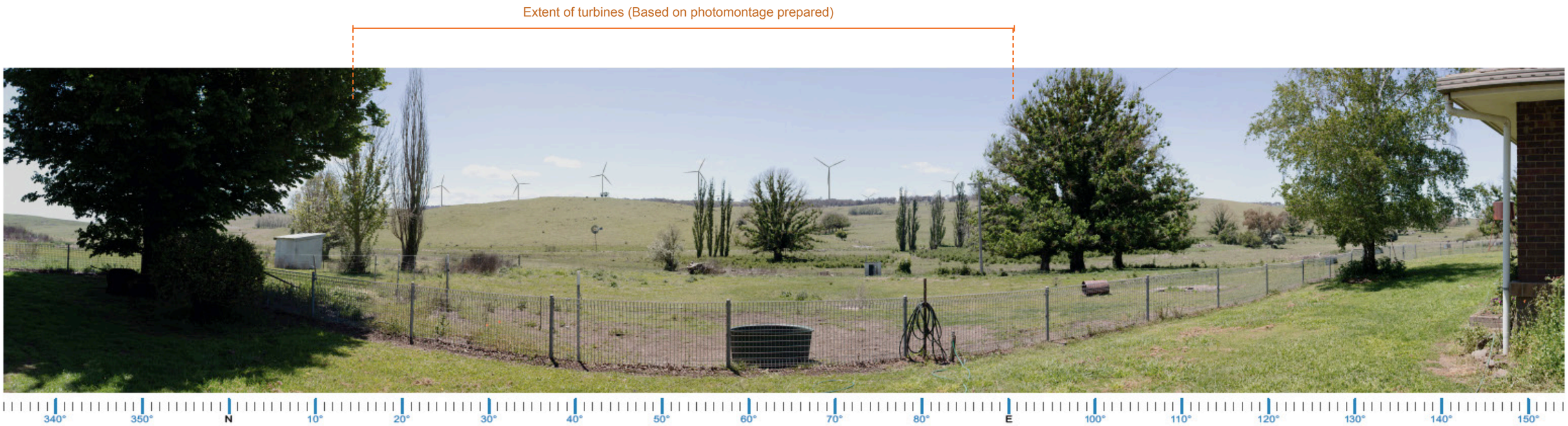


Figure 42a: Existing 180 degree Photomontage (Dwelling SR262)

Proposed screen planting set back from the dwelling to ensure desirable views across the property are maintained. Species to be selected in keeping with the existing landscape character and suitable to local conditions.

Figure 42b: Example of supplementary planting set back from residence (Dwelling SR262)

16.0 Mitigation Methods

16.4.2 Residence Supplementary Planting

Due to the vegetated character of areas surrounding the Project Site the Project is likely to be fragmented or screened by vegetation from a number of dwellings. Where turbines are located close to the dwelling or existing intervening vegetation is thin, supplementary planting is a mitigation method that has been identified. Supplementary planting in keeping with the existing landscape character would further reduce potential visibility and ensure longevity of the intervening vegetation.

Existing scattered vegetation obstructs views towards some wind turbines from SR088. Existing vegetation is scattered in the foreground. Where screening may be required from a static position (ie. kitchen / living room window) screen planting sited away from the residence ensures desirable views across land are retained where possible, whilst selectively screening views to WTGs.

An example of how supplementary planting could be used to mitigate potential views towards visible turbines from *Dwelling SR207* illustrated in ***Figure 43.*** 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.

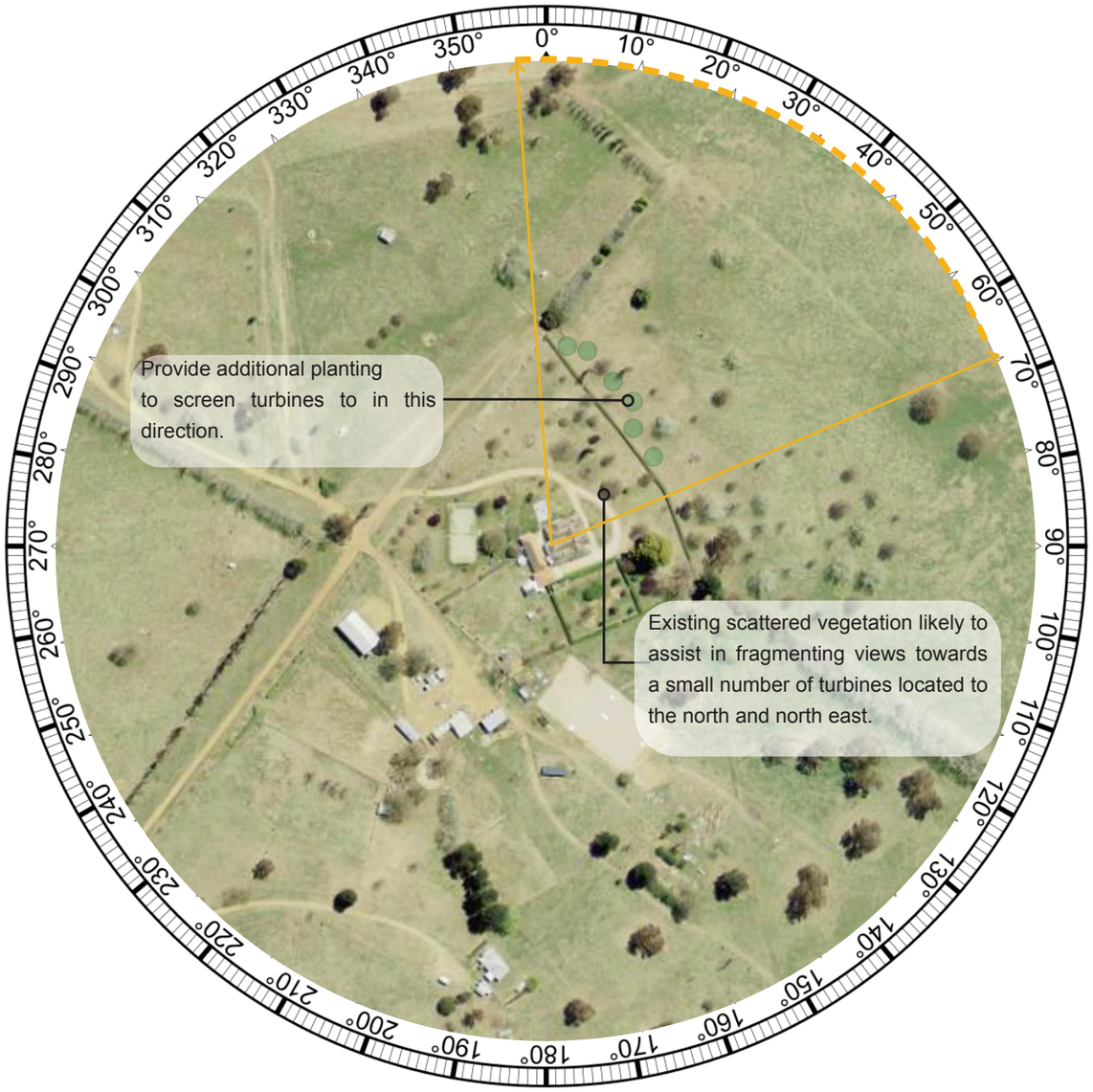


Figure 43: Example of mitigation principles (SR207) (Image Source: Six Maps 2021)

16.0 Mitigation Methods

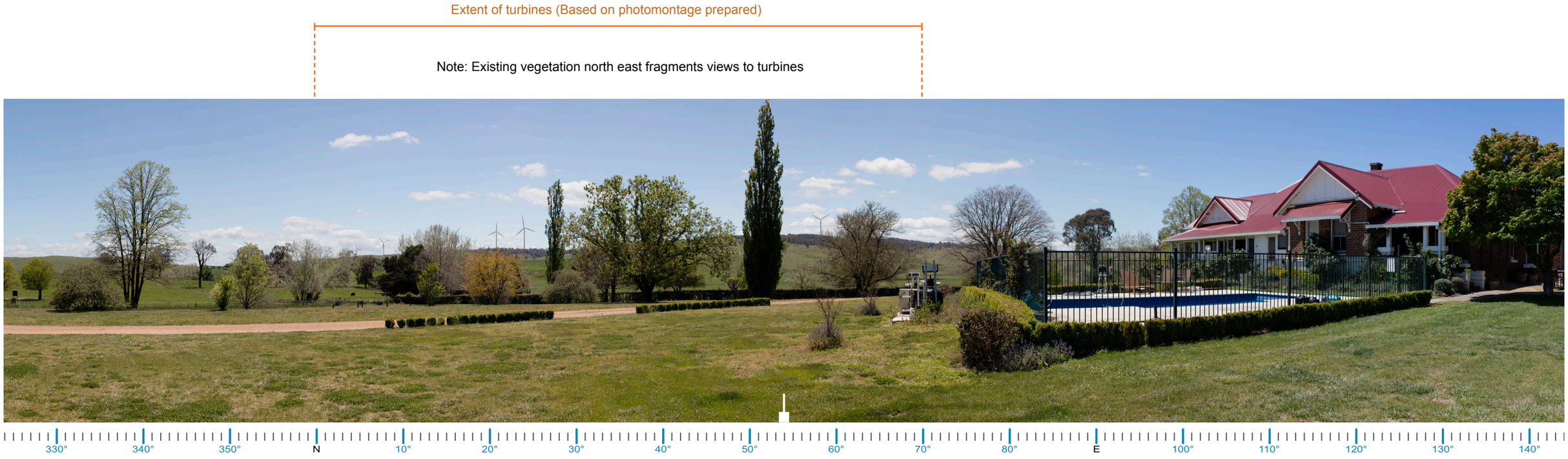


Figure 44a: Existing 180 degree Photomontage (Dwelling SR207)

Figure 44b: Example of supplementary planting set back from residence (Dwelling SR207)

16.0 Mitigation Methods

16.5 Landscaping Principles

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 help to 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.

17.0 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.

Of the non-involved dwellings identified within the blue and black lines the following VIZ ratings have been applied as per the Bulletin and are summarised below.

Visual Influence Zone 1 (VIZ1):
A total of 10 dwellings were rated as Visual Influence Zone 1 (VIZ1). The visual performance objectives have been assessed for each of the dwellings in accordance with the Visual Assessment Bulletin.
Visual Influence Zone 1 (VIZ1).

Visual Influence Zone 2 (VIZ2):
A total of 33 dwellings were rated as Visual Influence Zone 2 (VIZ2). The visual performance objectives have been assessed for each of the dwellings in accordance with the Visual Assessment Bulletin.

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 (4550m for Winterbourne WF)	*Manage impacts as far as practicable, justify residual impacts, and describe proposed mitigation measures below the black line (3100m for Winterbourne WF). Consider screening between the blue line and the black line.*	*Consider screening below the black line (within 3100m).*
Summary of LVIA Evaluation		
• *Refer to Section 6.0 - Visual Magnitude* **Dwellings within 3100 m (below the black line):** • *20 non-involved dwellings were identified within 3,100 metres of the nearest proposed WTG.* • *The visual impact rating has been rated as nil, negligible or low from 12 non-involved dwellings.* • *Mitigation methods proposed for the remaining eight (8) dwellings is likely to reduce impacts to an acceptable level.* **Dwellings within 3100 m - 4550 m (between the blue and black line):** • *23 non-involved dwellings were identified between 3,100 - 4,550 metres of the nearest proposed WTG.* • *The visual impact rating has been rated as nil, negligible or low from 14 non-involved dwellings.* • *Mitigation methods proposed for the remaining 9 non-involved dwellings is likely to reduce impacts to an acceptable level.*		

Table 23: Visual Magnitude - Evaluation of Visual Performance Objectives

17.0 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:

- In accordance with the Bulletin, the Visual Influence Zone (VIZ) was rated for 56 viewpoints within the Study Area, the visual performance objectives were assessed for all viewpoints rated as VIZ2. It is noted that there were no viewpoints rates as VIZ1 identified.
  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 was summarised for each Landscape Character Unit.
  Refer to Section 5 and Appendix F: Overview of LCUs

- The LVIA concluded that whilst the Project is likely to 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

- 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.

Refer to Section 5 and Appendix F: Overview of LCUs

Table 25: Key Feature Disruption - Evaluation of Visual Performance Objectives

17.0 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 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.
  Refer to Section 6.0: Preliminary Assessment Tools

Summary of Assessment:

Based on a 2D Assessment:

- A total of 12 non-involved dwellings were identified as having the potential to view turbines in more than two (2) 60º sectors.
- 11 Non-involved Dwellings had turbines within three (3) 60º sectors
- 1 Non-involved Dwelling had turbines within up to four (4) 60º sectors.

3D Assessment (based on topography alone):

- A 3D assessment found the number of potential turbines was reduced to acceptable levels (one or two 60º sectors) for 2 of the 12 dwellings identified (SR264 and SR282).
- Nine (9) dwellings have turbines in up to three (3) 60º sectors and one (1) in up to four (4) 60º sectors
- It has been determined that intervening factors such as vegetation and built form reduce the potential visibility of turbines in some of the 60 degree sectors.

Refer to Section 6.0: Preliminary Assessment Tools and Appendix E: Detailed Dwelling Assessments

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

Shadow Flicker:

- No methodology is provided for the assessment of shadow flicker. Moir LA have utilised the Draft National Guidelines to assist in formulating a methodology for assessment.
- A total of two (2) non-involved dwellings were identified with potential shadow flicker hours. *Refer to Table 17.*
- Of the ftwo (2) non-involved dwelling with potential shadow flicker, none have the potential to experience more than 30 hours per year.
- The assessment is based on a worst case scenario considering topography alone.

Refer to Section 11.0 Shadow Flicker

Blade Glint:

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

Refer to Section 11.4 Blade Glint

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

17.0 Evaluation of Visual Performance Objectives

Aviation Hazard Lighting
Objectives (Applies to all Visual Influence Zones) *Objective 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
• The visual effect from night lighting has the potential to have a visual impact on receptors including motorists and residents in the area. • Mitigation methods have been outlined in Section 12.4. *Refer to Section 12.0 Night Lighting Assessment*

Table 28: 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 proposed wind farm contrasts with the existing landscape character of the region which is typically rural, pastoral 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 proposal 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 wind turbines, the overall visual impact of the wind farm 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 wind farm 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 wind farm.

The visual impact of the wind turbines are lessened as the distance of the vantage point from the Project is lengthened. The topography surrounding the wind turbines significantly alters the visibility of the proposed development 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 proposed turbine locations.

The greatest visual effect is most likely to be felt by residents in the immediate vicinity of the wind farm. 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 proposed wind farm. Through mitigation methods described it will be possible to significantly reduce the visual impact to an acceptable level at sensitive viewpoints such as rural residential properties.

However due to their simplicity in form (especially when compared to transmission lines, towers and associated infrastructure) wind turbines can be considered a temporary installation in the landscape due to their modular construction and ability to be 'packed down' and removed and relatively low impact during the construction phase.

When implemented with appropriate environmental management, the development of wind farms can be undertaken with low impact on the surrounding environment whilst providing positive local, regional and national benefits. It is the professional opinion of Moir Landscape Architecture that with the appropriate mitigation measures implemented, the proposed Winterbourne Wind Farm can be developed accordance with the visual performance objectives of the Bulletin.

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Appendix A

VIZ Methodology

Appendix B

Landscape Character Unit (LCU) Descriptions

Appendix C

Viewpoint Analysis

Appendix D

Photomontages and Wireframe Diagrams

Appendix E

Detailed Dwelling Assessments

Appendix F

Overview of Impacts on Landscape Character Units (LCU)

Appendix G

Non-involved Dwelling Mitigation Measure