APPENDIX 8

Landscape and Visual Impact Assessment

Cumulative Landscape and Visual Impact Assessment

Green Bean Design

UPDATES TO THE ENVIRONMENTAL IMPACT STATEMENT

During the preparation of this Environmental Impact Statement, a number of changes occurred.

Please consider these changes while reviewing this Appendix.

- The Assessment Type of the Bango Wind Farm has transitioned from Part 3A, after its repeal, and is now being assessed as a State Significant Development under Part 4 of the EP&A Act. Any reference to a Part 3A assessment in attached technical assessments may be disregarded, and considered as State Significant Development;

- Rugby Wind Farm, a wind farm that was proposed to the north of the Project has been withdrawn. Where references are made to cumulative impacts with the Rugby Wind Farm, please disregard these;

- Slight changes have occurred to the Rye Park Wind Farm layout, a wind farm under development to the east of the Project. The changes made to the layout are not significant and therefore sit within the cumulative impact assessment undertaken for this EIS. The revised layout has been considered in the Environmental Noise Assessment and Landscape Visual Impact Assessment. Where further references are made to the Rye Park Wind Farm layout, these will be incorporated into future documentation where required;

- Four turbines at the south east extent of the Project, situated in the Mt Buffalo cluster have been removed through consultation with landowners. This change has been highlighted in maps and a review of all technical assessments has deemed that the removal of the four turbines has resulted in a reduced. This change will be incorporated into future documentation. These wind turbines are identified as “removed wind turbines” in the Project maps in Volume 2; and

- A number of changes were made to the residence information for the Project, as a result of construction of houses and change in occupancy status of existing buildings. These changes have been incorporated into the EIS.

GREEN BEAN DESIGN landscape architects

Siobhan Isherwood
CWP Renewables Pty Ltd
PO Box 1708, 45 Hunter Street
NEWCASTLE NSW2300

1st September 2016

Dear Siobhan

Re Bango Wind Farm Landscape and Visual Impact Assessment – turbine modification for an 8m increase to tip of blade height

Further to the preparation of our Landscape and Visual Impact Assessment (LVIA) and Supplementary Cumulative Visual Impact Assessment for the Bango Wind Farm Project, we understand that CWP Renewables Pty Ltd (the Proponent) propose to consider a wind turbine model extending to a tip height of 200 metres (m) for the Project.

The Bango Wind Farm LVIA originally determined levels of impact for a 192m wind turbine tip height. The parameters for the 192m tip of blade wind turbine and the proposed 200m tip of blade wind turbine are outlined in the following table and the diagram below.

Element	192m tip of blade	200m tip of blade	Difference (%)
Rotor Diameter	144m	144m	Nil
Overall height to tip of blade	192m	200m	+4%
Total number of turbines	**122**	**122**	**Nil**

The maximum rotor diameter of 144m will not increase and the final tower and rotor dimensions will sit within the 200m blade tip height envelope.

We understand that the proposed '200m tip height' wind turbines would be located in the same position as the previously assessed '192m tip height' wind turbines and include up to a maximum of 122 wind turbines.

As requested we have reviewed the Bango Wind Farm LVIA (V5 – Final Issue 14 May 2016) to identify any additional level of landscape or visual impact that might result from an 8m increase to the wind turbine tip of blade height. Our review included as assessment of potential changes:

- in wind turbine visibility within the Bango Wind Farm 10km viewshed;
- to levels of visual impact determined for residential and public view locations;
- to the shadow flicker assessment; and
- to the extent of cumulative impact.

Our review of the Bango Wind Farm LVIA has determined that:

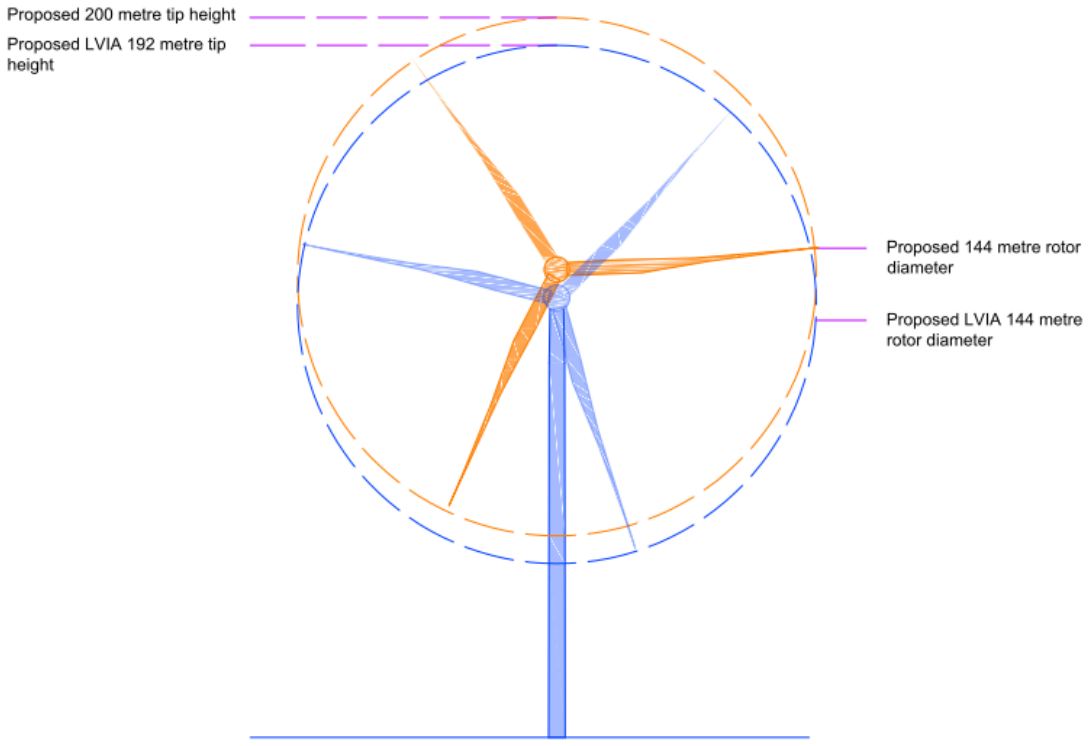
- An 8m increase in wind turbine tip height would not result in any significant increase in the level of visibility of wind turbines over and above that originally determined in the Bango Wind Farm LVIA for the 192m tip of blade wind turbine. There would be no significant or discernable difference to the ZVI Diagrams prepared for the 192m tip height wind turbine (Figures 22, 23 and 24 ZVI Diagrams 1, 2 and 3 within the LVIA).

- An 8m increase in wind turbine tip height would not result in overall changes to the level of visual impact

determined for residential dwellings or public view locations identified and assessed in the Bango Wind Farm LVIA Table 18.

- An 8m increase in tip height would be unlikely to result in any associated or non associated residential dwelling experiencing shadow flicker in excess of the hours per year identified in the Bango Wind Farm LVIA (Table 19).

- An 8m increase in tip height would not result in any additional level of cumulative impact over and above that determined in the Bango Wind Farm LVIA.



Yours sincerely,

GREEN BEAN DESIGN
landscape architects

Andy Homewood, BSc (Dual Hons), Grad DipLM, DipHort, AILA
Registered Landscape Architect

GREEN BEAN DESIGN landscape architects

Bango Wind Farm

LANDSCAPE & VISUAL IMPACT ASSESSMENT

Prepared for:

WIND PROSPECT CWP PTY LTD

Prepared by:

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May 2016

DOUCMENT CONTROL

ITEM	DETAIL
Project Name:	**Bango Wind Farm**
Report Title:	**Landscape and Visual Impact Assessment**
Project Number:	**12-164**
Version Number:	**v5**
Status:	**Final**
Author:	**Andrew Homewood**, Registered Landscape Architect, AILA *Graduate Diploma Landscape Management, Bachelor Science (Dual Honours) Landscape Design and Archaeology, National Diploma Horticulture*
Date:	**14 May 2016**

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Glossary

This Landscape and Visual Impact Assessment has adopted and adapted the following definitions from *Guidelines for Landscape and Visual Impact Assessment* (2013).

Table 1 Glossary

Term	Definition
Cumulative effects	The summation of effects that result from changes caused by a development in conjunction with other past, present or reasonably foreseeable actions.
Magnitude	A combination of the scale, extent and duration of an effect.
Mitigation	Measures, including any processes, activity or design to avoid, reduce, remedy or compensate for adverse landscape and visual effects of a development project.
Sensitivity	Susceptibility of a receiver to a specific type of change.
Visibility	A relative determination at which the proposal can be clearly discerned and described.
Visual amenity	The value of a particular area or view in terms of what is seen.
Visual envelope	Extent of potential visibility to or from a specific area or feature.
Visual Impact Assessment	A process of applied professional and methodical techniques to assess and determine the extent and nature of change to the composition of existing views that may result from a development.
View location	A place or situation from which a proposed development may be visible.
Visual receiver	Individual and/or defined groups of people who have the potential to be affected by a proposal.
Visual significance	A measure of the importance or gravity of the visual effect culminating from the degree of magnitude and receiver sensitivity.

Executive summary

Green Bean Design (GBD) has been commissioned by Bango Wind Farm Pty Ltd (the Proponent), a wholly owned subsidiary of Wind Prospect CWP Pty Ltd, to undertake a Landscape and Visual Impact Assessment (LVIA) for the Bango wind farm development (the project).

The project comprises a wind farm development with two potential layouts. Layout Option 1 proposes up to 122 wind turbines, and Layout Option 2 proposes up to 96 wind turbines. For the purpose of this LVIA, an assessment (including ZVI and photomontages) has been prepared for Layout Option 1 as it contains the greater number of proposed wind turbines.

The proposed wind turbines have been assessed with a maximum blade tip height of 192 m from ground level to tip of blade, and a maximum blade length of up to 72 m. Associated electrical works include a proposed overhead powerline (rated up to 132 kV) connection to an existing 132 kV overhead powerline which spans north to south across the western portion of the project site. The proposed overhead powerline would connect to the grid via a collector substation and switching station.

This LVIA involved desktop studies and site inspections to collect and analyse information to describe and define the characteristics of the landscape in which the project would be located. This LVIA has determined that the landscape surrounding the project has an overall medium/medium to high sensitivity to change. The existing landscape character is reasonably typical of landscape character areas that are commonly found in the surrounding areas of the New South Wales Southern Tablelands and the NSW/ACT Border Region Renewable Energy Precinct.

As a landscape with an overall medium/medium to high sensitivity to change, some recognisable characteristics of the landscape character will be altered by the proposed project, and result in the introduction of visually prominent elements that will alter the perceived characteristics of the landscape; however, the degree of alteration may be partially mitigated by existing landscape elements and features within the landscape. The main characteristics of the landscape, patterns and combinations of landform and landcover will still be evident.

The Bango wind farm visibility was determined within a 10 km viewshed from the Bango wind turbines, and illustrated within a series of panoramic photographs and 3 Zone of Visual Influence (ZVI) diagrams (up to a

distance of 10 km). The ZVI diagrams demonstrate the influence of topography on visibility and identify theoretical areas from which the wind farm turbines would, and would not, be visible.

A total of twenty one involved, neighbouring and uninvolved dwellings have been identified within 2 km of the proposed Bango wind turbines. Three dwellings have been determined to have a low to medium visual significance and 5 with a medium visual significance. Three dwellings within the 2 km viewshed have been determined to have a medium to high visual significance, and 10 dwellings would have a high visual significance.

A total of 98 involved and uninvolved dwellings have been identified between 2 km and 5 km of the proposed Bango wind turbines. Twenty three of the dwellings between 2 km and 5 km of the Bango wind farm turbines would have a Nil to Low visual significance. Sixty one dwelling locations between the 2 km and 5 km viewshed have been determined to have a low visual significance and 10 with a low to medium visual significance. Two dwellings between the 2 km and 5 km viewshed have been determined to have a medium visual significance.

This LVIA assessed the potential visual impact associated with the proposed sections of an overhead 132 kV powerline, including the three optional collector substation and switching station locations and associated electrical infrastructure. The LVIA determined that the overall visual significance of the electrical elements would be very low to low due to the potential screening influence of landform and tree cover relative to dwelling locations.

A cumulative assessment identified two proposed wind farm developments (the Rye Park and Rugby wind farm projects) in local vicinity of the Bango wind farm 10 km viewshed. This LVIA determined that there would be some potential for wind turbine intervisibility between the Bango wind farm and other wind farm developments, although the potential for direct cumulative impacts for the majority of residents within the Boorowa Township and Rye Park Village would be limited by the arrangement of wind turbine arrays within separate wind farm development, as well as the nature of local topography and exiting tree cover.

Night time obstacle lighting, if implemented, would have the potential to create a visual impact on residential dwelling locations surrounding the Bango wind farm. This LVIA notes that further to the withdrawal of the

CASA Advisory Circular there are no guidelines by which to define criteria for wind farm night time obstacle lighting. This LVIA notes that night time lighting has been determined as not required for the Gullen Range

Wind Farm, and that obstacle lighting has also been removed from the Cullerin wind farm adjoining the Hume Highway to the east of Yass.

Although some mitigation measures are considered appropriate to minimise the visual effects for a number of the elements associated with the wind farm, it is acknowledged that the degree to which the wind turbines can be visually mitigated is limited by their scale and position within the landscape relative to surrounding view locations.

Introduction

Section 1

1.1 Introduction

This LVIA addresses one of the key requirements of the Bango wind farm Environmental Assessment (EA) to be submitted and assessed under Part 3A of the Environmental Planning & Assessment Act 1979 (EP&A Act).

This LVIA methodology adopted by GBD has been applied to a number of similar LVIA for large scale infrastructure projects prepared by GBD, which have been assessed and approved by the New South Wales Department of Planning under Part 3A of the EP&A Act, and peer reviewed by independent landscape architectural experts.

This LVIA addresses and responds to the Director General's Requirements (DGR's) dated 31 March 2011, for the assessment of potential landscape and visual impacts of the project. **Table 1** outlines the relevant landscape and visual impact assessment requirements of the DGR's and the corresponding section in which they are addressed within this LVIA report.

Table 1 Director General's Requirements

DGR's	Report Reference
• provide a comprehensive assessment of the landscape character and values and any scenic or significant vistas of the area potentially affected by the project, including an assessment of the significance of landscape values and character in a local and regional context. This should describe community and stakeholder values of the local and regional visual amenity and quality, and perceptions of the project based on surveys and consultation.	Refer LVIA **Sections 6** and **15**
• assess the impact of shadow "flicker", blade "glint" and night lighting from the wind farm.	Refer LVIA **Sections 9** and **12**,
• identify the zone of visual influence including consideration of night lighting (no less than 10 kilometres) and assess the visual impact of all project components on this landscape.	Refer LVIA **Sections 7** and **12**.
• Include an assessment of any cumulative visual impacts from powerline infrastructure.	Refer LVIA **Section 10**.
• include photomontages of the project taken from potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights), settlements and significant public view points, and provide a clear description of	Refer LVIA **Sections 11** and **16**.

Table 1 Director General's Requirements

DGR's	Report Reference
proposed visual amenity mitigation and management measures for both the wind farm and the powerline. The photomontages must include representative views of turbine night lighting if proposed.	
• provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented.	Refer LVIA **Section 16**.
• Include consideration of alternative powerline pole designs to minimise visual impact.	Refer LVIA **Section 13**.

The Bango wind farm project site would be located within two Local Government Areas (LGA) including the:

- Boorowa Shire Council; and
- Yass Valley Shire Council.

The Upper Lachlan Shire Council LGA is located to the east of the Bango wind farm project site; however, portions of the Upper Lachlan Shire Council LGA are located within the Bango wind farm 10 km viewshed. GBD has reviewed the Upper Lachlan Shire Council's Development Control Plans (DCP) for Wind Power Generation and confirm that this LVIA addresses a number of key DCP requirements with regard to consideration of visual assessment, and includes provision for:

- the assessment of visual impact and scenic value;
- the assessment of cumulative impact;
- shadow flicker assessment;
- viewshed mapping; and
- photomontages.

The assessment of potential visual impact associated with shadow flicker has been assessed and included in **Section 9** of this LVIA.

GBD is not aware of any landscape areas within the immediate wind farm viewshed that are subject to any Local, State or Federal statutory designations for high landscape values or scenic quality and/or scenic protection.

GBD is cognisant of the Australian Wind Energy Association and Australian Council of National Trust's publication Wind Farms and Landscape Values National Assessment Framework, June 2007, and have encompassed the general assessment framework outlined in the National Assessment Framework within the LVIA methodology. In addition to the National Assessment Framework, the preparation of this LVIA has also included a review of the Draft NSW Planning Guidelines: Wind Farms (December 2011).

This LVIA involved a comprehensive evaluation of the landscape character in which the Bango wind farm and ancillary structures would be located, and an assessment of the potential landscape and visual impacts that could result from the construction and operation of the wind farm, taking into account appropriate mitigation measures. This LVIA is based on technical and design information provided by the Proponent to GBD.

1.2 Draft NSW Planning Guidelines: Wind Farms (December 2011)

The NSW DoP&I issued the Draft Planning Guidelines: Wind Farms (NSW Draft Guidelines) in December 2011, which provide guidance and information for wind farm applicants, consent authorities as well as communities and stakeholder groups. The NSW Draft Guidelines were placed on public exhibition between December 2011 and March 2012; however, had not been finalised or formally adopted by the New South Wales Government prior to completion of this LVIA.

The NSW Draft Guidelines set out key considerations for the upfront assessment of landscape and visual impact for residential dwellings within a 2km radius of proposed wind turbines (through the Gateway Process and Site Compatibility Certification) and specific assessment requirements that may be set out in the NSW DoP&I Director Generals Requirements on a project by project basis. The NSW Draft Guidelines also set out a comprehensive framework for the assessment of landscape and visual impacts including residential dwellings within 2 km proximity of proposed wind turbines. Landscape and visual issues are outlined in Appendix A of the NSW Draft Guidelines 'Meeting assessment requirements - Landscape and visual amenity' (Refer **Appendix A** of this LVIA).

This LVIA has considered and given regard to the NSW Draft Guidelines to the fullest extent practicable, and addresses the key landscape and visual amenity aspects set out in the DoP&I checklist issued to the Proponent in the DoP&I correspondence dated 18 April 2012. The key landscape and visual amenity aspects are set out in **Table 2**.

Table 2 DoP&I Landscape and visual amenity checklist

Key aspects	LVIA Reference/Response
Provide photomontage from all non-host dwellings within 2 km of a proposed wind turbine	Photomontages have been prepared from all non host dwellings within 2 km of a proposed wind turbine, as well as 6 residential dwellings subject to negotiations for neighbour agreements (Refer LVIA **Section 11**).
Identify the zone of visual influence of the wind farm (no less than 10 km) and likely impacts in community and stakeholder values.	This LVIA has identified a 10 km zone of visual influence surrounding the proposed wind farm development and assessed likely impacts in community and stakeholder values (Refer LVIA **Sections 7, 8** and **15**).
Consider cumulative impacts on landscape and views.	This LVIA has considered potential cumulative landscape and visual impacts (Refer LVIA **Section 10**).
Outline mitigation measures to avoid or manage impacts.	This LVIA has outlined mitigation measures to minimise potential impacts (Refer LVIA **Section 16**).

1.3 National Assessment Framework

GBD is cognisant of the Australian Wind Energy Association and Australian Council of National Trust's publication Wind Farms and Landscape Values National Assessment Framework (NAF), June 2007, and have encompassed the general assessment framework outlined in the NAF within the LVIA methodology. **Table 3** outlines the relevant requirements of the NAF and the corresponding section in which they are addressed within this LVIA report.

Table 3 NAF Recommendations

NAF Tasks (through Steps 1 to 4)	LVIA Reference/Response
Step 1 Assess the Landscape Values **1A Preliminary Landscape Assessment**	This LVIA has been prepared through a comparable methodology to that outlined in the NAF and has included a

Table 3 NAF Recommendations

NAF Tasks (through Steps 1 to 4)	LVIA Reference/Response
• 1A.1 Desktop Review • 1A.2 Seek information from Local Authority • 1A.3 Identify potential community and stakeholder interests • 1A.4 Site survey • 1A.5 Preliminary assessment of landscape values **1B Full Landscape Assessment** • 1B.1 Define the study area for assessment, including the zone of visual influence • 1B.2 Landscape Character Analysis • 1B.3 Natural and cultural values analysis • 1B.4 Involve communities and stakeholders in identifying landscape values • 1B.5 Document values and analyse significance	desktop review (pre site inspection) to determine potential view locations as well as establishing the extent and types of landscape characteristics within the 10km viewshed. Discussions with the relevant Local Authorities determined that no additional wind farm developments were current other than those notified on the DoP&I website: (http://majorprojects.planning.nsw.gov.au/page/project-sectors/transport--communications--energy---water/generation-of-electricity-or-heat-or-co-generation/) Community and stakeholder interests have been identified by an ongoing process of direct consultation between the Proponent and relevant stakeholders. The results of the consultative process are included in this LVIA as well as other relevant sections of the **EA**. Site survey and preliminary assessment work has been undertaken and incorporated into this LVIA. The preparation of a separate preliminary assessment of landscape values is not a requirement under the NSW DoP&I DGR's. This LVIA addresses the requirements of Step 1B and presents an analysis of key considerations included in the NAF.
Step 2 Describe and Model the Wind Farm in the Landscape • 2.1 Describe the development • 2.2 Model the development • 2.3 Prepare a visual assessment report	This LVIA has described and modelled the Bango wind farm development and selected view points from a range of view locations including uninvolved residential dwellings and road corridors within the 10km viewshed.
Step 3 Assess the Impacts of the Wind Farm on Landscape Values • 3.1 Seek community input to potential impacts • 3.2 Identify and describe impacts • 3.3 Identify potential cumulative impacts	Community and stakeholder interests have been identified by an ongoing process of direct consultation between the Proponent and relevant stakeholders. The results of the consultative process are outlined and included in this LVIA as well as other relevant sections of the **EA**.

Table 3 NAF Recommendations

NAF Tasks (through Steps 1 to 4)	LVIA Reference/Response
• 3.4 Identify other relevant factors • 3.5 Evaluate impacts	This LVIA has identified and described potential landscape and visual impacts associated with the Bango wind farm development as well as potential cumulative impacts resulting from other wind farm projects within the NSW/ACT Border Region Renewable Energy Precinct.
Step 4 Respond to Impacts • 4.1 Changes to location or siting of the wind farm or ancillary infrastructure • 4.2 Layout and design considerations • 4.3 Minor changes and mitigation measures • 4.4 Recommend changes to the development	The development of the Bango wind farm turbine layout has been reviewed and adjusted throughout the preparation of this LVIA. Changes to the layout have occurred as a result of stakeholder consultation and specific concerns directed toward the visual impact of the wind farm from surrounding view locations. Layout changes have occurred throughout the development of the preferred design layouts including the removal and repositioning of turbines within site boundary.

The NAF is noted by its authors as a framework document and does not set out a detailed or prescribed method to undertake an assessment of landscape values. This LVIA has; however, followed the majority of techniques and has tested and determined outcomes for the principal issues that have been raised in the NAF.

1.4 Auswind Best Practice Guidelines (December 2006)

The Auswind Best Practice Guidelines were developed to assist wind farm proponents to implement best practice in regards to the location and siting of wind energy facilities and to conduct wind farm investigations and impact assessments. The guidelines have been subject to revisions following technical reviews and consultation with both industry and broader stakeholder input.

The Guidelines, developed between (the former) Auswind and the National Trust, provide a landscape assessment approach to describe, assess and evaluate the potential landscape and visual impact of a proposed wind energy project. A summary of the approach includes:

- Consultation with experts in the analysis of the environments visual characteristics e.g. Landscape Architects;
- Preparation of 'Zone of Visual Influence' or 'Seen Area Diagrams';

- Preparation of photomontages (also referred to as Visual Simulations);
- Determination of cumulative impact from existing wind energy projects;
- Investigation of impacts with associated infrastructure elements, including substation, service roads and power lines; and
- Assessment of Shadow Flicker.

The Auswind Best Practice Guidelines offer best practice advice and are not a mandatory requirement for wind farm developments within Australia and have been incorporated into this LVIA.

1.5 Methodology

This LVIA methodology included the following activities:

- desktop study addressing visual character and identification of view locations within the surrounding area;
- fieldwork and photography;
- preparation of ZVI diagrams;
- assessment and determination of landscape sensitivity;
- assessment of significance of visual impact; and
- preparation of photomontages and illustrative figures.

1.6 Desktop study

A desktop study was carried out to identify an indicative viewshed for the Bango wind farm. This was carried out by reference to 1:25,000 scale topographic maps as well as aerial photographs and satellite images of the project area and surrounding landscape. A preliminary ZVI diagram was also produced prior to the commencement of fieldwork in order to inform the likely extent and nature of areas within the nominated 10km viewshed of the proposed wind farm.

Topographic maps and aerial photographs were also used to identify the locations and categories of potential view locations that could be verified during the fieldwork component of the assessment. The desktop study also outlined the visual character of the surrounding landscape including features such as landform, elevation, landcover and the distribution of settlements.

1.7 Preparation of ZVI diagrams

The Proponent prepared ZVI Diagrams to illustrate the potential visibility of the wind turbines within the Project 10km viewshed. ZVI Diagrams included visibility from tip of blade, hub height and whole turbine. The ZVI are illustrated in **Figures 23, 24** and **25** and detailed in **Section 7** of this LVIA. The Proponent has also prepared cumulative ZVI Diagrams which are illustrated in **Figures 30**, **31** and **32** and detailed in **Section 10** of this LVIA.

1.8 Fieldwork and photography

GBD undertook a total three days fieldwork associated with the Bango wind farm development:

- two days of general site inspections to determine and confirm the potential extent of visibility of the project and ancillary structures, and to identify landscape characteristics surrounding the wind farm site, and around the proposed electrical works; and
- one day of site photography for the public photomontages locations.

The Proponent undertook separate fieldwork to capture panorama photographs from uninvolved and neighbouring dwellings within 2 km of the proposed Bango wind farm turbine locations.

1.9 Assessment of landscape sensitivity

The potential impact of the project on the sensitivity of the landscape surrounding the wind farm would result primarily from the capability of the landscape to integrate with, or to accommodate the wind farm.

The capability of the landscape to accommodate the wind farm would result primarily from the nature and degree of perceptual factors that can influence interpretation and appreciation of the landscape, including landform, scale, topographic features, landcover and human influence or modifications.

1.10 Significance of visual impact

The potential significance for visual impact of the project on surrounding view locations would result primarily from a combination of the potential visibility of the wind turbines and the characteristics of the landscape between, and surrounding, the view locations and the wind farm. The potential degree of visibility and resultant visual impact would be partly determined by a combination of factors such as:

- category and type of situation from which people could view the wind farm (examples of view location categories include residents or motorists);
- visual sensitivity of view locations surrounding the wind farm;
- potential number of people with a view toward the proposed wind farm from any one location;
- distance of visual effect (between view locations and the wind farm); and
- duration of time people could view the wind farm from any particular static or dynamic view location.

An underpinning rationale for this LVIA is that if people are not normally present at a particular location, such as agricultural areas, or they are screened by landform or vegetation, then there is likely to be a nil visual impact at that location.

If, on the other hand, a small number of people are present for a short period of time at a particular location then there is likely to be a low visual impact at that location, and conversely, if a large number of people are present then the visual impact is likely to be higher.

Although this rationale can be applied at a broad scale, this LVIA also considers, and has determined, the potential visual impact for individual view locations that would have a higher degree of sensitivity to the wind farm development, including the potential impact on individual residential dwellings situated in the surrounding landscape. The determination of a visual impact is also subject to a number of other factors which are considered in more detail in this LVIA.

Whilst this LVIA addresses a number of static elements associated with the project, the assessment acknowledges and has considered the potential visual impact associated with the movement of the wind turbine rotors.

1.11 Photomontages

Twenty three photomontages have been prepared from nineteen locations (10 from public road corridors and 9 from potential dwellings) to illustrate the potential visibility of the Bango wind farm following construction. The photomontages locations include uninvolved and neighbouring residential dwellings within 2 km of the Bango wind turbines, in accordance with the requirements of the NSW Draft Guidelines.

The public photomontages locations were selected to provide representative views from the vicinity of residential dwellings as well as publically accessible areas and road corridors. The photomontages locations are illustrated in **Figure 33** and the public photomontages in **Figures 34** to **53**. The photomontages prepared for uninvolved and neighbouring residential dwellings within 2 km of the Bango wind turbines are illustrated in **Figures 54** to **79**.

1.12 Shadow flicker & blade glint

The Proponent undertook and shadow flicker assessment and prepared a shadow flicker diagram (**Figure 27**) for the Bango wind farm project. The results of the shadow flicker assessment and a consideration of potential blade glint impacts are included in **Section 9** of this LVIA.

Location

Section 2

2.1 Location

The project would be located on the edge of the Southern Tablelands and the South West Slopes in the NSW/ACT Border Region Renewable Energy Precinct.

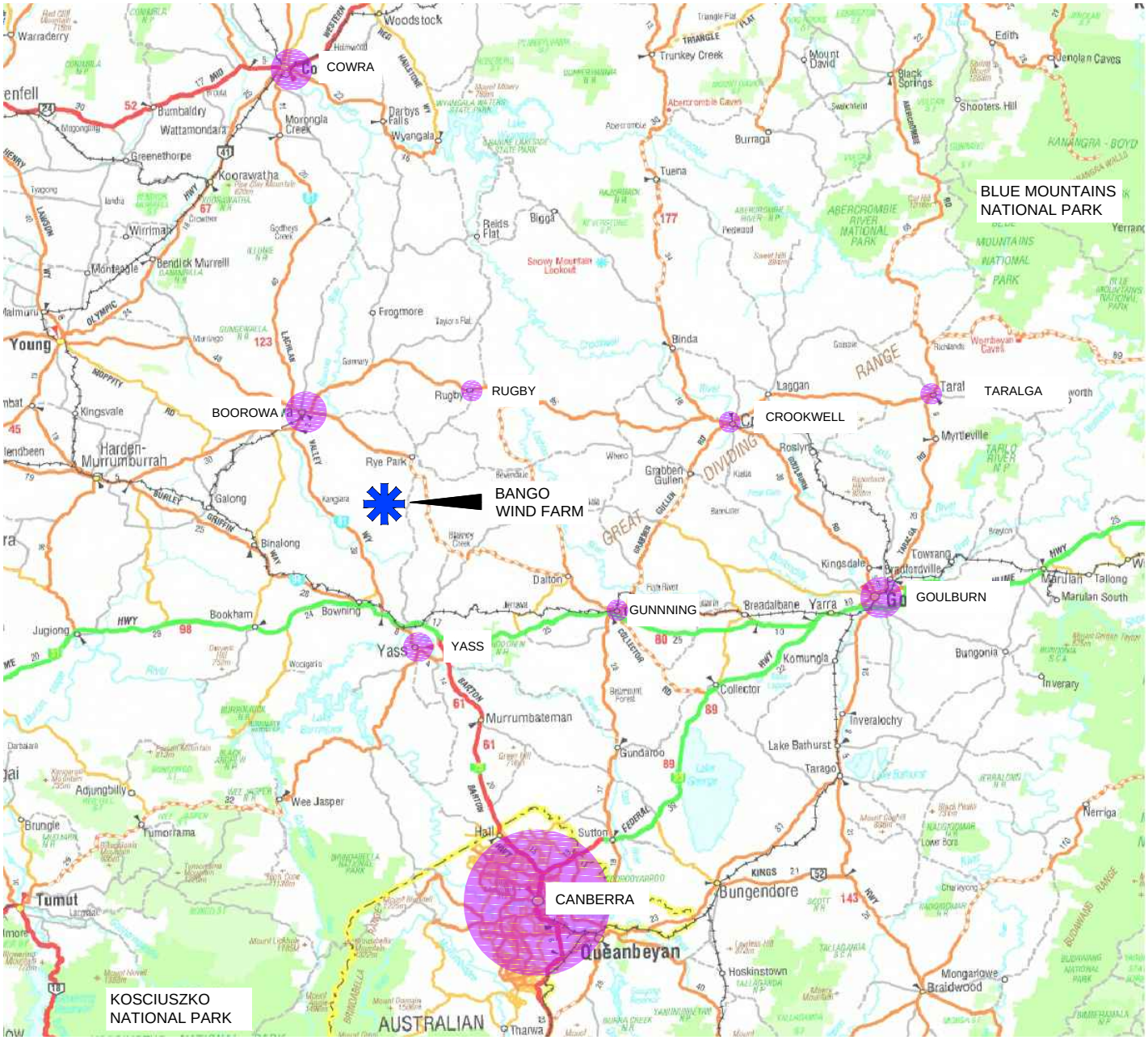
The project would extend in an approximate north south alignment along a series of hills and ridgelines at 430 m to 760 m in elevation. The project site would incorporate around 15 participating rural residential and farming properties covering an area around 7,683 hectares across portions of the Yass Valley Shire and Boorowa Shire Local Government Areas.

There are a small number of Townships and gazetted localities that occur within and immediately beyond the Bango wind farm 10 km viewshed. These include localities such as:

- Boorowa (approximately 7 km to the north west of the Langs Creek cluster);
- Rye Park (approximately 4 km to the north east of the Mt Buffalo cluster);
- Rugby (approximately 20 km to the north east of the Mt Buffalo cluster);
- Bowning (approximately 13.5 km to the south of the Mt Buffalo cluster); and
- Yass (approximately 22 km to the south of the Mt Buffalo cluster).

The Main Southern Railway and Hume Highway transport corridors extend approximately east to west around 14 km south of the project site boundary.

The location of the Bango wind farm is illustrated in **Figure 1**.



BANGO WIND FARM -
LOCATION PLAN, REGIONAL CONTEXT (Not to scale)

BANGO WIND FARM -
LOCATION PLAN, STATE CONTEXT (Not to scale)

Figure 1
Location Plan

BANGO WIND FARM

Project description

Section 3

3.1 Project description

The key visual components of the Bango wind farm (Layout Option 1) would comprise:

- up to 122 wind turbines;
- up to 122 individual 33kV external kiosk transformers and switchgear with associated control systems to be located in the vicinity of the wind turbine towers (in some turbine models transformer equipment will be integrated within the tower or nacelle);
- underground and overhead electrical and communication cable network linking turbines to each other within the project boundary;
- a collector substation located adjacent to the existing TransGrid 132 kV powerline;
- a switching station located adjacent to the existing TransGrid 132 kV powerline that spans the western portion of the project site;
- up to 6 permanent wind monitoring masts up to 120 m high. The permanent monitoring masts may be either static guyed or un-guyed structures and will be to a minimum height of the wind turbine hubs;
- up to 4 site access tracks for construction traffic as well as operation and ongoing maintenance; and
- appropriate Bango wind farm signage and maintenance facilities.

Temporary works associated with the construction of the wind farm that may be visible during construction and operational phases include:

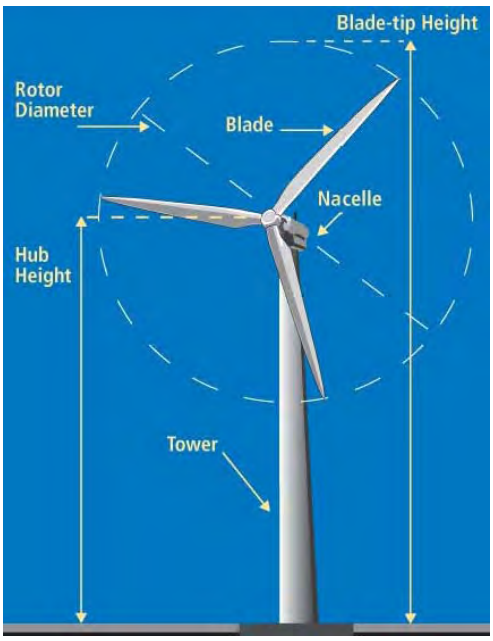
- approximately 4 material lay down areas;
- construction site office and compound;
- crane hardstand areas; and
- mobile concrete batching plant and rock crushing facilities.

3.2 Wind turbines

The specific elements of the wind turbine structures comprise:

- concrete foundations;
- tubular tapering steel or concrete towers;
- nacelles at the top of the tower housing the gearbox and electrical generator;
- rotors comprising a hub (attached to the nacelle) with three blades; and
- three fibreglass / carbon fibre blades attached to each hub.

The following diagram identifies the main components of a typical wind turbine:



Configuration and components of a typical wind turbine

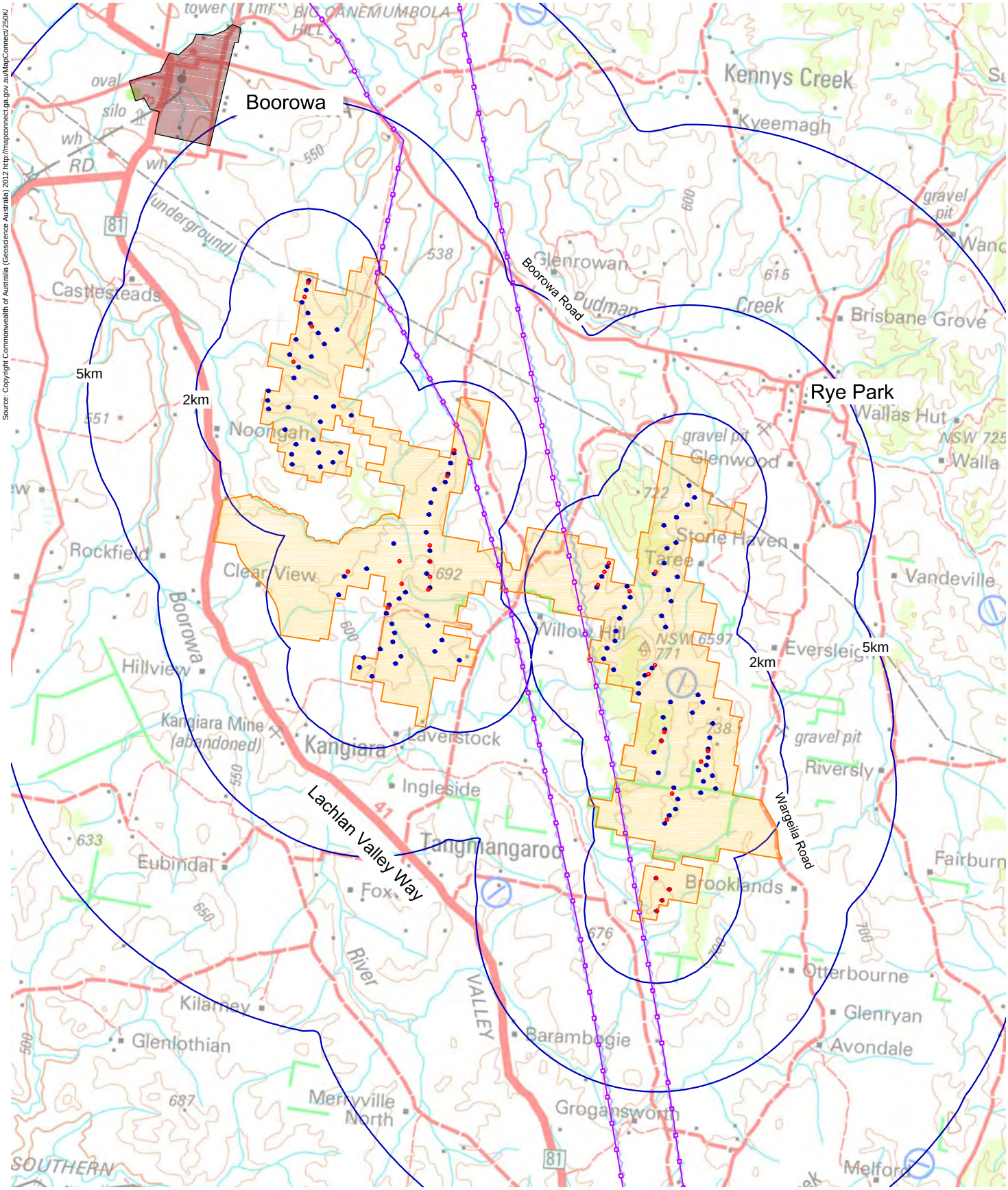
Table 4 outlines the main design parameters for the proposed Bango wind turbine for Layout Option 1.

Table 4 Bango wind turbine details:

Element	Description
Tower height	120 m
Rotor Diameter	144 m
Overall height from ground level to tip of blade	192 m
Proposed number of Bango wind turbines	**122 turbines**

As new turbines come onto the market, it is possible that the final turbine selected may exceed, in minor respects, the assessed maximum turbine envelope. The indicative Bango wind farm layout (for Options 1 and 2) is illustrated in **Figure 2.**

The wind farm is likely to be constructed in stages and comprise 3 main clusters of wind turbines. This LVIA refers to these clusters as:



Legend

- Bango wind farm project area
- Proposed Bango wind turbine (Layout Option 1)
- Proposed Bango wind turbine (Layout Option 2)
- Distance from proposed Bango wind turbine (Layout Option1)
- Existing 132 kV overhead powerline

0 km 2 km

Figure 2
Wind turbine Option 1 & Option 2 Layout

BANGO WIND FARM

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- The Mt Buffalo cluster;
- The Kangiara cluster; and
- The Langs Creek cluster.

Details for each wind turbine cluster are provided in **Table 5** and illustrated in **Figure 3**.

Table 5 Wind turbine clusters

Wind turbine cluster	Maximum number of wind turbines (Layout Option 1)	General location
Mt Buffalo cluster	58	Eastern cluster
Kangiara cluster	34	Central cluster
Langs Creek cluster	30	North western cluster

3.3 Wind monitoring masts

Up to 6 permanent wind monitoring masts would be installed on-site, extending to a minimum height of the wind turbine hubs (around 120 m in height for Option Layout 1). The wind monitoring masts would be of a guyed or un-guyed, narrow lattice or tubular steel design. The wind monitoring masts would be unlikely to create a significant visual impact, and are similar in scale, or smaller than a number of surrounding communication masts visible in the landscape surrounding the wind farm project area.

3.4 On-site access tracks

On-site tracks would be constructed to provide access to turbine locations across the site during construction and operation. During construction the majority of access tracks would be up to 6 m wide (wider at bends) to allow for over sized vehicle manoeuvring. The final access track design would be developed on a number of environmental grounds, including minimising the potential for visual impact by considering:

- overall length and extent;
- need for clearing vegetation;
- potential for erosion;

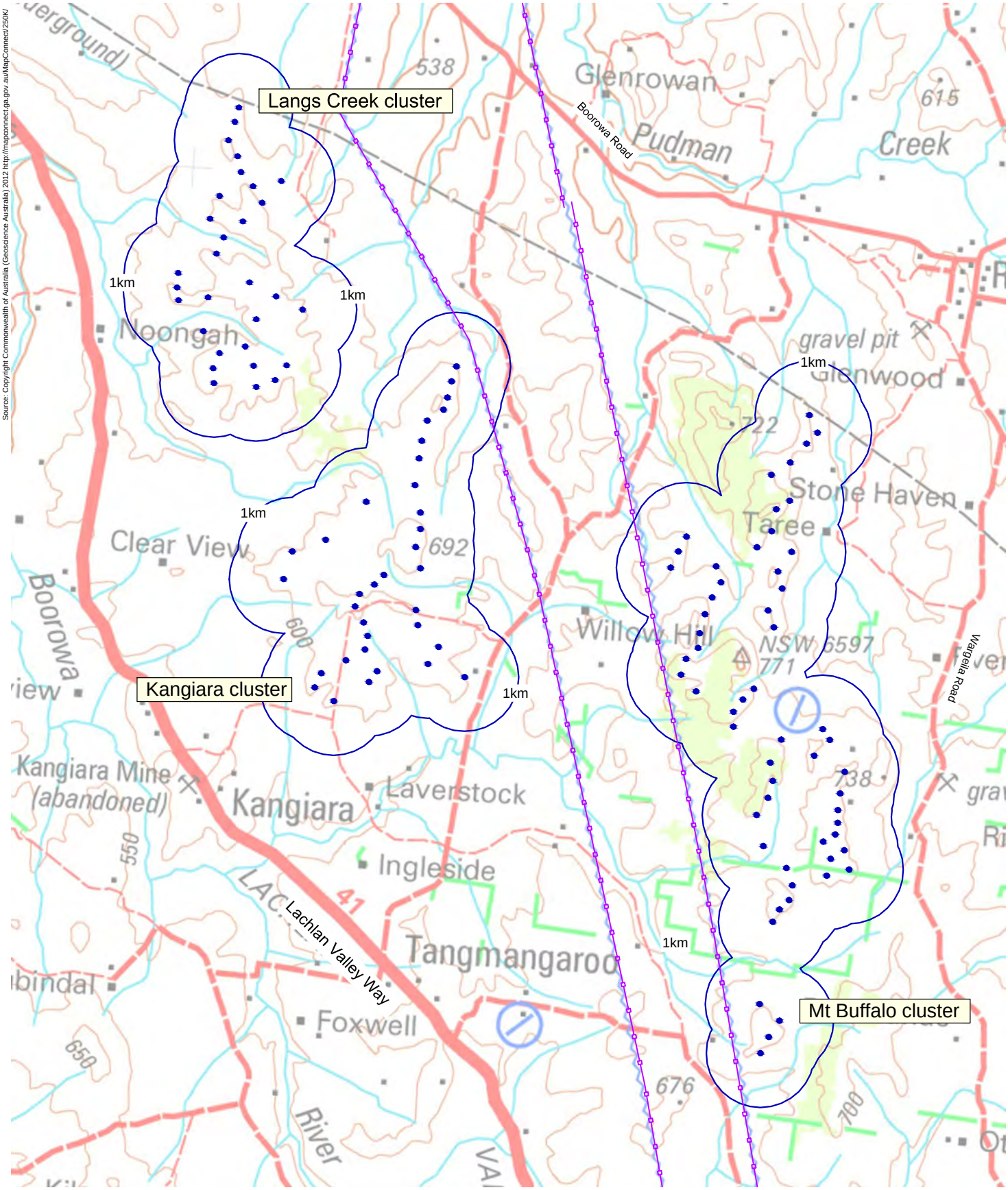
- extent of cut and fill; and
- potential to maximise rehabilitation at the completion of the construction phase.

3.5 Electrical works

The majority of cabling works, including the installation of control cables linking the turbines to the control building would be installed underground. For electrical reasons some cabling may be required to be installed on medium voltage (up to 132 kV) overhead powerline supported by single low profile tubular poles.

Grid connection would be achieved via a connection to an existing 132 kV powerline which spans north to south across the western portion of the project site between the Mt Buffalo and Kangiara wind turbine clusters. The wind farm turbines would be connected to a collector substation and switching station for grid connection.

The proposed electrical works are described in **Section 13** and illustrated in **Figure 83**. Typical photographs of existing 132 kV double circuit powerlines (at Glen Innes, NSW) are illustrated in **Figure 84**.



Legend

- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Bango wind turbine
- Existing 132 kV overhead powerline

0 km 2 km

Figure 3 Bango wind farm turbine clusters

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Local environmental factors

Section 4

4.1 Climatic and atmospheric conditions

Local climatic and atmospheric conditions have the potential to influence the visibility of the Bango wind farm project from surrounding view locations, and more significantly, from distant view locations. The climate of the New South Wales South Eastern Highlands Bioregion is characterised by a temperate climate of warm summers and no dry season, with elevated areas in the north and south of the bioregion experiencing milder summer conditions in montane climate zones.

Meteorological data collected over the past 113 years at Yass (Linton Hostel) indicates that there are:

- 92 clear days (annual mean average);
- 109 cloudy days (annual mean average); and
- 74 days of rain (annual mean average).

Rainfall would tend to reduce the level of visibility from a number of view locations surrounding the project with the degree of visibility tending to decrease over distance. Rain periods would be likely to reduce the number of visitors travelling through the areas from which the project could be visible, and potentially decrease the duration of time spent at a particular public view location with a view toward the project.

Cloud cover would also tend to reduce the level of visibility of the project and lessen the degree of contrast between the wind turbine structures and the background against which the wind turbines would be visible.

On clear or partly cloudy days, the position of the sun would also have an impact on the degree of visibility of the project. The degree of impact would be largely dependent on the relationship between the position and angle of the sun relative to the view location. Late afternoon and early evening views toward the west would result in the wind turbines silhouetted above the horizon line, and with increasing distance would tend to reduce the contrast between the wind turbine structures and the surrounding landform.

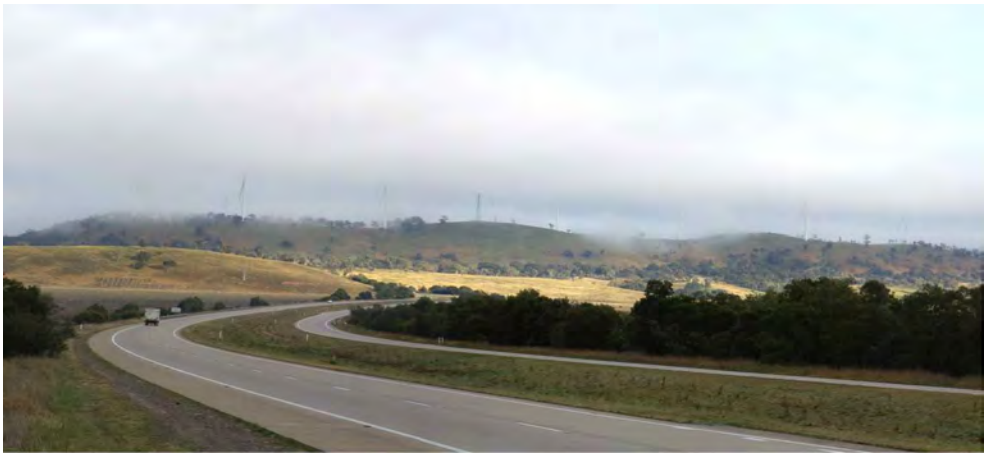
The extent to which local weather conditions can influence visibility toward turbine structures is illustrated in **Figure 4**.

PHOTOGRAPH A - DAY TIME VIEW FROM HUME HIGHWAY TOWARD CULLERIN WIND FARM AT AROUND 3.5KM (13th June 2010)

PHOTOGRAPH A
Illustrates the visibility of wind turbines against a clear and blue sky backdrop with sunlight from above and to the right of the wind turbines creating a shadow line along the left hand side of the towers as well as portions of the rotor blades.

PHOTOGRAPH B - DAY TIME VIEW FROM HUME HIGHWAY TOWARD CULLERIN WIND FARM AT AROUND 3.5KM (10th June 2010)

PHOTOGRAPH B
Illustrates the visibility of wind turbines against a partly cloudy and overcast backdrop. The wind turbines in cloud shadow appear off white to grey in colour.



PHOTOGRAPH C - DAY TIME VIEW FROM HUME HIGHWAY TOWARD CULLERIN WIND FARM AT AROUND 3.5KM (7th July 2010)

PHOTOGRAPH C -
Illustrates the visibility of wind turbines in fog/low cloud cover.

Figure 4 Visibility & weather

4.2 Topography and drainage

The topography of the landscape within the New South Wales Southern Highlands Bioregion covers a broad area of the dissected ranges and plateaus of the Great Dividing Range extending east toward the Great Escarpment and the western slopes of the inland drainage basins. The project would be located on portions of plateau remnants and low rolling hills cut by drainage lines. The elevation of the wind farm site falls gently from the south east to the north west. A number of ephemeral drainage lines occur across the project site, draining to broader valleys north and west of the wind farm project site.

Landform elevation within and surrounding the project site is illustrated in **Figure 5**.

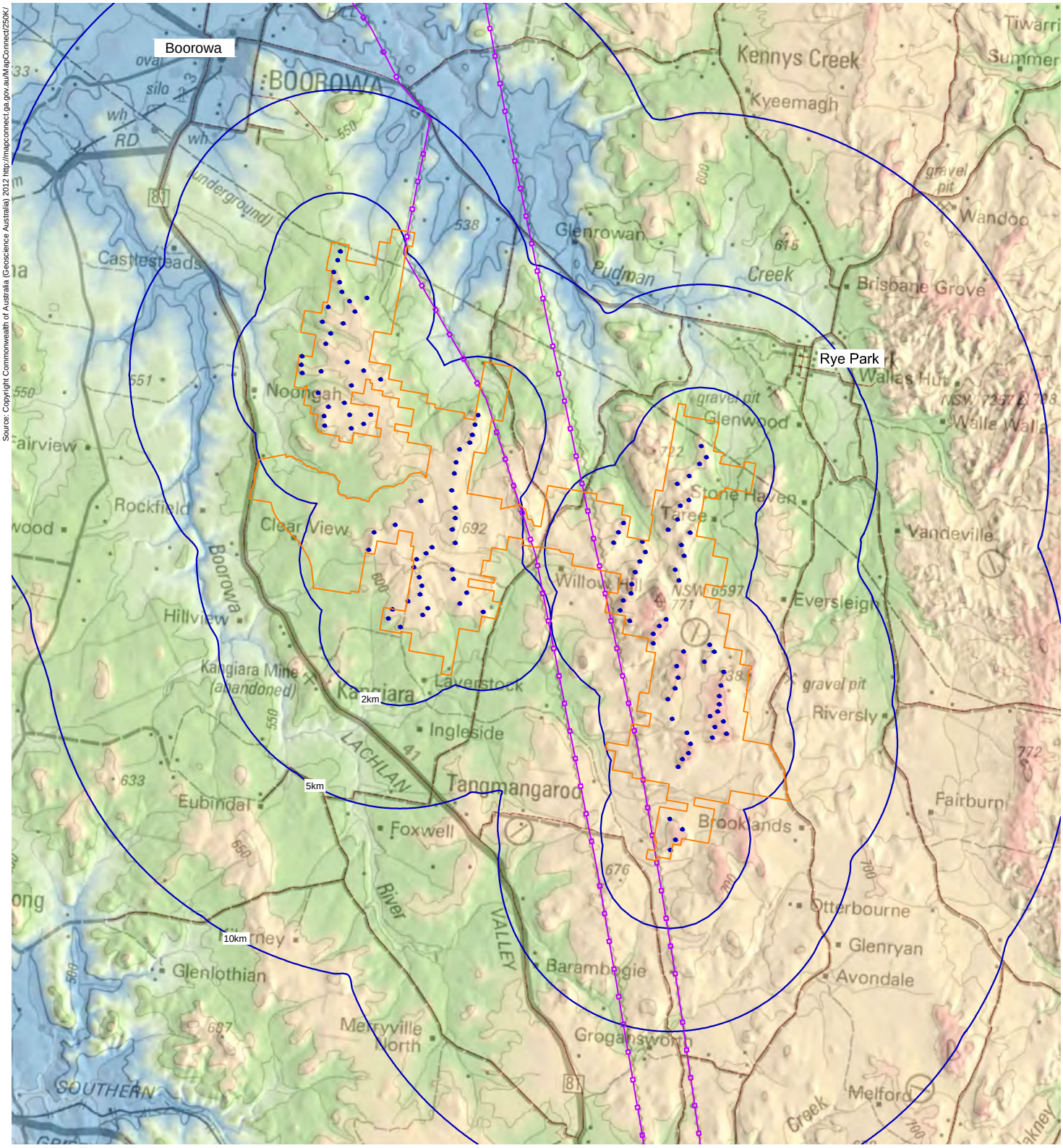
4.3 Vegetation

A detailed survey of existing vegetation has been carried out as part of the biodiversity assessment for the project EA and is summarised in the **Section 10** of the EA.

In general the landscape within the project site contains vegetation associated with woodland, drainage lines, small ponds/dams and cleared land for pasture and agricultural crop cultivation. Stands of remnant woodland occur within the wider context of a modified landscape which continues to be managed through a variety of farming activities.

Timbered areas have some potential to provide partial or full screening toward the project area from surrounding public and residential view locations. The screening potential tends to increase when combined with the local topography of hills and undulating landform.

The landscape within and surrounding the project site is illustrated in the panorama photographs presented in **Figures 7** to **19.**



Source: Copyright Commonwealth of Australia (Geoscience Australia) 2012 http://mapconnect.ga.gov.au/MapConnect/250K/

Legend

- Bango wind farm project area
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Bango wind turbine
- Existing powerline

Elevation

- 700 m - 800 m
- 600 m - 700 m
- 500 m - 600 m
- < 500 m

0km 2.5km

Figure 5
Topography

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Panoramic photographs

Section 5

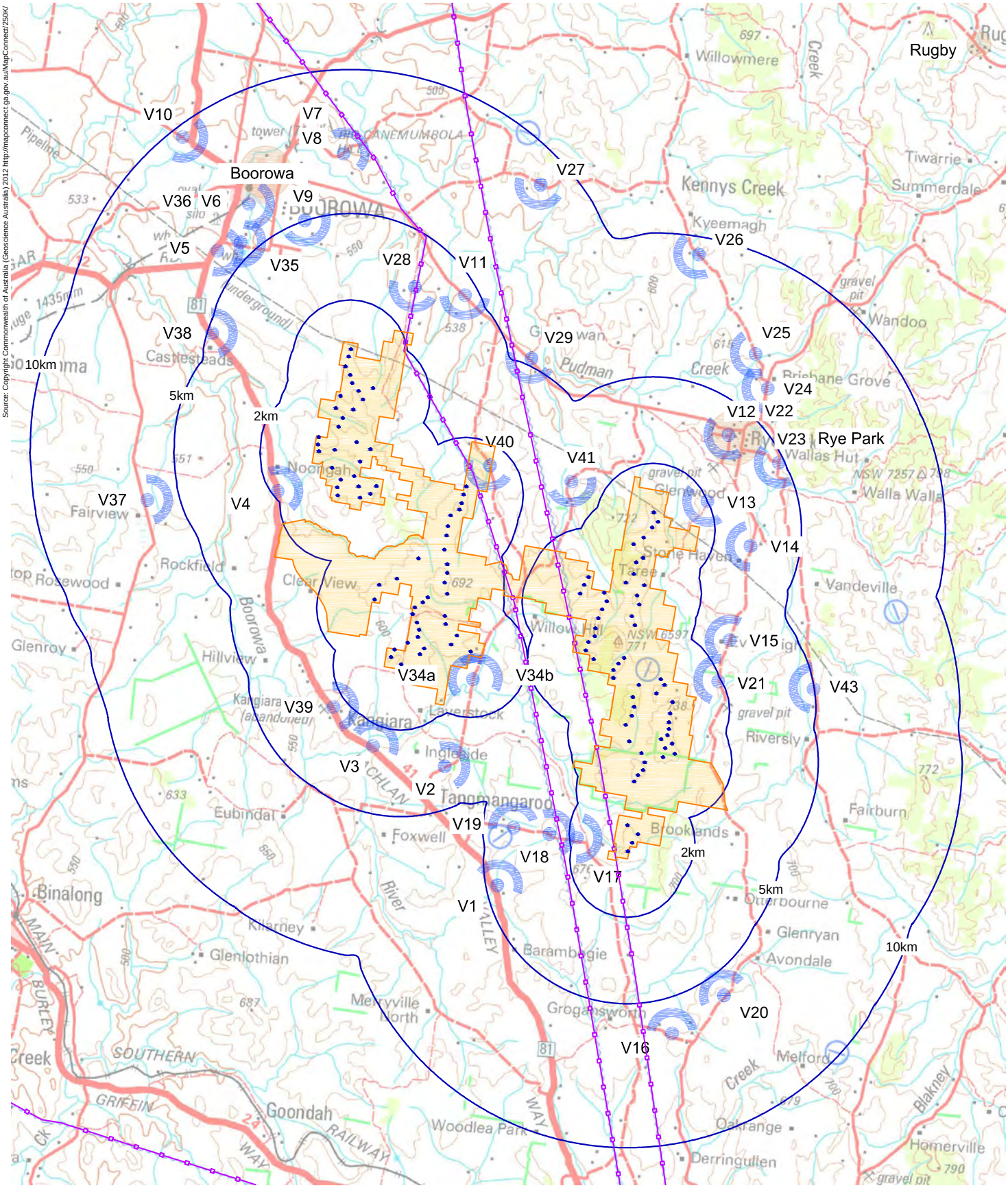
5.1 Panoramic Photographs

A series of digital photographs were taken during the course of the fieldwork to illustrate existing views in the vicinity of a number of view locations inspected and assessed as part of this LVIA. Individual photographs were digitally stitched together to form a segmented panorama image to provide a visual illustration of the existing view from each photo location.

The panoramic photographs presented in this LVIA have been annotated to identify key features or structures located within the existing view. They also indicatively illustrate the general extent and location of potentially visible wind turbines or portions of turbine structures for the project.

The panoramic photograph locations are illustrated in **Figure 6**, and the panoramic photographs illustrated in **Figures 7** to **19**.

The panoramic photographs are not to be confused with the photomontages. The panoramic photographs do not include a representation or model of the wind turbine structures. The photomontages are discussed in **Section 11** of this LVIA, and are illustrated in **Figures 34** to **79**.



Legend

- Bango wind farm project area
- Public photograph location
- Proposed Bango wind turbine (Layout Option 1)
- Existing powerline route
- Distance from proposed Bango wind turbine

0km 2.5km

Figure 6 Public photograph locations

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Long distance views toward proposed Bagno wind turbines within the Kangiara cluster

(Image source GBD 2013)

Photo Location V1 - View north to north east from residential access track adjoining Lachlan Valley Way (Approximate distance to closest wind turbine 4.7 km)
Photo coordinate Easting: 667999 Northing: 6158794

Long distance views toward proposed Bango wind turbines within the Kangiara and Mt Buffalo clusters

(Image source GBD 2013)

Photo Location V2 - View north to east from Tangmangaroo Road (Approximate distance to closest wind turbine 4 km)
Photo coordinate Easting: 664864 Northing: 6167599

Long distance views toward proposed Bango wind turbines within the Kangiara and Mt Buffalo clusters

(Image source GBD 2013)

Photo Location V3 - View north to east from access track adjoining Lachlan Valley Way (Approximate distance to closest wind turbine 3 km)
Photo coordinate Easting: 662679 Northing: 6167747

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 7 - Photo Sheet 1

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Photo Location V4 - View north to east from Lachlan Valley Way (Approximate distance to closest wind turbine 2 km)
Photo coordinate Easting: 658868 Northing: 6177164

Photo Location V5 - View east to south east from Lachlan Valley Way (Boorowa Township south) (Approximate distance to closest wind turbine 5.8 km)
Photo coordinate Easting: 656662 Northing: 6185158

Photo Location V6 - View east to south east from Boorowa Township (south) Trucking Yards Road (Approximate distance to closest wind turbine 6.1 km)
Photo coordinates Easting: 657466 Northing: 6186878

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 8 - Photo Sheet 2

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Boorowa Road

(Image source GBD 2013)

Photo Location V7 - View south from dwelling access road off Brial Road (Boorowa), contextual view toward general locality of proposed Rugby wind farm (no view toward Bango wind farm turbines)
Photo coordinate Easting: 661301 Northing: 6188888

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Big Canemumbola Hill

(Image source GBD 2013)

Photo Location V8 - View north to east from dwelling access road off Brial Road (Boorowa), contextual view toward general locality of proposed Rugby wind farm (no view toward Bango wind farm turbines)
Photo coordinate Easting: 661775 Northing: 6188514

Views toward wind turbines within the Langs Creek cluster screened by tree cover

Lachlan Valley Way

(Image source GBD 2013)

Photo Location V9 - View south from road to recycling facility (Boorowa) (Approximate distance to closest wind turbine 4.8 km)
Photo coordainte Easting: 659281 Northing: 6187233

Figure 9 - Photo Sheet 3

BANGO WIND FARM

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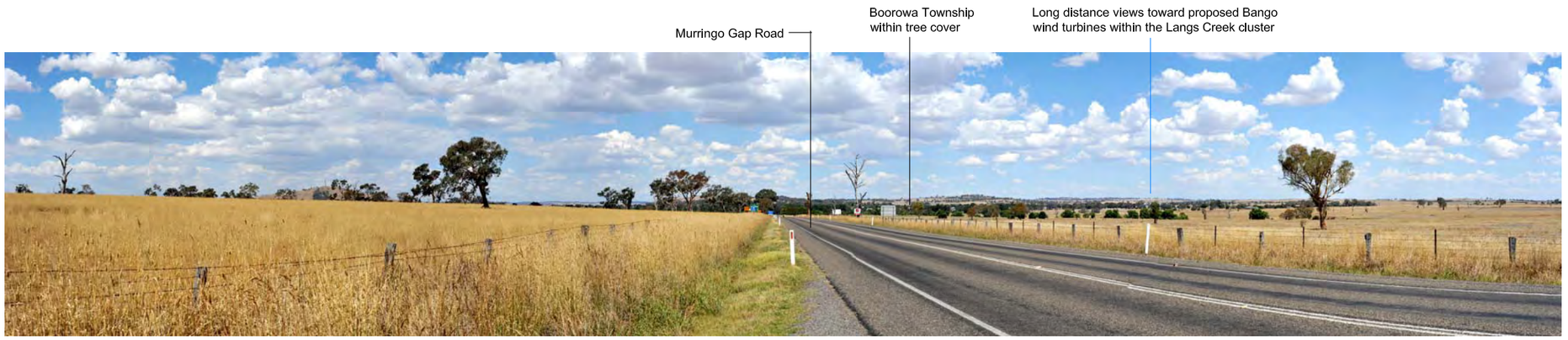

Photo Location V10 - View east to south east from Murringo Gap Road (Approximate distance to closest wind turbine 9.4 km)
Photo coordinate Easting: 655864 Northing: 6189276

Views toward Bango wind turbines are largely screened by landform rising to the south of Boorowa Road

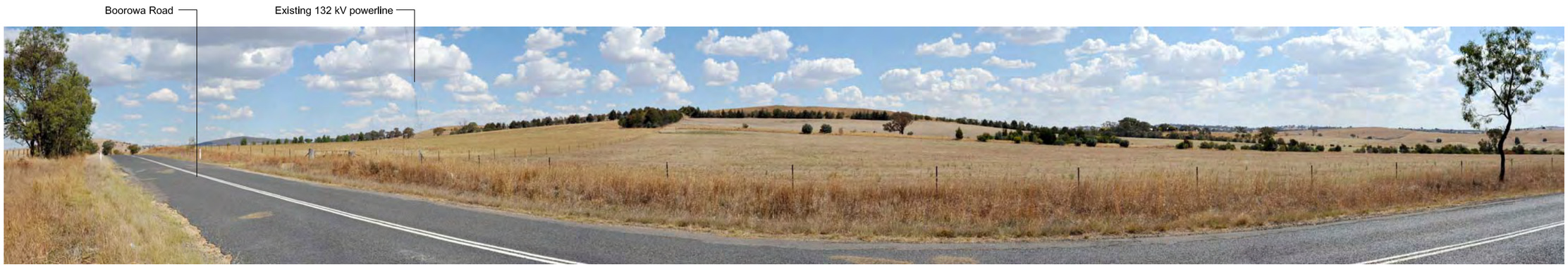

Photo Location V11 - View south from Boorowa Road (Approximate distance to closest wind turbine 4.5 km)
Photo coordinate Easting: 667106 Northing: 6182280

Photo Location V12 - View south to west from Cook Street (Rye Park) (Approximate distance to closest wind turbine 3.75 km)
Photo coordinate Easting: 674704 Northing: 6178978

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 10 - Photo Sheet 4

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Views toward Bango wind turbines within the north portion of the Mt Buffalo cluster

(Image source GBD 2013)

Photo Location V13 - View south to south west from Hill View Lane (Rye Park south) (Approximate distance to closest wind turbine 1.85 km)
Photo coordinate Easting: 674136 Northing: 6176999

Wargeila Road

Views toward Bango wind turbines within the north portion of the Mt Buffalo cluster will be largely screened by landform rising to the west of Wargeila Road

(Image source GBD 2013)

Photo Location V14 - View south to west from Wargeila Road (Approximate distance to closest wind turbine 3.5 km)
Photo coordinate Easting: 675452 Northing: 6175198

Short distance views toward Bango wind turbines within the central portion of the Mt Buffalo cluster

(Image source GBD 2013)

Photo Location V15 - View south west to west from Wargeila Road (Approximate distance to closest wind turbine 2.7 km)
Photo coordinate Easting: 674776 Northing: 6172266

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 11 - Photo Sheet 5

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Long distance views toward Bango wind turbines within the southern portion of the Mt Buffalo cluster

(Image source GBD 2013)

Photo Location V16 - View north from Davis Lane (Approximate distance to closest wind turbine 6.5 km)
Photo coordinate Easting: 672767 Northing: 6158149

Short distance views toward Bango wind turbines within the southern and central portion of the Mt Buffalo cluster

(Image source GBD 2013)

Photo Location V17 - View north to east from Moorby's Lane (Approximate distance to closest wind turbine 1.8 km)
Photo coordinate Easting: 669438 Northing: 6164993

Short distance views toward Bango wind turbines within the southern and central portion of the Mt Buffalo cluster

Moorby's Lane

(Image source GBD 2013)

Photo Location V18 - View north to north east from Moorby's Lane (Approximate distance to closest wind turbine 2.8 km)
Photo coordinate Easting: 668667 Northing: 6165173

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 12 - Photo Sheet 6

BANGO WIND FARM

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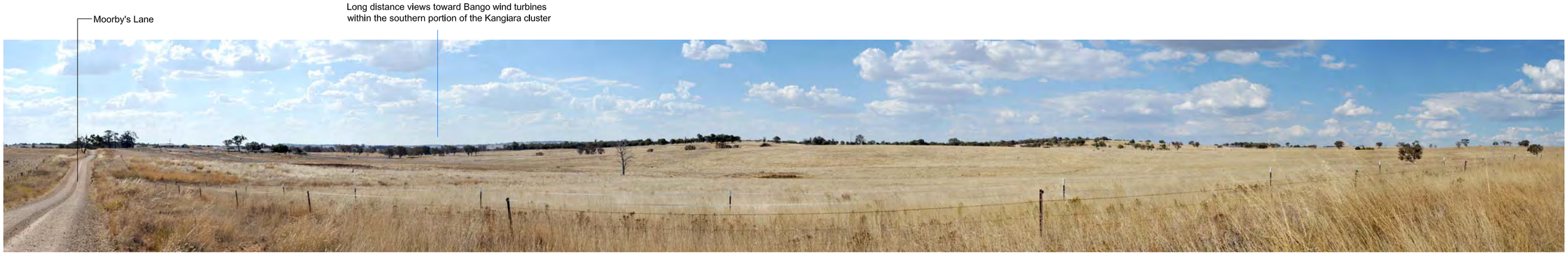

Photo Location V19 - View west to north east from Moorby's Lane (Approximate distance to closest wind turbine 6.3 km)
Photo coordinate Easting: 667163 Northing: 6165521

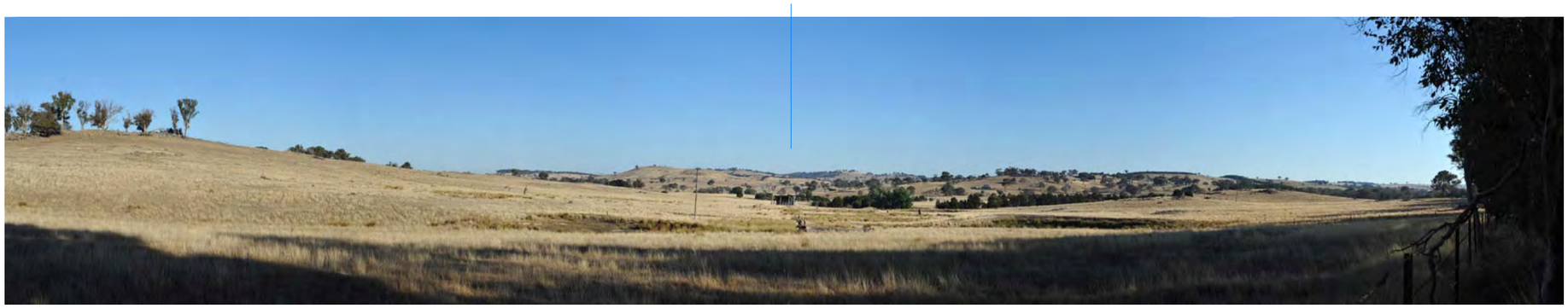

Photo Location V20 - View west to north from Wargeila Road (Approximate distance to closest wind turbine 6 km)
Photo coordinate Easting: 674192 Northing: 6159341

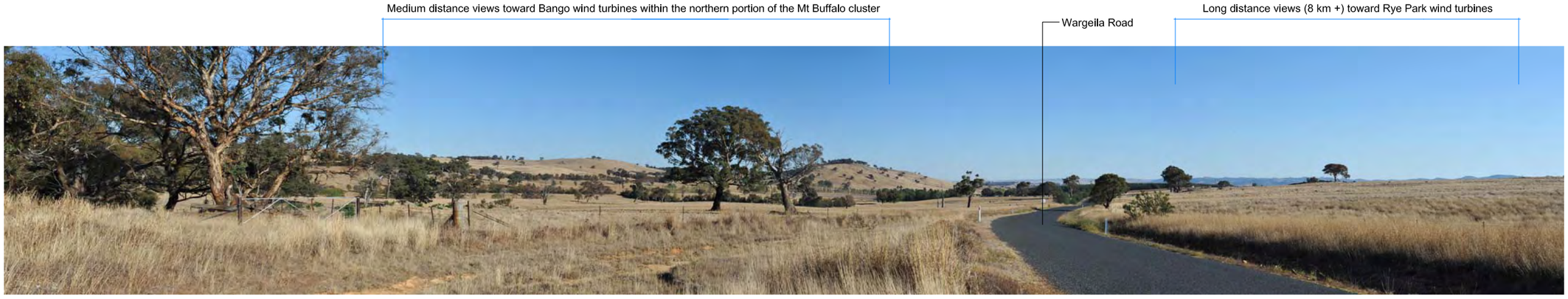

Photo Location V21 - View north west to north east from Wargeila Road (Approximate distance to closest wind turbine 3.5 km)
Photo coordinate Easting: 674010 Northing: 6167621

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 13 - Photo Sheet 7

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Photo Location V12 - View south west to west from Cook Street (Rye Park) (Approximate distance to closest wind turbine 3.75 km)
Photo coordinate Easting: 674704 Northing: 6178978

Photo Location V23 - View south west to west from Rye Park Cemetery Road (Approximate distance to closest wind turbine 4.7 km)
Photo coordinate Easting: 676399 Northing: 6178098

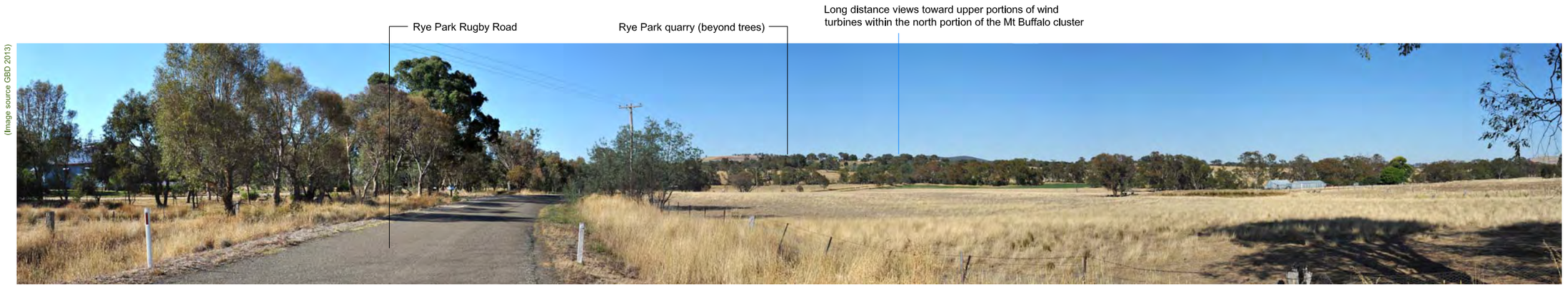

Photo Location V24 - View south east to south west from Rye Park Rugby Road (north of Rye Park Village) (Approximate distance toward closest wind farm turbine 5.8 km)
Photo coordinate Easting: 675763 Northing: 6179791

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 14 - Photo Sheet 8

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Photo Location V25 - View south to west from Little Plains Road (Approximate distance to closest wind farm turbine 6.5 km)
Photo coordinate Easting: 675693 Northing: 6181544

Photo Location V26 - View south east to west from Little Plains Road (Approximate distance to closest wind turbine 9 km)
Photo coordinate Easting: 674496 Northing: 6184105

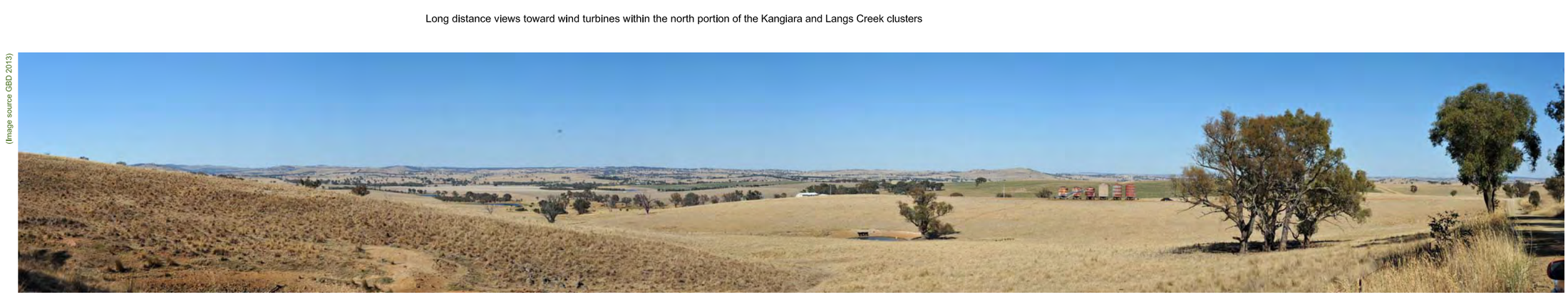

Photo Location V27 - View south from Kenny's Creek Road (Approximate distance to closest wind turbine 8.7 km)
Photo coordinate Easting: 667866 Northing: 6187889

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 15 - Photo Sheet 9

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Medium distance views toward wind turbines within the Langs Creek and Kangiara clusters

Hopefield Lane

(Image source GBD 2013)

Photo Location V28 - View south east to south west from Hopefield Lane (Approximate distance to closest wind turbine 3 km)
Photo coordinate Easting: 663516 Northing: 6183393

Boorowa Road

Long distance view toward Bango wind turbines
within the central portion of the Mt Buffalo cluster

Views toward turbines within the Kangiara cluster
screened by landform rising to the south of Boorowa Road

(Image source GBD 2013)

Photo Location V29 - View east/south to south west from Boorowa Road (Approximate distance to closest wind turbine 4.9 km)
Photo coordinate Easting: 668504 Northing: 6180858

Very short distance views toward wind turbines within the south portion of the Kangiara cluster

Tangmangaroo Road

(Image source GBD 2013)

Photo Location V34a - View west to north from Tangmangaroo Road (Approximate distance to closest wind turbine 985 m)
Photo coordinate Easting: 665502 Northing: 6169307

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 16 - Photo Sheet 10

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Medium distance views toward wind turbines within the Mt Buffalo cluster

Photo Location V34b - View north to east from Tangmangaroo Road (Approximate distance to closest wind turbine 4 km)
Photo coordinate Easting: 665502 Northing: 6169307

Photo Location V35 - View north to south east from Meads Lane (Boorowa Township south) (Approximate distance to closest wind turbine 5.3 km)
Photo coordinate Easting: 657182 Northing: 6185762

Photo Location V36 - View east to south east from Boorowa Township (south) Trucking Yards Road (Approximate distance to closest wind turbine 6.1 km)
Photo coordinate Easting: 657466 Northing: 6186878

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 17- Photo Sheet 11

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Long distance views toward proposed Bango wind turbines within the Langs Creek and Kangiara clusters

Big Canemumbola Hill

Boorowa Township (9 km beyond trees)

Binalong Road

(Image source GBD 2013)

Photo Location V37 - View north to south east from Binalong Road (Approximate distance to closest wind turbine 6.2 km)
Photo coordinate Easting: 654231 Northing: 6177062

Long distance views toward proposed Bango wind turbines within the Langs Creek cluster

Lachlan Valley Way

(Image source GBD 2013)

Photo Location V38 - View south east to south west from Lachlan Valley Way (Approximate distance to closest wind turbine 5 km)
Photo coordinate Easting: 657051 Northing: 6182202

Short distance views toward proposed Bango wind turbines within the Kangiara cluster

Long distance views toward proposed Bango wind turbines within the Mt Buffalo cluster

Lachlan Valley Way

(Image source GBD 2013)

Photo Location V39 - View east to south west from Lachlan Valley Way (Approximate distance to closest wind turbines 2.6 km - with Kangiara cluster)
Photo coordinate Easting: 661909 Northing: 6168475

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 18- Photo Sheet 12

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Short distance views toward wind turbines within the north portion of the Kangiara cluster

Harry's Creek Road

(Image source GBD 2013)

Photo Location V40 - View south from Harry's Creek Road (Approximate distance to closest wind turbine 1 km)
Photo coordinate Easting: 666492 Northing: 6177100

Medium distance views toward wind turbines within the central portion of the Mt Buffalo cluster

(Image source GBD 2013)

Photo Location V41 - View south to south east from Tangmangaroo Road (Approximate distance to closest visible wind turbine 4 km)
Photo coordinate Easting: 669103 Northing: 6177509

Medium distance views toward wind turbines within the central and southern portion of the Mt Buffalo cluster

Rye Park Dalton Road

(Image source GBD 2013)

Photo Location V42 - View north to south west from Rye Park Dalton Road (Approximate distance to closest wind turbine 4.9 km)
Photo coordinate Easting: 677690 Northing: 6170040

Notes

Individual photographs taken with a Nikon D700 camera with a 50 mm 1:1.4D prime lens. Composite digital stitching results in a panorama with an approximate view angle between 110° and 130°.

Individual panorama photo coordinate map datum is in GDA94 to ± 5 m accuracy.

Extent of potential wind turbine visibility and illustrated on each panorama photograph is indicative only.

Figure 19- Photo Sheet 13

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Landscape character areas

Section 6

6.1 Landscape character areas

A fundamental part of this LVIA is to understand and describe the nature and sensitivity of different components of the landscape within the project 10 km viewshed, and to assess the landscape character in a clear and consistent process. For the purpose of this LVIA, landscape character is defined as '*the distinct and recognisable pattern of elements that occur consistently in a particular type of landscape*' (The Countryside Agency and Scottish Natural Heritage 2002).

This LVIA has identified five Landscape Character Areas (LCA's), which occur within the project 10 km viewshed. The five LCA's represent areas that are relatively consistent and recognisable in terms of their key visual elements and physical attributes; which include a combination of topography/landform, vegetation/landcover, land use and built structures (including settlements and local road corridors).

The five LCA's have been identified through a desk top assessment and described during the landscape assessment fieldwork carried out for the LVIA. The five LCA are illustrated in **Figure 20**. The LCA's are not considered to be discrete areas, and characteristics within one LCA may occur within adjoining or surrounding LCA's. For the purpose of this LVIA the five LCA are:

- LCA 1 – Undulating pastoral/agricultural landscape;
- LCA 2 – Drainage lines;
- LCA 3 – Hills and ridgelines;
- LCA 4 – Timbered areas; and
- LCA 5 – Rural dwellings.

An overview of each LCA is presented below, with further description and assessment provided in **Tables 8** to **12**.

6.2 Landscape sensitivity assessment

The British Landscape Institute describes landscape sensitivity as '*the degree to which a particular LCA can accommodate change arising from a particular development, without detrimental effects on its character*'.

The assessment of landscape sensitivity is based upon an evaluation of the physical attributes identified within each LCA, both singularly and as a combination that gives rise to the landscape's overall robustness and the

Legend

- Bango wind farm project area
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Bango wind turbine
- Existing powerline
- Involved residential dwelling
- Uninvolved residential dwelling within 2 km of wind turbine
- Uninvolved residential dwelling within 2 km of wind turbine subject to neighbour agreement
- Uninvolved residential dwelling between 2 km and 5 km of wind turbine
- Uninvolved residential dwelling between 5 km and 10 km of wind turbine
- LCA 1 - Undulating pastoral & agricultural landscape
- LCA 2 - Drainage lines
- LCA 3 - Hills and ridgelines
- LCA 4 - Timbered areas
- LCA 5 - Urban/rural settlement

0 km 2.5 km

Figure 20 Landscape Character Areas

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extent to which it could accommodate the wind farm development. The criteria used to determine landscape sensitivity are outlined in **Table 6** and based on current good practice employed in the assessment of wind farm developments. This LVIA draws on the Land Use Consultants report on landscape sensitivity for wind farm developments on the Shetland Islands (March 2009) as well as the Western Australian Planning Commission manual for Visual Landscape Planning (2007). Landscape sensitivity is a relative term, and the intrinsic landscape values of the surrounding landscape could be considered of a higher or lower sensitivity than other areas in the Southern Tablelands region.

Whilst the assessment of landscape sensitivity is largely based on a systematic description and analysis of landscape characteristics, this LVIA acknowledges that some individuals and other members of the local community would place higher values on the local landscape. These values could transcend preferences (likes and dislikes) and include personal, cultural as well as other parameters.

Table 6 – Landscape Sensitivity Criteria

Landscape Sensitivity Assessment Criteria			
Characteristic	**Aspects indicating lower sensitivity to the wind farm development**	↔	**Aspects indicating higher sensitivity to the wind farm development**
Landform and scale: patterns, complexity and consistency	• Large scale landform • Simple • Featureless • Absence of strong topographical variety	↔	• Small scale landform • Distinctive and complex • Human scale indicators • Presence of strong topographical variety
Landcover: patterns, complexity and consistency	• Simple • Predictable • Smooth, regular and uniform	↔	• Complex • Unpredictable • Rugged and irregular
Settlement and human influence	• Concentrated settlement pattern • Presence of contemporary structures (e.g. utility, infrastructure or industrial elements)	↔	• Dispersed settlement pattern • Absence of modern development, presence of small scale, historic or vernacular settlement
Movement	• Prominent movement, busy	↔	• No evident movement, still
Rarity	• Common or widely distributed example of landscape character area within a regional context	↔	• Unique or limited example of landscape character area within a regional context

Table 6 – Landscape Sensitivity Criteria

Landscape Sensitivity Assessment Criteria			
Characteristic	**Aspects indicating lower sensitivity to the wind farm development**	↔	**Aspects indicating higher sensitivity to the wind farm development**
Intervisibility with adjacent landscapes	• Limited views into or out of landscape • Neighbouring landscapes of low sensitivity • Weak connections, self contained area and views • Simple large scale backdrops	↔	• Prospects into and out from high ground or open landscape • Neighbouring landscapes of high sensitivity • Contributes to wider landscape • Complex or distinctive backdrops

The landscape sensitivity assessment criteria set out in **Table 6** have been evaluated for each of the five LCA's by applying a professionally determined judgement on a sliding scale between 1 and 5.

A scale of 1 indicates a landscape characteristic with a lower sensitivity to the wind farm development (and would be more likely to accommodate the wind farm development). A scale of 5 indicates a landscape characteristic with a high level of sensitivity to the wind farm development (and less likely to accommodate the wind farm development).

The scale of sensitivity for each LCA is outlined in **Tables 7** to **11** and is set out against each characteristic identified in **Table 6**.

The overall landscape sensitivity for each LCA is a summation of the scale for each characteristic identified in **Tables 7** to **11**. The overall scale is expressed as a total out of 30 (i.e. 6 characteristics for each LCA with a potential top scale of 5). Each characteristic is assessed separately and the criteria set out in **Table 6** are not ranked in equal significance. The overall landscape sensitivity for each of the five LCA has been determined as either:

High (Scale of 24 to **30)** – key characteristics of the LCA will be impacted by the proposed project, and will result in major and visually dominant alterations to perceived characteristics of the LCA which may not be fully mitigated by existing landscape elements and features. The degree to which the landscape may accommodate the proposed project development will result in a number of perceived uncharacteristic and significant changes.

Medium to High (Scale of 16 to **23)** – recognisable characteristics of the LCA will be altered by the proposed project, and result in the introduction of visually prominent elements that will alter the perceived characteristics of the LCA but may be partially mitigated by existing landscape elements and features within the LCA. The main characteristics of the LCA, patterns and combinations of landform and landcover will still be evident.

Medium (Scale 11 to 15) – distinguishable characteristics of the LCA may be altered by the proposed project, although the LCA may have the capability to absorb some change. The degree to which the LCA may accommodate the proposed project would potentially result in the introduction of prominent elements to the LCA, but may be accommodated to some degree.

Low Rating (Scale of 6 to **10)** – the majority of the LCA characteristics are generally robust, and would be less affected by the proposed project. The degree to which the landscape may accommodate the wind farm would not significantly alter existing landscape character.

Very Low or Negligible Rating (Less than 6) the characteristics of the LCA will not be impacted or visibly altered by the proposed project.

6.3 Analysis of landscape sensitivity

The following section of this LVIA provides an analysis of landscape sensitivity within the viewshed of the wind farm development and considers each of the five LCA's.

6.3.1 LCA 1 Undulating pastoral/agricultural landscape

Plate 1 – Typical view across undulating pastoral/agricultural landscape

Table 7 – LCA 1 - Undulating pastoral/agricultural landscape -Landscape Sensitivity

	Lower Sensitivity		↔		Higher Sensitivity
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Landform and Scale		**2**			
	The undulating pastoral/agricultural landscape is a medium to large scale open landscape with a gently undulating landform. The structure of the landform is simple containing few distinct features and has a general absence of any strong topographical elements.				
Landcover		**2**			
	Landcover is predominantly simple and predictable within the context of widespread pasture areas across the regional area of the Southern Tablelands. The overall landscape pattern created by the grass pasture is smooth, regular and uniform. Areas of cultural planting surround many rural dwellings in the form of evergreen windbreaks.				
Settlement and human influence			**3**		
	A dispersed settlement pattern occurs across the landscape and comprises rural farm homesteads including documented local historical structures. There is a general absence of modern development throughout this landscape, excluding agricultural structures and local roads and access tracks.				
Movement			**3**		
	Movement is generally restricted to occasional passing traffic, livestock as well as agricultural machinery.				
Rarity		**2**			
	Undulating grassland is generally well represented and a common feature across the regional area of the Southern Tablelands.				

	Lower Sensitivity		↔		Higher Sensitivity
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Intervisibility			3		
	Undulating grassland areas appear as a simple backdrop in views from surrounding elevated areas. Undulating landform can retain and constrict views within the landscape, but generally contributes to the wider landscape.				
Overall Sensitivity Rating	Medium (Score 15 out of 30)				

6.3.2 LCA 2 Drainage Lines

Plate 2 – Typical view across drainage lines landscape

Table 8 – LCA 2 - Drainage Lines - Landscape Sensitivity

	Lower Sensitivity		↔		Higher Sensitivity
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Landform and Scale		2			
	Drainage line areas are generally contained by the gently sloping landform resulting in a small to moderate scale landform. The landform is simple containing few distinct features and has an absence of any strong topographical elements.				
Landcover		2			
	Landcover is predominantly simple and predictable within the context of widespread drainage areas across the broader regional area of the Southern Tablelands. The overall landscape pattern created by grass pasture within this landscape is smooth, regular and uniform, although mosaics of timbered stands on adjoining slopes and hillsides create some diversity and contrast in pattern.				
Settlement and human influence			3		
	There is a general absence of settlement within this landscape with a small and				

	Lower Sensitivity		↔		Higher Sensitivity
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
	dispersed number of agricultural structures (some abandoned), minor access tracks and fences occurring throughout. Some modifications to landscape have been carried out to accommodate road access and the former railway line.				
Movement			3		
	Movement within this LCA is largely defined by traffic travelling along local road corridors such as the Lachlan Valley Way and the Boorowa Road.				
Rarity		**2**			
	Drainage lines and their surrounding landscape are generally well represented and a common feature across the broader regional area of the Southern Tablelands.				
Intervisibility			**3**		
	Intervisibility is limited as views from within this landscape are often contained by sloping landform rising above drainage lines. Views along drainage lines, as well as views from areas above and across drainage lines provide links with adjoining landscape areas.				
Overall Sensitivity Rating	Medium (Score 15 out of 30)				

6.3.3 LCA 3 Hills and ridgelines

Plate 3 – Typical views along hills and ridgeline landscape

Table 9 – LCA 3 - Hills and ridgelines - Landscape Sensitivity

	Lower Sensitivity		↔		Higher Sensitivity
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Landform and Scale		2			
	Hill and ridgeline areas are represented by a generally open and large scale landform with distant views available from elevated areas within this landscape. The landform is simple containing few distinct features and has a general absence of any strong topographical elements.				
Landcover		2			
	Landcover is predominantly simple and predictable within the context of similar areas across the Southern Tablelands. The overall landscape pattern created by grass pasture within this landscape is smooth, regular and uniform, although mosaics of timbered areas on surrounding slopes and cultural planting surrounding dwellings create some diversity and contrast in pattern.				
Settlement and human influence			3		
	Settlement is occasional and dispersed within this landscape and does not generally occur along the top of ridgelines or on elevated and exposed slopes. The main influences of human activity are the effects of agricultural improvement within the landscape.				
Movement				4	
	Movement is generally limited to local roads and access tracks.				
Rarity		2			
	Simple slopes and ridgelines are generally well represented and a common feature across the broader regional area of the Southern Tablelands.				
Intervisibility			3		

	Lower Sensitivity		↔		Higher Sensitivity
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
	Intervisibility is limited as views from within this landscape are often contained by undulating or sloping landform rising to ridgelines, however, potential distant views do occur from elevated landform to provide links to adjoining landscape areas.				
Overall Sensitivity Rating	Medium to High (Score 16 out of 30)				

6.3.4 LCA 4 Timbered Areas

Plate 4 – Typical views across timbered areas

Table 10 – LCA 4 - Timbered Areas- Landscape Sensitivity

	Lower Sensitivity		↔		Higher Sensitivity
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Landform and Scale		2			
	Timbered areas occur across a range of landform types that are generally defined by gently sloping or undulating landform resulting in a moderate scale landform. The landform is simple containing few distinct features and has an absence of any strong topographical elements.				
Landcover		2			
	Landcover is predominantly simple and predictable within the context of similar timbered areas across the Southern Tablelands. The overall landscape pattern created by timbered areas creates diversity and contrast to the smooth, regular and uniform grass pasture and cultivated areas within this landscape. The darker coloured foliage of timbered areas contrast against the surrounding backdrop of lighter toned pasture and cultivated areas.				
Settlement and human			3		

	Lower Sensitivity		↔		Higher Sensitivity
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
influence	Settlement is occasional and dispersed within timbered areas with the majority of dwellings visually screened from surrounding landscape areas. The main influences of human activity are the effects of agricultural improvement within the landscape.				
Movement				**4**	
	Movement is generally limited to local roads and access tracks.				
Rarity		**2**			
	Timbered areas are reasonably well represented and an established feature across broader regional areas of the New South Wales Southern Tablelands.				
Intervisibility			**3**		
	The level of intervisibility between this landscape and adjoining areas is generally determined by the location and extent of timbered area relative to view locations, but on the whole is limited as views from within this landscape are constrained by vegetation, combined with sloping landform. Views from scattered or lightly timbered areas provide links to adjoining landscape areas.				
Overall Sensitivity Rating	Medium to High (Score 16 out of 30)				

6.3.5 LCA 5 Urban/Rural settlement

Plate 5 – Typical view across urban settlement area

Table 11 – LCA 5 – Urban/rural settlement - Landscape Sensitivity

	Lower Sensitivity		↔		Higher Sensitivity
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Landform and Scale				4	
	Urban and rural settlement is generally surrounded and contained by gently sloping and low undulating landform resulting in an overall small scale rural urban environment.				
Landcover		2			
	The overall landscape pattern is defined by human scale indicators including houses, shops and roads together with a variety of urban structures which create some diversity and contrast in pattern. There are generally no elements that result in the presence of strong topographical variety within developed areas.				
Settlement and human influence			3		
	Dwellings are dispersed beyond village settlement and urban areas (such as Rye Park and Boorowa) and are generally associated with individual farms and rural structures.				
Movement		2			
	Movement is generally limited to local roads and access tracks.				
Rarity		2			
	Small scale urban settlements are dispersed across the landscape, as well as the broader regional area of the Southern Tablelands.				
Intervisibility			3		
	Intervisibility is limited where views are partially contained by buildings and structures, although views from elevated areas of the settlement extend beyond and across adjoining landscape areas.				

	Lower Sensitivity		↔		Higher Sensitivity
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Overall Sensitivity Rating	Medium to High (Score 16 out of 30)				

6.4 Landscape values (local and regional)

6.4.1 What are landscape values?

For the purpose of this LVIA landscape values have been considered as a set of professional judgements on the importance to society of the local and regional landscape surrounding the proposed wind farm development. Societal landscape values may extend across a range of specific interests such as historic, ecological or cultural issues. The purpose of identifying local and regional landscape values is to consider what, if any, losses to landscape features or characteristics may result from the construction and operation of the wind farm development, and how this may impact upon local and regional landscape values.

6.4.2 Historical landscape values

Both the local and regional landscape has a strong association with early European settlement and agricultural production and specifically the establishment of pastoral properties. The European historical and cultural association with settlement and agrarian transition is set against a backdrop of indigenous populations being relocated and ultimately removed from the landscape. The removal of the indigenous population resulted in long held landscape cultural values and practices being replaced by those employed by early settlers in the mid to early 19th century. Landscape change resulting from the abrupt replacement of landscape values (from subsistence to industrial agriculture) has wrought significant alteration to the landscape; however the existing landscape pattern is one that most people at the local and regional scale would recognise as typical and representative of a rural agricultural landscape. A detailed consideration and assessment of the relationship between landscape and indigenous populations is described in the Heritage Assessment Report within the **EA**.

6.4.3 Existing landscape values

Whilst the landscape is likely to hold more significant value at a local level, for those who both work and reside within the landscape surrounding the proposed wind farm development, there are no specific references to designations or policies which indicate or recognise a 'high value' landscape. There are no 'iconic' landscape elements (including constructed or natural features) that occur within the local or regional landscape which have a broader public value or that are recognised at a national level. The majority of land within and surrounding the wind farm development is privately owned and, at a local and regional scale, opportunities for the broader public to access and explore the landscape and obtain distant and panoramic views are largely limited to existing rights of way such as road corridors. The proposed wind farm development is not considered to have the potential to have a significant impact on existing landscape values.

6.5 Summary

In terms of overall landscape sensitivity and value, this LVIA has determined that the landscape within the viewshed of the proposed Bango wind farm has a medium/medium to high sensitivity to accommodate change, and represents a landscape that is reasonably typical of landscape types found in surrounding areas of the Southern Tablelands.

As a landscape with an overall medium/medium to high sensitivity to accommodate change, some characteristics are likely to be altered by the wind farm; however, the landscape will have some capability to accommodate change. This capability is largely derived from the presence of predominantly large scale and open landscape across portions of the wind farm, together with the relatively low settlement density within the Bango 10km viewshed.

This LVIA has determined that the wind farm would not be an unacceptable development within the Bango wind farm viewshed, which in a broader context also contains built elements such as roads, agricultural industry, aircraft landing strips, communication towers, powerlines as well as operating and approved wind farms within the regional location of the Bango wind farm site.

Despite being 'naturalistic' in appearance large portions of the Southern Tablelands landscape have been heavily modified by agricultural improvement for pasture and arable production post European settlement. Irrespective of the extent and nature of modifications to the landscape, it is not correct to assume that the

landscape surrounding the wind farm should be any less valued as a result of modification. Physical change in the appearance of the landscape is an ongoing and constant process from both human and environmental influences and can result in both positive and negative effects.

Viewshed, zone of visual influence and visibility

Section 7

7.1 Introduction

A key component of this LVIA is defined by the description, assessment and determination of the viewshed, zone of visual influence and visibility associated with the wind farm. It is a combination of these issues that sets out the framework for determining the significance and magnitude of potential visual impact of the wind farm on view locations within the landscape.

In order to clarify and explain this component of this LVIA, the relationship between viewshed, zone of visual influence and visibility is outlined and defined in **Table 12**.

Table 12 – Definitions

	Definition	Relationship
Viewshed	An area of land surrounding and beyond the project area which may be potentially affected by the wind farm.	Identifies the majority of this LVIA study area that incorporates view locations that may be subject to a degree of visual impact.
Zone of Visual Influence (ZVI)	A theoretical area of landscape from which the wind farm structures may be visible.	Determines areas within a viewshed from which the wind turbines may be visible.
Visibility	A relative determination at which a wind turbine or cluster of wind turbines can be clearly discerned and described.	Describes the likely number and relative scale of wind turbines visible from a view location.

An overview of viewshed, zone of visual influence and visibility is discussed in the following sections.

7.2 Viewshed

For the purpose of this LVIA viewshed is defined as the area of land surrounding and beyond the project area which could be potentially affected by the wind farm. In essence, the viewshed defines this LVIA study area. The viewshed for the project has been divided into a series of concentric bands (at 2 km, 5 km and 10 km distance offsets) extending across the landscape from the wind turbines. The viewshed extent can vary between wind farm projects, and be influenced or informed by a number of criteria including the height of the wind turbines together with the nature, location and height of landform that could limit visibility.

It is important to note that the wind turbines would be visible from some areas of the landscape beyond the 10 km viewshed; however, within the general parameters of normal human vision, a wind turbine at around

192 m to the tip of the rotor blade would occupy a relatively small proportion of a person's field of view from distances in excess of 10 km.

The viewshed is used as a framework and guide for visibility assessment, as the degree of visual significance would tend to be gradated with distance although there are unlikely to be any distinct or abrupt noticeable changes between the nominated distances.

7.3 Zone of Visual Influence

The ZVI diagrams are used to identify theoretical areas of the landscape from which a defined number of wind turbines, or portions of turbines, could be visible within the viewshed. They are useful for providing an overview as to the extent to which the project could be visible from surrounding areas.

ZVI diagrams have been prepared to include:

- ZVI Diagram 1 from tip of blade;
- ZVI Diagram 2 from hub height; and
- ZVI Diagram 3 toward the whole turbine.

The extents to which the wind turbines may be visible are illustrated in **Figure 21**, and the ZVI Diagrams in **Figures 22, 23** and **24**.

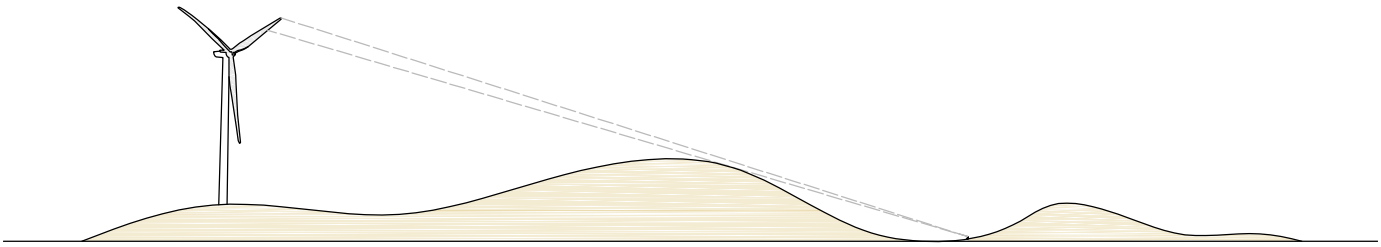
7.4 ZVI methodology

The methodology adopted for the ZVI is a purely geometric assessment where the visibility of the project is determined from carrying out calculations based on a digital terrain model of the site and the surrounding terrain.

Calculations have been made to determine the visibility of the wind turbines:

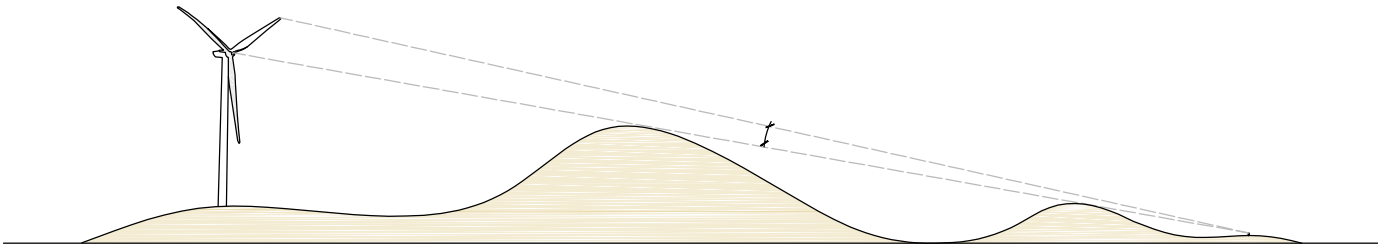
- to blade tips (essentially a view toward any part of the wind turbine rotor, including views toward the tips of blades above ridgelines);
- to hub height (essentially a view toward half the swept path of the wind turbine blades); and
- to the whole turbine (essentially a view toward the whole turbine).

The calculations also take into account the terrain relief and earth curvature.



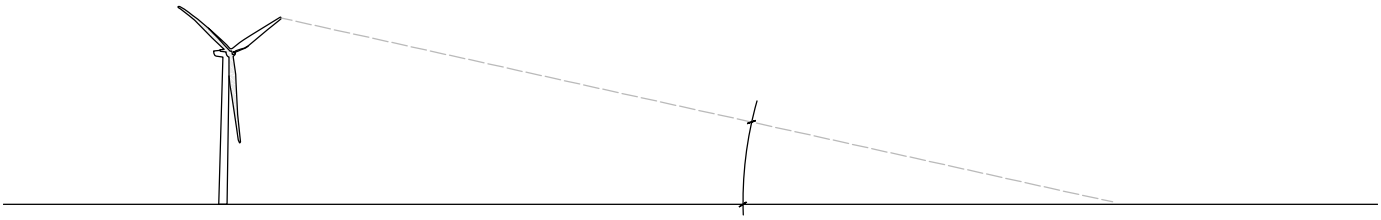
'Tip of blade'

View toward 'tip of blade' - where views extend toward the tip of blades above hill and ridgelines.



'Hub height'

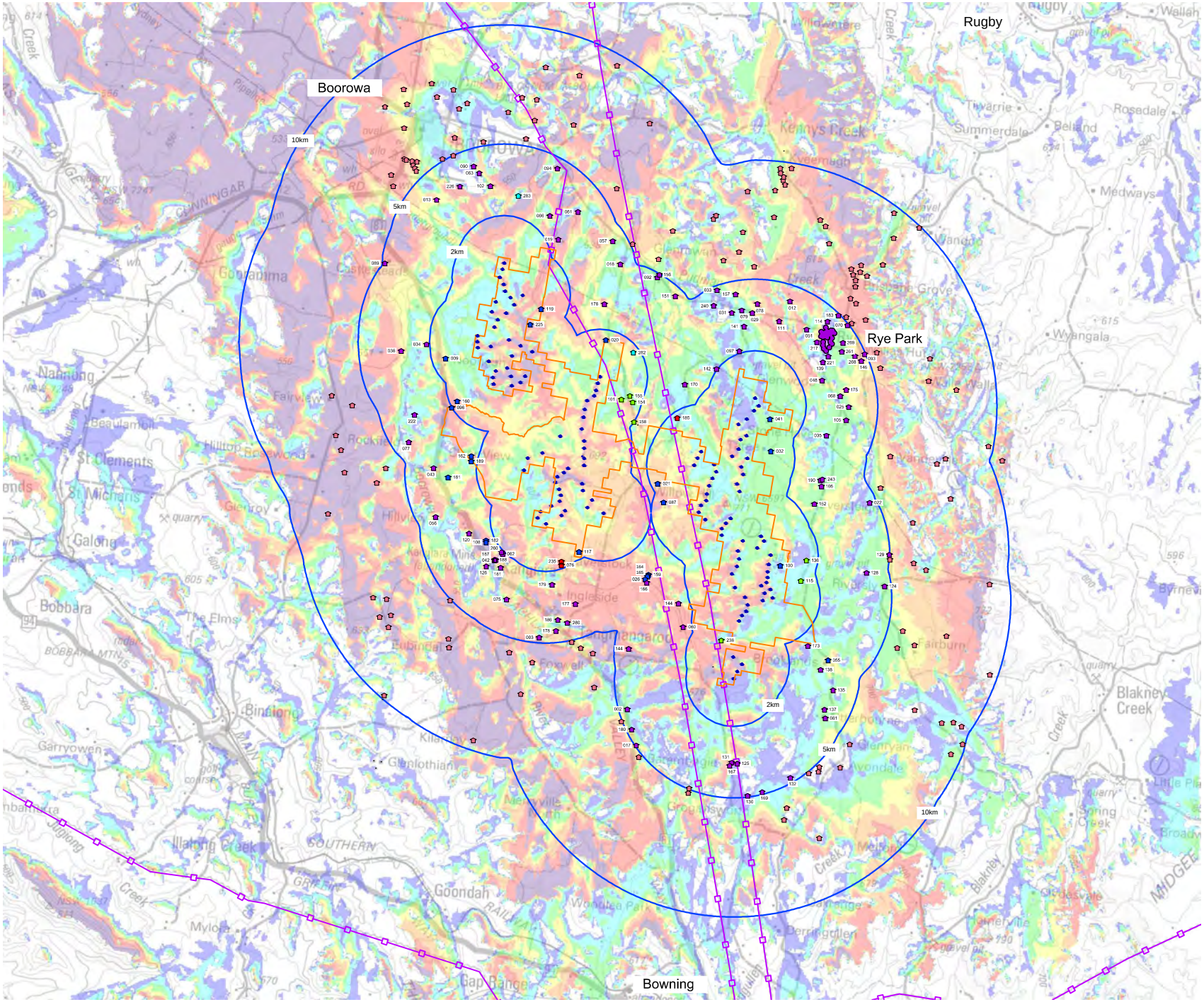
View toward 'hub height' - where views extend toward the upper half of the wind turbine rotor with views toward the lower half of the rotor face and tower screened by landform.



'Whole turbine'

View toward 'whole turbine' - where views extend from the base of the tower to the tip of the rotor blade.

Figure 21
ZVI visibility zones



NOTES:

The ZVI methodology is a purely geometric assessment where the visibility of the proposed Bango wind farm is determined from carrying out calculations based on a digital terrain model of the site and the surrounding terrain.
This assessment methodology is assumed to be conservative as the screening affects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not visible at many of the locations indicated on the ZVI maps due to the local presence of trees, vegetation or other screening potential. While the ZVI maps are a useful visualisation tool, they are very conservative in nature.
Additionally, the number of turbines visible at any one time is also affected by the weather condition at the time. Inclement or cloudy weather tends to mask the visibility of the proposed wind project.

LEGEND:
Number of wind turbine tip of blade visible

- 0
- 1-20
- 21-40
- 41-60
- 61-80
- 81-100
- 101-120
- 121-122

- Involved residential dwelling
- Neighbour dwelling within 2 km of Bango wind turbine (subject to agreement)
- Uninvolved dwelling within 2 km of Bango wind turbine
- Uninvolved dwelling between 2 km and 5 km of Bango wind turbine
- Proposed dwelling (not built) with approved Development Application
- Uninvolved dwelling between 5 km and 10 km of Bango wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Bango wind turbine
- Existing 132 kV overhead powerline

Figure 22
ZVI Diagram 1
Tip of blade

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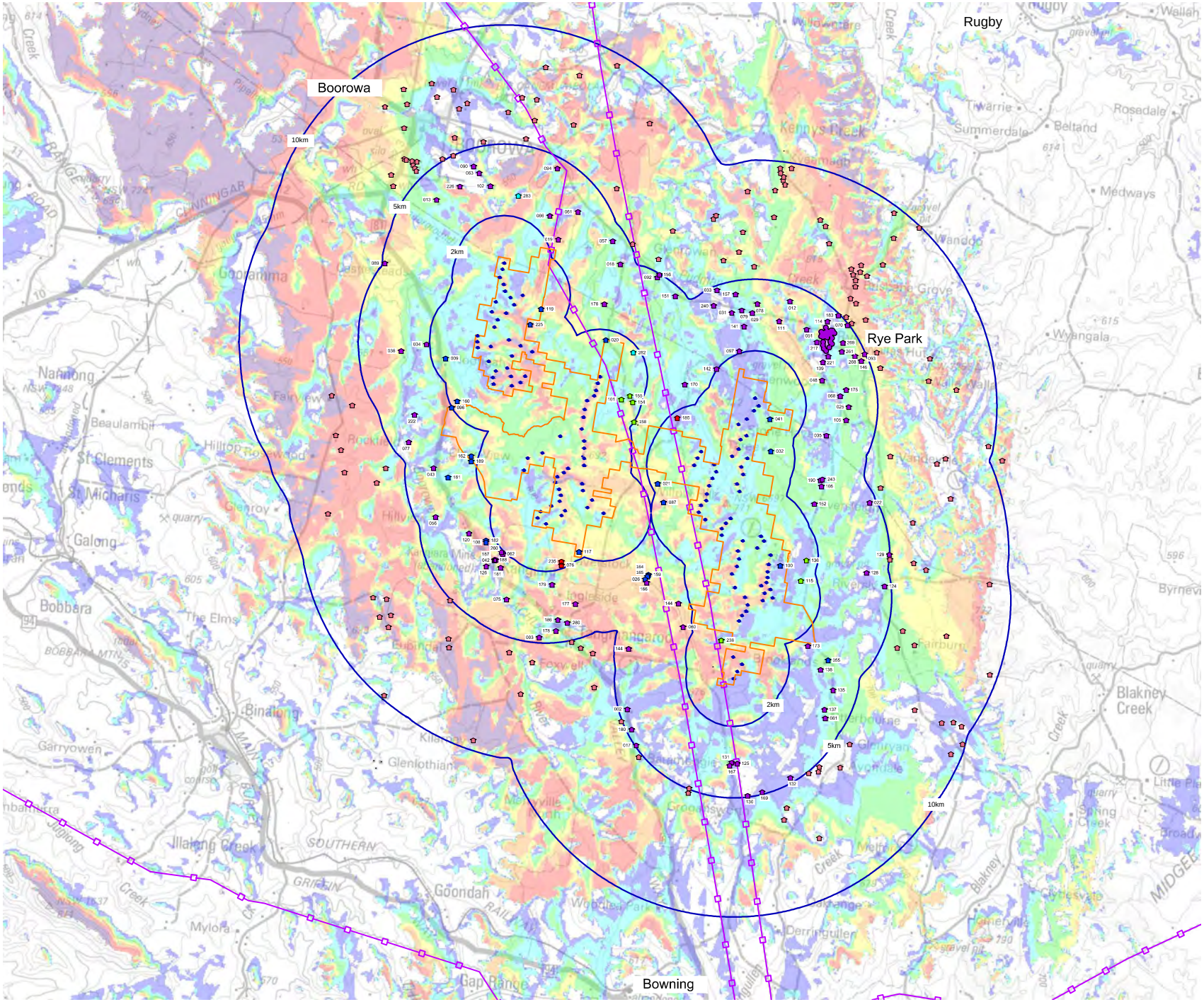

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LEGEND:

Number of wind turbine s visible from hub height

- 0
- 1-20
- 21-40
- 41-60
- 61-80
- 81-100
- 101-120
- 121-122

- Involved residential dwelling
- Neighbour dwelling within 2 km of Bango wind turbine (subject to agreement)
- Uninvolved dwelling within 2 km of Bango wind turbine
- Uninvolved dwelling between 2 km and 5 km of Bango wind turbine
- Proposed dwelling (not built) with approved Development Application
- Uninvolved dwelling between 5 km and 10 km of Bango wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Bango wind turbine
- Existing 132 kV overhead powerline

Figure 23
ZVI Diagram 2
Hub height

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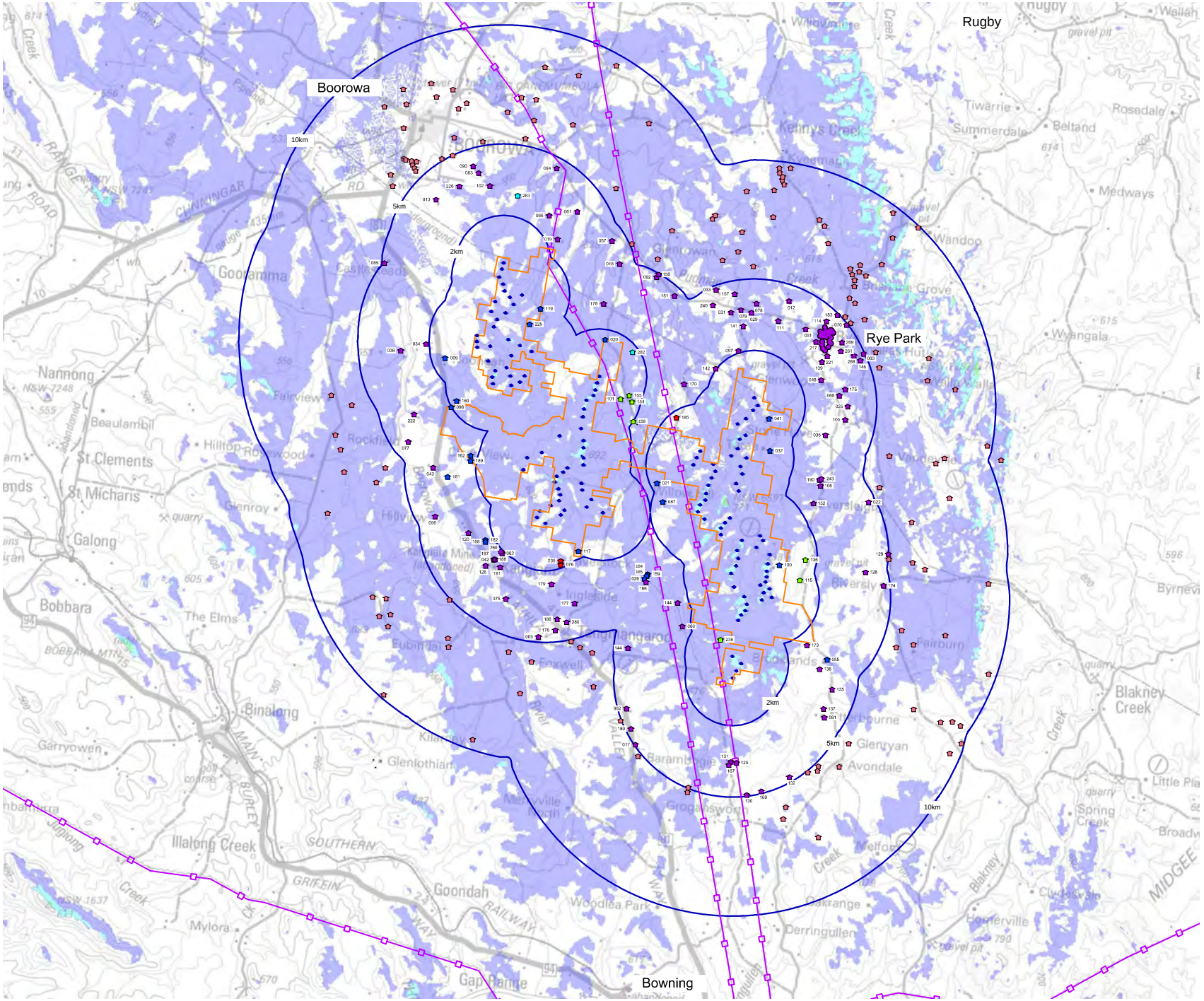

NOTES:

The ZVI methodology is a purely geometric assessment where the visibility of the proposed Bango wind farm is determined from carrying out calculations based on a digital terrain model of the site and the surrounding terrain. This assessment methodology is assumed to be conservative as the screening affects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not visible at many of the locations indicated on the ZVI maps due to the local presence of trees, vegetation or other screening potential. While the ZVI maps are a useful visualisation tool, they are very conservative in nature. Additionally, the number of turbines visible at any one time is also affected by the weather condition at the time. Inclement or cloudy weather tends to mask the visibility of the proposed wind project.

LEGEND:

Number of whole wind turbines visible

- 0
- 1-20
- 21-40
- 41-60
- 61-80
- 81-100
- 101-120
- 121-122

- Involved residential dwelling
- Neighbour dwelling within 2 km of Bango wind turbine (subject to agreement)
- Uninvolved dwelling within 2 km of Bango wind turbine
- Uninvolved dwelling between 2 km and 5 km of Bango wind turbine
- Proposed dwelling (not built) with approved Development Application
- Uninvolved dwelling between 5 km and 10 km of Bango wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Bango wind turbine
- Existing 132 kV overhead powerline

Figure 24
ZVI Diagram 3
Whole turbine

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This assessment methodology is conservative as:

- the screening effects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not be visible at many of the locations indicated on the ZVI diagrams due to the local presence of trees or other screening materials.
- additionally, the number of turbines visible is also affected by the weather conditions at the time. Inclement or cloudy weather tends to mask the visibility of the proposed wind project.

Accordingly, while ZVI diagrams are a useful visualisation tool, they are very conservative in nature.

7.5 ZVI summary

The most extensive and continuous area of visibility toward the project turbines would generally occur where the tips of the wind turbine rotor blades are visible above surrounding ridgelines or vegetation; however, views toward the tips and upper portions of the wind turbine rotors are likely to become less noticeable at reasonably short distances from the wind farm due to the screening influence of topography and dense tree cover. Views toward tip of blade are visually negligible from medium to longer distance view locations.

The ZVI diagrams for 'tip' and 'hub height' cover similar extents of landscape surrounding the wind farm, and extend toward isolated pockets of rural landscape beyond 10 km of the nearest wind turbine. The number and distribution of turbines visible between 'tip' and 'hub' height is influenced by ridgelines and surrounding hills for a number of areas between the 5 km to 10 km distance offsets.

The ZVI diagrams illustrate areas of landscape which are likely to offer views toward the wind turbines and demonstrate that the majority of views generally occur within private property and across tracts of unoccupied rural landscape.

The ZVI diagrams also illustrate a number of discrete pockets within portions of the 5 km to 10 km distance offset from which the wind turbines would not be visible, although this band of the viewshed also represents areas from which a greater number of turbines would also be visible.

The ZVI diagrams illustrate that the influence of surrounding landform begins to disperse visibility from beyond 5 km, although opportunities to view turbines from elevated, but moderately distant and generally unoccupied areas occur from areas beyond 5 km.

It should be noted that the wind turbines, when viewed from distances of around, or greater than 10 km, will generally be less distinct from other distant elements within the same field of view, and that the majority of land within the viewshed comprises rural agricultural land and areas of dense timber growth.

7.6 Visibility

The level of wind turbine visibility within the Bango wind farm 10 km viewshed can result from a number of factors such as:

- distance effect;
- movement;
- relative position; and
- weather.

7.6.1 Distance effect

With an increase in distance the proportion of a person's horizontal and vertical view cone occupied by a visible turbine structure, or group of turbine structures, will decline. In order to demonstrate this a series of single frame photographs have been taken from pre-set distances (1.5 km, 4 km, 7 km and 10 km) toward wind turbines at the Capital wind farm in New South Wales. The photographs, illustrated in **Figure 25**, demonstrate the degree to which the apparent visible height of a wind turbine decreases with increasing distance (in a negative exponential relationship), and the increasing amount of horizontal skyline visible with an increasing distance.

As the view distance increases so do the atmospheric effects resulting from dust particles and moisture in the atmosphere, which makes the turbines appear to be grey thus potentially reducing the contrast between the wind turbines and the background against which they are viewed.

Whilst the distance between a view location and the wind turbines is a significant factor to consider when determining potential visibility, there are other issues which may also affect the degree of visibility. **Table 13** outlines the relative effect of distance on visibility and has been based on empirical research conducted by the University of Newcastle (2002) as well as direct observations made during wind farm site inspections.

Capital Wind Farm - View distance 1.5 km

Capital Wind Farm - View distance 4 km

Capital Wind Farm - View distance 7 km

Capital Wind Farm - View distance 10 km

Capital Wind Farm turbines: Suzlon88, 80 m hub height, 88 m rotor diameter

Photographs: Pentax K10D, 50mm lens

Figure 25 Distance effect

Table 13 – Distance effect

Distance from turbine	Distance effect
>20 km	Wind turbines become indistinct with increasing distance. Rotor movement may be visible but rotor structures are usually not discernible. Turbines may be discernible but generally indistinct within viewshed resulting in **Low** level visibility and **Nil** where influenced or screened by surrounding topography and vegetation.
10 km – 20 km	Wind turbines noticeable but tending to become less distinct with increasing distance. Blade movement may be visible but becomes less discernible with increasing distance. Turbines discernible but generally less distinct within viewshed (potentially resulting in **Low** level visibility).
5 km – 10 km	Wind turbines visible but tending to become less distinct depending on the overall extent of view available from the potential view location. Movement of blades discernible where visible against the skyline. Turbines potentially noticeable within viewshed (potentially resulting in **Low to Moderate** level visibility).
3 – 5 km	Wind turbines clearly visible in the landscape but tending to become less dominant with increasing distance. Movement of blades discernible. Turbines noticeable but less dominant within viewshed (potentially resulting in **Moderate** level visibility).
1 – 3 km	Wind turbines would generally dominate the landscape in which the wind turbine is situated. Potential for high visibility depending on the category of view location, their location, sensitivity and subject to other visibility factors. Turbines potentially dominant within viewshed (potentially resulting in **Moderate to High** level visibility).
<1 km	Wind turbines would dominate the landscape in which they are situated due to large scale, movement and proximity. Turbines dominant and significant within viewshed (potentially resulting in **High** level visibility).

7.6.2 Movement

The visibility of the wind turbines would vary between the categories of static and dynamic view locations. In the case of static views the relationship between a wind turbine and the landscape would not tend to vary greatly. The extent of vision would be relatively wide as a person tends to scan back and forth across the landscape.

In contrast views from a moving vehicle are dynamic as the visual relationship between wind turbines is constantly changing, as is the visual relationship between the wind turbines and the landscape in which they are seen. The extent of vision can be partially constrained by the available view from within a vehicle at proximate distances.

7.6.3 Relative position

In situations where the view location is located at a lower elevation than the wind turbine, most of the turbine would be viewed against the sky. The degree of visual contrast between a white coloured turbine and the sky would depend on the presence of background clouds and their colour. For example, dark grey clouds would contrast more strongly with white turbines than a background of white clouds.

The level of visual contrast can also be influenced by the position of the sun relative to individual wind turbines and the view location. Where the sun is located in front of the viewer some visible portions of the wind turbine would be seen in shadow. If the background to the wind turbine is dark toned then visual contrast would tend to be reduced. Conversely where the sun is located behind the view location then the visible portion of the wind turbine would be in full sun.

Significance of visual effect

Section 8

8.1 Introduction

The significance of visual effect resulting from the construction and operation of the Bango wind farm would result primarily from a combination of:

- the overall sensitivity of visual receptors in the surrounding landscape; and
- the scale or magnitude of visual effects presented by the wind farm development.

The sensitivity of visual receptors has been determined and described in this LVIA by reference to:

- the location and context of the view point;
- the occupation or activity of the receptor; and
- the overall number of people affected.

This LVIA notes that although a large number of viewers in a category that would otherwise be of low or moderate sensitivity may increase the sensitivity of the receptor, it is also the case that a small number of people (such as residents) with a high sensitivity may increase the significance of visual effect.

Table 14 – View Location Sensitivity

View Category	Sensitivity
Residential Properties	***Highest Sensitivity***
Pedestrians (recreational)	▽
Public Recreational Space	▽
Rural employment/farming	▽
Motorists	▽
Business (commercial)	▽
Industry	*Lower Sensitivity*

Table 15 – Numbers of viewers

Criteria	Definition
Number of viewers	
High	> 500 people per day
Medium to high	100 - 499 people per day

Criteria	Definition
Medium	26 - 99 people per day
Low	10 - 25 people per day
Very low	< 10 people per day

The scale or magnitude of visual effects associated with the project have been determined and described by reference to:

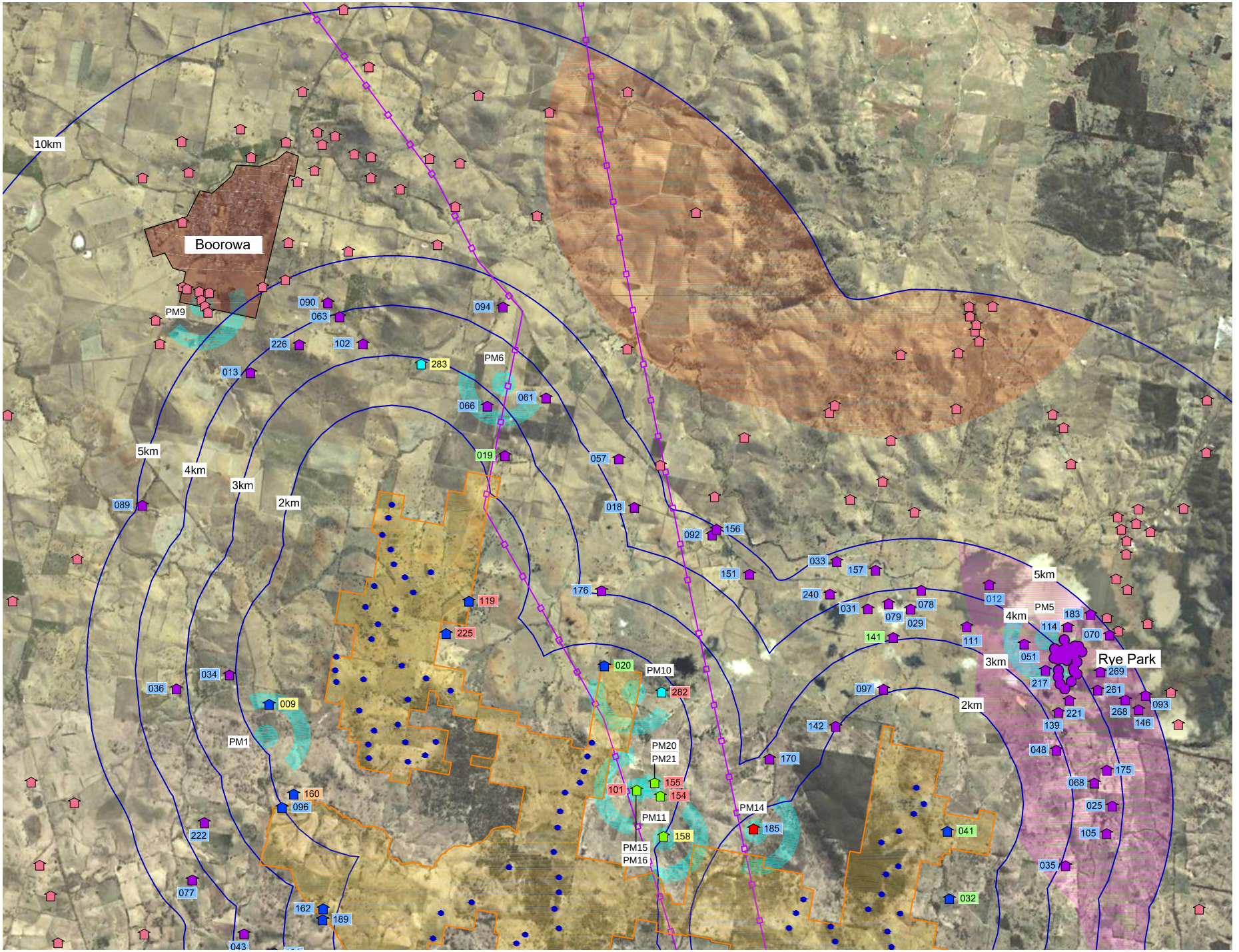
- the distance between the view location and the wind farm turbines;
- the duration of effect;
- the extent of the area over which the wind farm could be theoretically visible (ZVI hub height)
- the degree of visibility subject to existing landscape elements (such as forested areas or tree cover).

An overall determination of visual effect at each view location has also been assessed and determined against the criteria outlined in **Table 16** below:

Table 16 – Sensitivity and magnitude assessment criteria

Criteria	Definition
Distance	
Very short	<1 km
Short	1 – 3 km
Medium	3 km – 5 km
Long	5 km - 10 km +
Duration of effect	
High	> 2 hours
Medium	30 - 120 minutes
Low	10 – 30 minutes
Very low	< 10 minutes
Extent of visibility	
High	81 -122 wind turbines visible
Medium	41 – 80 wind turbines visible
Low	21 – 40 wind turbines
Very low	1 – 20 wind turbines visible

The sensitivity and magnitude assessment criteria outlined in **Tables 15** and **16** are used **as a guide** to determine levels of visual significance. The residential views locations surrounding the Bango wind farm are illustrated in **Figures 26a** and **26b**.



Legend

- Bango wind farm project area
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Bango wind turbine
- Existing powerline
- Involved residential dwelling
- Neighbour dwelling within 2 km of Bango wind turbine (subject to agreement)
- Uninvolved dwelling within 2 km of Bango wind turbine
- Proposed dwelling (not built) with approved Development Application
- Uninvolved dwelling between 2 km and 5 km of Bango wind turbine
- Uninvolved dwelling between 5 km and 10 km of Bango wind turbine

Visual significance

- 003 Low - Nil/Low
- 164 Low - Medium
- 060 Medium
- 117 Medium - High
- 155 High

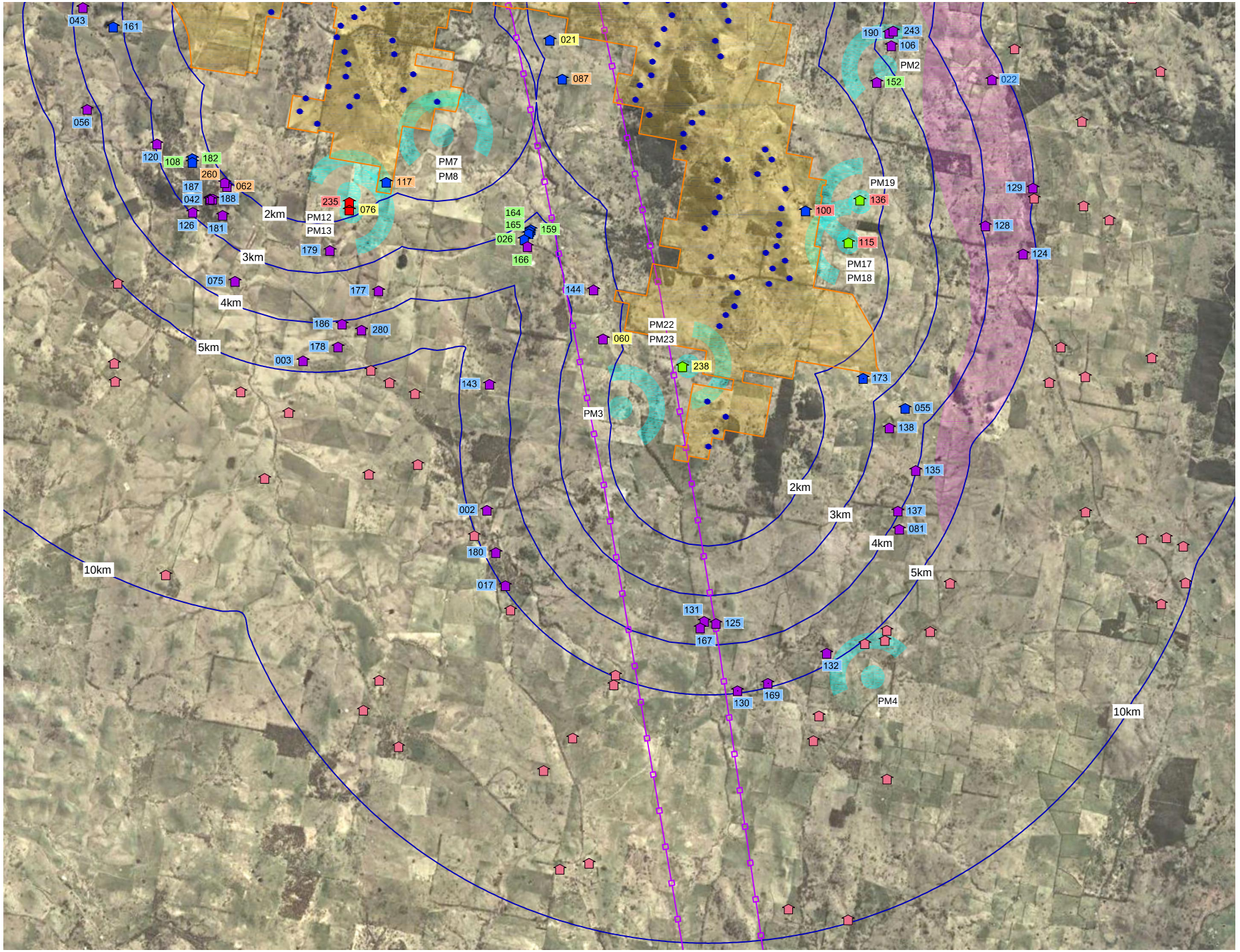
- Boorowa Township
- Landscape area between 2 km and 5 km of the Bango and Rye Park wind turbines
- Landscape area between 2 km and 5 km of the Rugby wind farm turbines (within the Bango 10 km viewshed)
- Photomontage location. Refer Section 11and Figures 34 to 79

Figure 26a Residential dwellings (detail north)

BANGO WIND FARM

GREEN BEAN DESIGN
landscape architects

WIND PROSPECT
CWP



Legend

- Bango wind farm project area
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Bango wind turbine
- Existing powerline
- Involved residential dwelling
- Neighbour dwelling within 2 km of Bango wind turbine (subject to agreement)
- Uninvolved dwelling within 2 km of Bango wind turbine
- Proposed dwelling (not built) with approved Development Application
- Uninvolved dwelling between 2 km and 5 km of Bango wind turbine
- Uninvolved dwelling between 5 km and 10 km of Bango wind turbine

Visual significance

- 003 Low - Nil/Low
- 164 Low - Medium
- 060 Medium
- 117 Medium - High
- 155 High

- Boorowa Township
- Landscape area between 2 km and 5 km of the Bango and Rye Park wind turbines
- Landscape area between 2 km and 5 km of the Rugby wind farm turbines (within the Bango 10 km viewshed)
- Photomontage location. Refer Section 11and Figures 34 to 79

Figure 26b Residential dwellings (detail south)

BANGO WIND FARM

GREEN BEAN DESIGN
landscape architects

WIND PROSPECT
CWP

Table 17 Visual significance criteria matrix

			Scale or magnitude of change in view caused by proposed development			
			High	**Medium**	**Low**	**Very Low**
			Very short distance view over a long duration of time. A high extent of wind turbine visibility would tend to dominate the available skyline view and significantly disrupt existing views or vistas.	Short to medium distance views over a medium duration of time. A moderate extent of wind turbine visibility would have the potential to dominate available views with visibility recessing over increasing distance.	Medium to long distance views over a low to medium duration of time. Wind turbines in views, at long distances or visible for a short duration not expected to be significantly distinct in the existing view.	Visible change perceptible at a very long distance, or visible for a very short duration, and/or is expected to be less distinct within the existing view.
Sensitivity of visual receptor	**High**	**Indicator**				
		Large numbers of viewers or those with proprietary interest and prolonged viewing opportunities such as residents and users or visitors to attractive and/or well-used recreational facilities. Views from a regionally important location whose interest is specifically focussed on the landscape	High	Medium to High	Medium	Low to Medium
	Medium	Medium numbers of residents and moderate numbers of visitors with an interest in their environment e.g. visitors to State Forests, such as bush walkers and horse riders etc…. Larger numbers of travellers with an interest in their surroundings	Medium to High	Medium	Low to medium	Low
	Low	Low numbers of visitors with a passing interest in their surroundings e.g. those travelling along principal roads. Viewers whose interest is not specifically focussed on the landscape e.g. workers, commuters.	Medium	Low to Medium	Low	Very low to low
	Very Low	Very low numbers of viewers or those with a passing interest in their surroundings e.g. those travelling along minor roads.	Low to Medium	Low	Very low to low	Very low

This table is used as a guide only. The descriptions of magnitude and sensitivity are illustrative only. Each case is assessed on its own merits using professional judgement and experience, and there is no defined boundary between levels of effects.

8.2 Visual significance matrix

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
Assessment of dwelling locations within 0 to 2 km of the proposed Bango wind turbines (Refer Figure 26a and 26b for locations)							
009 Photomontage location PM1 (in general vicinity)	Involved residential dwelling High	Very low	1.4 km	High	Medium	Short distance views east to north east toward wind turbines within the Langs Creek cluster. Views toward wind turbines within the Kangiara and Mt Buffalo clusters are more likely to be screened by landform and tree cover.	Medium
020 Photomontage location PM10 (in general vicinity)	Involved residential dwelling High	Very low	1.5 km	High	Medium	Short distance views south toward the Kangiara cluster and west toward the Langs Creek cluster will be partially filtered by tree planting surrounding the residential dwelling. Views toward wind turbines within the Mt Buffalo cluster are more likely to be screened by undulating landform to the south east of the dwelling.	Low to Medium
021	Involved residential dwelling High	Very low	1.7 km	High	Medium	Short distance views will extend east and west toward wind turbines within the Mt Buffalo and Kangiara clusters. Views toward wind turbines within the Langs Creek cluster are likely to be screened by undulating and ridgeline landform to the north west of the dwelling.	Medium
032	Involved residential dwelling High	Very low	1.0 km	High	Low to medium	Short distance views will extend west toward wind turbines within the north portion of the Mt Buffalo cluster. Views toward wind turbines in the Kangiara and Langs Creek clusters will be largely screened by rising landform to the west of the dwelling.	Low to Medium
041	Involved residential	Very low	0.7 km	High	Medium	Very short distance views will extend west toward wind turbines	Low to Medium

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
	dwelling High					within the north portion of the Mt Buffalo cluster. Views toward wind turbines in the Kangiara and Langs Creek clusters will be largely screened by rising landform to the west of the dwelling.	
076 Photomontage location PM12	Uninvolved residential dwelling High	Very low	1.9 km (wind turbine within south portion of Kangiara cluster)	High	High	Short distance views will extend north toward wind turbines within the southern portion of the Kangiara cluster. Views toward turbines within the northern portion of the Kangiara cluster, as well as turbines within the Langs Creek cluster will be largely distant, and/or screened by landform and tree cover. Long distance views (between 6 km and 7 km) will extend east toward turbines within the Mt Buffalo cluster.	Medium
087	Involved residential dwelling (weekender) High	Very low	1.5 km	High	High	Short distance views will extend north east to south east toward wind turbines within the Mt Buffalo cluster. Views toward wind turbines within the Kangiara and Langs Creek clusters will be largely screened by landform and tree cover.	Medium to High
100 Photomontage location PM17 and PM18 (in general vicinity)	Involved residential dwelling (uninhabited) High	Very low	0.5 km	High	Low	Views will extend toward a small number of turbines within the south east portion of Mt Buffalo cluster. The wind turbines will located on a hill to the west of the dwelling. Views toward the majority of wind turbines within the Mt Buffalo cluster, as well as wind turbines within the Langs Creek and Kangiara clusters, will be screened by landform and tree cover.	High
101 Photomontage location PM15 and	Neighbour residential dwelling	Very low	1.1 km	High	Low to medium	Short distance views will extend west and north west toward wind turbines within the northern portion of the Kangiara cluster. Views toward wind turbines within the Mt Buffalo and Langs Creek cluster	High

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
PM16	High					will be largely screened by landform and tree cover.	
115 Photomontage location PM17 and PM18	Neighbour residential dwelling High	Very low	1.3 km	High	Low	Short distance views will extend toward a small number of turbines within the south east portion of Mt Buffalo cluster. The wind turbines will be located on a hill to the west of the dwelling. Views toward the majority of wind turbines within the Mt Buffalo cluster, as well as wind turbines within the Langs Creek and Kangiara clusters, will be screened by landform and tree cover.	High
117 Photomontage location PM12 (in general vicinity)	Involved residential dwelling High	Very low	1.7 km	High	Medium to high	Short distance views will extend north toward wind turbines within the southern portion of the Kangiara cluster, with some partial filtering of views provided by tree planting surrounding dwelling. Potential views may also extend east (in excess of 5 km) toward turbines within the Mt Buffalo cluster. Views toward wind turbines within the Langs Creek cluster, as well as wind turbines within the northern portion of the Kangiara and Mt Buffalo clusters are likely to be screened by landform and tree cover.	Medium to High
119 Photomontage location PM10 (in general vicinity)	Involved residential dwelling High	Very low	1.0 km	High	Medium to high	Very short distance views will extend west to north west toward wind turbines within the central and north portion of the Langs Creek cluster. Views toward wind turbines within the Kangiara and Mt Buffalo clusters will be largely screened by tree cover and landform.	High
136 Photomontage location PM19	Neighbour residential dwelling High	Very low	1.5 km	High	Low	Short distance views will extend toward a small number of turbines within the south east portion of Mt Buffalo cluster. The wind turbines will be located on a hill to the west of the dwelling. Views toward the majority of wind turbines within the Mt Buffalo cluster, as well as	High

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
						wind turbines within the Langs Creek and Kangiara clusters, will be screened by landform and tree cover.	
154 Photomontage location PM20 and PM21 (in general vicinity)	Neighbour weekender High	Very low	1.9 km	Varies	Low	Short distance views west will extend toward a small number of wind turbines within the northern portion of the Kangiara cluster. Views toward wind turbines within the Langs Creek and Mt Buffalo clusters will be largely screened by landform.	High
155 Photomontage location PM20 and PM21	Neighbour weekender High	Very low	1.4 km	Varies	Low	Short distance views west will extend toward a small number of wind turbines within the northern portion of the Kangiara cluster. Views toward wind turbines within the Langs Creek and Mt Buffalo clusters will be largely screened by landform.	High
160 Photomontage location PM1 (in general vicinity)	Involved residential dwelling High	Very low	1.7 km	High	Medium to high	Short distance views will extend north east toward wind turbines within the central and southern portion of the Langs Creek cluster. Views toward wind turbines within the Mt Buffalo cluster will be screened by landform and tree cover.	Medium to High
172 Photomontage location PM22 and PM23	Neighbour - Shed	N/A	N/A	N/A	N/A	N/A	N/A
185 Photomontage location PM11	Uninhabited dwelling (derelict) High	Very low	1.7 km	High	Low	Short distance views east to south east toward wind turbines within the Mt Buffalo cluster will be largely screened by tree cover and landform.	N/A

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
225	Involved residential dwelling High	Very low	1.0 km	High	High	Very short distance views will extend west to north west toward wind turbines within the central and north portion of the Langs Creek cluster. Views toward wind turbines within the Kangiara and Mt Buffalo clusters will be largely screened by tree cover and landform.	High
235 Photomontage location PM13	Uninvolved residential dwelling High	Very low	1.7 km	High		Short distance views will extend north toward wind turbines within the southern portion of the Kangiara cluster. Views toward turbines within the northern portion of the Kangiara cluster, as well as turbines within the Langs Creek and Mt Buffalo clusters will be largely distant, and/or screened by landform and tree cover.	High
238 Photomontage location PM22 and PM23	Neighbour	Very low	1.0 km	Varies	Low	Very short distance views north east and south east will extend toward a small number of wind turbines within the southern portion of the Mt Buffalo cluster. Views toward wind turbines within the central and northern portion of the Mt Buffalo cluster, as well as wind turbines within the Kangiara and Langs Creek clusters, will be largely screened by landform and tree cover.	Medium
282	Approved DA (no house)	Very Low	1.7 km	High	Medium	Short distance views will extend west to south west toward wind turbines within the Kangiara cluster. Whilst existing tree cover will provide some filtering of views, the distance between the approved dwelling locality and the wind turbines will result in opportunities for proximate and direct views toward wind turbines.	High

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
Assessment of dwelling locations between 2 km and 3 km of the proposed Bango wind turbines (Refer Figures 26a and 26b for locations)							
019	Uninvolved residential dwelling High	Very low	2.5 km	High	High	Short distance views will extend toward wind turbines within the northern portion of the Langs Creek cluster, with some filtering effect provided by scattered tree cover beyond the residential dwelling.	Low to Medium
034 Photomontage location PM1 (in general vicinity)	Uninvolved residential dwelling High	Very low	2.1 km	High	Medium	Short distance views will extend east toward wind turbines within the Langs Creek cluster, with some partial screening by scattered tree cover beyond the residential dwelling.	Low
042	Uninvolved residential dwelling High	Very low	2.5 km	High	Low to medium	Short distance views north east toward wind turbines within the southern portion of the Kangiara cluster will be largely screened by scattered tree cover to the north east of the residential dwelling.	Nil/Low
048	Uninvolved residential dwelling High	Very low	2.9 km	High	Medium to high	Short distance views south west toward wind turbines within the northern portion of the Mt Buffalo cluster will be partially screened by tree planting beyond the residential dwelling.	Low
060 Photomontage location PM3 (in general vicinity)	Uninvolved Residential dwelling High	Very low	2.4 km	High	High	Short distance views will extend toward wind turbines within the southern and central portions of the Mt Buffalo cluster.	Medium
062	Uninvolved residential dwelling High	Very low	2.1 km	High	High	Short distance views north east toward wind turbines within the southern portion of the Kangiara cluster will be partially screened by tree cover and agricultural building surrounding and beyond the	Medium/High

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
						residential dwelling.	
066 Photomontage location PM6 (in general vicinity)	Uninvolved residential dwelling High	Very low	2.8 km	High	Medium to High	Short distance views will extend toward wind turbines within the northern portion of the Langs Creek cluster, with some filtering effect provided by scattered tree cover beyond the residential dwelling.	Low
096 Photomontage location PM1 (in general vicinity)	Involved residential dwelling High	Very low	2.0 km	High	High	Short distance views toward wind turbines within the southern portion of the Langs Creek cluster will be partially screened by tree cover and agricultural buildings beyond the residential dwelling.	Low
097	Uninvolved residential dwelling (weekender) High	Very low	2.1 km	High	Low	Short distance views toward wind turbines will be largely screened by topography and tree cover beyond the residential dwelling.	Low
108	Involved residential dwelling High	Very low	2.4 km	High	High	Short distance views will extend north east toward wind turbines within the southern portion of the Kangiara cluster. Views will be partially filtered by tree cover surrounding and beyond the dwelling. Views toward wind turbines within the Langs Creek and Mt Buffalo clusters will be largely screened by landform and tree cover.	Low to Medium
142	Uninvolved residential dwelling High	Very low	2.0 km	High	Low	Short distance views south east toward wind turbines will be largely screened by topography and tree cover beyond the residential dwelling.	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
144	Uninhabited residential dwelling High	Very low	2.5 km	High	Medium	Short distance views will extend east toward wind turbines within the southern portion of the Mt Buffalo cluster with some partial screening by tree cover surrounding the dwelling.	Low
152 Photomontage location PM2 (in general vicinity)	Uninvolved residential dwelling High	Very low	2.6 km	High	Low	Short distance views west toward wind turbines within the Mt Buffalo cluster will be partially screened by landform and scattered tree cover beyond the residential dwelling.	Low to Medium
158 Photomontage location PM11 (in general vicinity)	Neighbour caravan High	Very low	2.1 km	Varies	Medium	Short distance view will extend toward wind turbines within the north portion of the Kangiara cluster. Views toward wind turbines within the Mt Buffalo and Langs Creek clusters will be largely screened by ridgeline landforms.	Medium
162	Involved residential dwelling High	Very low	2.3 km	High	Medium to high	Medium distance views north toward wind turbines within the southern portion of the Lang Creek cluster, and east toward wind turbines within the Kangiara cluster will be largely screened by landform and tree cover surrounding and beyond the residential dwelling.	Low
170 Photomontage location PM14 (in general vicinity)	Uninvolved residential dwelling High	Very low	2.8 km	High	Low	Medium distance views toward wind turbines within the Mt Buffalo and Kangiara clusters will be largely screened by landform and tree cover. Views toward wind turbines within the Langs Creek cluster will be screened by landform.	Nil/Low
173	Involved residential dwelling	Very low	2.5 km	High	Low	Short distance views toward wind turbines within the south eastern portion of the Mt Buffalo cluster will be partially screened by gently	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
	High					rising landform to the north west of the residential dwelling.	
179 Photomontage location PM12 (in general vicinity)	Uninvolved residential dwelling High	Very low	2.6 km	High	Low	Short distance views north toward wind turbines within the southern portion of the Kangiara cluster will be partially screened by landform beyond the residential dwelling. Potential distant (in excess of 7 km) view east to south east toward wind turbines within the southern portion of the Mt Buffalo cluster.	Low
181	Uninvolved residential dwelling High	Very low	2.6 km	High	Low to medium	Short distance views north east toward wind turbines within the southern portion of the Kangiara cluster will be screened by tree cover and landform.	Nil/Low
182	Involved residential dwelling High	Very low	2.4 km	High	High	Short distance views will extend north east toward wind turbines within the southern portion of the Kangiara cluster. Views toward wind turbines within the Langs Creek and Mt Buffalo clusters will be largely screened by landform and tree cover.	Low to Medium
187	Uninhabited residential dwelling High	Very low	2.5 km	High	Low to medium	Short distance views north east toward wind turbines within the southern portion of the Kangiara cluster will be largely screened by scattered tree cover to the north east of the residential dwelling.	Nil/Low
188	Uninhabited residential dwelling High	Very low	2.5 km	High	Low to medium	Short distance views north east toward wind turbines within the southern portion of the Kangiara cluster will be largely screened by scattered tree cover to the north east of the residential dwelling.	Nil/Low
189	Involved residential	Very low	2.2 km	High	Medium	Short distance views north toward wind turbines within the southern portion of the Lang Creek cluster, and east toward wind turbines	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
	dwelling High					within the Kangiara cluster will be largely screened by landform and tree cover surrounding and beyond the residential dwelling.	
260	Uninvolved Empty dwelling High	Very low	2.0 km	High	High	Short distance views north east toward wind turbines within the southern portion of the Kangiara cluster will be partially filtered by tree cover beyond the residential dwelling.	Medium/High
283	Approved DA (no house)	Very Low	2.7 km	High	Medium	Short distance views extend south from the general locality of the proposed dwelling toward wind turbines within the north portion of the Langs Creek cluster. Some partial screening or filtering may be provided by scattered tree cover, but will be dependent on the location and orientation of the dwelling.	Medium
Assessment of dwelling locations between 3 km and 4 km of the proposed Bango wind turbines (Refer Figures 26a and 26b for locations)							
013 Photomontage location PM9 (in general vicinity)	Uninvolved residential dwelling High	Very low	3.9 km	High	Medium	Medium distance views extend south east toward the northern portion of the Langs Creek cluster with some potential for partial screening through undulating landform and scattered tree cover beyond the residential dwelling.	Low
025	Uninvolved residential dwelling High	Very low	3.8 km	High	Medium	Medium distance views will extend west toward wind turbines within the northern portion of the Mt Buffalo cluster. Some partial filtering of views may be provided by tree cover beyond the residential dwelling.	Low
026	Involved residential dwelling High	Very low	3.3 km	High	High	Medium distance views will extend east to north east toward wind turbines within the central portion of the Mt Buffalo cluster.	Low to Medium

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
029	Uninvolved residential dwelling High	Very low	3.6 km	High	Low	Medium distance views toward wind turbines will be largely screened by topography and tree cover beyond the residential dwelling.	Low
031	Uninvolved residential dwelling High	Very low	3.7 km	High	Low	Medium distance views toward wind turbines will be largely screened by topography and tree cover beyond the residential dwelling.	Low
035	Uninvolved residential dwelling High	Very low	3.1 km	High	Low	Medium distance views west to north west toward wind turbines within the southern and central portion of the Mt Buffalo cluster will be partially screened by tree cover beyond the residential dwelling.	Low
036	Uninvolved residential dwelling High	Very low	3.2 km	High	Medium	Medium distance views will extend east toward wind turbines within the Langs Creek cluster, with some partial screening by scattered tree cover beyond and to the east of the residential dwelling.	Low
043	Uninvolved residential dwelling High	Very low	3.8 km	High	Low to medium	Medium distance views north east toward wind turbines within the Langs Creek cluster and east toward the Kangiara cluster, will be largely screened by landform and tree cover beyond the residential dwelling.	Nil/Low
051 Photomontage location PM5 (in general vicinity)	Uninvolved residential dwelling High	Very low	3.6 km	High	Low	Medium distance views south west toward wind turbines within the northern portion of the Mt Buffalo cluster will be partially screened by gently rising landform beyond the dwelling.	Low
055	Involved	Very low	3.5 km	High	Medium	Medium distance views west to north west toward wind turbines	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
	residential dwelling High					within the southern and central portion of the Mt Buffalo cluster will be partially screened by scattered tree cover beyond the residential dwelling.	
061 Photomontage location PM6 (in general vicinity)	Uninvolved residential dwelling High	Very low	3.8 km	High	Low	Medium distance views toward wind turbines will be largely restricted by gently rising landform to the south and south west of the residential dwelling as well as some filtering through tree cover beyond the residential dwelling.	Low
063	Uninvolved residential dwelling High	Very low	3.9 km	High	Low	Medium distance views toward wind turbines will be largely screened by topography and tree cover beyond the residential dwelling.	Nil/Low
064	Rye Park School High	Low	3.6 km	High	Low	Medium distance views south west to south will generally be screened by ridgeline landform and tree cover alongside road corridors to the south of the school.	Nil/Low
068	Agricultural shed	N/A	N/A	N/A	N/A	N/A	N/A
075	Uninvolved residential dwelling High	Very low	3.6 km	High	Medium to high	Medium distance views will extend north to north east toward wind turbines within the southern portion of the Kangiara cluster and potentially distant (in excess of 9 km) views east toward wind turbines within the southern portion of the Mt Buffalo cluster.	Low
079	Uninvolved residential dwelling	Very low	3.7 km	High	Low	Medium distance views toward wind turbines will be largely screened by landform rising gently to the south of the residential dwelling.	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
	High						
102	Uninvolved residential dwelling High	Very low	3.3 km	High	Low	Medium distance views toward wind turbines will be largely screened by topography and tree cover beyond the residential dwelling.	Nil/Low
105	Uninvolved residential dwelling High	Very low	3.7 km	High	Medium	Medium distance views west to north west toward wind turbines within the northern portion of the Mt Buffalo cluster will be partially screened by tree cover beyond the residential dwelling.	Low
106 Photomontage location PM2 (in general vicinity)	Uninvolved residential dwelling High	Very low	3.3. km	High	Low	Medium distance views west and south west toward wind turbines within the Mt Buffalo cluster will be partially screened by gently rising landform beyond the residential dwelling.	Low
111 Photomontage location PM5 (in general vicinity)	Uninhabited residential dwelling High	Very low	3.4 km	High	High	Medium distance views extend south toward wind turbines within the northern portion of the Mt Buffalo cluster with some partial filtering created by scattered tree cover beyond the residential dwelling.	Low
125	Uninvolved residential dwelling High	Very low	3.6 km	High	Low	Medium distance views north toward wind turbines within the southern portion of the Mt Buffalo cluster will be largely screened and tree cover.	Nil/Low
126	Uninvolved residential dwelling High	Very low	3.0 km	High	Low to medium	Medium distance views north east toward wind turbines within the southern portion of the Kangiara cluster will be largely screened by scattered tree cover to the north east of the residential dwelling. Views toward wind turbines within the Langs Creek and Mt Buffalo	Nil/Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
						clusters will be screened by landform and tree cover.	
131	Uninvolved residential dwelling High	Very low	3.5 km	High	Low to medium	Medium distance views north toward wind turbines within the southern portion of the Mt Buffalo cluster will be largely screened by landform and scattered tree cover beyond the residential dwelling.	Nil/Low
138	Involved residential dwelling High	Very low	3.3 km	High	Medium	Medium distance views west toward wind turbines within the southern portion of the Mt Buffalo cluster will be partially screened by landform rising to the west of the dwelling as well as tree cover surrounding the dwelling.	Low
139 Photomontage location PM5 (in general vicinity)	Uninvolved residential dwelling High	Very low	3.2 km	High	Low	Medium distance views south west toward wind turbines within the northern portion of the Mt Buffalo cluster are largely screened by ridgeline landform to the south west of the residential dwelling.	Nil/Low
141 Photomontage location PM5 (in general vicinity)	Uninvolved residential dwelling High	Very low	3.0 km	High	Low	Medium distance views south and south west toward wind turbines will be largely screened by topography and tree cover beyond the residential dwelling.	Low to Medium
159	Involved residential dwelling High	Very low	3.2 km	High	Medium to high	Medium distance views will extend east to north east toward wind turbines within the central portion of the Mt Buffalo cluster.	Low to Medium
161	Involved residential dwelling	Very low	3.2 km	High	Low	Medium distance views will extend east toward wind turbines within the western portion of the Kangiara cluster with partial screening provided by a gently undulating and rising landform to the east of the	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
	High					residential dwelling.	
164	Involved residential dwelling High	Very low	3.2 km	High	High	Medium distance views will extend east to north east toward wind turbines within the central portion of the Mt Buffalo cluster.	Low to Medium
165	Involved residential dwelling High	Very low	3.2 km	High	High	Medium distance views will extend east to north east toward wind turbines within the central portion of the Mt Buffalo cluster.	Low to Medium
166	Uninvolved residential dwelling High	Very low	3.4 km	High	High	Medium distance views will extend east to north east toward wind turbines within the southern and central portion of the Mt Buffalo cluster.	Low to Medium
167	Uninvolved residential dwelling High	Very low	3.6 km	High	Medium	Medium distance views north toward wind turbines within the southern portion of the Mt Buffalo cluster will be largely screened by landform and scattered tree cover beyond the residential dwelling.	Nil/Low
175	Uninvolved residential dwelling High	Very low	3.7 km	High	Low	Medium distance views west toward wind turbines within the northern portion of the Mt Buffalo cluster will be partially screened by landform and tree cover to the west of the residential dwelling.	Low
176	Uninvolved residential dwelling High	Very low	3.0 km	High	Medium	Medium distance views will extend south toward wind turbines within the north portion of the Kangiara cluster and wind turbines within the Langs Creek cluster. Wind turbines within the Mt Buffalo cluster will be largely screened by ridgeline landform and tree cover south east	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
						of the residential dwelling.	
177	Uninvolved residential dwelling High	Very low	3.6 km	High	Low	Medium distance views will extend north toward wind turbines within the southern portion of the Kangiara cluster. Potential distant (in excess of 6.5 km) view east to south east toward wind turbines within the southern portion of the Mt Buffalo cluster.	Low
178	Agricultural shed	N/A	N/A	N/A	N/A	N/A	N/A
180	Agricultural shed	N/A	N/A	N/A	N/A	N/A	N/A
190 Photomontage location PM2 (in general vicinity)	Uninvolved residential dwelling High	Very low	3.2 km	High	Low	Medium distance views west toward wind turbines within the Mt Buffalo cluster will be partially screened by landform and tree cover beyond the residential dwelling.	Low
217	Agricultural shed	N/A	N/A	N/A	N/A	N/A	N/A
221	Agricultural shed	N/A	N/A	N/A	N/A	N/A	N/A
222 Photomontage location PM1 (in general vicinity)	Uninvolved residential dwelling High	Very low	3.5 km	High	Low	Medium distance views east to north east toward the southern portion of the Langs Creek cluster are partially screened by landform rising to the east of the dwelling.	Low
226 Photomontage location PM9 (in	Uninvolved residential dwelling	Very low	3.7 km	High	Low	Medium distance views south east toward the north portion of the Langs Creek cluster will be generally screened by a low ridgeline to	Nil/Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
general vicinity)	High					the south of the residential dwelling.	
243 Photomontage location PM12 (in general vicinity)	Uninvolved residential dwelling High	Very low	3.2 km	High	Low	Medium distance views west toward wind turbines within the Mt Buffalo cluster will be partially screened by landform and tree cover to the west of the residential dwelling.	Low
Assessment of dwelling locations between 4 km and 5 km of the proposed Bango wind turbines (Refer Figures 26a and **26b for locations)**							
002	Uninvolved residential dwelling High	Very low	4.6 km	High	Low	Medium distance views toward wind turbines within the southern portion of the Mt Buffalo cluster will be largely screened by landform and tree cover.	Low
003	Uninvolved residential dwelling High	Very low	4.9 km	High	Low to medium	Medium distance views extend north toward the southern portion of the Kangiara cluster, with some partial screening through rising landform to the north of the Lachlan Valley Way road corridor.	Low
017	Uninvolved residential dwelling High	Very low	4.8 km	High	Low	Medium distance views toward wind turbines within the southern portion of the Mt Buffalo cluster will be largely screened by landform and tree cover beyond the residential dwelling.	Low
018	Uninvolved residential dwelling High	Very low	4.3 km	High	Low to medium	Medium distance views will extend south toward wind turbines within the north portion of the Kangiara cluster and wind turbines within the Langs Creek cluster. Wind turbines within the Mt Buffalo cluster will be largely screened by ridgeline landform and tree cover south east of the residential dwelling.	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
022	Uninvolved residential dwelling High	Very low	4.7 km	High	Low	Medium distance views west toward wind turbines within the Mt Buffalo cluster will be partially screened by landform rising to the west of the dwelling together with scattered tree cover.	Low
033	Uninvolved residential dwelling High	Very low	4.8 km	High	Low	Medium distance views south and south west toward the northern portion of the Mt Buffalo and Kangiara clusters will be largely screened by landform. Views toward wind turbines within the Langs Creek cluster will be screened by landform.	Low
056	Uninvolved residential dwelling High	Very low	4.2 km	High	Low	Medium distance views east to north east toward wind turbines within the western portion of the Kangiara cluster will be partially screened landform and scattered tree cover beyond the residential dwelling.	Low
057	Uninvolved residential dwelling High	Very low	4.4 km	High	Low	Medium distance views toward wind turbines will be largely restricted by gently rising landform to the south and south west of the residential dwelling.	Low
070	Uninvolved residential dwelling High	Very low	4.9 km	High	Medium	Medium distance views south west toward wind turbines within the northern portion of the Mt Buffalo cluster will be largely screened by tree cover beyond the residential dwelling.	Nil/Low
077	Uninvolved residential dwelling High	Very low	4.3 km	High	Medium	Medium distance views north east toward the southern portion of the Langs Creek cluster are partially screened by landform rising to the east of the dwelling. Views toward wind turbines within the Kangiara and Mt Buffalo clusters will be largely screened by landform and tree	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
						cover.	
078	Uninvolved residential dwelling High	Very low	4.0 km	High	Medium	Medium distance views will extend south to south west toward turbines within the northern portion of the Mt Buffalo and Kangiara clusters with some partial screening by tree cover beyond dwelling. Views toward the Langs Creek cluster will be largely screened by landform.	Low
081	Uninvolved residential dwelling High	Very low	4.2 km	High	Low	Medium distance views north west toward wind turbines within the southern portion of the Mt Buffalo cluster will be partially screened by landform rising to the west and north west of the dwelling.	Low
089	Uninvolved residential dwelling High	Very low	4.9 km	High	Medium	Medium distance views east to south east toward wind turbines within the Langs Creek cluster will be generally screened by a gently rising landform and tree/vegetation cover beyond the residential dwelling.	Low
092	Uninvolved residential dwelling High	Very low	4.7 km	High	Low	Medium distance views south, south east and south west toward wind turbines will be largely screened by topography and tree cover beyond the residential dwelling.	Nil/Low
093	Uninvolved residential dwelling High	Very low	4.9 km	High	Medium to High	Medium distance views south west toward wind turbines within the Mt Buffalo cluster will be partially screened by tree cover beyond the residential dwelling.	Low
094 Photomontage	Uninvolved residential	Very low	4.5 km	High	High	Medium distance views will extend south to south west toward wind turbines within the northern portion of the Langs Creek cluster.	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
location P6 (in general vicinity)	dwelling High					Views will be partially screened by tree cover and agricultural buildings beyond the dwelling. Views toward wind turbines within the southern portion of the Langs Creek cluster, as well as the Kangiara and Mt Buffalo clusters will be screened by landform and tree cover.	
114	Uninvolved residential dwelling High	Very low	4.4 km	High	Low	Medium distance views south west toward wind turbines in the northern portion of the Mt Buffalo cluster will be largely screened by landform beyond the residential dwelling.	Nil/Low
120	Derelict building	N/A	N/A	N/A	N/A	N/A	N/A
124	Derelict building	N/A	N/A	N/A	N/A	N/A	N/A
128	Uninvolved residential dwelling High	Very low	4.1 km	High	Low	Medium distance views west toward wind turbines within the Mt Buffalo cluster will be largely screened by landform beyond the dwelling.	Nil/Low
129	Uninvolved residential dwelling High	Very low	5.0 km	High	Medium	Medium distance views west toward wind turbines within the Mt Buffalo cluster will be partially screened by landform and tree cover, as well as outbuildings to the west of the residential dwelling.	Low
130	Uninvolved residential dwelling High	Very low	5.0 km	High	Low	Medium distance views toward the wind turbines within the southern portion of the Mt Buffalo cluster are largely screened by landform.	Nil/Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
132	Uninvolved residential dwelling High	Very low	4.8 km	High	Low	Medium distance views north toward wind turbines within the southern portion of the Mt Buffalo cluster and largely screened by landform and scattered tree cover beyond the residential dwelling.	Nil/Low
135	Uninvolved residential dwelling High	Very low	4.1 km	High	Low to medium	Medium distance views west to north west toward wind turbines within the southern portion of the Mt Buffalo cluster will be partially screened by landform rising to the west of the dwelling as well as tree cover along ridgelines.	Low
137	Uninvolved residential dwelling High	Very low	4.2 km	High	Low	Medium distance views north west toward wind turbines within the southern portion of the Mt Buffalo cluster will be partially screened by landform rising to the west and north west of the dwelling as well as tree cover surrounding the residential dwelling.	Low
143 Photomontage location PM3 (in general vicinity)	Uninvolved residential dwelling High	Very low	4.4 km	High	High	Medium distance views will extend east toward wind turbines within the southern portion of the Mt Buffalo cluster. Views toward wind turbines within the Langs Creek and Kangiara clusters will be largely screened	Low
146	Uninvolved residential dwelling High	Very low	4.7 km	High	Medium	Medium distance views south west toward wind turbines within the Mt Buffalo cluster will be partially screened by tree cover surrounding the residential dwelling.	Low
151	Uninvolved residential dwelling High	Very low	4.6 km	High	Low	Medium distance views south and south west toward wind turbines will be largely screened by topography and tree cover beyond the residential dwelling.	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
156	Uninvolved residential dwelling High	Very low	5.0 km	High	Low	Medium distance views south, south east and south west toward wind turbines will be largely screened by topography and tree cover beyond the residential dwelling.	Nil/Low
157	Uninvolved residential dwelling High	Very low	4.4 km	High	Low	Medium distance views south and south west toward the northern portion of the Mt Buffalo and Kangiara clusters will be largely screened by landform. Views toward wind turbines within the Langs Creek cluster will be screened by landform.	Low
169	Uninvolved residential dwelling High	Very low	4.9 km	High	Low	Medium distance views north toward wind turbines within the southern portion of the Mt Buffalo cluster will be largely screened by landform and tree cover beyond the residential dwelling.	Low
183	Uninvolved residential dwelling High	Very low	4.9 km	High	Low	Medium distance views south west toward wind turbines within the northern portion of the Mt Buffalo cluster will be largely screened by landform and tree cover.	Low
186	Uninvolved residential dwelling High	Very low	4.1 km	High	Low to medium	Medium distance views north toward wind turbines within the southern portion of the Kangiara cluster will be partially screened by landform beyond the residential dwelling. Potential distant (in excess of 7 km) view east to south east toward wind turbines within the southern portion of the Mt Buffalo cluster.	Low
261	Uninvolved residential dwelling High	Very low	4.1 km	High	Low	Medium distance views west to south west toward wind turbines within the Mount Buffalo cluster would be partially screened by scattered tree cover beyond the dwelling and more significantly by a	Low

Table 18 – Visual significance matrix (Refer **Figures 26a** and **26b** for residential view locations)

View location (Refer to Figure 26a/b)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
						gently rising landform to the west of the dwelling.	
268	Uninvolved residential dwelling High	Very low	4.5 km	High	Low	Medium distance views west to south west toward wind turbines within the Mount Buffalo cluster would be partially screened by scattered tree cover beyond the dwelling and more significantly by a gently rising landform to the west of the dwelling.	Low
269	Uninvolved residential dwelling High	Very low	4.3 km	High	Low	Medium distance views west to south west toward wind turbines within the Mount Buffalo cluster would be partially screened by scattered tree cover surrounding and beyond the dwelling.	Low
240	Uninvolved residential dwelling High	Very low	4.4 km	High	Very low	Medium distance views west to south toward wind turbine in the north portion of the wind farm will be largely screened by landform rising to the south and south west of dwelling.	Nil/Low
241	Derelict building	N/A	N/A	N/A	N/A	N/A	N/A
280 Photomontage location PM7 and PM8 (in general vicinity)	Uninvolved residential dwelling High	Very low	4.4 km	High	Medium	Medium distance views north toward wind turbines within the southern portion of the Kangiara cluster will be partially screened by landform beyond the residential dwelling. Potential distant (in excess of 7 km) view east to south east toward wind turbines within the southern portion of the Mt Buffalo cluster.	Low

8.3 Summary of visual significance (within 2 km of wind turbines)

This LVIA identified a total of 22 potential dwelling locations (including 4 weekenders) within 2 km of the Bango wind farm turbines. These potential dwellings have been identified as:

- 11 involved residential dwellings
- 2 uninvolved residential dwellings
- 7 neighbouring properties* (subject to negotiation and agreement);
- 1 proposed dwelling with approved Development Application and
- 1 uninhabited (and derelict) dwelling.

* The 7 neighbouring properties identified in **Table 18** consist of 3 residential dwellings and 4 weekender structures (including 1 caravan).

An assessment of the 21 locations (excluding the derelict dwelling – house 185) within 2 km of the Bango wind turbines determined that:

- 3 of the 21 locations would have a low to medium visual significance
- 5 of the 21 locations would have a medium visual significance
- 3 of the 21 locations would have a medium to high visual significance and
- 10 of the 21 locations would have a high visual significance.

The locations with a potential high visual significance would include:

- 3 involved landowners with residential dwellings
- 1 uninvolved landowner with a residential dwelling
- 3 neighbouring landowners with residential dwellings
- 2 neighbouring landowners with weekenders and
- 1 proposed dwelling with approved Development Application.

8.4 Summary of visual significance (between 2 km and 5 km of wind turbines)

This LVIA identified a total of 106 potential dwelling locations between 2 km and 5 km of the wind turbines. Eight structures were determined to be either derelict or agricultural sheds during the fieldwork and have not been assessed in the LVIA. The 98 dwellings between 2 km and 5 km of the wind turbines included:

- 12 involved residential dwellings
- 86 uninvolved residential dwellings
- 1 proposed dwelling with an approved Development Application and
- 5 uninhabited dwellings.

An assessment of the dwelling locations between 2 km and 5 km of the Bango wind turbines determined that:

- 2 of the 98 residential view locations would have a medium to high visual significance
- 2 of the 98 residential view locations would have a medium visual significance
- 10 of the 98 residential view locations would have a low to medium visual significance
- 61 of the 98 residential view locations would have a low visual significance and
- 23 of the 98 residential view locations would have a nil to low visual significance.

The field assessment for the majority of residential view locations was undertaken from the closest publicly accessible location, with a conservative approach adopted where there was no opportunity to confirm the actual extent of available view from areas within or immediately surrounding the residence. It is anticipated that some visibility ratings would be less than those determined subject to a process of verification from private property.

8.5 Summary of visual significance (beyond 5 km of wind turbines)

There are a number of rural residential dwellings located beyond 5 km of the Bango wind farm turbines and within the 10 km viewshed. The rural residential dwellings beyond 5 km of the Bango wind turbines are primarily agricultural homesteads, but also include a small number of weekender dwellings, uninhabited dwellings and derelict structures. Dwelling locations beyond 5 km of the Bango wind farm turbines have a greater potential to be screened by topography, as well as tree cover to the east of the project area. It is

unlikely that residential dwelling locations beyond 5 km of the Bango wind turbines would experience any high or moderate to high visual significance.

8.6 Public view locations

A local road network extends roughly parallel to the main ridgelines and hills within the project area and provides a variety of direct and indirect view opportunities toward the wind farm turbines. Tree planting alongside road corridors to the west of the project area tends to restricts views to partial and glimpsed opportunities (including views from the Lachlan Valley Way and the Wargeila Road). A greater range of open views tend to occur along minor roads to the east of the site. This LVIA did not identify any formalised or designated public lookout points within the Bango wind farm 10 km viewshed.

8.7 Towns and localities

There are two population centres within the Bango wind farm 10 km viewshed, and include:

- Boorowa Township, population 1,211 (2011 Census). The Boorowa Township is located approximately 7 km to the north west of the Langs Creek cluster and
- Rye Park Village, population 237 (within the Rye Park gazetted locality – 2011 Census). The Rye Park Village is approximately 4 km to the north east of the Mt Buffalo cluster.

The population centres are illustrated in **Figure 26a** and **26b**.

It is unlikely that the Bango wind farm will have any significant visual effect on the Boorowa Township and smaller rural localities, including the Rye Park Village, which are located in the landscape surrounding the project site. This is primarily due to the screening influence of undulating landform as well as the distance between the wind farm and potential view locations within the population centres.

Views toward the wind farm from the main streets of Boorowa (including the Lachlan Valley Way and Pudman Street) are screened by buildings within the town as well as a rising and gently undulating landform to the south and south east of the Township. Similarly, views toward the Bango wind farm turbines from the majority of residential dwellings within the Boorowa Township will also be screened by a combination of built infrastructure, tree planting within and beyond residential dwellings. Distant views toward wind turbines within the north portion of the Langs Creek cluster may occur from a small number of residential dwellings in the south of the Boorowa population centre, as illustrated in **Photomontage 9**, **Figures 50** and **51**.

Views toward the Bango wind farm turbines from Yass Street (the Rye Park main street), and the majority of residential dwellings within Rye Park, will be screened by landform rising to the west, as well as tree cover alongside local roads within the village. Views toward a small number of wind turbines within the northern portion of the Mt Buffalo cluster, and more distant views toward portions of the Langs Creek cluster, will be visible from Cook Street which delineates the western edge of the village. The proposed view toward the Bango wind farm turbines from Cook Street is illustrated in **Photomontage 5**, **Figures 42** and **53**.

8.8 Future residential dwellings

In general existing residential dwellings in the vicinity of the wind farm are located below surrounding ridgelines to maximise potential for shelter from prevailing wind, and/or where exposed tend to include a degree of shelter from windbreak planting or tree planting around dwellings. The tendency to locate residential dwellings in sheltered situations also acts to limit the extent of available views across the surrounding landscape for the majority of residential view locations, although there are a small number of dwellings that appear to have been located on properties to take advantage of distant and panoramic views.

Potential future planning considerations for residential dwellings would be able to take advantage of any approved layout design for the Bango wind farm when determining the optimal location for residential dwellings on individual portions of land to minimise views toward wind turbines if desired. In some circumstances future residential dwellings could be located to take advantage of local topographic features in order to screen views toward wind turbines or implement in advance mitigation measures such as tree planting for windbreak and/or screening purposes.

Should residential dwellings be constructed on existing portions of land immediately adjacent to the wind farm site, there is likely to be an associated visual effect not only with additional residential structures within the landscape but also a range of domestic infrastructure associated with it.

Shadow flicker assessment and blade glint

Section 9

9.1 Introduction

Due to their height, wind turbines can cast shadows on surrounding areas at a significant distance from the base of the wind turbine tower. Coupled with this, the moving blades create moving shadows. When viewed from a stationary position, the moving shadows appear as a flicker giving rise to the phenomenon of 'shadow flicker'. When the sun is low in the sky the length of the shadows increases, increasing the shadow flicker affected area around the wind turbine.

A shadow flicker assessment has been prepared by the Proponent to determine and illustrate the potential effect of shadow flicker on surrounding residential dwellings. A shadow flicker assessment may over estimate the actual number of annual hours of shadow flicker at a particular location due to a number of reasons including:

- The probability that the wind turbines will not face into or away from the sun all of the time
- The occurrence of cloud cover
- The amount of particulate matter in the atmosphere (moisture, dust, smoke etc…) which may diffuse sunlight
- The presence of vegetation and
- Periods where the wind turbine may not be in operation due to low winds, or high winds or for operational or maintenance reasons.

The shadow flicker diagram is illustrated in **Figure 27**.

9.2 Residents

The Proponent has adopted the NSW Draft Guidelines which state:

"The impact of shadow flicker from wind turbines on neighbours' houses within 2 km of a proposed wind turbine should be assessed. The shadow flicker experienced at any dwelling should not exceed 30 hours per year as a result of the operation of the wind farm".

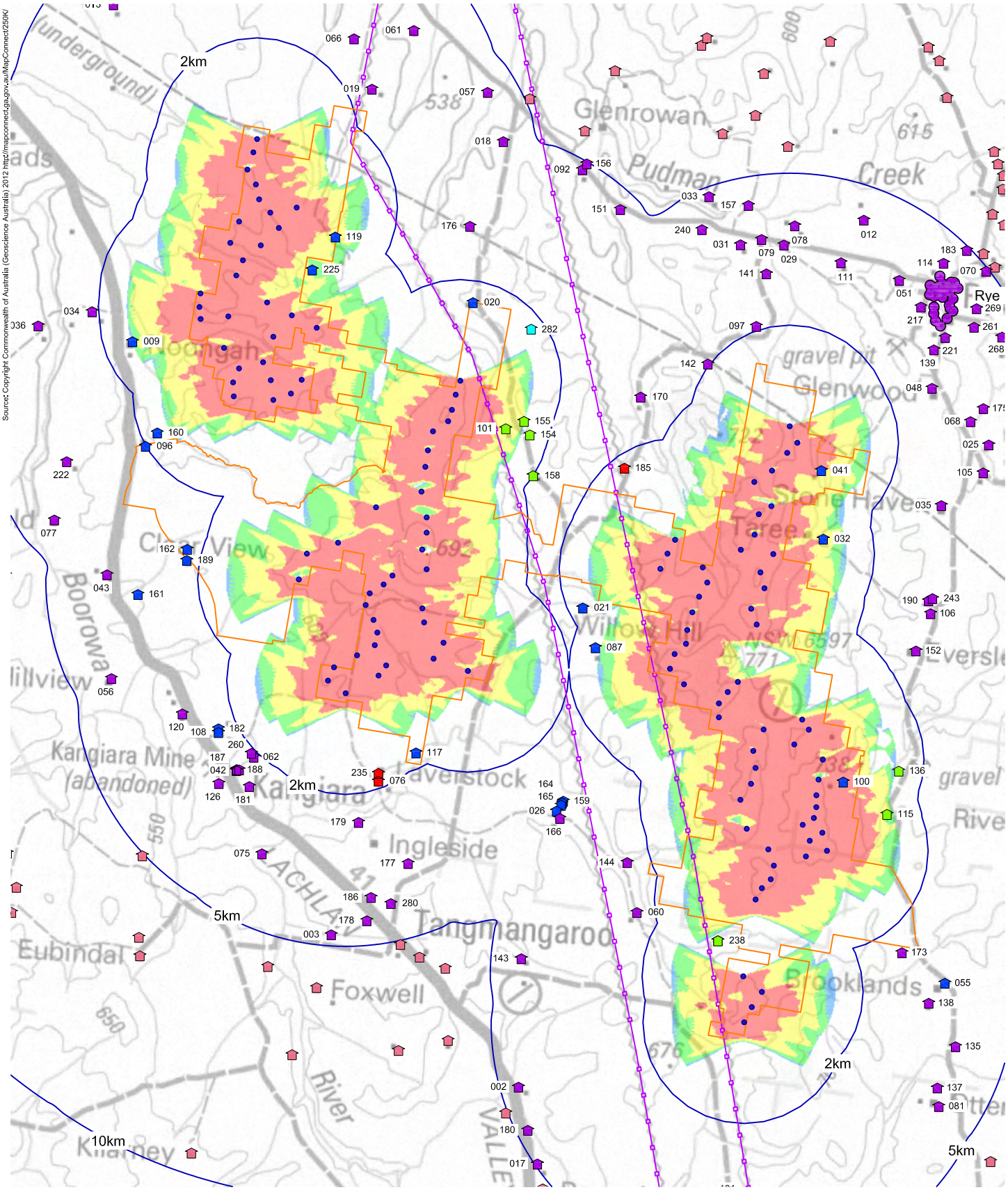


Figure 27 Shadow flicker diagram

BANGO WIND FARM

WIND PROSPECT CWP

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The results of the shadow flicker assessment for the Bango wind farm project determined that nine dwellings (comprising six involved landowners and three neighbouring landowners), may be subject to some levels of shadow flicker. The results of the shadow flicker assessment are outlined in **Table 19**.

Table 19 – Shadow flicker assessment

House ID	Status	Turbine cluster	Shadow flicker hours/year
009	Involved	Langs Creek	10.5
032	Involved	Mt Buffalo	75.03
041	Involved	Mt Buffalo	95.59
100	Involved	Mt Buffalo	136.19
101	Neighbour	Kangiara	73.34
115	Neighbour	Mt Buffalo	26.43
119	Involved	Langs Creek	60.4
155	Neighbour (weekender)	Kangiara	0
225	Involved	Langs Creek	28.5

Eight of the dwellings have been identified as having some potential to experience shadow flicker. Six of the residential dwellings would be involved landowners, and three neighbouring landowners. Three of the eight dwellings (two involved and one neighbour) would have less than 30 shadow flickers hours per year, including houses 009, 115 and 225. Five of the eight dwellings (four involved and one neighbour) would have more than 30 shadow flicker hours per year, including houses 032, 041, 100, 101 and 119.

9.3 Mitigation Options

If shadow flicker presents a problem, its effects can be reduced through a number of measures. These include the installation of screening structures or planting of trees to block shadows cast by the turbines, the use of turbine control strategies which shut down turbines when shadow flicker has the potential to occur. The Proponent will discuss various mitigation options with involved and neighbouring property owners with potential shadow flicker impacts exceeding 30 hours per year.

9.4 Photosensitive Epilepsy

The Canadian Epilepsy Alliance (http://www.epilepsymatters.com) defines photosensitivity as 'a sensitivity to flashing or flickering lights, usually of high intensity, which are pulsating in a regular pattern – and people with photosensitive epilepsy can be triggered into seizures by them'. Both the Canadian Epilepsy Alliance and Epilepsy Action Australia (http://www.epilepsy.org.au) estimate that less than 5% of people with epilepsy are photosensitive.

Epileptic seizures caused by photosensitive epilepsy may be triggered by a range of electronic devices including material broadcast by televisions, computer screens or flashing lights in nightclubs. Seizures may also be triggered by natural light shining off water, through tree leaves or by flickering caused by travelling past railings. Not all flashing or flickering light will trigger a seizure in people with photosensitive epilepsy, and the potential to trigger a seizure may also be dependent on the frequency of flashing or flicker, and the duration and intensity of light.

Epilepsy Action Australia suggest that the frequency of flashing or flickering light most likely to trigger seizures occurs between 8 to 30Hz (or flashes/flickers per second), although this may vary between individuals. It also suggests that 96% of people with photosensitive epilepsy are sensitive to flicker between 15 to 20Hz.

The majority of three bladed wind turbines are unlikely to create a flicker frequency greater than 1Hz (or 1 flicker per second). The flicker frequency for a three blade wind turbine can be calculated by multiplying the hub rotation frequency (in revolutions per second) by the number of blades. As the maximum rotational speed for the Bango wind turbines would be around 20 revolutions per minute (rpm), the hub rotation frequency would be 20rpm divided by 60 seconds resulting in 0.3 revolutions per second. Multiplying 0.3 revolutions per second by three blades equals around 1Hz (or 1 flicker per second).

Given the low flicker frequency associated with the Bango wind turbines, which falls below the range suggested by Epilepsy Action Australia as a potential trigger for photosensitive epileptic seizures, it is unlikely that the Bango wind turbines would present a risk to people with photosensitive epilepsy.

9.5 Motorists

Motorists can experience shadow flicker sensations whilst driving as a result of shadows cast on the road from roadside or overhead objects such as trees, poles or buildings. Under certain conditions the sensation of shadow flicker may cause annoyance and may impact on a driver's ability to operate a motor vehicle safely.

The photograph in **Plate 6** illustrates a typical situation where shadow flicker may be experienced whilst driving along a road where trees cast shadows.

Plate 6 – Shadow flicker created by roadside tree planting (Image GBD 2013)

There are no specific guidelines to address the potential impact of shadow flicker on motorists cast by wind turbines across roads, although there are lighting standards that can be applied to minimise the adverse effects of flicker caused by roadside or overhead objects. These standards include AS 1158:5:2007 (Lighting for roads and public spaces – Part 5: Tunnels and underpasses), section 3.3.8 and CIE 88:2004 (Guide for lighting of roads tunnels and underpasses, 2nd ed.), section 6.14. The standards suggest that the flicker effect will be noticeable and possibly cause annoyance between 2.5 and 15Hz (2.5 to 15 flickers per second), and that a flicker effect between 4 and 11Hz should be avoided for longer than 20 seconds.

As the potential flicker frequency for the Bango wind turbines is likely to be around 1Hz, it is unlikely that the flicker effect will cause annoyance or impact on a driver's ability to operate a motor vehicle safely whilst travelling along local roads surrounding the wind farm.

9.6 Blade Glint

Glint is a phenomenon that results from the direct reflection of sunlight (also known as specular reflection) from a reflective surface that would be visible when the sun reflects off the surface of the wind turbine at the same angle that a person is viewing the wind turbine surface. Glint may be noticeable for some distance, but usually results in a low impact. The surfaces of the wind turbines, including the towers and blades, are largely

convex, which will tend to result in the divergence of light reflected from the surfaces, rather than convergence toward a particular point. This will reduce the potential for blade glint.

Blade glint can also be further mitigated through the use of matt coatings which, if applied correctly, will generally mitigate potential visual impacts caused by glint.

Cumulative assessment

Section 10

10.1 What is cumulative assessment?

A cumulative effect could result from a proposed wind farm development being constructed in conjunction with other existing or proposed wind farm developments, and could be either associated or separate to it.

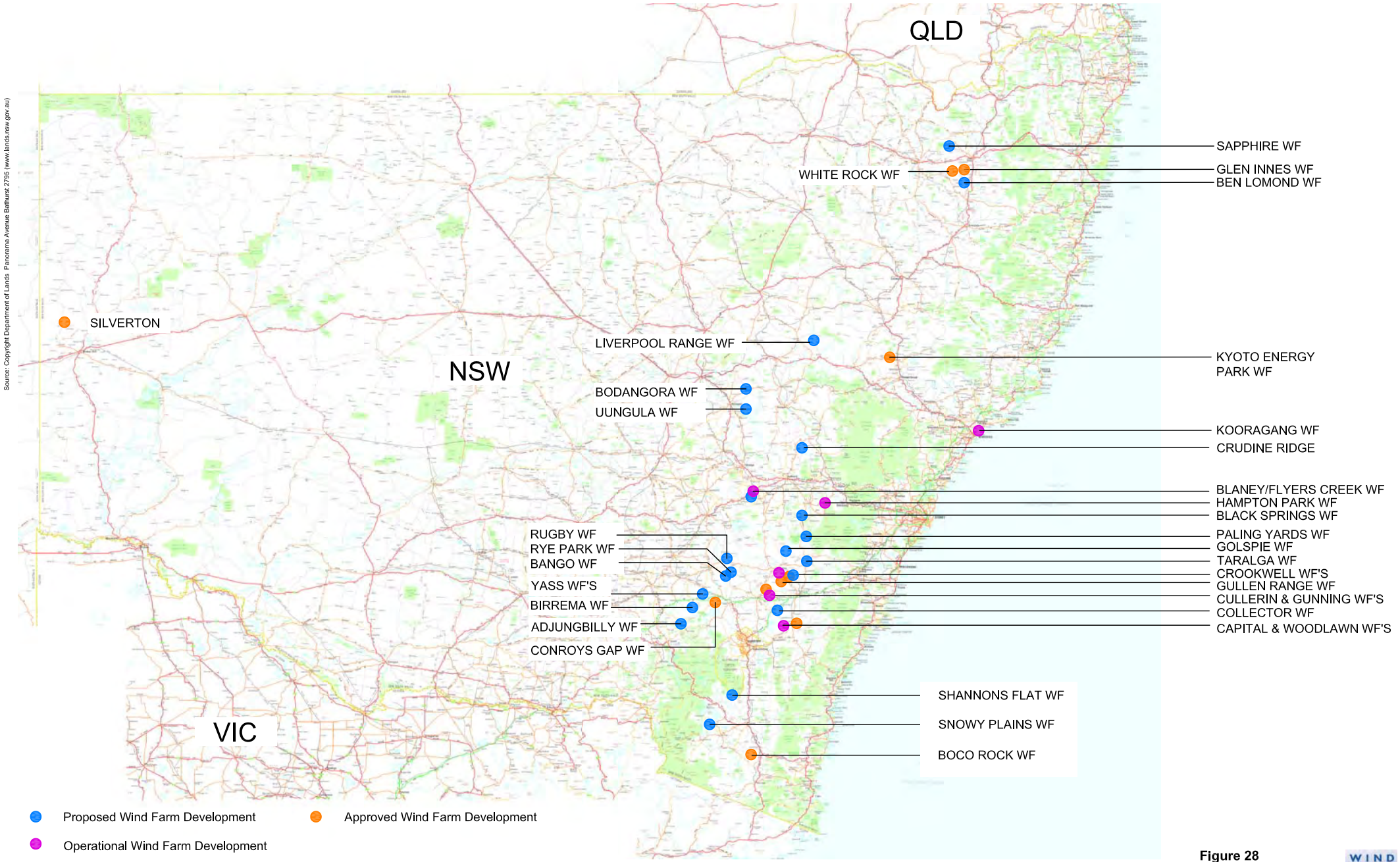
Separate wind farm developments could occur within the established viewshed of the proposed wind farm, or be located within a regional context where visibility is dependent on a journey between each site or an individual project viewshed. Cumulative effects presented by multiple wind farm developments may be presented as 'direct', 'indirect' or 'sequential' effects.

- 'direct' cumulative visual effects could occur where two or more winds farms have been constructed within the same locality, and could be viewed from the same view location simultaneously.
- 'indirect' cumulative visual effects could occur where two or more winds farms have been constructed within the same locality, and could be viewed from the same view location but not within the same field of view.
- 'sequential' cumulative visual effects could arise as a result of multiple wind farms being observed at different locations during the course of a journey (e.g. from a vehicle travelling along a highway or from a network of local roads), which could form an impression of greater magnitude and effect within the construct of short term memory.

10.2 Regional wind farm developments

There are a number of proposed, approved and operating wind farm developments within New South Wales which are illustrated in **Figure 28**. The regional locality of wind farms surrounding the Bango wind farm are illustrated in **Figure 29**. These figures illustrate the location of wind farms known at the time this LVIA was prepared. The number and location of wind farms is likely to change as more wind farm projects are announced.

There are currently around 20 existing or proposed wind farm projects at various stages of development within an approximate 70 km radius of the proposed Bango wind farm. Whilst 5 of the 21 wind farms are



Not to scale

Figure 28
NSW wind farms
(as of April 2013)

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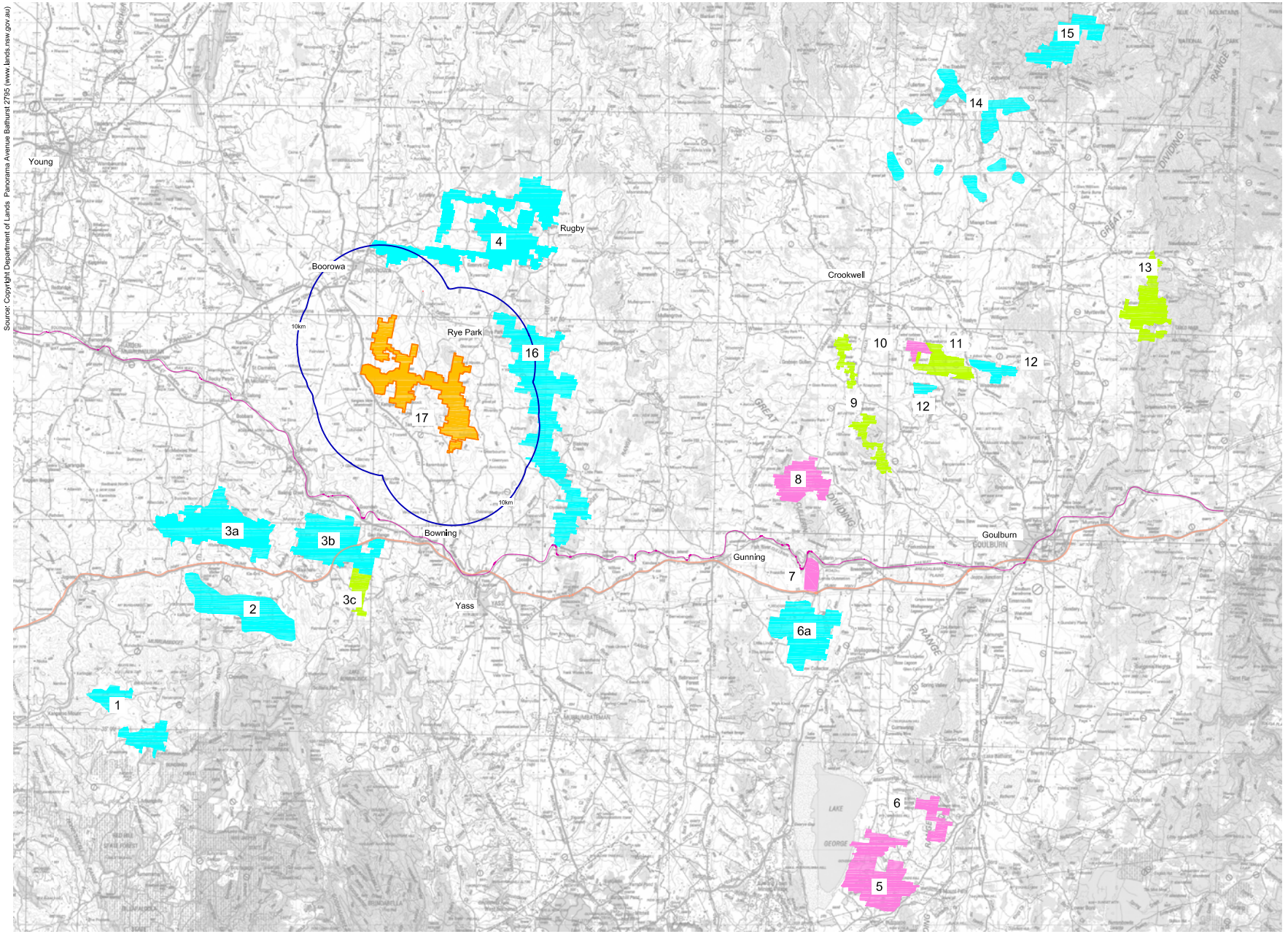

Not to scale

Figure 29
Regional wind farm developments

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operational and 4 have progressed to early construction phases, the remaining 11 projects (including those that have been approved) may not necessarily progress to construction.

Long distance views (around 30 km) can be obtained toward the operational Gunning and Cullerin wind farms from elevated areas of the landscape to the south west of the Bango project area. Although visible, these wind farm developments are unlikely to result in any significant additional level of 'direct' and 'indirect' cumulative effect for view locations within the Bango 10 km viewshed due to the distance effect on overall visibility between the wind farm developments. The potential for cumulative effect will be dependent on a number of factors such as the separation distance between turbines and layout of turbines relative to the proposed Bango project.

The existing and proposed wind farm developments within the Bango project 70 km radius and identified and described in **Table 20**.

Table 20 - Regional wind farm developments

Wind Farm	Proponent or Owner	Status	Number of turbines
Adjungbilly	CBD Energy	Planning stage – not yet lodged	Up to 26
Birrema	Epuron	Planning stage – not yet lodged	Up to 68
Capital 1	Infigen Energy	Operational	63
Capital 2	Infigen Energy	Approved – Construction Stage	41
Cullerin	Origin Energy	Operational	15
Collector	RATCH	Planning - assessment	68
Conroy's Gap	Epuron	Approved	15
Coppabella	Epuron	Planning - assessment	Up to 86
Crookwell 1	Eraring Energy	Operational	8
Crookwell 2	Crookwell Development	Approved – Construction Stage	46

Wind Farm	Proponent or Owner	Status	Number of turbines
Crookwell 3	Crookwell Development	Planning – not approved	30
Golspie	Wind Prospect/ CWP	Planning stage – not yet lodged	up to 100
Gullen Range	Gullen Range Wind Farm Pty Ltd	Approved - Construction Stage	73
Gunning	Acciona	Operational	31
Marilba	Epuron	Planning - assessment	Up to 66
Paling Yards	Union Fenosa Wind Australia	Planning stage – not yet lodged	Up to 60
Taralga	RES Australia	Approved – Construction Stage	62
Woodlawn	Infigen Energy	Operational	23
Yass Valley Wind Farm	Epuron	Planning - assessment	Up to 148

GBD is not aware of any smaller wind farm developments that are currently lodged, or being assessed by the Yass Valley Shire or Boorowa Shire Councils.

Table 21 Wind farm developments within Bango 10 km viewshed

Wind Farm	Proponent or Owner	Status	Number of turbines
Rye Park	Epuron Pty Ltd	Planning stage – not yet lodged	Up to 126
^Rugby	Suzlon Energy and Windlab	Planning stage – not yet lodged	Up to 52

^ Whilst the Rugby wind farm turbines would not be located within the Bango wind farm 10 km viewshed, a small number of residential dwellings (around 15) within the Bango wind farm 5 km to 10 km viewshed would also be within the Rugby 2km to 5 km viewshed. These dwellings are illustrated in **Figure 26a**.

10.3 Bango, Rye Park and Rugby wind farm intervisibility

The proposed Rye Park and Rugby wind farm developments are currently in the planning stage, and as such the final proposed location and number of wind turbines associated with each development were not known during the preparation of this LVIA. Information on local wind farm developments has been gathered from publically available sources.

The investigative areas included in the Rye Park and Rugby preliminary environmental assessment indicate that some of the Rye Park wind turbines would be located within the Bango wind farm 10 km viewshed. The closest Rye Park wind farm turbines would potentially be located around 6 km east of the Bango wind turbines within the Mt Buffalo cluster. The Rugby wind farm turbines would be potentially located over 11 km north to north east of the Bango wind turbines within the Mt Buffalo cluster.

It is likely that some level of cumulative effect would occur from public and residential view locations to the south east, east, north east and north of the Bango wind farm project area. This may include opportunities for 'direct', 'indirect' and sequential effects, which may result in an increase in the significance of effects, determined for individual view locations in this LVIA. View locations to the west of the Bango wind farm will be afforded a greater degree of screening toward other wind farm projects by undulating landform and tree cover across, and beyond the project site.

Whilst the Cumulative ZVI **Figures 30, 31** and **32**, indicate that there will be some limited potential for 'direct' and 'indirect' views toward the Bango, Rye Park and Rugby wind farm projects from areas within the Boorowa Township, views toward the Bango wind turbines will be largely screened by tree cover and buildings from the majority of the Township.

Given the degree of tree cover within the Rye Park Village, and the screening influence of the local landform between the Village and the Bango wind turbines, the overall opportunity for residential dwellings to experience any significant degree of cumulative effect is considered to be low. A very small number of residential dwellings (up to five) may have an opportunity for indirect views toward some wind turbines within

the Bango and Rye Park wind farm projects. Local tree cover, including vegetation within and around these dwellings will provide a degree of screening potential.

Whilst some degree of intervisibility between all three projects is expected for a small number of rural residential dwellings, the nature and extent of the undulating landform surrounding each of the project sites, would partially limit the overall potential for 'direct' and 'indirect' views for many of the residential dwellings located between them.

Around twenty residential dwellings, as well as dwellings within the Rye Park Village, would be located in an area between 2 km and 5 km of both the proposed Bango and Rye Park wind farm turbines (Refer **Figures 26a** and **26b**). There are no residential dwellings that would occur within 2 km of any more than one wind farm development.

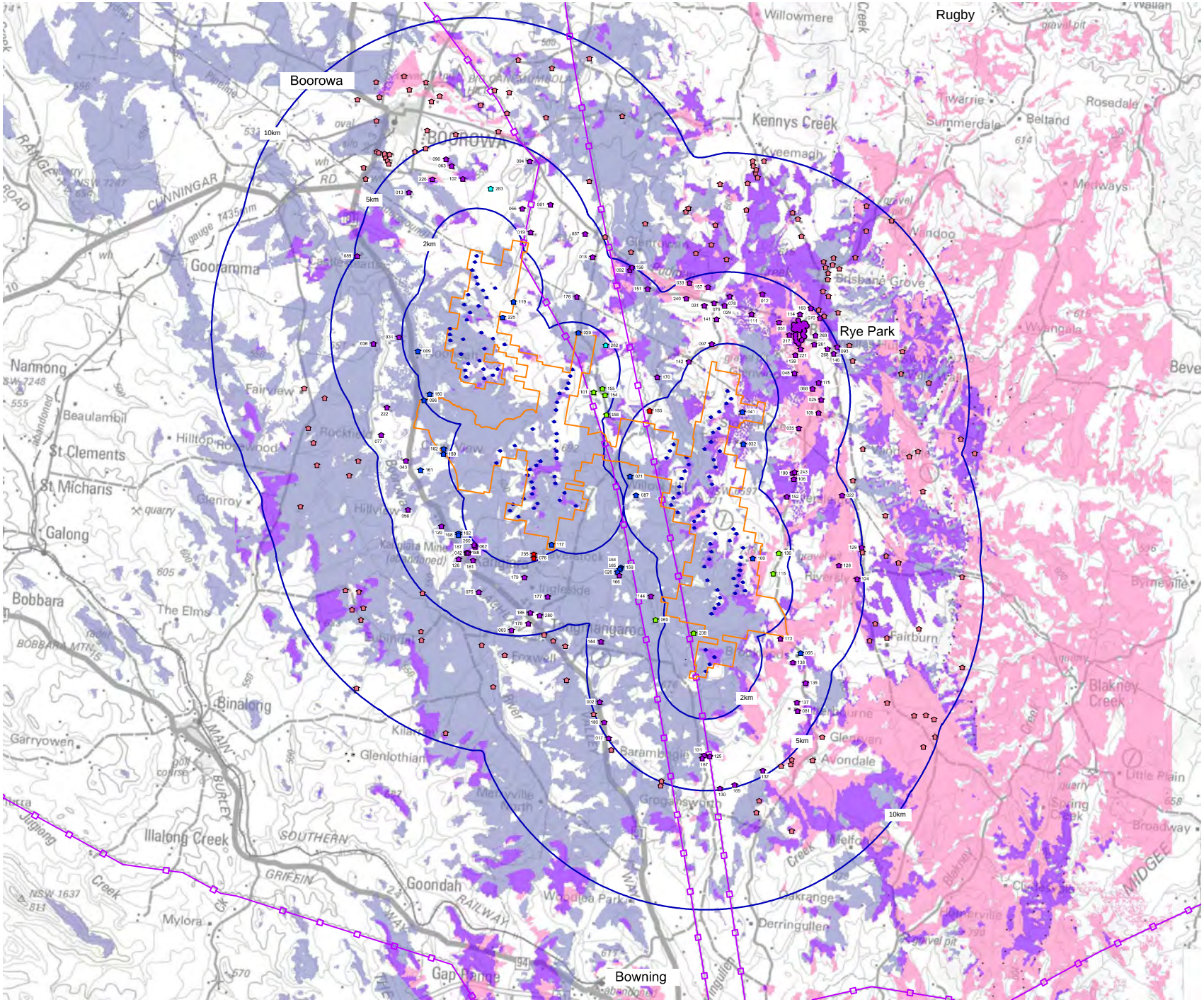
A series of 'sequential' views would also occur from local roads although the journey between the wind farms would include a range of views extending toward and beyond turbines. The extent and overall visibility of turbines would be influenced by the direction of travel relative to the alignment of the wind farm developments as well as the relatively short travel time along the local road network between wind farm developments.

Three cumulative ZVI diagrams (**Figures 30, 31** and **32)** have been prepared to illustrate the potential visibility between the proposed Bango wind turbines, and wind turbines within the proposed Rye Park and Rugby wind farm developments.

The ZVI diagrams include:

- Cumulative ZVI Diagram 1 – Bango and Rye Park Wind Farms;
- Cumulative ZVI Diagram 2 – Bango and Rugby Wind Farms; and
- Cumulative ZVI Diagram 3 – Bango, Rye Park and Rugby Wind Farm.

A supplementary Cumulative Landscape and Visual Impact Assessment has been prepared to assess and determine potential cumulative landscape and visual effects between the Bango and Rye Park Wind Farms. The Cumulative Landscape and Visual Assessment is included in Appendix B.



NOTES:

The ZVI methodology is a purely geometric assessment where the visibility of the proposed Bango wind farm is determined from carrying out calculations based on a digital terrain model of the site and the surrounding terrain.

This assessment methodology is assumed to be conservative as the screening affects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not visible at many of the locations indicated on the ZVI maps due to the local presence of trees, vegetation or other screening potential. While the ZVI maps are a useful visualisation tool, they are very conservative in nature.

Additionally, the number of turbines visible at any one time is also affected by the weather condition at the time. Inclement or cloudy weather tends to mask the visibility of the proposed wind project.

LEGEND:

- Bango wind farm turbine visible
- Rye Park wind farm turbine visible
- Bango and Rye Park wind farm turbine visible
- Involved residential dwelling
- Neighbour dwelling within 2 km of Bango wind turbine (subject to agreement)
- Uninvolved dwelling within 2 km of Bango wind turbine
- Uninvolved dwelling between 2 km and 5 km of Bango wind turbine
- Proposed dwelling (not built) with approved Development Application
- Uninvolved dwelling between 5 km and 10 km of Bango wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Bango wind turbine
- Existing 132 kV power line

Figure 30
Cumulative ZVI Diagram 1
Bango and Rye Park

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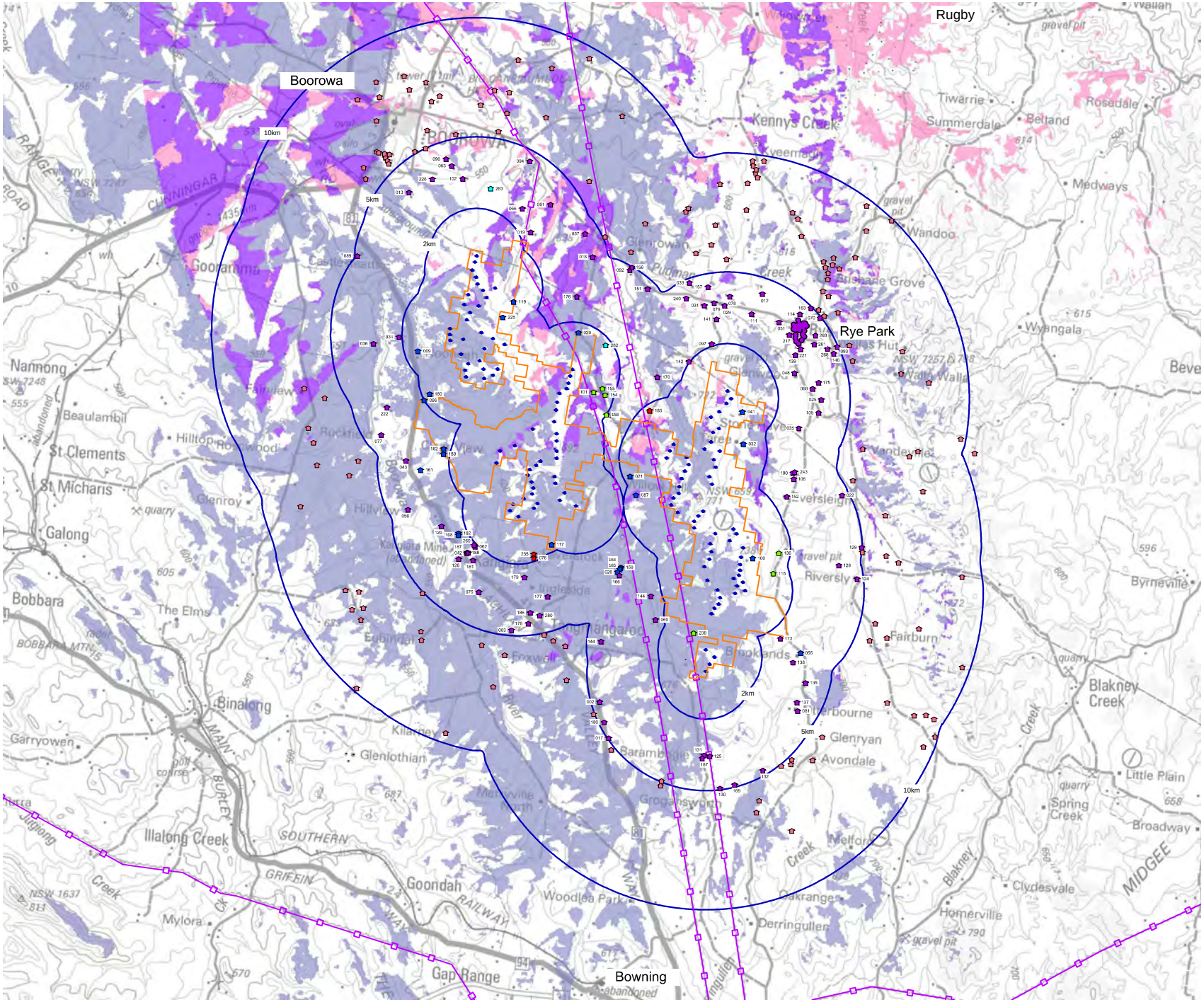

NOTES:

The ZVI methodology is a purely geometric assessment where the visibility of the proposed Bango wind farm is determined from carrying out calculations based on a digital terrain model of the site and the surrounding terrain.

This assessment methodology is assumed to be conservative as the screening affects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not visible at many of the locations indicated on the ZVI maps due to the local presence of trees, vegetation or other screening potential. While the ZVI maps are a useful visualisation tool, they are very conservative in nature.

Additionally, the number of turbines visible at any one time is also affected by the weather condition at the time. Inclement or cloudy weather tends to mask the visibility of the proposed wind project.

LEGEND:

- Bango wind farm turbine visible
- Rugby Park wind farm turbine visible
- Bango and Rugby wind farm turbine visible
- Involved residential dwelling
- Neighbour dwelling within 2 km of Bango wind turbine (subject to agreement)
- Uninvolved dwelling within 2 km of Bango wind turbine
- Uninvolved dwelling between 2 km and 5 km of Bango wind turbine
- Proposed dwelling (not built) with approved Development Application
- Uninvolved dwelling between 5 km and 10 km of Bango wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Bango wind turbine
- Existing 132 kV power line

Figure 31
Cumulative ZVI Diagram 2
Bango and Rugby

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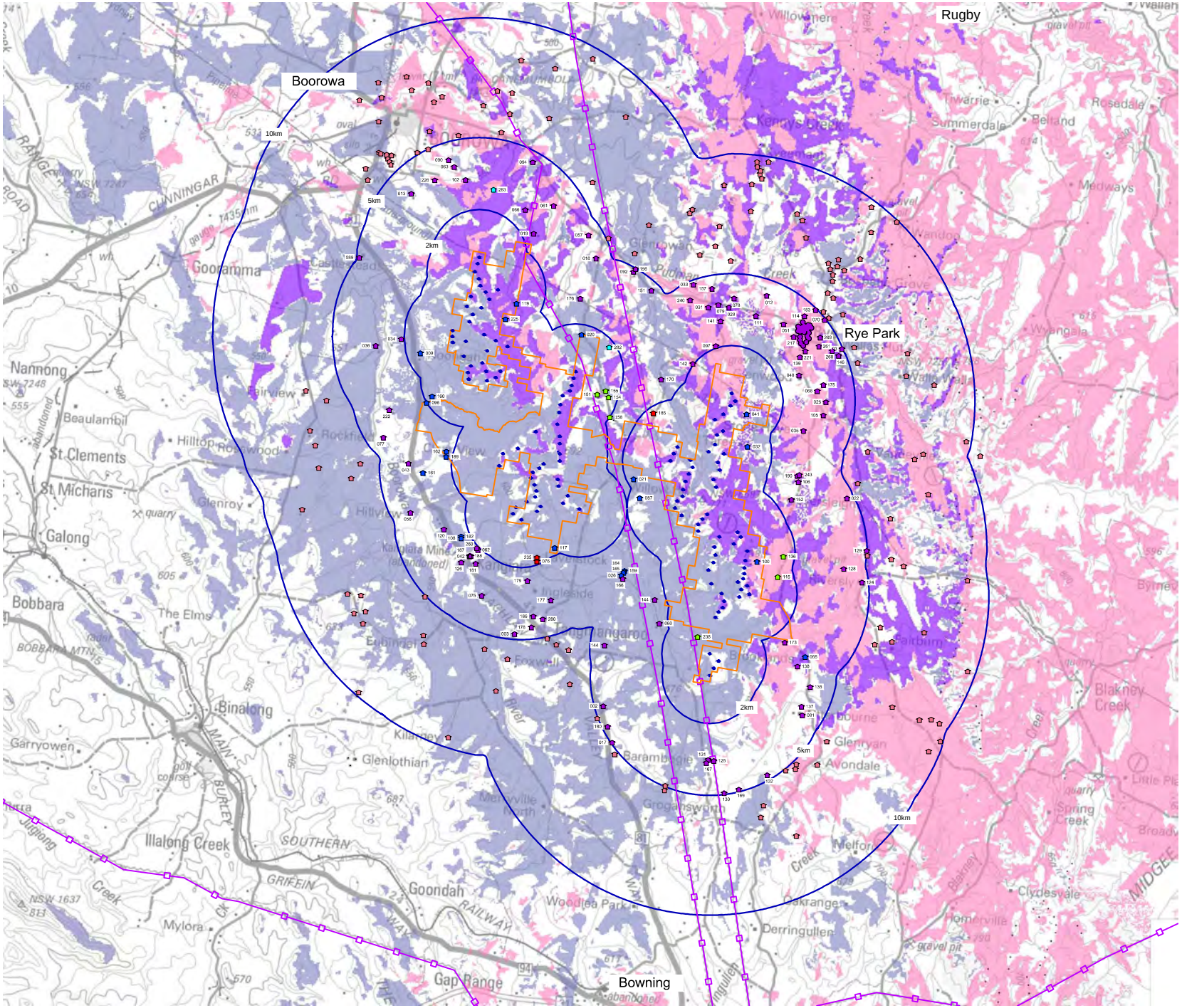

NOTES:

The ZVI methodology is a purely geometric assessment where the visibility of the proposed Bango wind farm is determined from carrying out calculations based on a digital terrain model of the site and the surrounding terrain.

This assessment methodology is assumed to be conservative as the screening affects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not visible at many of the locations indicated on the ZVI maps due to the local presence of trees, vegetation or other screening potential. While the ZVI maps are a useful visualisation tool, they are very conservative in nature.

Additionally, the number of turbines visible at any one time is also affected by the weather condition at the time. Inclement or cloudy weather tends to mask the visibility of the proposed wind project.

LEGEND:

- Bango wind farm turbine visible
- Rugby and Rye Park wind farm turbine visible
- Bango, Rye Park and Rugby wind farm turbine visible
- Involved residential dwelling
- Neighbour dwelling within 2 km of Bango wind turbine (subject to agreement)
- Uninvolved dwelling within 2 km of Bango wind turbine
- Uninvolved dwelling between 2 km and 5 km of Bango wind turbine
- Proposed dwelling (not built) with approved Development Application
- Uninvolved dwelling between 5 km and 10 km of Bango wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Bango wind turbine
- Existing 132 kV power line

Figure 32
Cumulative ZVI Diagram 3
Bango, Rye Park and Rugby wind farms

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Photomontages

Section 11

11.1 Photomontages

The DGR's state that the EA must "*include photomontages of the project taken from potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights), settlements and significant public view points…*"

A total of twenty three photomontages have been prepared to illustrate views from neighbouring and uninvolved residential dwellings within 2km of the proposed Bango wind farm turbines, as well as public view locations from surrounding road corridors.

Photomontages PM 1 to PM 10 illustrate the proposed wind turbines from public view locations (such as road corridors). The public photomontage locations have been selected to represent a range of views including outlooks from Boorowa and Rye Park. Photomontages from public road corridors include the Lachlan Valley Way, Wargeila Road and local unsealed access roads within the project area.

Photomontages PM 11 to PM 23 illustrate views toward the proposed wind turbines from uninvolved residential dwellings and a derelict structure as well as neighbouring residential dwellings and weekender structures located within 2 km of a proposed wind turbine location. The photomontages locations are illustrated in **Figure 33** and presented in **Figures 34** to **79**.

11.2 Photomontages preparation

The photomontages have been prepared with regard to the general guidelines set out in the Scottish Natural Heritage (2006) Visual representation of windfarms: good practice guidance and British Landscape Institute Advice Note 01/11 (March 2011) Photography and photomontage in landscape and visual impact assessment.

Photography for the public photomontages was undertaken by GBD using a tripod mounted Nikon D700 digital single-lens reflex (SLR) cameras. A 50 mm focal length prime lens was attached to the Nikon D700 camera.

The Nikon D700 has a full frame image censor (36 x 23.9 mm Nikon FX format), and when mounted with a 50mm lens results in a single photographic image with a view angle equivalent to a 35 mm SLR camera with a 50 mm lens. Photography for the neighbouring and uninvolved residential dwelling locations was undertaken by the Proponent using a tripod mounted Canon EOS400D digital SLR camera with a 30mm 1:14DC HMS lens.

Following site photography each of the Bango photomontage was generated through the following steps:

- a digital terrain model (DTM) of the project site was created from a terrain model of the surrounding area using digital contours;
- the site DTM was loaded in the ReSoft 'WindFarm' software package;
- the layout of the wind farm and 3D representation of the wind turbine was configured in WindFarm;
- the location of each viewpoint (photo location) was configured in WindFarm – the sun position for each viewpoint was configured by using the time and date of the photographs from that viewpoint;
- the view from each photomontage location was then assessed in WindFarm. This process requires accurate mapping of the terrain as modelled, with that as seen in the photographs. The photographs, taken from each photomontage location were loaded into WindFarm and the visible turbines superimposed on the photographs;
- the photomontage were adjusted using GIMP 2.6 to compensate for fogging due to haze or distance, as well as screening by vegetation or obstacles; and
- the final image was converted to JPG format and imported and annotated as the final figure.

Table 22 identifies the twenty three photomontage locations, property names (where relevant), corresponding reference number identified in the residential view matrix (**Table 18**) as well as the status of each photomontage location.

Table 22 – Photomontage details

Photomontage Location	Figure Reference	Status:
PM 1	**Figures 34** & **35**	Lachlan Valley Way – sealed road
PM 2	**Figures 36** & **37**	Wargeila Road – unsealed road
PM 3	**Figures 38** & **39**	Moorbys Lane – unsealed road
PM 4	**Figures 40** & **41**	Wargeila Road – unsealed road
PM 5	**Figures 42** & **43**	Cooks Road – Rye Park

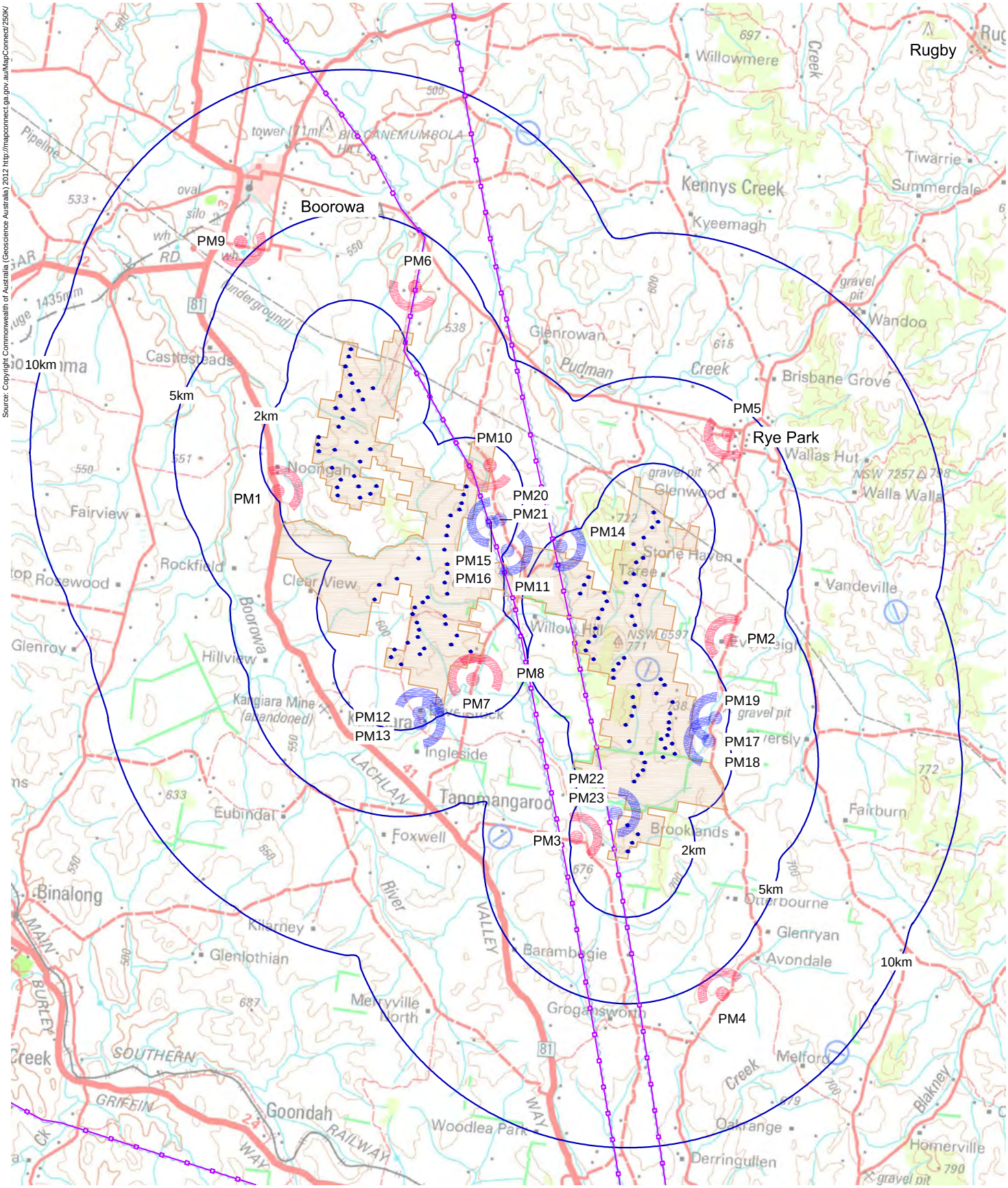
Table 22 – Photomontage details

Photomontage Location	Figure Reference	Status:
PM 6	**Figures 44** & **45**	Hopfield Lane – unsealed road
PM 7	**Figures 46** & **47**	Tangmangaroo Road – unsealed road
PM 8	**Figures 48** & **49**	Tangmangaroo Road - unsealed road
PM 9	**Figure 50** & **51**	Meads Lane – sealed road
PM10	**Figure 52** & **53**	Harry's Creek Road – unsealed road
PM11	**Figures 54** & **55**	Uninvolved residential dwelling 185 Klondyke
PM 12	**Figures 56 & 57**	Uninvolved residential dwelling 076 Laverstock
PM 13	**Figures 58 & 59**	Uninvolved residential dwelling 235 Laverstock
PM 14	**Figures 60 & 61**	Neighbour residential dwelling 158 Undurba Park
PM 15	**Figures 62 & 63**	Neighbour residential dwelling 101 Valrosa
PM 16	**Figures 64 & 65**	Neighbour residential dwelling 101 Valrosa
PM 17	**Figures 66 & 67**	Neighbour residential dwelling 115 Banksia Downs
PM 18	**Figures 68 & 69**	Neighbour residential dwelling 115 Banksia Downs
PM 19	**Figures 70 & 71**	Neighbour residential dwelling 136 Bobby's Hill
PM 20	**Figures 72 & 73**	Neighbour residential dwelling 155 Reeve Nikia/Rocky Springs
PM 21	**Figures 74 & 75**	Neighbour residential dwelling 155 Reeve Nikia/Rocky Springs
PM 22	**Figures 76 & 77**	Neighbour residential dwelling 172 Brookdale
PM 23	**Figures 78 & 79**	Neighbour residential dwelling 172 Brookdale

The horizontal and vertical field of view within the majority of the photomontages exceeds the parameters of normal human vision. However, in reality the eyes, head and body can all move and, under normal conditions, the human brain would 'see' a broad area of landscape within a panorama view. Each of the Bango photomontage panoramas indicates the extent of a single photograph within the full extent of the panorama.

Whilst a photomontage can provide an image that illustrates a photo realistic representation of a wind turbine in relation to its proposed location and scale relative to the surrounding landscape, this LVIA acknowledges that large scale objects in the landscape can appear smaller in photomontage than in real life and is partly due to the fact that a flat image does not allow the viewer to perceive any information relating to depth or distance.

The British Landscape Institute states that '*it is also important to recognise that two-dimensional photographic images and photomontages alone cannot capture or reflect the complexity underlying the visual experience and should therefore be considered an approximate of the three-dimensional visual experiences that an observer would receive in the field'.*



Legend

- Proposed Bango wind turbine (Layout Option 1)
- Bango wind farm project area
- Existing powerline route
- Distance from proposed Bango wind turbine
- Public photomontage location
- Uninvolved and neighbour residential dwelling photomontage location (within 2 km of wind turbine)

0km 2.5km

Figure 33 Photomontages locations

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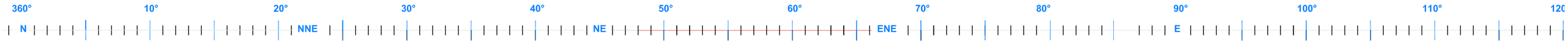
Lachlan Valley Way

Photomontage Location PM 1 Lachlan Valley Way - Existing view, panorama north to east (Bearing 360° to 120°)



Photomontage Location PM 1 Proposed view, Lachlan Valley Way, Extended panorama north to east (Bearing 360° to 120°)

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Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 658868 Northing 6177164 (MGA 94z55H).
Approximate distance to nearest visible turbine 2 km

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Image Source GBD 2013

Photomontage Location PM 1, Lachlan Valley Way - Proposed view

Indicative extent of single frame photo
(refer detail below)

Image Source GBD 2013

Photomontage Location PM 1 - Single frame photo detail, proposed view

Figure 35
Photomontage PM 1 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates:
Easting 658868
Northing 6177164 (MGA 94z55H)

Approximate distance to nearest visible turbine 2 km

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Image Source GBD 2013

Photomontage Location PM 2 Wargeila Road - Existing view, panorama south west to north west (Bearing 200° to 330°)

220° SW 230° 240° WSW 250° 260° 270° W 280° 290° WNW 300° 310° NW 320° 330°

Image Source GBD 2013

Photomontage Location PM 2 Proposed view, Wargeila Road, Extended panorama south west to north west (Bearing 200° to 330°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 674761 Northing 6172273 (MGA 94z55H).
Approximate distance to nearest visible turbine 3.3 km

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BANGO WIND FARM

Image Source GBD 2013

Photomontage Location PM 2, Wargeila Road - Proposed view

Indicative extent of single frame photo (refer detail below)

Image Source GBD 2013

Photomontage Location PM 2 - Single frame photo detail, proposed view

Figure 37
Photomontage PM 2 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates:
Easting 674761
Northing 6172273 (MGA 94z55H)

Approximate distance to nearest visible turbine 3.3 km

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WIND PROSPECT
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Image Source GBD 2013

Photomontage Location PM 3 Moorbys Lane - Existing view, panorama north north west to east (Bearing 345° to 105°)

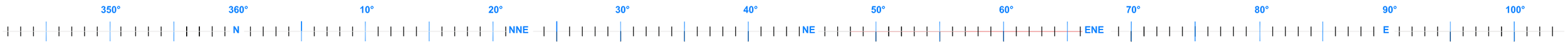

Image Source GBD 2013

Photomontage Location PM 3 Proposed view, Moorbys Lane, Extended panorama north north west to east (Bearing 345° to 105°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 669411 Northing 6165009 (MGA 94z55H).
Approximate distance to nearest visible turbine 1.8 km

GREEN BEAN DESIGN
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WIND PROSPECT
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BANGO WIND FARM

Image Source GBD 2013

Photomontage Location PM 3, Moorbys Lane - Proposed view

Indicative extent of single frame photo
(refer detail below)

Image Source GBD 2013

Photomontage Location PM 3 - Single frame photo detail, proposed view

Figure 39
Photomontage PM 3 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates:
Easting 669411
Northing 6165009 (MGA 94z55H)

Approximate distance to nearest visible turbine 1.8 km

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WIND PROSPECT
CWP

Image Source GBD 2013

Photomontage Location PM 4 Wargeila Road - Existing view, panorama west north west to north east (Bearing 295° to 50°)

Image Source GBD 2013

Photomontage Location PM 4 Proposed view, Wargeila Road, Extended panorama west north west to north east (Bearing 295° to 50°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 674197 Northing 6159364 (MGA 94z55H).
Approximate distance to nearest visible turbine 6 km

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WIND PROSPECT
CWP

BANGO WIND FARM

Image Source GBD 2013

Photomontage Location PM 4, Wargeila Road - Proposed view

Indicative extent of single frame photo
(refer detail below)

Image Source GBD 2013

Photomontage Location PM 4 - Single frame photo detail, proposed view

Figure 41
Photomontage PM 4 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates:
Easting 674197
Northing 6159364 (MGA 94z55H)

Approximate distance to nearest visible turbine 6 km

GREEN BEAN DESIGN
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WIND PROSPECT
CWP

Image Source GBD 2013

Photomontage Location PM 5 Cook Street Rye Park - Existing view, panorama south south west to north west (Bearing 195° to 310°)

200° SSW 210° 220° SW 230° 240° WSW 250° 260° 270° W 280° 290° WNW 300° 310°

Image Source GBD 2013

Photomontage Location PM 5 Proposed view, Cook Street Rye Park, Extended panorama south south west to north west (Bearing 195° to 310°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 674691 Northing 6178960 (MGA 94z55H).
Approximate distance to nearest visible turbine 3.7 km

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BANGO WIND FARM

Indicative extent of single frame photo
(refer detail below)

Image Source GBD 2013

Photomontage Location PM 5, Cook Street Rye Park - Proposed view

Image Source GBD 2013

Photomontage Location PM 5 - Single frame photo detail, proposed view

Figure 43
Photomontage PM 5 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates:
Easting 674691
Northing 6178960 (MGA 94z55H)

Approximate distance to nearest visible turbine 3.7 km

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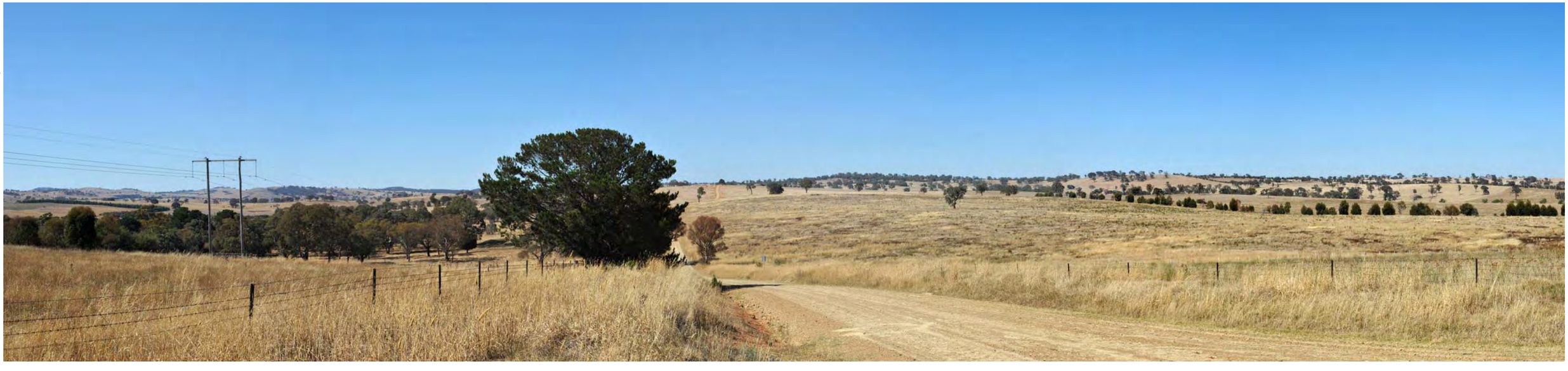
Image Source GBD 2013



Photomontage Location PM 6 Hopefield Lane - Existing view, panorama south east to west (Bearing 140° to 260°)

150° 160° 170° 180° 190° 200° 210° 220° 230° 240° 250° 260°

SSE S SSW SW WSW

Image Source GBD 2013

Photomontage Location PM 6 Proposed view, Hopefield Lane, Extended panorama south east to west (Bearing 140° to 260°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 6663516 Northing 6183393 (MGA 94z55H).
Approximate distance to nearest visible turbine 3.1 km

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WIND PROSPECT CWP

BANGO WIND FARM

Image Source GBD 2013

Photomontage Location PM 6, Hopefield Lane - Proposed view

Indicative extent of single frame photo
(refer detail below)

Image Source GBD 2013

Photomontage Location PM 6 - Single frame photo detail, proposed view

Figure 45
Photomontage PM 6 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates:
Easting 663516
Northing 6183393 (MGA 94z55H)

Approximate distance to nearest visible turbine 3.1 km

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WIND PROSPECT
CWP

Image Source GBD 2013

Photomontage Location PM 7 Tangmangaroo Road - Existing view, panorama west to north east (Bearing 280° to 40°)

280° 290° WNW 300° 310° NW 320° 330° NNW 340° 350° 360° N 10° 20° NNE 30°

Image Source GBD 2013

Photomontage Location PM 7 Proposed view, Tangmangaroo Road, Extended panorama west to north east (Bearing 280° to 40°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 665502 Northing 6169307 (MGA 94z55H).
Approximate distance to nearest visible turbine 1.4 km

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WIND PROSPECT CWP

BANGO WIND FARM

Image Source GBD 2013

Photomontage Location PM 7, Tangmangaroo Road - Proposed view

Indicative extent of single frame photo
(refer detail below)

Image Source GBD 2013

Photomontage Location PM 7 - Single frame photo detail, proposed view

Figure 47
Photomontage PM 7 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates:
Easting 665502
Northing 6169307 (MGA 94z55H)

Approximate distance to nearest visible turbine 1.4 km

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WIND PROSPECT
CWP

Image Source GBD 2013

Photomontage Location PM 8 Tangmangaroo Road - Existing view, panorama north north east to south east (Bearing 20° to 135°)

Image Source GBD 2013

Photomontage Location PM 8 Proposed view, Tangmangaroo Road, Extended panorama north north east to south east (Bearing 20° to 135°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 665502 Northing 6169307 (MGA 94z55H).
Approximate distance to nearest visible turbine 4 km

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WIND PROSPECT
CWP

BANGO WIND FARM

Image Source GBD 2013

Photomontage Location PM 8, Tangmangaroo Road - Proposed view

Indicative extent of single frame photo
(refer detail below)

Image Source GBD 2013

Photomontage Location PM 8 - Single frame photo detail, proposed view

Figure 49
Photomontage PM 8 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates:
Easting 665502
Northing 6169307 (MGA 94z55H)

Approximate distance to nearest visible turbine 4 km

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WIND PROSPECT
CWP

Image Source GBD 2013

Photomontage Location PM 9 Meads Lane Boorowa- Existing view, panorama east north east to south south east (Bearing 60° to 170°)

60° ENE 70° 80° 90° E 100° 110° 120° 130° SE 140° 150° SSE 160° 170°

Image Source GBD 2013

Photomontage Location PM 9 Proposed view, Meads Lane Boorowa, Extended panorama east north east to south south east (Bearing 60° to 170°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 657182 Northing 6185762 (MGA 94z55H).
Approximate distance to nearest visible turbine 5.2 km

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WIND PROSPECT CWP

BANGO WIND FARM

Image Source GBD 2013

Photomontage Location PM 9, Meads Lane - Proposed view

Indicative extent of single frame photo
(refer detail below)

Image Source GBD 2013

Photomontage Location PM 9 - Single frame photo detail, proposed view

Figure 51
Photomontage PM 9 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates:
Easting 657182
Northing 6185762 (MGA 94z55H)

Approximate distance to nearest visible turbine 5.3 km

GREEN BEAN DESIGN
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WIND PROSPECT
CWP

Image Source GBD 2013

Photomontage Location PM 10 Harry's Creek Road - Existing view, panorama south to west north west (Bearing 180° to 300°)

190° 200° SSW 210° 220° SW 230° 240° WSW 250° 260° 270° W 280° 290° WNW 300°

Image Source GBD 2013

Photomontage Location PM 10 Proposed view, Harry's Creek Road, Extended panorama south to west north west (Bearing 180° to 300°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates: Easting 666492 Northing 6177100 (MGA 94z55H).
Approximate distance to nearest visible turbine 1 km

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WIND PROSPECT CWP

BANGO WIND FARM

Image Source GBD 2013

Photomontage Location PM 10, Harry's Creek Road - Proposed view

Indicative extent of single frame photo
(refer detail below)

Image Source GBD 2013

Photomontage Location PM 10 - Single frame photo detail, proposed view

Figure 53
Photomontage PM 10 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Nikon D700 digital SLR camera with 50 mm prime lens.

Photo coordinates:
Easting 666492
Northing 6177100 (MGA 94z55H)

Approximate distance to nearest visible turbine 1 km

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WIND PROSPECT
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Image Source WPCWP 2013

Photomontage Location PM 11 Uninvolved residential dwelling 185 Klondyke - Existing view, panorama east to south south west (Bearing 80° to 215°)
Access to Klondyke property was not granted. Photo taken from edge of Tangmangaroo Road adjacent to property fenceline -derelict structure is located below road level off photo r.h.s

80° 90° 100° 110° 120° 130° 140° 150° 160° 170° 180° 190° 200° 210°
E SE SSE S SSW

Image Source WPCWP 2013

Photomontage Location PM 11 Proposed view, Uninvolved residential dwelling 185 Klondyke, Extended panorama east to south south west (Bearing 80° to 215°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 666492 Northing 6177100 (MGA 94z55H).
Approximate distance to nearest visible turbine 1.7 km

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WIND PROSPECT
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BANGO WIND FARM

Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 11, Uninvolved residential dwelling 185 Klondyke - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 11 - Single frame photo detail, proposed view

Figure 55
Photomontage PM 11 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 668766
Northing 6175478 (MGA 94z55H)

Approximate distance to nearest visible turbine 1.7 km

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WIND PROSPECT
CWP

Image Source WPCWP 2013

Photomontage Location PM 12 Uninvolved residential dwelling 076 Laverstock - Existing view, panorama north to south south east (Bearing 5° to 168°)

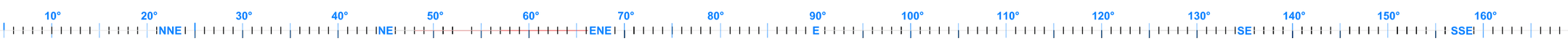

Image Source WPCWP 2013

Photomontage Location PM 12 Proposed view, Uninvolved residential dwelling 076 Laverstock, Extended panorama north to south south east (Bearing 5° to 168°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 663894 Northing 6169298 (MGA 94z55H).
Approximate distance to nearest visible turbine 2.8 km

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WIND PROSPECT
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Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 12, Uninvolved residential dwelling 076 Laverstock - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 12 - Single frame photo detail, proposed view

BANGO WIND FARM

Figure 57
Photomontage PM 12 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 663894
Northing 6169298 (MGA 94z55H)

Approximate distance to nearest visible turbine 2.8 km

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WIND PROSPECT
CWP

Image Source WPCWP 2013

Photomontage Location PM 13 Uninvolved residential dwelling 235 Laverstock Cottage - Existing view, panorama north west to south east (Bearing 304° to 114°)

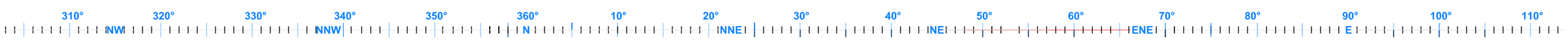

Image Source WPCWP 2013

Photomontage Location PM 13 Proposed view, Uninvolved residential dwelling 235 Laverstock Cottage, Extended panorama north west to south east (Bearing 304° to 114°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 663849 Northing 6169495 (MGA 94z55H).
Approximate distance to nearest visible turbine 1.7 km

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WIND PROSPECT
CWP

Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 13, Uninvolved residential dwelling 235 Laverstock Cottage - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 13 - Single frame photo detail, proposed view

BANGO WIND FARM

Figure 59
Photomontage PM 13 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 663849
Northing 6169495 (MGA 94z55H)

Approximate distance to nearest visible turbine 1.7 km

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WIND PROSPECT
CWP

Image Source WPCWP 2013

Photomontage Location PM 14 Neighbour weekender 158 Undurba - Existing view, panorama west south west to north north west (Bearing 240° to 350°)

Image Source WPCWP 2013

Photomontage Location PM 14 Proposed view, Neighbour weekender 158 Undurba, Extended panorama west south west to north north west (Bearing 240° to 350°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 666917 Northing 6175308 (MGA 94z55H).
Approximate distance to nearest visible turbine 2 km

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WIND PROSPECT
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Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 14, Neighbour weekender 158 Undurba - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 14 - Single frame photo detail, proposed view

BANGO WIND FARM

Figure 61
Photomontage PM 14 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 666917
Northing 6175308 (MGA 94z55H)

Approximate distance to nearest visible turbine 2 km

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WIND PROSPECT
CWP

Image Source WPCWP 2013

Photomontage Location PM 15 neighbour residential dwelling 101 Valrosa
Existing view, panorama south to west south west (Bearing 173° to 260°)

Image Source WPCWP 2013

Photomontage Location PM 15 Proposed view, neighbour residential dwelling 101 Valrosa,
Extended panorama south to west south west (Bearing 173° to 260°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 666368 Northing 6176282 (MGA 94z55H).
Approximate distance to nearest visible turbine 1.13 km

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Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 15, neighbour residential dwelling 101 Valrosa - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 15 - Single frame photo detail, proposed view

BANGO WIND FARM

Figure 63
Photomontage PM 15 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 666368
Northing 6176282 (MGA 94z55H)

Approximate distance to nearest visible turbine 1.13 km

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WIND PROSPECT
CWP

Image Source WPCWP 2013

Photomontage Location PM 16 neighbour residential dwelling 101 Valrosa
Existing view, panorama west south west to north north west (Bearing 250° to 340°)

250° 260° 270° W 280° 290° WNW 300° 310° NW 320° 330° 340° NNW

Image Source WPCWP 2013

Photomontage Location PM 16 Proposed view, neighbour residential dwelling 101 Valrosa,
Extended panorama west south west to north north west (Bearing 250° to 340°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 666368 Northing 6176282 (MGA 94z55H).
Approximate distance to nearest visible turbine 1.13 km

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WIND PROSPECT
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Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 16, neighbour residential dwelling 101 Valrosa - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 16 - Single frame photo detail, proposed view

BANGO WIND FARM

Figure 65
Photomontage PM 16 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 666368
Northing 6176282 (MGA 94z55H)

Approximate distance to nearest visible turbine 1.13 km

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CWP

Image Source WPCWP 2013

Photomontage Location PM 17 neighbour residential dwelling 115 Banksia Downs
Existing view, panorama south south west to west (Bearing 200° to 280°)

Image Source WPCWP 2013

Photomontage Location PM 17 Proposed view, neighbour residential dwelling 115 Banksia Downs,
Extended panorama south south west to west (Bearing 240° to 280°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 673909 Northing 6168670 (MGA 94z55H).
Approximate distance to nearest visible turbine 1.32 km

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WIND PROSPECT
CWP

BANGO WIND FARM

Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 17, neighbour residential dwelling 115 Banksia Downs - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 17 - Single frame photo detail, proposed view

Figure 67
Photomontage PM 17 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 673909
Northing 6168670 (MGA 94z55H)

Approximate distance to nearest visible turbine 1.32 km

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WIND PROSPECT
CWP

Image Source WPCWP 2013

Photomontage Location PM 18 neighbour residential dwelling 115 Banksia Downs
Existing view, panorama west to north (Bearing 275° to 360°)

280° 290° 300° 310° 320° 330° 340° 350° 360°
WNW NW NNW N

Image Source WPCWP 2013

Photomontage Location PM 18 Proposed view, neighbour residential dwelling 115 Banksia Downs,
Extended panorama west to north (Bearing 275° to 360°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 673909 Northing 6168670 (MGA 94z55H).
Approximate distance to nearest visible turbine 1.32 km

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WIND PROSPECT
CWP

Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 18, neighbour residential dwelling 115 Banksia Downs - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 18 - Single frame photo detail, proposed view

Figure 69
Photomontage PM 18 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 673909
Northing 6168670 (MGA 94z55H)

Approximate distance to nearest visible turbine 1.32 km

BANGO WIND FARM

GREEN BEAN DESIGN
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WIND PROSPECT
CWP

Image Source WPCWP 2013

Photomontage Location PM 19 neighbour residential dwelling 136 Bobby's Hill
Existing view, panorama south west to west north west (Bearing 215° to 318°)

Image Source WPCWP 2013

Photomontage Location PM 19 Proposed view, neighbour residential dwelling 136 Bobby's Hill
Extended panorama south west to west north west (Bearing 215° to 318°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 674135 Northing 6169484 (MGA 94z55H).
Approximate distance to nearest visible turbine 1.52 km

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WIND PROSPECT
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Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 19, neighbour residential dwelling 136 Bobby's Hill - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 19 - Single frame photo detail, proposed view

BANGO WIND FARM

Figure 71
Photomontage PM 19 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 674135
Northing 6169484 (MGA 94z55H)

Approximate distance to nearest visible turbine 1.52 km

GREEN BEAN DESIGN
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WIND PROSPECT
CWP

Image Source WPCWP 2013

Photomontage Location PM 20 neighbour residential dwelling 155 Reve Nikia/Rocky Springs
Existing view, panorama south to west (Bearing 180° to 285°)

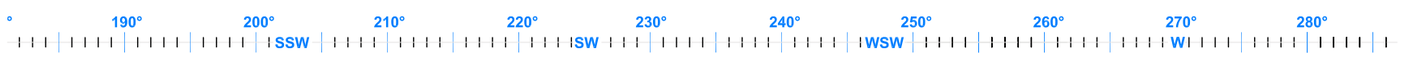

Image Source WPCWP 2013

Photomontage Location PM 20 Proposed view, neighbour residential dwelling 155 Reve Nikia/Rocky Springs
Extended panorama south to west (Bearing 180° to 285°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 666663 Northing 6176379 (MGA 94z55H).
Approximate distance to nearest visible turbine 1.13 km

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WIND PROSPECT
CWP

Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 20, neighbour residential dwelling 155 Reve Nikia/Rocky Springs - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 20 - Single frame photo detail, proposed view

BANGO WIND FARM

Figure 73
Photomontage PM 20 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 666663
Northing 61766379 (MGA 94z55H)

Approximate distance to nearest visible turbine 1.13 km

GREEN BEAN DESIGN
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Image Source WPCWP 2013

Photomontage Location PM 21 neighbour residential dwelling 155 Reve Nikia/Rocky Springs
Existing view, panorama south to west (Bearing 180° to 285°)

230° 240° 250° WSW 260° 270° W 280° 290° WNW 300° 310° NW 320° 330°

Image Source WPCWP 2013

Photomontage Location PM 21 Proposed view, neighbour residential dwelling 155 Reve Nikia/Rocky Springs
Extended panorama south to west (Bearing 180° to 285°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 666663 Northing 6176379 (MGA 94z55H).
Approximate distance to nearest visible turbine 1.13 km

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Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 21, neighbour residential dwelling 155 Reve Nikia/Rocky Springs - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 21 - Single frame photo detail, proposed view

Figure 75
Photomontage PM 21 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 666663
Northing 61766379 (MGA 94z55H)

Approximate distance to nearest visible turbine 1.13 km

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Image Source WPCWP 2013

Photomontage Location PM 22 neighbour weekender 172 Brookdale
Existing view, panorama north west to east north east (Bearing 301° to 67°)

Image Source WPCWP 2013

Photomontage Location PM 22 Proposed view, neighbour weekender 172 Brookdale
Extended panorama north west to east north east (Bearing 301° to 67°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 670661 Northing 6166182 (MGA 94z55H).
Approximate distance to nearest visible turbine 851 km

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Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 22, neighbour weekender 172 Brookvale - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 22 - Single frame photo detail, proposed view

BANGO WIND FARM

Figure 77
Photomontage PM 22 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 670661
Northing 6166182 (MGA 94z55H)

Approximate distance to nearest visible turbine 851 m

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Image Source WPCWP 2013

Photomontage Location PM 23 neighbour weekender 172 Brookdale
Existing view, panorama east south east to south south west (Bearing 115° to 200°)

Image Source WPCWP 2013

Photomontage Location PM 23 Proposed view, neighbour weekender 172 Brookdale
Extended panorama east south east to south south west (Bearing 115° to 200°)

BANGO WIND FARM

Refer Figure 33 for Photomontage Location.

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14 DC HMS lens.

Photo coordinates: Easting 670661 Northing 6166182 (MGA 94z55H).
Approximate distance to nearest visible turbine 851 km

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Indicative extent of single frame photo
(refer detail below)

Image Source WPCWP 2013

Photomontage Location PM 23, neighbour residential dwelling 172 Brookvale - Proposed view

Image Source WPCWP 2013

Photomontage Location PM 23 - Single frame photo detail, proposed view

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Figure 79
Photomontage PM 23 Sheet 2

Refer Figure 33 for Photomontage Location

Individual panorama photos taken with a Canon EOS400D digital SLR camera with 30 mm 1:14DC HMS lens.

Photo coordinates:
Easting 670661
Northing 6166182 (MGA 94z55H)

Approximate distance to nearest visible turbine 851 m

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Night time lighting

Section 12

12.1 Introduction

Although not currently proposed, the Bango wind farm may require obstacle lighting in the future. The future requirement for lighting would be subject to the advice and endorsement of the Civil Aviation Safety Authority (CASA). CASA is currently undertaking a safety study into the risk to aviation posed by wind farms to develop a new set of guidelines to replace the Advisory Circular with regard to lighting for wind turbines that was withdrawn by CASA in mid 2008.

Should future CASA regulations require a lighting assessment; the proponent will undertake an Aeronautical Impact Assessment, to first determine the risks posed to aviation activities by the wind farm. If required, an Obstacle Lighting Assessment would be undertaken by an Aeronautical Impact Assessment expert to stipulate the turbine lighting layout which would mitigate any risks to aviation. The outcomes of the Aeronautical Impact Assessment and the Obstacle Lighting Assessment would then be submitted to CASA for their comment.

Potential visual effects associated with obstacle marking and lighting at night time have not been extensively researched or tested in New South Wales, although some site investigations have been carried out at existing wind farms in Victoria. Investigations have generally concluded that although night time lighting mounted on wind turbines could be visible for a number of kilometres from the wind farm project area, the actual intensity of the lighting appears no greater than other sources of night time lighting, including vehicle head and tail lights.

Previous investigations have also suggested that replacing the more conventional incandescent lights with light emitting diodes (LED) could help to minimise the potential visual effect of the wind turbine lights (Epuron 2008).

In order to illustrate the visual effect of turbine mounted lighting a series of night time photographs were taken of the Cullerin wind farm in the New South Wales Southern Tablelands. These were taken at distances of 500 m, 3.5 km and 17 km from the turbines and are illustrated in **Figures 80, 81** and **82**. Each night time view is presented below a corresponding day time photograph taken from the same photo location. It should be

noted that following community consultation, and the preparation of an aviation risk assessment, Origin Energy have removed night time obstacle lighting from the Cullerin wind turbines.

12.2 Existing light sources

A small number of existing night time light sources occur within the Bango wind farm viewshed, and include residential and general lighting within surrounding villages.

Localised lighting is associated with a small number of dispersed homesteads located within the project boundary, but lighting is unlikely to be visually prominent and does not emit any significant illumination beyond immediate areas surrounding residential and agricultural buildings.

Lights from vehicles travelling along the local roads provide dynamic and temporary sources of light.

12.3 Potential light sources

The main potential light sources associated with the Bango wind farm would include:

- low intensity night lights for substations, control and auxiliary buildings; and
- night time obstacle lights mounted on some wind turbines (if required in the future).

In accordance with the withdrawn CASA Advisory Circular two red medium intensity obstacle lights were required on specified turbines at a distance not exceeding 900 m and all lights were to flash synchronously. To minimise visual effect some shielding of the obstacle lights below the horizontal plane was permitted. Lighting for aviation safety could also be required prior to and during the construction period, including lighting for large equipment such as cranes.

In addition to the standard level of lighting required for normal security and safety, lighting could also be required for scheduled or emergency maintenance around the control building, substation and wind turbine areas.

As the visibility of the substation and control room would be largely contained by the surrounding landform, it is unlikely that light spill from these sources would be visible from the majority of surrounding view locations including surrounding residences.

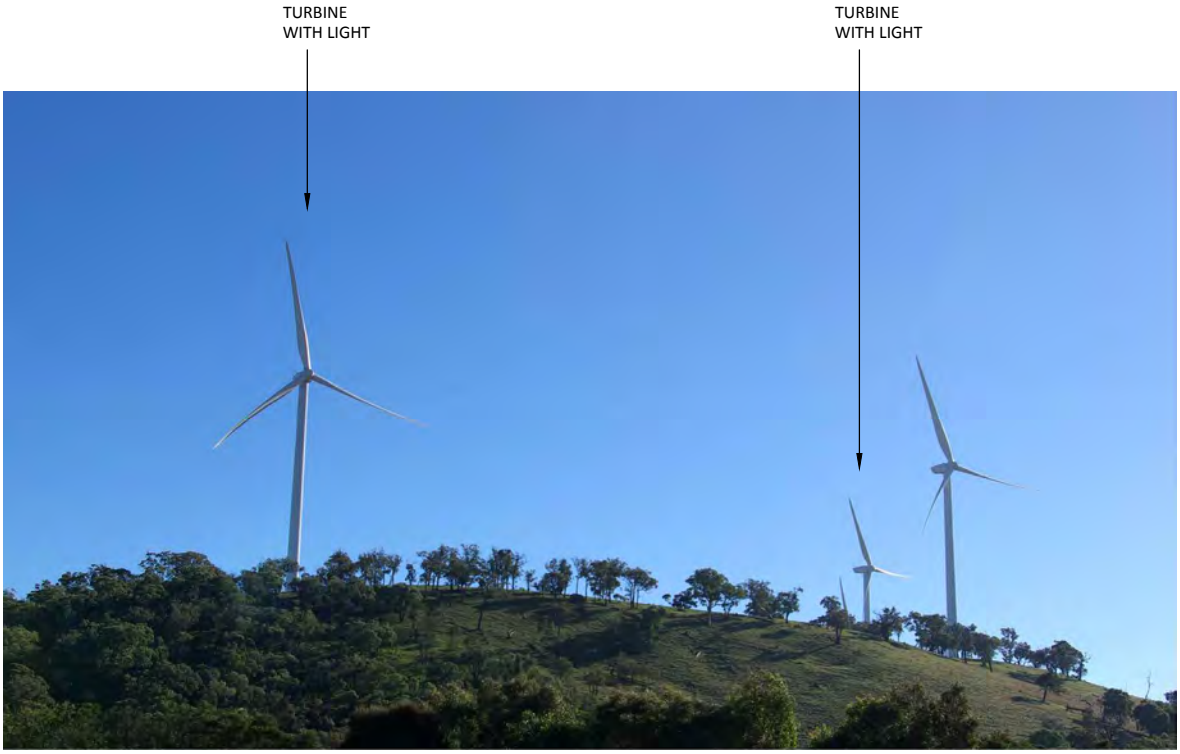
12.4 Potential view locations and effect

The categories of potential view locations that could be impacted by night time lighting generally include residents and motorists.

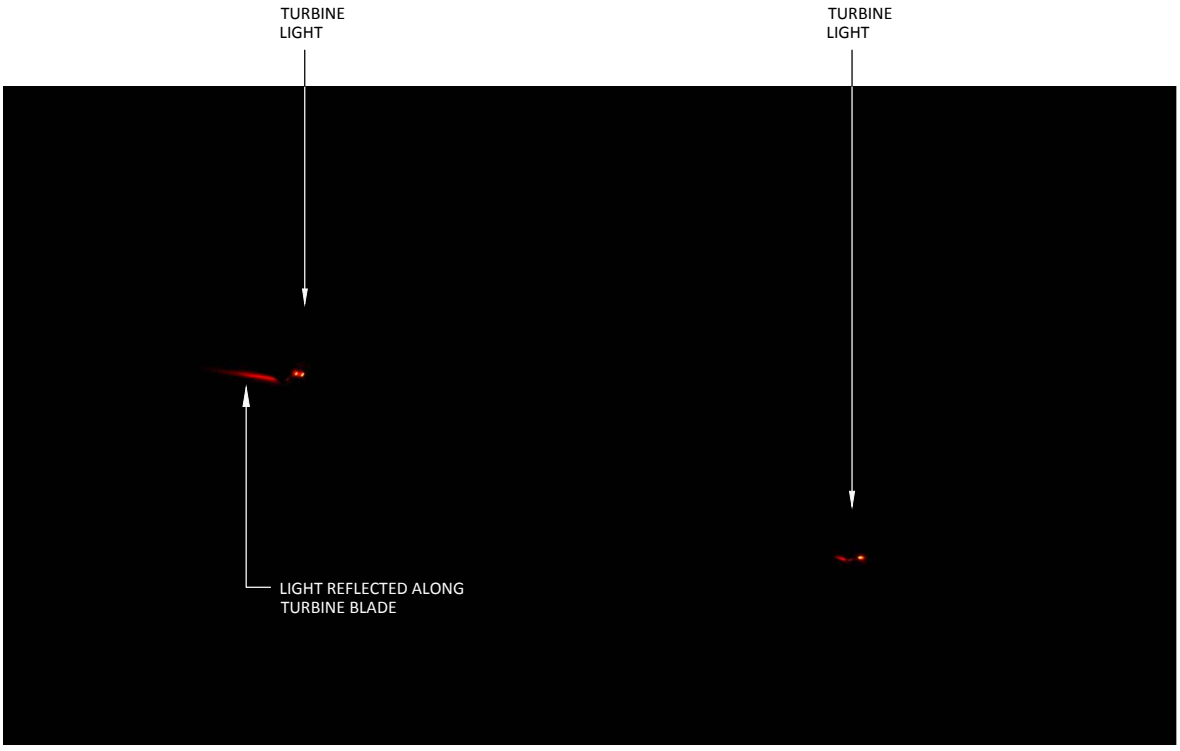
Night time lighting associated with the wind farm is unlikely to have a significant visual impact on the majority of public view locations. Whilst obstacle lighting would be visible to motorists travelling along the local roads, the duration of visibility would tend to be very short and partially screened by undulating landform along some sections of local road corridors and influenced by the direction of travel.

Night time obstacle lighting associated with the wind farm would be visible from a number of the residential view locations surrounding the Bango wind farm; however, topography and screening by vegetation and screen planting around residential dwellings would screen or partially obscure views toward night time obstacle lighting.

Irrespective of the total number of visible lights, obstacle lighting is more likely to be noticeable from exterior areas surrounding residences rather than from within residences, where internal lighting tends to reflect and mirror views in windows, or where exterior views would be obscured when curtains and blinds are closed.



Day time view from Hume highway toward Cullerin wind farm at around 500m

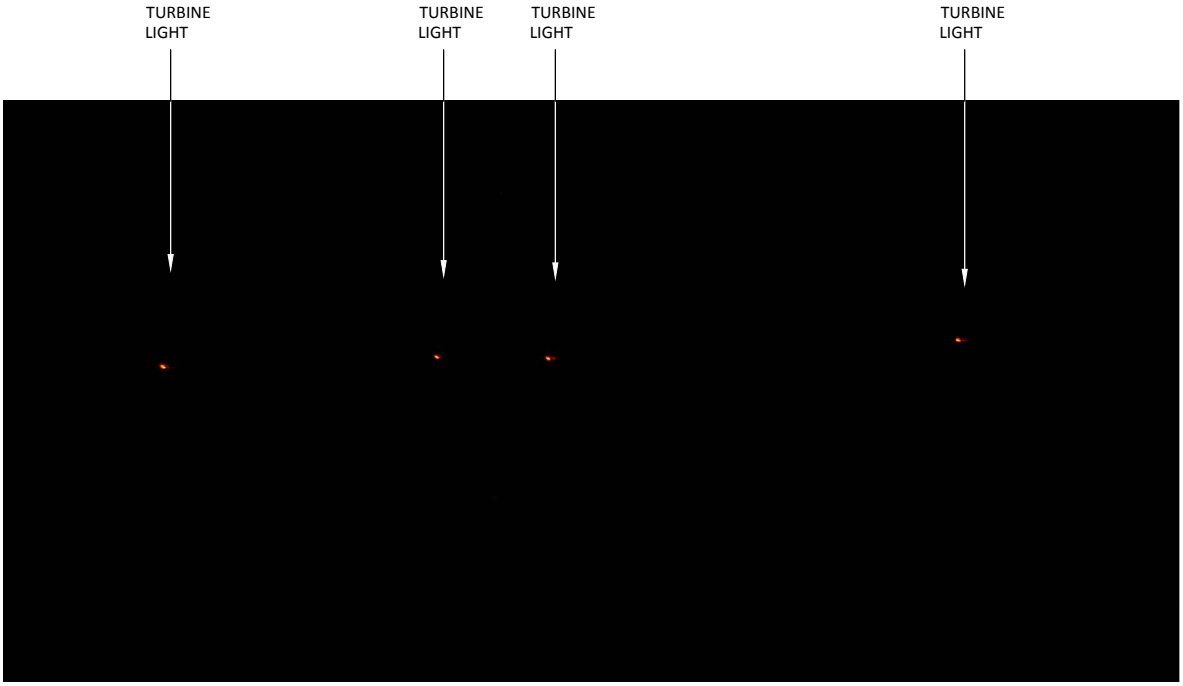


Night time view from Hume highway toward Cullerin wind farm at around 500m

Figure 80
Night lighting Cullerin wind farm at 500m

Cullerin wind farm night time lighting. View approximately 500 m west from Hume Highway

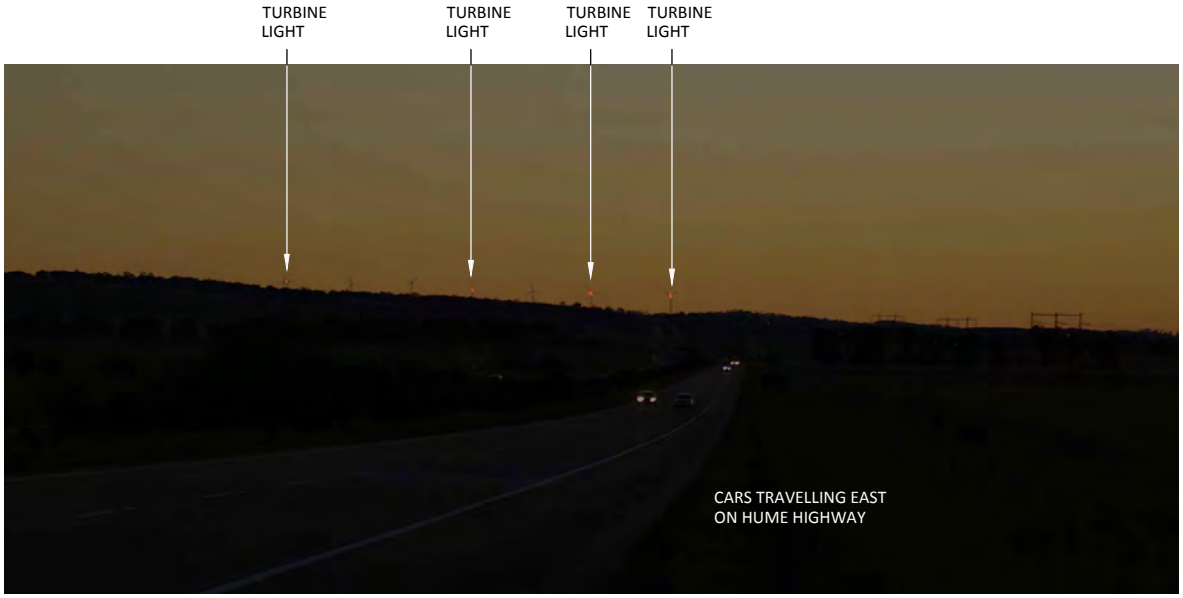
Day time view from Hume highway toward Cullerin wind farm at around 3.5km



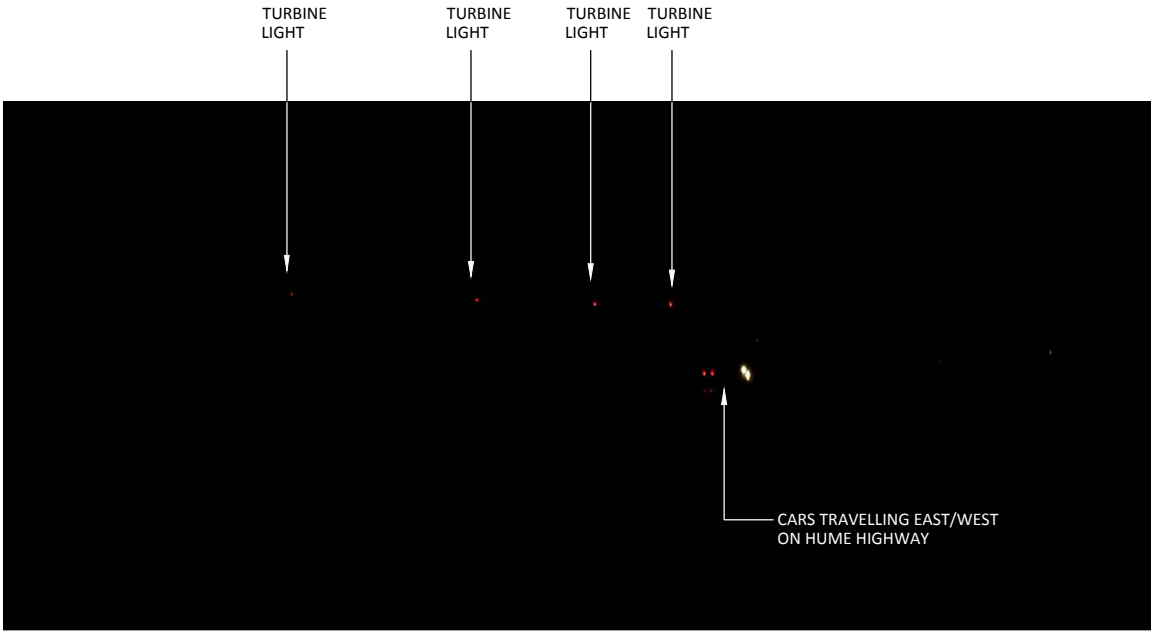
Night time view from Hume highway toward Cullerin wind farm at around 3.5km

Cullerin wind farm night time lighting . View approximately 3.5 km west from Hume highway.

Figure 81
Night lighting Cullerin wind farm at 3.5km



View west at dusk from Hume highway toward Cullerin wind farm at around 17km



View west after dark from Hume highway toward Cullerin wind farm at around 17km

Cullerin wind farm night time lighting . view west from Hume highway at around 17km distance.

Figure 82
Night lighting Cullerin wind farm at 17km

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Electrical works

Section 13

13.1 Introduction

The Bango wind farm would include a range of electrical infrastructure to collect and distribute electricity generated by the wind turbines. Electrical works would include elements such as:

- a collector substation comprising cable marshalling, switchgear, high voltage transformers and associated protection and communication assets;
- a switching station comprising switching and protection devices, busbars, circuit breakers, isolators and communications assets
- generator transformers;
- overhead powerlines (up to 132 kV) and
- underground powerlines (up to 132 kV) and control cables within and between each of the wind turbines and clusters connecting to the collector substation and switching station.

The general arrangement for the proposed electrical works is illustrated in **Figure 83**.

A typical design for a wind farm collector substation is illustrated in **Plate 7** and demonstrates the relatively small scale development required for this component of the electrical infrastructure. A typical illustration of a double circuit supporting structure and angle poles is presented in **Plate 8** and **Figure 84**. The majority of electrical connections between the wind turbines would be via underground cabling, including areas along ridgelines within the project boundary. Small sections of 33kV overhead reticulation could be required within the site boundary; however, the scale of these structures would be similar to existing domestic distribution utility infrastructure found throughout the landscape. **Plate 9** illustrates a generator transformer located below and adjacent to a wind turbine tower.

Plate 7 – Typical wind farm collector substation

Plate 8 – Typical illustration of a 132 kV double circuit powerline

Plate 9 – Generator transformer

13.2 Collector substation and switching station

The Bango wind farm project has identified three potential locations for a collector substation and switching station. Subject to detail design and engineering requirements, only one of the locations will be selected for construction. The potential collector substation and switching station locations are illustrated in **Figure 83**. The key visual components of the wind farm collector substation and switching station would include elements such as:

- incoming and outgoing overhead powerlines
- a single storey control building

- an access road (or road utilising wind turbine maintenance access track)
- various switch bays and transformers
- a communications pole
- lightning masts
- water tank
- low intensity lighting for security and maintenance and
- security fencing including a palisade fence and internal chainmesh fence.

The three potential collector substation and switching station locations would not be significantly visible from areas beyond the immediate project area, and would be largely screened by landform and scattered trees within the north and central sections of the project. Views from individual residential dwellings toward the substations would also be partially screened by localised landform and would not be expected to result in any significant visual effect from surrounding view locations.

13.3 Overhead 132 kV powerline structure

Electricity generated by the Bango wind farm would be connected to the grid via an overhead double circuit 132 kV powerline extending approximately east to west for around 9 km through the central portion of the site. The 132 kV powerline route illustrated in **Figure 83** includes 4 distinct sections extending east and west of the optional substation locations and connecting the Langs Creek and Kangiara clusters.

The key visual components of the 132 kV powerline would comprise:

- single tapered steel poles up to 35 m high
- aluminium alloy 132 kV conductors and
- an aerial earth wire and communications link.

Photographs of typical 132 kV double circuit transmission lines are illustrated in **Figure 84**.

13. 4 Visual absorption capability

Visual absorption capability (VAC) is a classification system used to describe the relative ability of the landscape to accept modifications and alterations without the loss of landscape character or deterioration of

visual amenity. The application of a VAC classification system is not particularly useful for large scale structures such as wind turbines and has not been applied to the assessment of the landscapes ability to accept the wind turbines; however, it can be applied to smaller ancillary structures, such as powerline infrastructure, where scale and form is more readily absorbed by elements (topography and vegetation) within the surrounding landscape. VAC relates to physical characteristics of the landscape that are often inherent and often quite static in the long term.

Undulating areas with a combination of open views interrupted by groups of trees and small forested areas would have a higher capability to visually absorb the proposed substations and powerline without significantly changing its amenity.

On the other hand, areas of cleared vegetation on level ground with limited screening, or areas spanning across prominent ridgelines without significant vegetation, would have a lower capability to visually absorb the proposed substations and powerline without changing the visual character and potentially reducing visual amenity.

Given the extent and combination of existing natural and cultural character within the wind farm site, the capability of the landscape to absorb the key components of the electrical infrastructure would be primarily dependent upon vegetation cover and landform.

For the purpose of this LVIA, the VAC ratings have been determined as:

Low – electrical infrastructure components would be highly visible either due to lack of screening by existing vegetation or surrounding landform (e.g. open flat farmland cleared of vegetation, or steep hillside crossing ridgeline).

Medium – electrical infrastructure components would be visible but existing vegetation and surrounding landform would provide some screening or background to reduce visual contrast.

High – electrical infrastructure components would be extensively screened by surrounding vegetation and undulating landform.

The landscape VAC along and surrounding the proposed and alternative 132 kV powerline route is illustrated in **Figure 83**.

13. 5 VAC summary

The landscape along the majority of the preferred and alternative powerline route, including the substation sites, is considered to have an overall moderate to high VAC, with some ability to accept modifications and alterations without the loss of landscape character or deterioration of existing levels of visual amenity. A higher VAC would occur in areas that present a backdrop of timbered or scattered tree cover.

The overall moderate to high level of VAC would largely result from the location of the proposed powerline routes relative to densely timbered hill sides, more gently undulating landforms and scattered tree cover. The moderate VAC would also tend to reduce the potential for cumulative effects to occur where views toward the existing powerline included views toward proposed electrical infrastructure elements.

13.6 Assessment of visual significance (electrical infrastructure)

Utilising a methodology very similar to the assessment of the wind turbine visual impact, the potential visibility and resultant visual significance of the substations and powerline infrastructure would primarily result from the combination of two factors:

- the extent to which the substation and powerline would be visible from surrounding areas; and
- the degree of visual contrast between the substation and powerline and the surrounding landscape that would be visible from surrounding view locations.

The overall visual effect is generally determined by a combination of factors including:

- the category and type of situation from which people may view the components of the substation and powerline (e.g. resident or motorist)
- the potential number of people with a view toward components of the substation and powerline from any one view location
- the distance between a person and components of the substation and powerline and
- the duration of time that a person may view components of the substation and powerline.

The potential view catchment is the extent to which the proposed powerline would be visible from surrounding areas. Identification of the view catchment considers the character of the landscape, landform and existing structural elements with regard to their potential for localised visual screening effects.

For the purpose of this LVIA, the electrical infrastructure view catchment has been determined within an approximate 2 km offset from the proposed substation location or each side of the powerline, beyond which the views would have a greater tendency to be screened by undulating landform or the presence of vegetation for portions of the powerline route. It is also considered that whilst the powerline would be noticeable from areas beyond a 2km distance, the substation and powerlines are unlikely to appear as a dominant visual element within the landscape beyond this distance.

The 2 km view catchment is a generalised assessment, where views toward the proposed powerline could, in some situations, be blocked by buildings, vegetation or local landform features at specific points within the 2 km offset, and similarly glimpses of the proposed powerline would be available from isolated positions outside the view catchment area. **Table 23** presents the view location matrix for electrical infrastructure. Involved and uninvolved residential dwelling locations within 2 km of the electrical infrastructure are illustrated in **Figure 83**.

The distance criteria for the proposed powerline visual assessment have been adopted as follows:

Category	**Distance**
Long distance view	>1 km
Medium distance view	500 m – 1 km
Short distance view	200 m – 500 m
Very short distance view	< 200 m

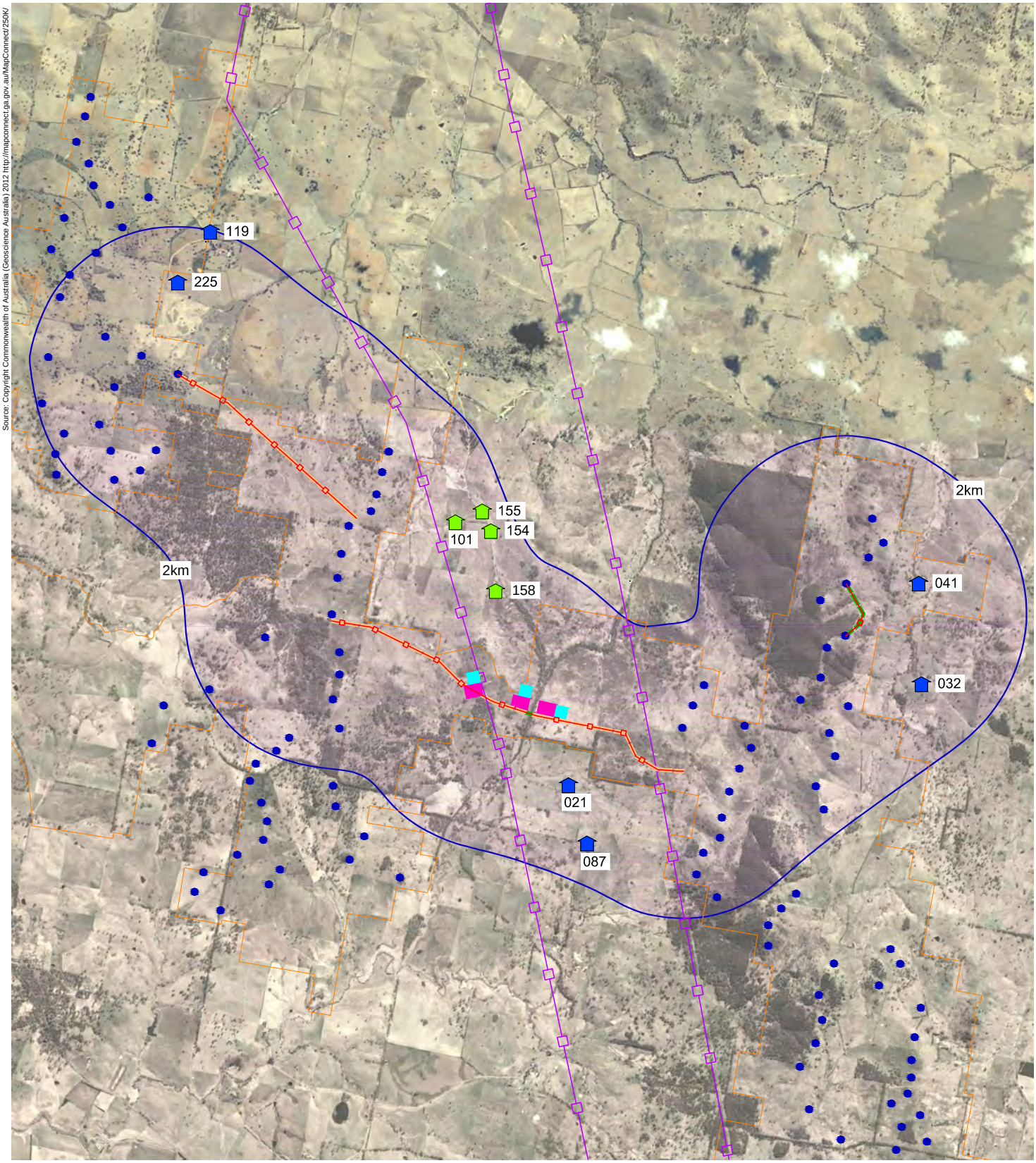
The potential visual significance of the proposed powerline is expressed as a rating of High, Medium, Low or Nil. For the purposes of this LVIA visibility ratings have been defined as:

High – The construction of the powerline may result in a very prominent physical change to the landscape, and includes the potential for proximate views toward extensive portions of the powerline from sensitive receptor locations.

Medium – The construction of the powerline may result in a noticeable physical change to the landscape although the powerline would not appear to be substantially different in scale and character to the existing landscape from surrounding receptor locations.

Low – The construction of the powerline is unlikely to result in a prominent change to the landscape and views from surrounding receptor locations toward the powerline may be difficult to distinguish from elements within the surrounding landscape.

Nil – The construction of the powerline would not create a noticeable change to the existing landscape and is unlikely to result in views toward the powerline from surrounding receptor locations.



Legend

- Bango wind farm project area
- Electrical infrastructure study area
- Proposed Bango wind turbine (Layout Option 1)
- Approximate 2 km offset from proposed 132 kV powerline
- Proposed powerline (up to 132 kV)
- Existing 132 kV overhead powerline
- Proposed collector substation (3 optional locations)
- Proposed switching station (3 optional locations)
- Involved dwelling within 2 km of proposed powerline and wind turbine
- Neighbour dwelling within 2 km of proposed powerline

Visual Absorption Capability (VAC)

- High
- Medium

0 km 1 km

Figure 83 Electrical works

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13.7 Visual significance matrix (electrical infrastructure)

Table 23 – Visual significance matrix (Refer **Figure 83** for potential dwelling locations)

View location (Refer to Figure 59)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest powerline	Duration of effect	VAC within proximity to powerline	Degree of visibility	Visual significance
021	Involved residential dwelling High	Very low	840 m	High	Medium	Medium distance views south to south east toward the proposed overhead powerline route will be partially screened by a gently rising and undulating landform beyond the dwelling. The optional collector substation and switching station locations will not be visible from this location.	Low
032	Involved residential dwelling High	Very low	1,157 m	High	High	Long distance views north west toward the proposed overhead powerline route will be partially screened by scattered tree cover. The optional collector substation and switching station locations will not be visible from this location.	Low
041	Involved residential dwelling High	Very low	843 m	High	High	Medium distance views west to south west toward the proposed overhead powerline will be partially screened by landform rising to the west of the dwelling, together with scattered tree cover. The optional collector substation and switching station locations will not be visible from this location.	Low
087	Involved residential dwelling High	Very low	1,1360 m	High	Medium	Long distance views north will extend toward portions of the overhead powerline extending east to west between the Mt Buffalo cluster and the proposed collector substation and switching station locations. Views will be partially screened by tree cover alongside field boundaries and generally mitigated by distance between the dwelling and elements of electrical infrastructure.	Low

Table 23 – Visual significance matrix (Refer **Figure 83** for potential dwelling locations)

View location (Refer to Figure 59)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest powerline	Duration of effect	VAC within proximity to powerline	Degree of visibility	Visual significance
101	Neighbour Residential dwelling High	Very low	1,331 m	High	Medium	Long distance views north west to south west toward portions of the overhead powerline will be largely screened by undulating landform. The optional collector substation and switching station locations will not be visible from this location.	Nil
119	Involved residential dwelling High	Very low	1,945 m	High	Medium	Long distance views toward the proposed overhead powerline, and the optional collector substation and switching station locations, will be screened by tree cover and landform beyond the dwelling.	Nil
154	Neighbour weekender High	Very low	1,729 m	High	Medium	Long distance views north west to south west toward portions of the overhead powerline will be largely screened by undulating landform. The optional collector substation and switching station locations will not be visible from this location.	Nil
155	Neighbour weekender High	Very low	1,458 m	High	Medium	Long distance views north west to south west toward portions of the overhead powerline will be largely screened by undulating landform. The optional collector substation and switching station locations will not be visible from this location.	Nil
158	Neighbour (caravan) High	Very low	1,208 m	High	Medium	Long distance views toward the proposed overhead powerline routes and the collector substation and switching station locations will be screened by landform.	Nil
225	Involved residential dwelling	Very low	1,227 m	High	Medium	Long distance views south toward the proposed overhead powerline are partially screened by a gently rising and undulating	Low

Table 23 – Visual significance matrix (Refer **Figure 83** for potential dwelling locations)

View location (Refer to Figure 59)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest powerline	Duration of effect	VAC within proximity to powerline	Degree of visibility	Visual significance
	High					landform. The optional collector substation and switching station locations will not be visible from this location.	

13.8 Summary of visual significance (electrical infrastructure)

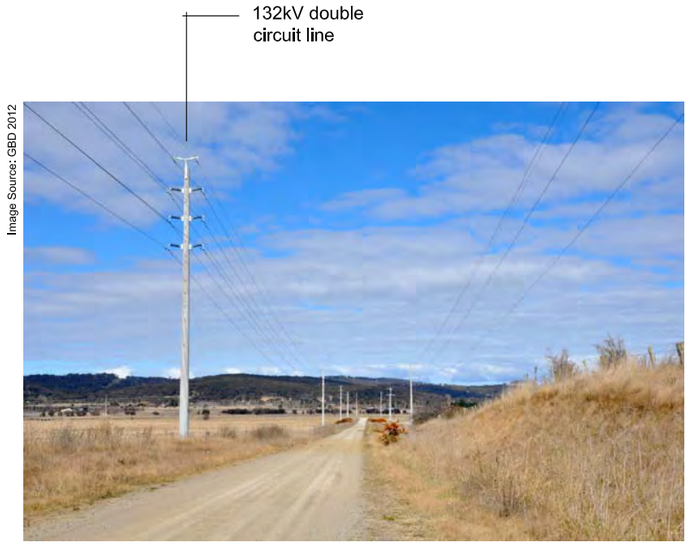
A total of 10 potential dwellings have been identified within a 2 km offset from the proposed 132 kV powerline routes, optional collector substation and switching station locations.

Six of the dwellings are involved landowners and four are neighbouring landowners subject to a potential agreement to place wind turbines within 2 km of their dwellings. As assessment of visual significance for the proposed overhead powerline routes, collector substation and switching station determined that:

- 5 of the 11 residential dwellings would have a Nil visual significance and
- 5 of the 11 residential dwellings would have a Low visual significance.

This LVIA has determined that the electrical works (including overhead powerline routes, a collector substation and a switching station) would be unlikely to have a significant visual effect on surrounding involved, neighbouring and uninvolved dwelling locations within 2 km of the proposed electrical works.

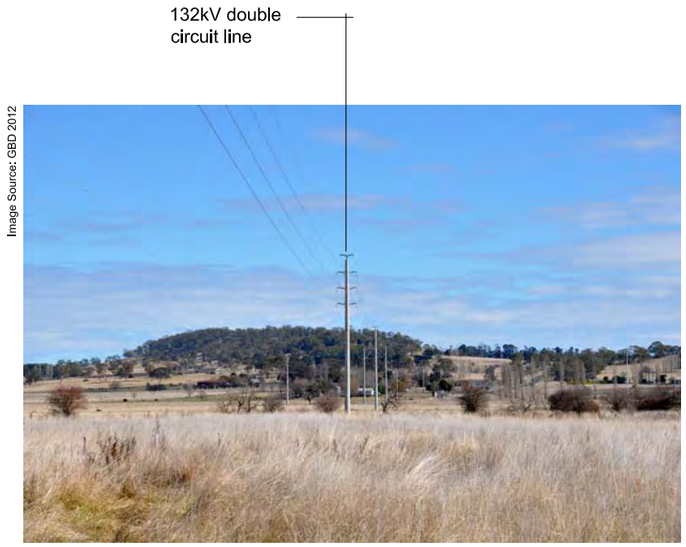
Comparative single and double circuit 132kV transmission line (supporting structures)



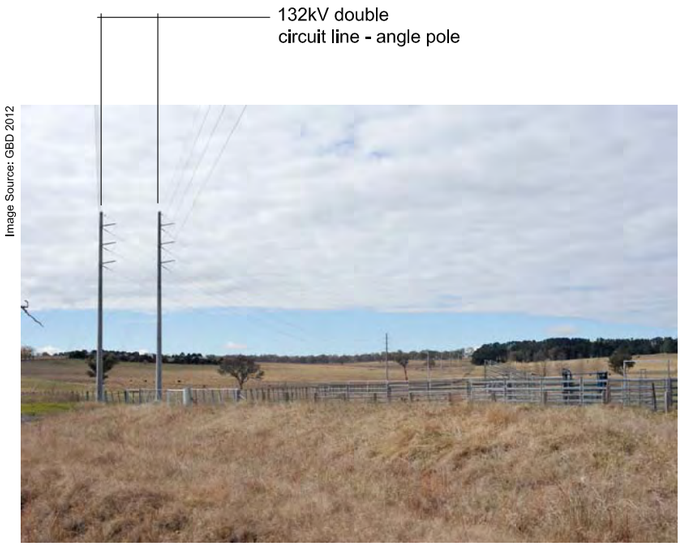
Double circuit 132kV transmission line (supporting structure) along road

Double circuit 132kV transmission line (angle pole structure) at road crossing

132kV double circuit line crossing rural agricultural land



132kV double circuit line crossing rural agricultural land



Double circuit 132kV transmission line (angle pole structure) at road crossing

Figure 84
Typcial double circuit 132 kV powerline

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Pre-construction and construction

Section 14

14.1 Potential visual impacts

There are potential visual impacts that could occur during both pre-construction and construction phases of the project. The wind farm construction phase is likely to occur over a period of around 30 months, although the extent and nature of pre-construction and construction activities would vary at different locations within the project area.

The key pre-construction and construction activities that would be visible from areas surrounding the proposed wind farm include:

- ongoing detailed site assessment including sub surface geotechnical investigations
- various civil works to upgrade local roads and access point
- construction compound buildings and facilities
- construction facilities, including portable structures and laydown areas
- various construction and directional signage
- mobilisation of rock crushing equipment and concrete batching plant (if required)
- excavation and earthworks and
- various construction activities including erection of wind turbines, monitoring masts and substation with associated electrical infrastructure works.

The majority of pre-construction and construction activities, some of which would result in physical changes to the landscape (which have been assessed in this LVIA report), are generally temporary in nature and for the most restricted to various discrete areas within or beyond the immediate wind farm project area. The majority of pre-construction and construction activities would be unlikely to result in an unacceptable level of visual impact for their duration and temporary nature.

Plate 10 Illustrating typical construction activities during turbine construction and installation.

(Image: Wind Prospect CWP Pty Ltd).

Perception and public consultation

Section 15

15.1 Perception

People's perception of wind farms is an important issue to consider as the attitude or opinion of individual people adds significant weight to the level of potential visual impact. The attitudes or opinions of individuals toward wind farms can be shaped or formed through a multitude of complex social and cultural values. Whilst some people may accept and support wind farms in response to global or local environmental issues, others may find the concept of wind farms completely unacceptable. Some may support the environmental ideals of wind farm development as part of a broader renewable energy strategy but do not consider them appropriate for their regional or local area. It is unlikely that wind farm projects will ever conform or be acceptable to all points of view; however, research within Australia as well as overseas consistently suggests that the majority of people who have been canvassed do support the development of wind farms.

Wind farms are generally easy to recognise in the landscape and to take advantage of available wind resources are more often located in elevated and exposed locations. The geometrical form of a wind turbine is a relatively simple one and can be visible for some distance beyond a wind farm, and the level of visibility may be accentuated by the repetitive or repeating pattern of multiple wind turbines within a local area. Wind farms do have a significant potential to alter the physical appearance of the landscape, as well as change existing landscape values.

15.2 Consultation

The Proponent has undertaken a wide range of consultative activities with the local community and stakeholders for the Bango wind farm project which commenced in April 2011. The opinions and perception of individuals from the local community and broader area were sought and provided through a range of consultation activities. These included:

- establishment of a Project website (www.bangowindfarm.com.au) for general information dissemination, announcements, feedback requests and documentation distribution
- letters of notification to various stakeholders, including local, state and national groups and agencies
- face-to-face notification (or letter drop where necessary) of neighbouring residents within a 3 km radius of the Project

- newsletters (x2), Public Opinion Surveys (x2), Landscape Values Survey, advertisements, media releases and press / radio interviews
- public open day held at Boorowa Bowling Club, Boorowa and
- ongoing consultation meetings with various stakeholders throughout the Project planning and design stages.

The public open day was held at the Boorowa Bowling Club on the 16th August 2012. The public open day provided an opportunity for members of the local community to view preliminary photomontages as well as other maps and plans illustrating layouts and potential locations for the project infrastructure. The open day also provided an opportunity for the local community to provide feedback (via a landscape values questionnaire) on their experience and personal values associated with the surrounding landscape.

An opportunity for members of the local community to provide feedback on potential landscape and visual impacts was provided through a landscape values questionnaire, made available at the public open day. The public open day was attended by almost forty people with one landscape values questionnaire being returned.

15.3 Quantitative research

Whilst published Australian research into the potential landscape and visual impacts of wind farms is limited, there are general corresponding results between the limited number that have been carried out when compared with those carried out overseas.

A recent survey was conducted by ARM Interactive on behalf of the NSW Department of Environment, Climate Change and Water (September 2010). The survey polled 2,022 residents across the 6 Renewable Energy Precincts established by the NSW Government; including the NSW/ACT Border Region Renewable Energy Precinct. Key findings of the survey indicated that:

- *97% of people across the Precincts had heard about wind farms or turbines, and 81% had seen a wind farm or turbine (in person or the media)*
- *85% of people supported the construction of wind farms in New South Wales, and 80% within their local region and*

- *79% supported wind farms being built within 10km of residences and 60% of people surveyed supported the construction of wind turbines within 1 to 2km from their residences.*

These results are reflected in other surveys including the community perception survey commissioned by Epuron for the *Gullen Range Wind Farm Environmental Assessment (August 2008).* The results of the survey, which targeted a number of local populations within the Southern Tablelands, suggested that around 89% of respondents were in favour of wind farms being developed in the Southern Tablelands, with around 71% of respondents accepting the development of a wind farm within one kilometre from their residential dwelling.

These general levels of support for wind farm developments have also been recorded for a number of wind farm developments around Australia as well as overseas.

Auspoll research carried out in February 2002 on behalf of a wind farm developer for a wind farm project in Victoria included just over 200 respondents. The results indicated that:

- *Over 92% of respondents agreed that wind farms can make a difference in reducing greenhouse emissions and mitigating the effects of global warming*
- *Over 88% disagreed with the statement that wind farms are ugly*
- *Over 93% of respondents identified 'interesting' as a good way to describe wind farms, over 73% nominating 'graceful' and over 55% selecting 'attractive'*
- *Over 79% of respondents thought that the wind farm would have a good impact on tourism, with 15% of respondents believing that the wind farm would make no difference and*
- *Over 40% of respondents believed that the impact of the wind farm on the visual amenity of the area would be good, with 40% believing that it would make no difference.*

A September 2002 MORI poll of 307 tourists conducted in Argyll (United Kingdom) indicated that:

- *43% maintained that the presence of wind farms had a positive impression of Argyll as a place to visit*
- *43% maintained that the presence of wind farms had an equally positive or negative effect*

- *Less than 8% maintained it had a negative effect and*
- *91% of tourists maintained that the presence of wind farms in Argyll made no difference to the likelihood of them visiting the area.*

There is no published Australian research on community attitudes to the impact of wind farms on landscape and visual issues before and after construction. However, overseas research in the United Kingdom conducted by MORI in 2003 indicated that:

- *Prior to construction 27% of people polled thought problems may arise from wind farm impact on the landscape and*
- *Following construction the number of people who thought the landscape has been spoiled was 12%.*

The majority of research carried out to date has focussed on public attitudes to wind farms and does not provide any indication for acceptable or agreed thresholds in relation to numbers and heights of turbines, and the potential effect of distance between turbines and view locations.

15.4 The broader public good

Whilst visual perceptions and attitudes of local communities toward wind farm developments are an important issue, and need to be assessed locally in terms of potential landscape and visual impacts, there is also an issue of the greater potential public benefit provided by renewable energy production. Wind farms are expected to make a contribution toward meeting the Government's commitment that 20% of Australia's electricity supply comes from renewable energy sources by 2020.

In the 2006 Land and Environment Court decision to grant, on an amended basis, consent for the construction of a wind farm at Taralga, Chief Judge Justice Preston said in his prologue to the judgement:

"The insertion of wind turbines into a non-industrial landscape is perceived by many as a radical change which confronts their present reality. However, those perceptions come in different hues. To residents, such as members of the Taralga Landscape Guardians Inc. (the Guardians), the change is stark and negative. It would represent a blight and the confrontation is with their enjoyment of their rural setting.

To others; however, the change is positive. It would represent an opportunity to shift from societal dependence on high emission fossil fuels to renewable energy sources. For them, the confrontation is beneficial – being one much needed step in the policy settings confronting carbon emission and global warming.

Resolving this conundrum – the conflict between the geographically narrower concerns of the guardians and the broader public good of increasing the supply of renewable energy – has not been easy. However, I have concluded that, on balance, the broader public good must prevail".

Whilst the exact circumstances between the Taralga wind farm and the Bango wind farm may differ, the comments provided by the Chief Judge make it clear that, in the circumstances of that case, there was a need for the broader public good to be put before the potential negative impacts on some members of the local community. Similar reasoning can be applied to the project.

Mitigation measures

Section 16

16.1 Mitigation measures

The British Landscape Institute states *'the purpose of mitigation is to avoid, reduce, or where possible remedy or offset any significant negative (adverse) effects on the environment arising from the proposed development' (2002).* In general mitigation measures would reduce the potential visual impact of the project in one of two ways:

- firstly, by reducing the visual prominence of the wind turbines and associated structures by minimising the visual contrast between the wind turbines and the landscape in which they are viewed and
- secondly, by screening views toward the wind turbines from specific view locations.

In relation to the first form of mitigation, the design of the turbine structures has been highly refined over a number of years to maximise their efficiency. The height of the supporting towers and dimensions of the rotors are defined by engineering efficiency and design criteria. Consequently, modification of the turbine design to mitigate potential visual impacts is not considered a realistic option.

Colour is one aspect of the wind turbine design that does provide an opportunity to reduce visual contrast between the turbine structures and the background against which they are viewed. The white colour that is used on a majority of turbine structures provides the maximum level of visual contrast with the background. This maximum level of visual contrast could be reduced through the use of an appropriate off white or grey colour for the turbines where the visual contrast would be reduced when portions of the turbine were viewed against the sky as well as for those portions viewed against a background of landscape. The final colour selection would, however, be subject to the availability of turbine models on the market at the time of ordering and to aviation safety requirements.

The potential visual impact of the project from specific view locations could be mitigated by planting vegetation close to the view locations. For instance, tree or large shrub planting close to a residence can screen potential views to individual or clusters of turbines. Similarly roadside tree planting can screen potential views of turbines from portions of road corridors.

The location and design of screen planting used as a mitigation measure is very site specific and requires detailed analysis of potential views and consultation with surrounding landowners. Planting vegetation would not provide effective mitigation in all circumstances and can reduce the extent of existing views available from residences or other view locations.

There is greater potential to mitigate the visual prominence for some of the ancillary structures and built elements associated with the wind farm through the appropriate selection of materials and colours, together with consideration of their reflective properties.

The potential visual impacts of vehicular tracks providing access for construction and maintenance can be mitigated by:

- minimising the extent of cut and fill in the track construction
- re-vegetating disturbed soil areas immediately after completion of construction works and
- using local materials as much as possible in track construction to minimise colour contrast.

16.2 Summary of mitigation measures

A summary of the mitigation measures available for the wind farm and powerline infrastructure is presented in **Tables 24** and **25**.

Table 24 - Mitigation measures summary

Safeguard	Implementation			
	Design	Site Preparation	Construction	Operation
Consider options for use of colour to reduce visual contrast between project structures and visible background.	✓			
Avoid use of advertising, signs or logos mounted on turbine structures, except those required for safety purposes.			✓	✓
If necessary, design and construct site control building and facilities	✓		✓	

Table 24 - Mitigation measures summary

Safeguard	Implementation			
	Design	Site Preparation	Construction	Operation
building sympathetically with nature of locality.				
If necessary, locate substations away from direct views from roads and residential dwellings.	✓		✓	
Enforce safeguards to control and minimise fugitive dust emissions.		✓	✓	✓
Restrict the height of permanent stockpiles to minimise visibility from outside the site.		✓	✓	
Minimise construction activities that may require night time lighting, and if necessary use low lux (intensity) lighting designed to be mounted with the light projecting inwards to the site to minimise glare at night.		✓	✓	✓
Minimise cut and fill for site tracks and revegetate disturbed soils as soon as possible after construction.		✓	✓	
Maximise revegetation of disturbed areas to ensure effective cover is achieved.			✓	
Consider options for planting screening vegetation in vicinity of nearby residences and along roadsides to screen potential views of turbines. Such works to be considered in consultation with local residents and authorities.	✓	✓	✓	
Undertake revegetation and off-set planting at areas around the site where required in consultation and agreement with landholders.	✓	✓	✓	

Table 25 – Powerline and substation, mitigation measures summary

Safeguard	Implementation			
	Design	Site Preparation	Construction	Operation
A careful and considered access route selection process to avoid sensitive view locations and loss of existing vegetation where possible.	✓		✓	
Wherever possible, select angle positions in strategic locations to minimise potential visual impact (e.g. avoiding, where possible, skyline views) and to provide a maximum setback from residential dwellings and road corridors.	✓		✓	
Selection of suitable component materials with low reflective properties.	✓		✓	
Selection of suitable storage areas for materials or plant with minimum visibility from residences and roads with screening where necessary.			✓	
Design for strategic tree or shrub planting between view locations and the powerline if required.	✓		✓	

Conclusion

Section 17

17.1 Summary

This LVIA has determined that the Bango wind farm would have an overall medium visual significance on the majority of involved, neighbouring and uninvolved dwellings located within the Bango wind farm 10 km viewshed. The Bango wind farm would have a slightly lower visual significance on views from surrounding road corridors and public spaces.

This LVIA has determined that the Bango wind farm project would have a high visual significance for nine dwellings within 2 km of the Bango wind turbines. One of the nine residential dwellings would be an uninvolved landowner. The balance of residential dwellings with a high visual significance would be involved and neighbouring landowners (three with dwellings and two with weekenders) subject to a negotiated agreement. This LVIA has also determined that the project will have a medium to high visual significance for three residential dwellings within 2 km of the proposed turbines. All three dwellings with a medium to high visual significance would be involved landowners.

This LVIA determined the overall landscape character sensitivity to be medium/medium to high. Some recognisable characteristics of the LCA's will be altered by the proposed project, and result in the introduction of visually prominent elements that will alter the perceived characteristics of the landscape. The potential extent and degree of alteration would be partially mitigated by existing and modified landscape elements within the landscape. The main characteristics of the landscape, including the pattern and combinations of landform and landcover will still be visually evident from within and beyond the project site boundary.

The LCA's identified and described in this LVIA are generally well represented throughout the surrounding Local Government Areas and more generally within other areas across the NSW/ACT Border Region Renewable Energy Precinct. This LVIA has determined that the landscape surrounding the project will have some ability to accommodate the physical changes associated with the wind farm and its associated structures.

Many of the residential dwellings surrounding the wind farm have been positioned within the landscape to mitigate exposure to inclement weather, or have adopted measures to reduce these impacts by planting and maintaining windbreaks around residential dwellings. The extent of windbreak planting reduces the potential visibility of the wind farm from a number of residential view locations in the surrounding landscape.

Wind turbines within the Bango wind farm project would be visible from a number of local roads beyond the project site, such as Lachlan Valley Way, Wargeila Road and the Boorowa-Rye Park Road. This LVIA has determined that views toward the Bango wind turbines would generally result in a low impact for the majority of motorists travelling through the area beyond the project site due to the short duration and transitory nature of effects, as well as the extent of screening provided by tree planting alongside road corridors. Wind turbines would be visible from some sections of local roads, including the Tangmangaroo and Harry's Creek Roads which pass through the project site. Views from unsealed roads within proximity to the project site will include some partial filtering through roadside planting and a locally undulating landform. Overall volumes of traffic on unsealed local access roads is very low and would tend to comprise journeys made by a number of the involved and neighbouring landowners.

This LVIA has determined that the construction of the project would result in some 'direct', 'indirect' or 'sequential' cumulative effects when considered in addition to existing or proposed wind farm developments, including the proposed Rye Park and Rugby wind farm projects. The potential for 'direct' and 'indirect' cumulative visual effects is likely to be more limited for residential dwellings within the 2 km viewshed where hill and ridgeline landforms, together with tree cover, directly influence the extent and degree of visibility between proposed and operational wind farm developments.

The proposed collector substation and switching station locations and proposed overhead powerline routes are unlikely to result in a significant visual effect for the majority of surrounding residential or public view locations. A combination of distance, undulating landform and tree cover between the collector substation, switching station and powerline structures to surrounding view locations would tend to result in a moderate to high visual absorption capability and reduction in overall visibility.

Both pre-construction and construction activities are unlikely to result in an unacceptable level of visual effect due to the temporary nature of these activities together with proposed restoration and rehabilitation strategies. The preferred location for some of the construction activities, including the on-site concrete batch plant and rock crushing equipment, would be located away from publicly accessible areas, with the closest residential view locations generally comprising involved landowners.

Although not currently proposed, night time obstacle lighting would have the potential to be visible from a number of surrounding view locations, as well as areas beyond the project 10 km viewshed. The level of visual effect would diminish when viewed from more distant view locations, with a greater probability of night time lighting being screened by landform and/or tree cover. It should also be noted that the night time lighting installed on the Cullerin wind farm (as illustrated in this LVIA) has been decommissioned by Origin Energy following a risk based aviation assessment. A number of recent wind farm developments in New South Wales have also been approved without a requirement for night time lighting, including the Gullen Range and White Rock Wind Farms. A number of other operational wind farm developments, including some in Victoria, have also had night lighting decommissioned.

Although some mitigation measures are considered appropriate to minimise the visual effects for a number of the elements associated with the wind farm, it is acknowledged that the degree to which the wind turbines would be visually mitigated is limited by their scale and position within the landscape relative to surrounding view locations.

The Proponent has engaged in ongoing consultation with local residents and made a number of adjustments to the location of individual turbines to minimise visual effects where possible.

Subject to any conditions of approval, the proponent would commit to negotiating and implementing landscape treatments to screen and mitigate the potential visual effect of the wind farm for individual neighbouring dwellings within an appropriate distance from the wind farm project area, subject to consultation and agreement with individual property owners.

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Limitations

GBD has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Bango Wind Farm Pty Ltd and only those third parties who have been authorised in writing by GBD to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the GBD Proposal dated 9th July 2012.

The methodology adopted and sources of information used are outlined in this report. GBD has made no independent verification of this information beyond the agreed scope of works and GBD assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to GBD was false.

This report was prepared between August 2012 and May 2016 and is based on the conditions encountered and information reviewed at the time of preparation. GBD disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

Appendix A – Draft NSW Planning Guidelines: Wind Farms. Meeting Assessment requirements, Landscape and visual amenity

Appendix A: Meeting assessment requirements

Where a wind farm application is State significant development (SSD), specific assessment requirements are specified in Director General's Requirements (DGRs). This appendix includes information to assist applicants with assessing particular impacts from a wind farm proposal in cases where DGRs require particular impacts to be assessed. The assessment must be detailed in the proponent's EIS.

Landscape and visual amenity

The visual impact of a wind farm depends on the extent of the change to the landscape caused by the development, taking into account:

- the visibility of the development
- the locations and distances from which the development can be viewed
- landscape values and their significance
- the sensitivity of the landscape features to change

The visual impact of the development relates to:

- the number, height, scale, spacing, colour and surface reflectivity of the wind turbines
- the quantity and characteristics of lighting, including aviation obstacle lighting (subject to CASA requirements and advice)
- potential for visual clutter caused by turbine layout and ability to view through a cluster or array (visually well ordered series) of turbines in an orderly manner
- the removal or planting of vegetation
- the location and scale of other buildings and works including transmission lines and associated access roads
- proximity to sensitive areas
- proximity to an existing or proposed wind farm, having regard to cumulative visual effects.

The features of the landscape include:

- the topography of the land
- the amount and type of vegetation
- natural features such as waterways, cliffs, escarpments, hills, gullies and valleys
- visual boundaries between major landscape types
- the type, pattern, built form, scale and character of development, including roads and walking tracks
- flora and fauna habitat
- cultural heritage sites
- the skyline

Assessing landscape and visual amenity impacts

DGRs typically require a comprehensive assessment of the impact of a proposed wind farm on the landscape character, landscape values, visual amenity and any scenic or significant vistas to be undertaken. There should be a particular focus on any neighbours' houses within 2 km of a proposed wind turbine that do not host the wind farm facility. The assessment should include:

- a description of the assessment methodology and a clear justification of it including discrete justification of the methodology for assessing impacts at neighbours' houses within 2 km of a proposed wind turbine
- a description of all relevant components of the project, including turbine heights and layout – where micro-siting or a range of turbines is proposed, the assessment should be based on the 'worst case' layout and turbine height
- a description of the landscape including key features

- a description of the visibility of the development
- photomontages of the project and associated transmission lines taken from:
  - potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights) within 2 km of a proposed wind turbine or other associated infrastructure (note that the number of photomontages may be reduced in less sensitive landscapes such as industrial areas),
  - urban settlements, and
  - significant public view points including roads, lookout points and walkways.
- identification of the zone of visual influence of the wind farm (no less than 10km)
- a description of the significance of the landscape values and character in a local and regional context
- a description of community and stakeholder values of the local and regional visual amenity and quality and perceptions of the project based on surveys and consultation.
- assessment of cumulative impacts on the landscape and any cumulative visual impacts from transmission line infrastructure and any surrounding approved or operational wind farms in the locality

Mitigating landscape and visual amenity impacts

The feasibility, effectiveness and reliability of proposed mitigation measures should be assessed. The extent of any residual impacts left over after mitigation measures have been implemented should also be described. Examples of mitigation measure that proponents can use to reduce the visual impact of a proposed wind farm include:

- where possible, locate turbines:
  - away from areas with high scenic values
  - away from areas with high visibility from local residents
- select turbines that :
  - look the same, have the same height and rotate the same way
  - are off-white or grey colouring
- minimise the removal of vegetation
- plant vegetation to provide a visual screen
- reduce impacts of night and obstacle lighting by
  - limiting lighting on towers to that required for safe operation and aviation safety and
  - use of lighting design which minimises glare
- underground electricity wires where practicable
- use alternative transmission line pole designs to minimise visual impact.

Appendix B – Supplementary Cumulative Landscape and Visual Impact Assessment

Supplementary Cumulative Landscape and Visual Impact Assessment Report for Bango Wind Farm

1 Introduction

This supplementary Cumulative Landscape and Visual Assessment (supplementary CLVIA) has been prepared in response to a request from the New South Wales Department of Planning and Environment (DPE) to provide additional information with regard to the potential cumulative visual impact of the Bango Wind Farm in addition to other proposed and approved wind farm developments within the surrounding landscape.

2 Information Provided To GBD

GBD confirm the following information has been provided by the Proponent for consideration and/or incorporation into this supplementary CLVIA:

- an updated wind turbine layout
- updated residential dwelling locations and
- a cumulative Zone of Theoretical Visibility (ZTV) diagram.

Information has also been provided by Rye Park Wind Farm Pty Ltd, which includes:

- the Rye Park wind turbine layout
- residential dwelling locations and
- a determination of potential visual impact with regard to the Rye Park Wind Farm layout.

3 Rugby Wind Farm Development

An application by REpower to construct and operate the Rugby Wind Farm and associated infrastructure comprising approximately 90 wind turbines has been withdrawn from the DPE. As the Rugby Wind Farm project has been withdrawn it is no longer considered pertinent to the Bango Wind Farm CLVIA.

Whilst the former Rugby Wind Farm proposal, which included wind turbines to the north and north east of the Bango Wind Farm, has been included in the Bango Wind Farm LVIA (Section 10 Cumulative Assessment), it has not been included in this supplementary CLVIA.

4 CLVIA Guidelines

This supplementary CLVIA has been prepared with regard to industry standard guidelines including:

Guidance for Assessing the Cumulative Impacts of Onshore Wind Energy Developments, Scottish Natural Heritage, March 2012 (SNHG); and

Guidelines for Landscape and Visual Impact Assessment (Chapter 7 Assessing cumulative landscape and visual effects), Third Edition, Landscape Institute and Institute of Environmental Management & Assessment, 2013 (GLVIA).

The SNHG describes cumulative impact of a wind farm development on landscape and visual amenity as a product of the:

- distance between individual wind farms (or turbines)
- distance over which they are visible
- overall character of the landscape and its sensitivity to wind farm
- siting and design of the wind farm themselves and
- way in which the landscape is experienced.

The GLVIA notes cumulative effects as the 'additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments taken together'. The GLVIA also notes that the emphasis of the cumulative assessment should 'be on **likely significant** effects rather than on comprehensive cataloguing of every conceivable effect that might occur'.

5 Cumulative landscape effects

The SNHG state that cumulative landscape effects include the potential impact on the 'physical fabric of the landscape which arises when two or more developments affect landscape components (such as woodland, water bodies or rural roads). Cumulative effects may also occur when two or more developments change the landscape character to such an extent that they create a different landscape character type.

The SNHG also state that wind farms may 'have a cumulative effect on the character of landscapes recognised to be of special value', 'where considered rare, unusual, highly distinctive or the best or most representative in a given area'.

The assessment and determination of potential cumulative landscape effects has considered and addressed different types of effects that may arise. Types of cumulative effect are identified and discussed in the following Table.

6 Cumulative visual effects

The GLVIA describes cumulative visual effects as those caused by combined visibility, which 'occurs where the observer is able to see two or more developments from one view point' and/or sequential effects which 'occur when the observer has to move to another viewpoint to see different developments'.

Cumulative effects on visual amenity can be caused by combined visibility and/or sequential effects. Combined visibility and sequential effects have been described in the Bango Wind Farm LVIA (Chapter 10 Cumulative assessment). The following Table outlines types of cumulative visual effects considered in the SNHG.

Table 1 – Types of cumulative visual effects

• Generic	• Specific	• Characteristics
Combined Occurs where the observer is able to see two or more developments from one viewpoint.	In combination	Where two or more developments are or would be within the observer's arc of vision at the same time without moving her/his head.
	In succession	Where the observer has to turn her/his head to see the various developments –

Table 1 – Types of cumulative visual effects

• Generic	• Specific	• Characteristics
		actual and visualised.
Sequential Occurs when the observer has to move to another viewpoint to see the same or different developments. Sequential effects may be assessed for travel along regularly used routes such as major roads or popular paths.	Frequently sequential	Where the features appear regularly and with short time lapses between instances depending on speed of travel and distance between the viewpoints.
	Occasionally sequential	Where longer time lapses between appearances would occur because the observer is moving very slowly and/or there are larger distances between the viewpoints.

7 Supplementary CLVIA study area

The supplementary CLVIA study area has been defined by reference to the Secretary's Environmental Assessment Requirements (SEARs) for the Bango Wind Farm project. The SEARs identified a zone of visual influence at no less than 10 kilometres from the wind farm.

The CLVIA study area has been established by overlapping the 10 km offset from the Bango and Rye Park Wind Farms which results in an area of 345 km^2. This area is considered to be adequate, reasonable and in proportion to the nature of the Bango Wind Farm project. The consideration of cumulative impact within the Bango Wind Farm LVIA identified other wind farms up to 70 km from the Bango Wind Farm site.

This supplementary CLVIA study area has been subdivided into four areas. These include:

- Area A - where residential dwellings are located within 5 km of both Bango and Rye Park wind turbines
- Area B - where residential dwellings are located with within 5 km of a Bango wind turbine and beyond 5 km of a Rye Park wind turbine
- Area C - where residential dwellings are located with within 5 km of a Rye Park wind turbine and beyond 5 km of a Bango wind turbine and
- Area D - where residential dwellings are located beyond 5 km of a Bango and Rye Park wind turbine.

This supplementary CLVIA has identified visual receptors from the desktop and field work as detailed in the Bango and Rye Park Wind Farm LVIA. These include residential receptors within the Bango and Rye Park Wind Farm viewshed and specifically those located within 5 km of the Bango and Rye Park wind turbines, as well as views from vehicles travelling along the local roads.

This supplementary CLVIA has not included a detailed assessment or determination of cumulative visual impacts for receiver locations beyond 5 km of the proposed Bango and Rye Park wind turbine locations. Whilst proposed wind turbines within each project would be visible from residential dwellings beyond 5 km, the overall visual scale of the proposed wind turbines within the landscape at a 5 kilometre (and over) view distance is unlikely to result in an order of visual magnitude that would result in high visual impact.

The supplementary CLVIA study area is illustrated in **Figure 1**.

The CLVIA study area has also been defined through preparation of zone of theoretical visibility (ZTV) diagrams. The ZTV diagrams, illustrated in **Figures 2**, **3**, **4** and **5**, identify areas in which the Bango and Rye Park wind turbine visibility overlaps and where people may be able to see wind turbines located in one or more projects and result in a potential cumulative visual impact.

The ZTV diagrams have been prepared from 'tip of blade' and 'hub height' and represent potential views toward a wind turbine up to and including the tips of the rotor blades and, in the case of hub height, up to half the wind turbine rotor face above surrounding hills and ridgelines. Actual wind turbine visibility depends on a variety of factors which include:

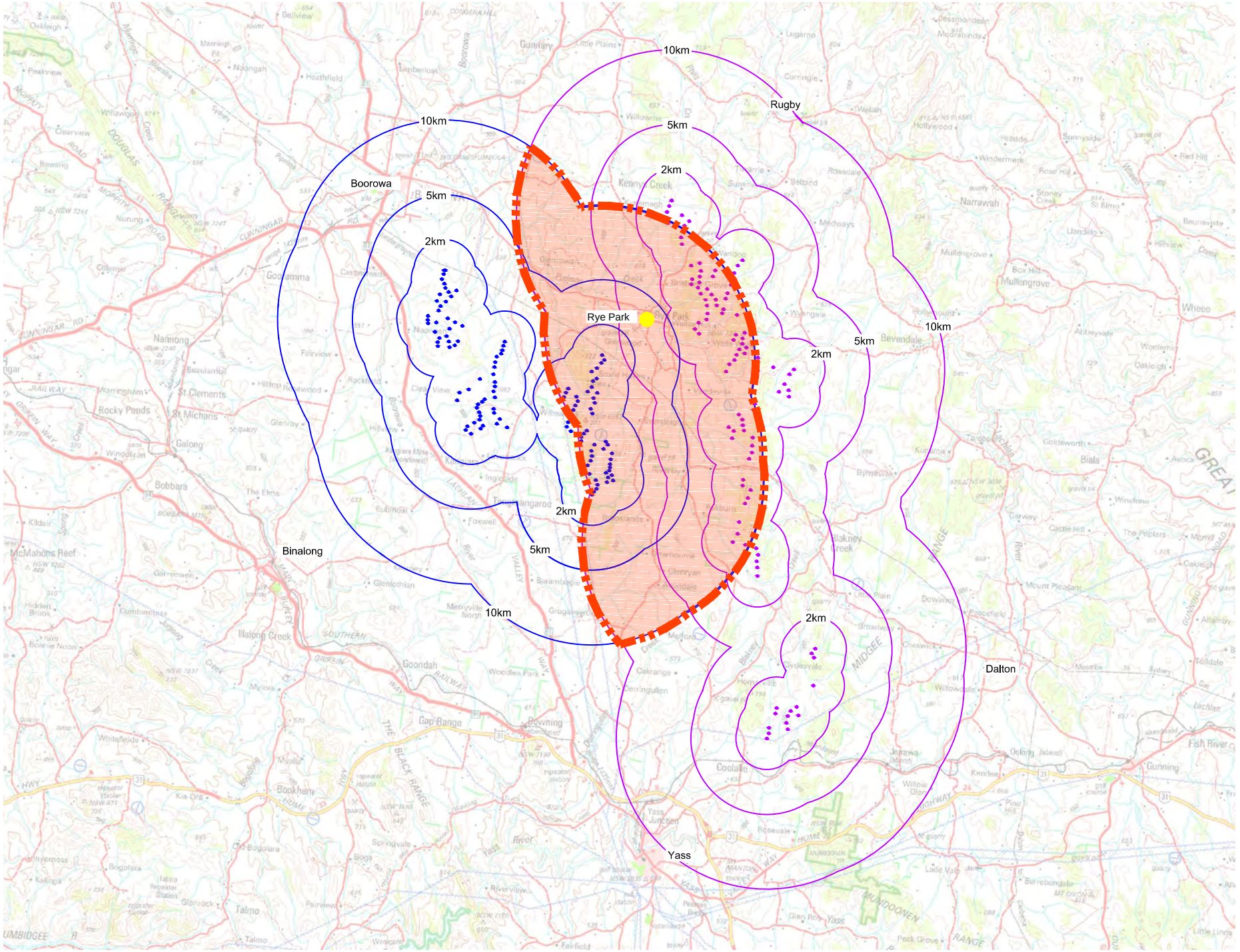
- topography
- aspect
- vegetation
- buildings or other visual obstructions
- elevation
- distance and direction of view and
- weather and light conditions.

Of these factors, vegetation and buildings or other visual obstructions may significantly influence views toward the Bango and Rye Park wind turbines but are not illustrated in the ZTV diagrams. The ZTV diagrams are therefore a very conservative tool in the determination of potential wind turbine visibility.

8 Identification and scoping of wind farm projects

Whilst the focus of this supplementary CLVIA is within a 10 km viewshed of the Bango and Rye Park Wind Farms, it has also included the scoping of wind farm developments within, and up to a 30 km distance of the Bango Wind Farm.

The following Tables outline the relative location and general details of wind farm projects which are located within 30 km of the Bango Wind Farm. The LVIA also notes and identifies operational, approved and proposed wind farm developments within the Bango Wind Farm regional context (refer Bango Wind Farm LVIA, Figure 29).



Legend

- Proposed Rye Park wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Rye Park wind turbine
- Distance from proposed Bango wind turbine
- Cumulative Landscape and Visual Assessment study area

Figure B1 - Cumulative Landscape and Visual Assessment Study Area

BANGO WIND FARM

0m 3km 6km

cwp Renewables

GREEN BEAN DESIGN
landscape architects

Table 2 – Wind Farms within Bango Wind Farm 10 km viewshed

• Wind Farm	• Proponent	• Status	• Number of turbines within 10km
• Rye Park	• Trustpower	• Planning	• 88

The distance between the closest Bango and Rye Park wind turbine would be 6.4 kilometres.

Table 3 – Other wind farm turbines within the Bango Wind Farm 30km viewshed

• Wind Farm	• Approximate number of turbines within Bango 30km viewshed	• Approximate distance between closest wind farm turbines
• Yass (Coppabella Precinct)	• 79	• 24 km
• Conroy's Gap	• 15	• 23 km

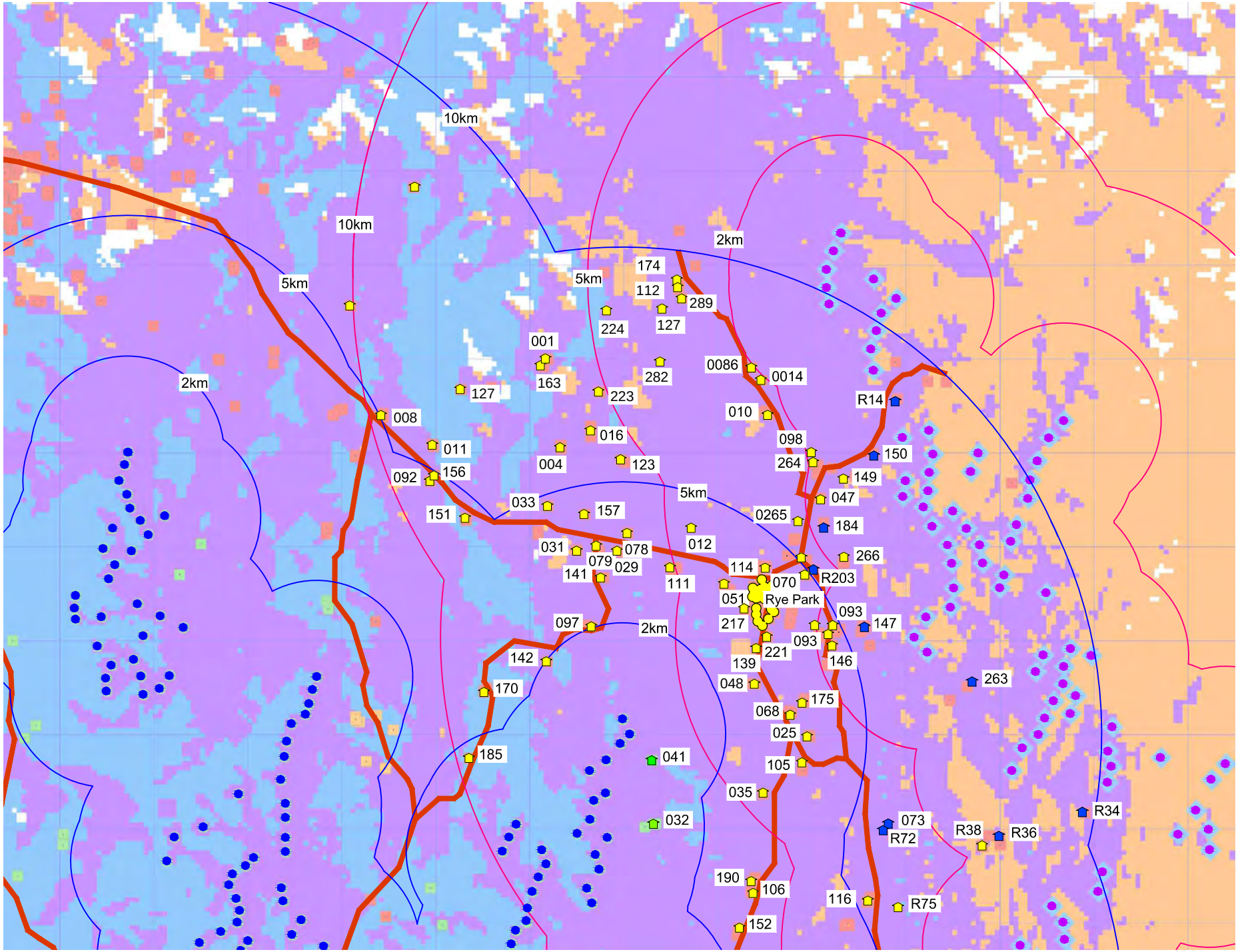
Whilst opportunities may exist for largely indirect views between the Bango, Yass and Conroy's Gap Wind Farms, the majority of dwellings assessed within the Bango Wind Farm LVIA would not experience any significant level of additional visual impact in association with the Yass and Conroy's Gap Wind Farm projects. The lack of potential cumulative visual impact results from:

- distance between wind turbines within the wind farm developments
- indirect nature of views for the majority of dwellings located between the Yass, Conroy's Gap and Bango Wind Farms
- distribution and extent of tree cover, including roadside vegetation and tree planting around urban development and
- landform characteristics beyond the Bango Wind Farm 10 km viewshed which tend to restrict views toward Bango Wind Farm.

9 Cumulative landscape effects

This supplementary CLVIA has adopted the baseline landscape character assessment from the Bango and Rye Park Wind Farm LVIA. Both LVIA identified landscape units within the CLVIA viewshed that are well represented and common across the Southern Tableland regional landscape. The landscape surrounding both wind farms was also determined to have an overall medium/medium to high sensitivity to accommodate change, and whilst some landscape characteristics are likely to be altered by the wind farm; the landscape will have some capability to accommodate change. This capability is largely derived from the presence of predominantly large scale and open landscape across portions of the wind farm viewshed.

Both LVIA concluded that the landscape character of the area in which the wind farms would be located is a cultural landscape that has been fundamentally modified to establish rural and agricultural industrial land uses



Legend

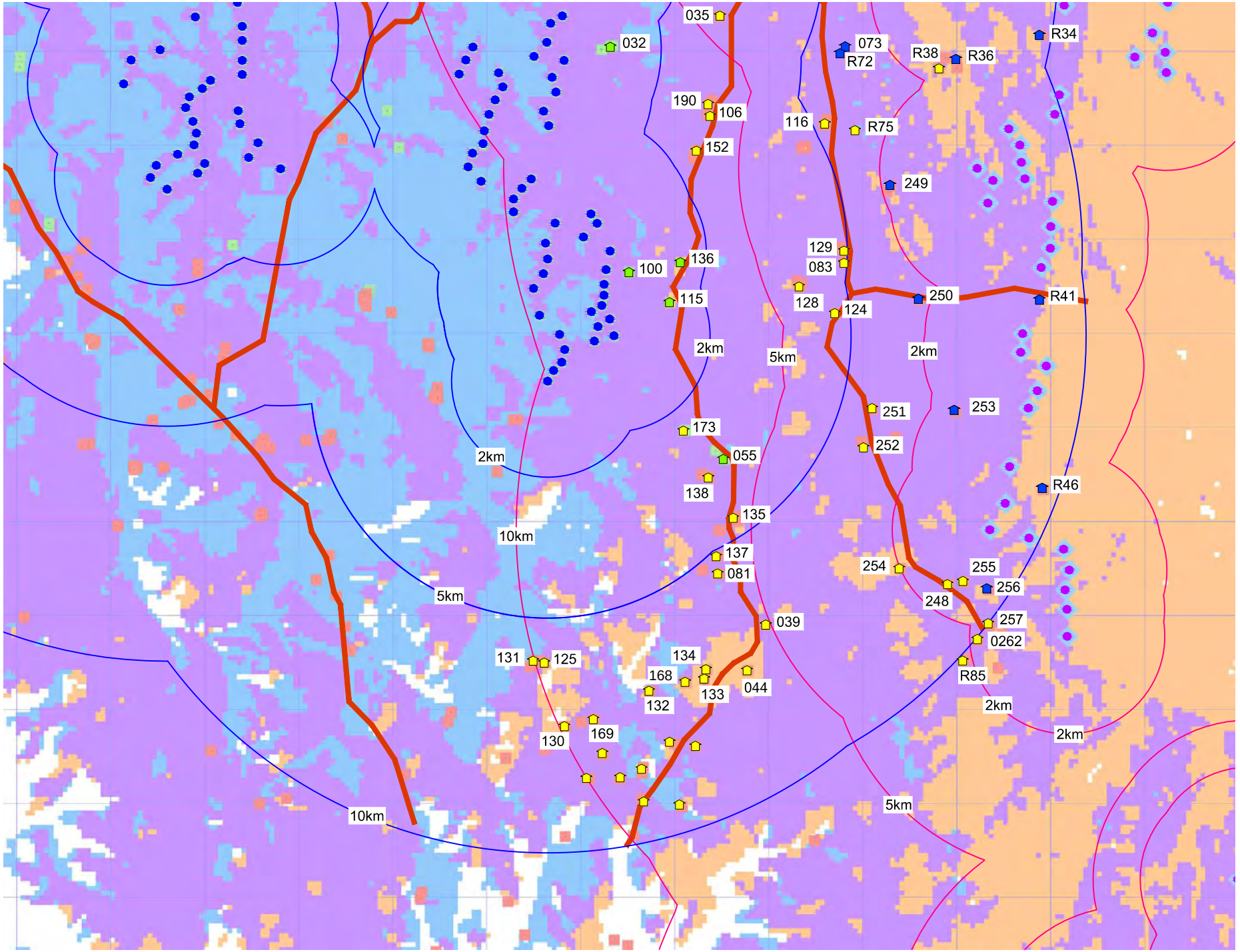
- Proposed Rye Park wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Rye Park wind turbine
- Distance from proposed Bango wind turbine
- Rye Park involved residential dwelling
- Bango involved residential dwelling
- Uninvolved dwelling
- Road
- Location with theoretical view toward proposed Rye Park wind turbines only
- Location with theoretical view toward proposed Bango wind turbines only
- Location with theoretical view toward Rye Park and Bango wind turbines

Figure B2 - Cumulative ZTV Tip of blade (north)

BANGO WIND FARM

cwp Renewables

GREEN BEAN DESIGN
landscape architects



Legend

- Proposed Rye Park wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Rye Park wind turbine
- Distance from proposed Bango wind turbine
- Rye Park involved residential dwelling
- Bango involved residential dwelling
- Uninvolved dwelling
- Road
- Location with theoretical view toward proposed Rye Park wind turbines only
- Location with theoretical view toward proposed Bango wind turbines only
- Location with theoretical view toward Rye Park and Bango wind turbines

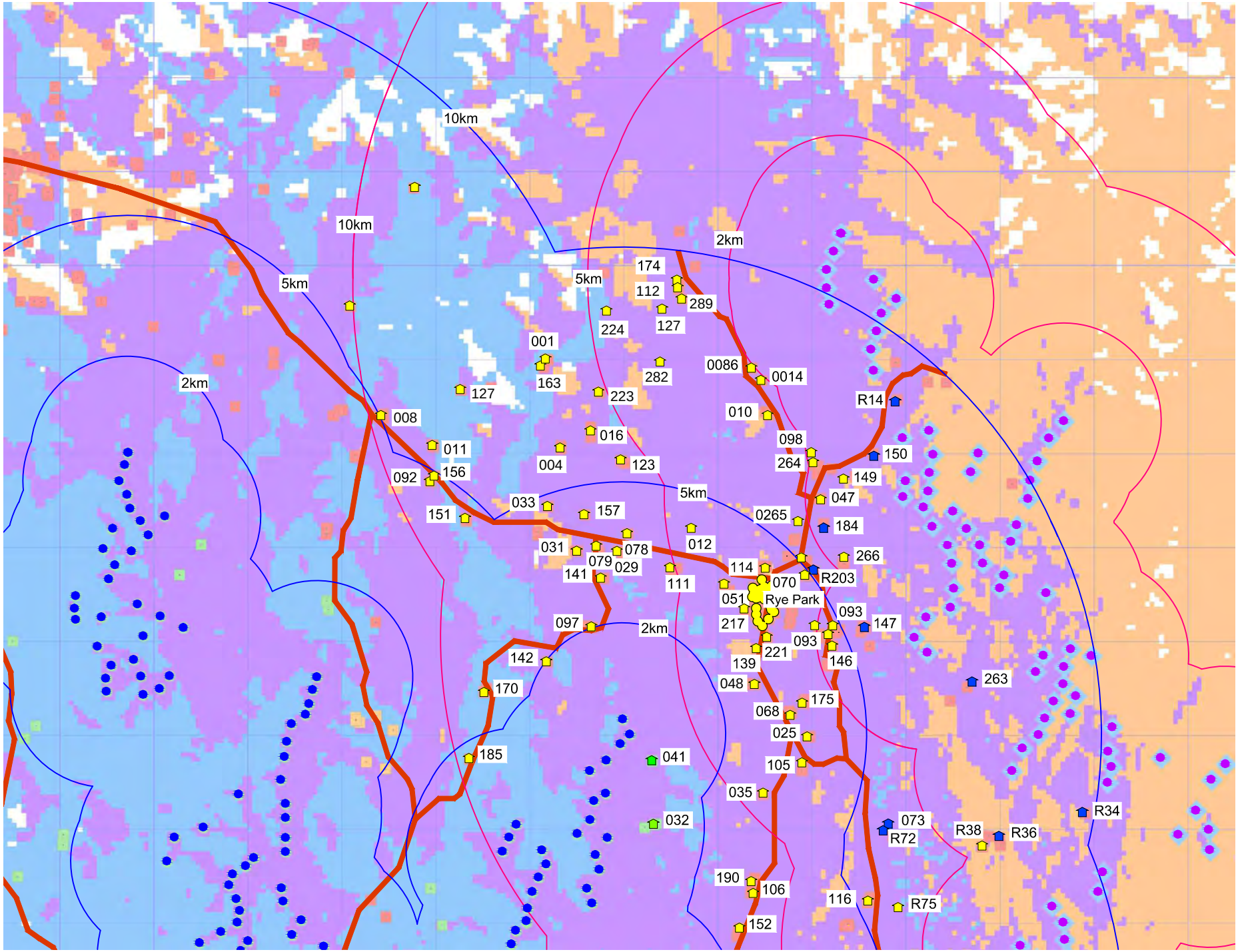
BANGO WIND FARM

0m 1km 2km

Figure B3 -
Cumulative ZTV Tip of blade (south)

cwp Renewables

GREEN BEAN DESIGN
landscape architects

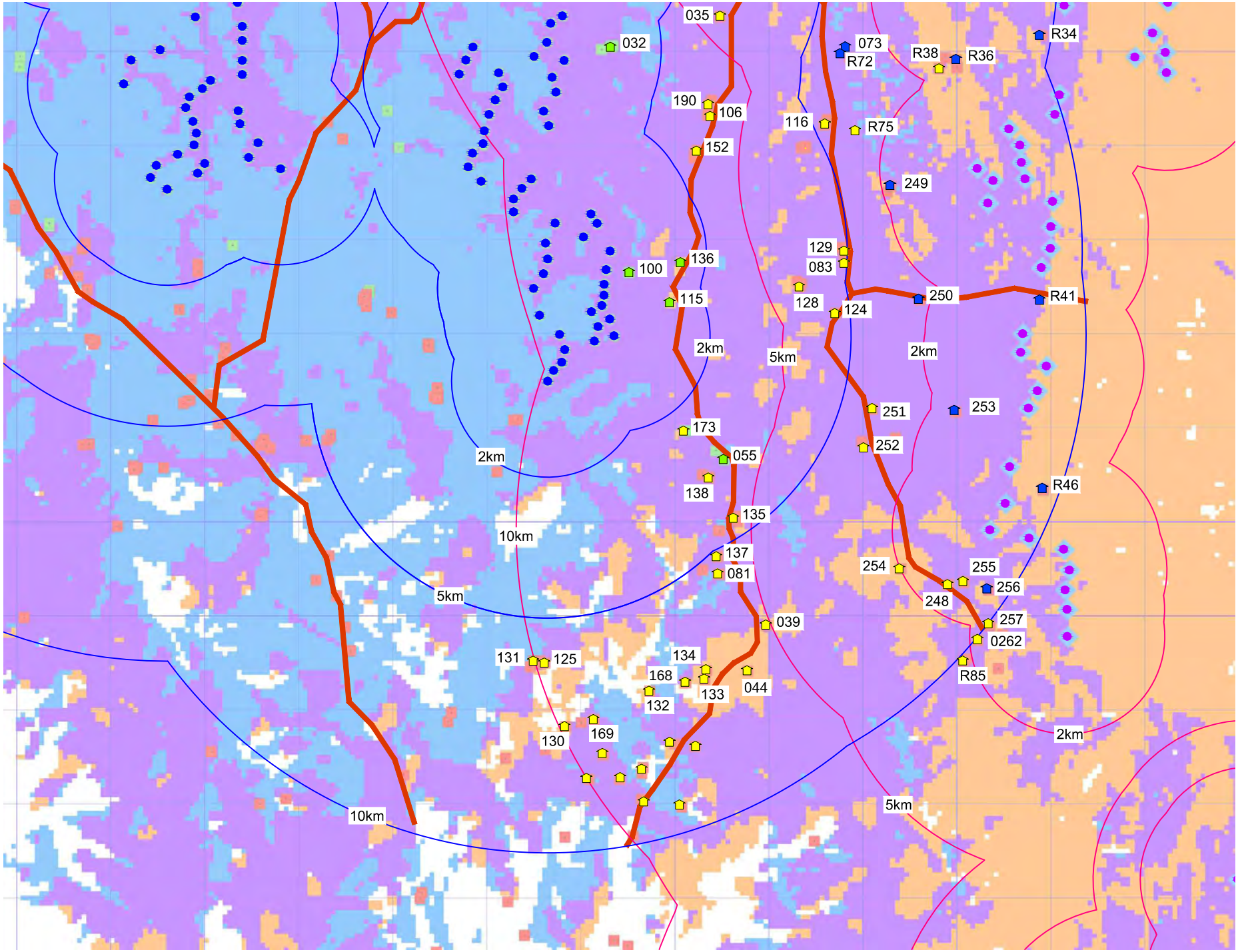


BANGO WIND FARM

Figure B4 -
Cumulative ZTV Hub height (north)

cwp Renewables

GREEN BEAN DESIGN
landscape architects



Legend

- Proposed Rye Park wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Rye Park wind turbine
- Distance from proposed Bango wind turbine
- Rye Park involved residential dwelling
- Bango involved residential dwelling
- Uninvolved dwelling
- Road
- Location with theoretical view toward proposed Rye Park wind turbines only
- Location with theoretical view toward proposed Bango wind turbines only
- Location with theoretical view toward Rye Park and Bango wind turbines

Figure B5 - Cumulative ZTV Hub height (south)

BANGO WIND FARM

0m 1km 2km

CWP Renewables

GREEN BEAN DESIGN
landscape architects

and is therefore not a 'natural' landscape of high visual quality. The Bango and Rye Park Wind Farm LVIA did not determine the landscape surrounding each project to be of 'special value' or considered rare, unusual, highly distinctive or most representative of the regional landscape typology.

The wind farms are considered largely compatible in relation to existing landscape characteristics and the broad nature of both scale and pattern across the regional landscape.

10 Cumulative visual effects

The following assessment considers and determines the potential cumulative visual effects for people at residential dwellings within 10 km of the Bango and Rye Park wind turbines. The cumulative visual effects have been determined in addition to the visual impacts determined in the Bango Wind Farm LVIA.

The methodology for the assessment of cumulative visual effects follows the methodology adopted in the Bango Wind Farm LVIA. The overall determination of cumulative visual effects resulting from the construction and operation of the Bango Wind Farm will result primarily from a combination of receiver sensitivity and the magnitude of cumulative visual effects.

A determination of cumulative visual effects from the combination of receiver sensitivity and the magnitude of cumulative visual effect is based on a well established methodology and has been applied extensively on VIA in New South Wales and across Australia. The standard methodology is set out in industry and best practice guidelines including the *Guidelines for Landscape and Visual Impact Assessment*, Third Edition, Landscape Institute and Institute of Environmental Management & Assessment, 2013 – Chapter 6 Assessment of visual effects.

Judging the sensitivity of visual receivers needs to take account of the occupation or activity of people experiencing the view at particular locations and the extent to which their attention or interest is focussed on views toward the Bango and Rye Park Wind Farms.

The sensitivity of visual receptors has been determined and described in this VIA by reference to:

- the location and context of the view point;
- the occupation or activity of the receptor.

For the purpose of this supplementary CLVIA the following table sets out various categories of receivers and their relative sensitivity.

Table 4 – Receiver sensitivity

Criteria	Definition
High Sensitivity (e.g. Residential dwellings, visitors to scenic areas or National Parks)	People with a proprietary interest and prolonged viewing opportunities such as those in dwellings or visitors to attractive and/or well-used recreational facilities. Views from a regionally important location whose interest is specifically focussed on the landscape e.g. from lookouts or areas within National Parks.

Table 4 – Receiver sensitivity

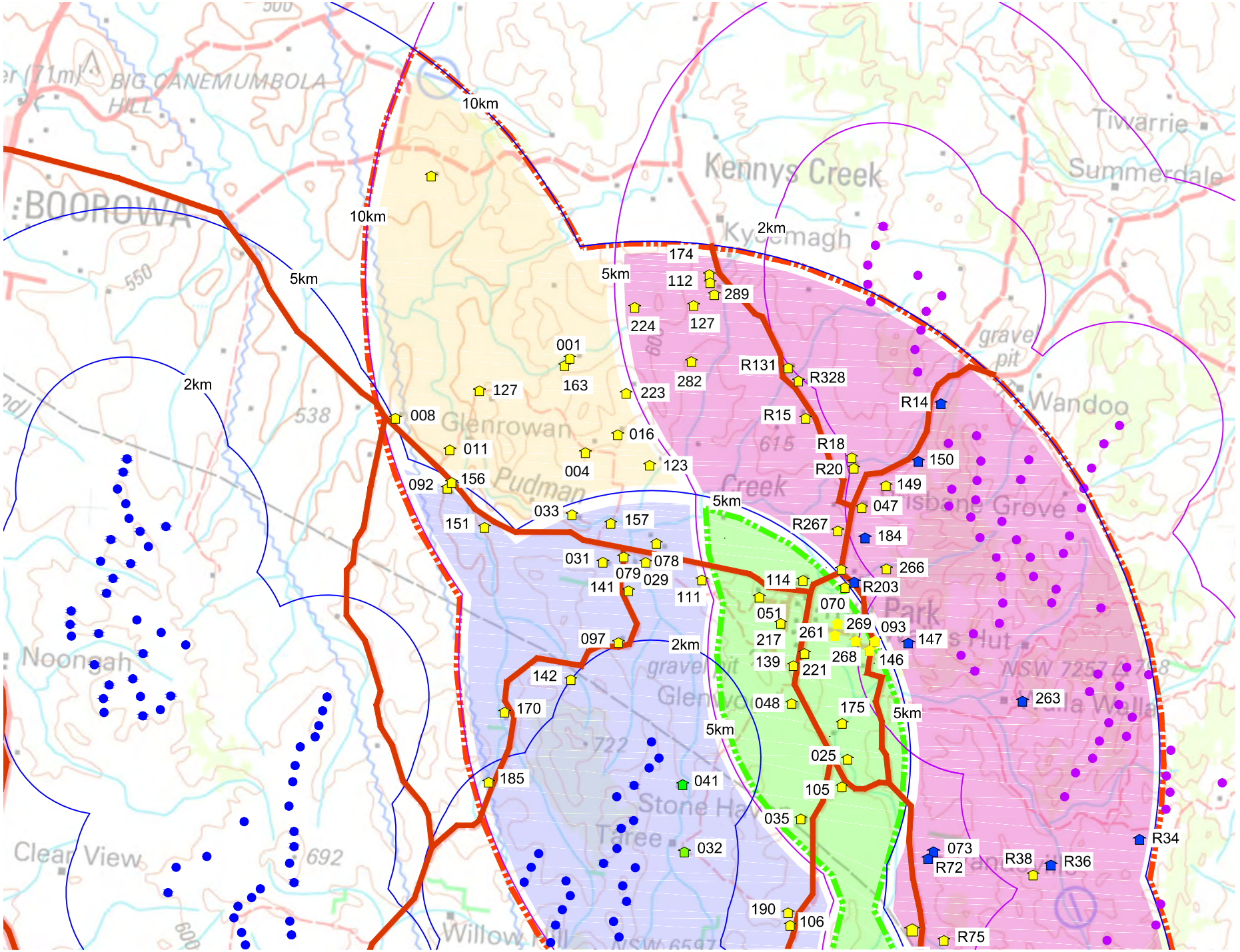
Criteria	Definition
Moderate Sensitivity (e.g. recreational spaces, outdoor pursuits)	People with an interest in their environment e.g. visitors to State Recreation Areas, bush walkers and horse riders etc…those travelling with an interest in their surroundings
Low Sensitivity (e.g. local roads, rural employment)	People with a passing interest in their surroundings e.g. those travelling along local roads between townships, or people whose interest is not specifically focussed on the wider landscape e.g. service providers or commuters.
Very Low (e.g. highways, business or industrial areas)	People with no specific interest in their surroundings or those with occasional and transient views travelling at speed along highways or from a place of work where attention may not be focussed on surrounding views.

The criterion used to evaluate the magnitude of cumulative visual effects at residential view locations includes consideration of:

- distance from view location to wind turbines within Bango and Rye Park Wind Farms
- visibility with regard to direct or indirect views
- direction of operating, approved or proposed wind farm relative to the view location
- existing Bango and Rye Park LVIA rating for residential dwellings within Area A
- angle of visual separation (to the north and south of residential dwellings) between the Bango and Rye Park Wind Farm turbines and
- the screening influence of existing vegetation.

A professional judgement of the combination of sensitivity and magnitude provides the rating of cumulative visual effect for receiver locations.

The location of the residential dwellings within 10 km of the Bango and Rye Park wind turbines are illustrated in **Figures 6** and **7**. Unoccupied residential dwellings have been included and assessed as part of this supplementary CLVIA where structures and buildings were considered to be habitable at the time of the field work undertaken for the Bango Wind Farm LVIA. **Table 5** presents an assessment matrix for residential dwellings within Area A, where dwellings are located within 5 km of the Bango and Rye Park wind turbines.



Legend

- Proposed Rye Park wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Rye Park wind turbine
- Distance from proposed Bango wind turbine
- Rye Park involved residential dwelling
- Bango involved residential dwelling
- Uninvolved dwelling
- Road
- Cumulative study area
- Area A within 5 km of Rye Park and Bango wind turbines
- Area B within 5 km of Bango wind turbines but beyond 5 km of Rye Park wind turbines
- Area C within 5 km of Rye Park wind turbines but beyond 5 km of Bago wind turbines
- Area D beyond 5 km of Rye Park and Bango wind turbines

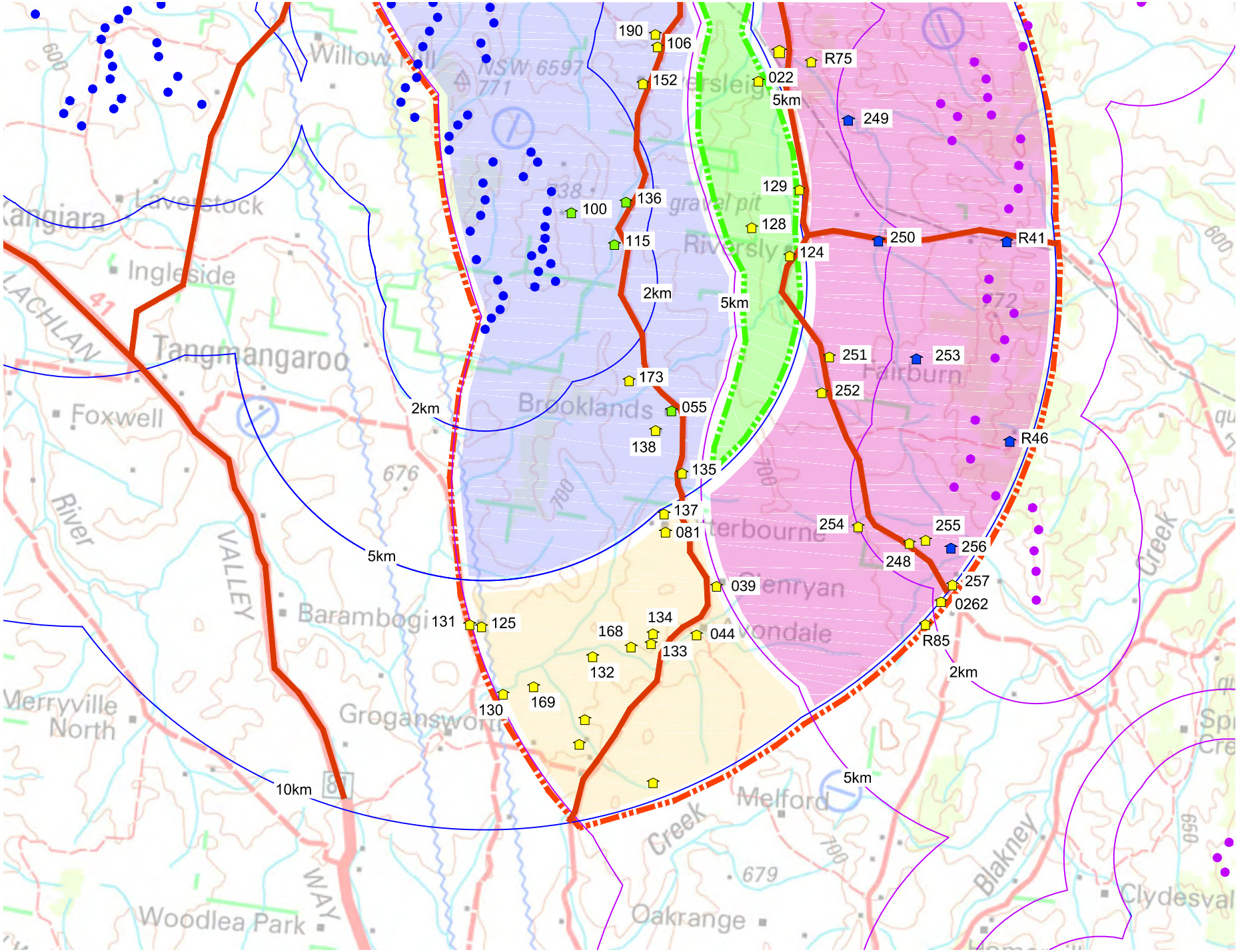
Figure B6 -
Cumulative Landscape and Visual Assessment
Residential dwellings (north)

BANGO WIND FARM

0m 1km 2km

CWP Renewables

GREEN BEAN DESIGN
landscape architects



Legend

- Proposed Rye Park wind turbine
- Proposed Bango wind turbine (Layout Option 1)
- Distance from proposed Rye Park wind turbine
- Distance from proposed Bango wind turbine
- Rye Park involved residential dwelling
- Bango involved residential dwelling
- Uninvolved dwelling
- Road
- Cumulative study area
- Area A within 5 km of Rye Park and Bango wind turbines
- Area B within 5 km of Bango wind turbines but beyond 5 km of Rye Park wind turbines
- Area C within 5 km of Rye Park wind turbines but beyond 5 km of Bago wind turbines
- Area D beyond 5 km of Rye Park and Bango wind turbines

Figure B7 -
Cumulative Landscape and Visual Assessment
Residential dwellings (south)

BANGO WIND FARM

0m 1km 2km

CWP Renewables

GREEN BEAN DESIGN
landscape architects

Table 5 Area A Assessment Matrix – residential dwellings within 5 km of Bango and Rye Park wind turbines

• Bango receiver viewpoint ID	• Corresponding Rye Park receiver viewpoint	• Associated or non associated	• Approximate distance to closest Bango and Rye Park wind turbine (metres)	• Approximate view angle between Bango and Rye Park wind turbines (degrees)	• Direct or indirect view between Bango and Rye Park wind farm turbines	• Bango visual impact rating	• Bango and Rye Park visibility	• Cumulative visual impact
114	R288	Non associated	Bango: 4.4 km	North 148	Indirect	Bango: Nil/Low	Bango and Rye Park wind turbine inter-visibility would be partially restricted by tree planting surrounding and to the south of the residential dwelling, as well as tree planting alongside the Boorowa Road.	Sensitivity: High Magnitude: Low **Cumulative impact: Low**
			Rye Park: 3.2km	South 31		Rye Park: Moderate		
051	R284	Non associated	Bango: 3.6 km	North 160	Indirect	Bango: Low	Bango and Rye Park wind turbine inter-visibility would be partially restricted by tree planting and a low undulating landform above and beyond the residential dwelling.	Sensitivity: High Magnitude: Low **Cumulative impact: Moderate-low**
			Rye Park: 4.2 km	South 30		Rye Park: Moderate		

Table 5 Area A Assessment Matrix – residential dwellings within 5 km of Bango and Rye Park wind turbines

• Bango receiver viewpoint ID	• Corresponding Rye Park receiver viewpoint	• Associated or non associated	• Approximate distance to closest Bango and Rye Park wind turbine (metres)	• Approximate view angle between Bango and Rye Park wind turbines (degrees)	• Direct or indirect view between Bango and Rye Park wind farm turbines	• Bango visual impact rating	• Bango and Rye Park visibility	• Cumulative visual impact
070	R204	Non associated	Bango: 4.9 km	North 134	Indirect	Bango: Nil/Low	Bango and Rye Park wind turbine inter-visibility would be restricted by tree planting surrounding and beyond the residential dwelling.	Sensitivity: High Magnitude: Low **Cumulative impact: Nil/Low**
			Rye Park: 2.7 km	South 33		Rye Park: Moderate-low		
217	R183	Non associated	Bango: 3.5 km	North 145	Indirect	n/a	Bango and Rye Park wind turbine inter-visibility would be restricted by tree planting surrounding the shed (and/or dwelling) and broader areas of tree cover within the north of the Rye Park Village.	**Cumulative impact: Nil/Low**
			Rye Park: 3.6 km	South 32		Moderate-low		

Table 5 Area A Assessment Matrix – residential dwellings within 5 km of Bango and Rye Park wind turbines

• Bango receiver viewpoint ID	• Corresponding Rye Park receiver viewpoint	• Associated or non associated	• Approximate distance to closest Bango and Rye Park wind turbine (metres)	• Approximate view angle between Bango and Rye Park wind turbines (degrees)	• Direct or indirect view between Bango and Rye Park wind farm turbines	• Bango visual impact rating	• Bango and Rye Park visibility	• Cumulative visual impact
268	R266	Non associated	Bango: 4.9 km	North 134	Indirect	Bango: Low	Bango and Rye Park wind turbine inter-visibility would be restricted by a gently rising landform above and to the west of the residential dwelling as well as some scattered tree cover within surrounding paddocks and alongside creeklines.	Sensitivity: High Magnitude: Low **Cumulative impact: Low**
			Rye Park: 2.1 km	South 33		Rye Park: Moderate-low		
269	R269	Non associated	Bango: 4.3 km	North 134	Indirect	Bango: Low	Bango and Rye Park wind turbine inter-visibility would be restricted by a gently rising landform	Sensitivity: High Magnitude: Low **Cumulative impact:**

Table 5 Area A Assessment Matrix – residential dwellings within 5 km of Bango and Rye Park wind turbines

• Bango receiver viewpoint ID	• Corresponding Rye Park receiver viewpoint	• Associated or non associated	• Approximate distance to closest Bango and Rye Park wind turbine (metres)	• Approximate view angle between Bango and Rye Park wind turbines (degrees)	• Direct or indirect view between Bango and Rye Park wind farm turbines	• Bango visual impact rating	• Bango and Rye Park visibility	• Cumulative visual impact
			Rye Park: 2.7 km				above and to the west of the residential dwelling as well as some scattered tree cover within surrounding paddocks and alongside creeklines.	**Low**
261	R270	Non associated	Bango: 4.1 km Rye Park: 2.7	North 134	Indirect	Bango: Low	Bango and Rye Park wind turbine inter-visibility would be restricted by a gently rising landform above and to the west of the residential dwelling as well as some scattered tree cover within surrounding paddocks and alongside creeklines.	Sensitivity: High Magnitude: Low **Cumulative impact: Low**

Table 5 Area A Assessment Matrix – residential dwellings within 5 km of Bango and Rye Park wind turbines

• Bango receiver viewpoint ID	• Corresponding Rye Park receiver viewpoint	• Associated or non associated	• Approximate distance to closest Bango and Rye Park wind turbine (metres)	• Approximate view angle between Bango and Rye Park wind turbines (degrees)	• Direct or indirect view between Bango and Rye Park wind farm turbines	• Bango visual impact rating	• Bango and Rye Park visibility	• Cumulative visual impact
093	R26	Non associated	Bango: 4.9 km Rye Park: 1.7 km	North 118 South 36	Indirect	Bango: Low Rye Park: Moderate-low	Bango and Rye Park wind turbine inter-visibility would be restricted by a gently rising landform above and to the west of the residential dwelling as well as some scattered tree cover within surrounding paddocks and alongside local road corridors.	Sensitivity: High Magnitude: Low **Cumulative impact: Nil/Low**
146	R29	Non associated	Bango: 4.7 km Rye Park: 1.7	North 109 South 37	Indirect	Bango: Low Rye Park: Moderate-	Bango and Rye Park wind turbine inter-visibility would be restricted by tree planting surrounding the	Sensitivity: High Magnitude: Low **Cumulative impact:**

Table 5 Area A Assessment Matrix – residential dwellings within 5 km of Bango and Rye Park wind turbines

• Bango receiver viewpoint ID	• Corresponding Rye Park receiver viewpoint	• Associated or non associated	• Approximate distance to closest Bango and Rye Park wind turbine (metres)	• Approximate view angle between Bango and Rye Park wind turbines (degrees)	• Direct or indirect view between Bango and Rye Park wind farm turbines	• Bango visual impact rating	• Bango and Rye Park visibility	• Cumulative visual impact
			km			low	residential dwelling.	**Low**
139	R279	Non associated	Bango: 3.2 km	North 130	Indirect	Bango: Nil/Low	Bango and Rye Park intervisibility would be restricted by rising landform and tree cover to the south west of the residential dwelling.	Sensitivity: High Magnitude: Low **Cumulative impact: Nil/Low**
			Rye Park: 3.3 km	South 35		Rye Park: Moderate-low		
048	R277	Non associated	Bango: 2.9 km	North 116	Indirect	Bango: Low	Bango and Rye Park wind turbine inter-visibility would be partially restricted by tree planting beyond the residential dwelling.	Sensitivity: High Magnitude: Low **Cumulative impact: Moderate-low**
			Rye Park: 3.5 km	South 37		Rye Park: Moderate-low		

Table 5 Area A Assessment Matrix – residential dwellings within 5 km of Bango and Rye Park wind turbines

• Bango receiver viewpoint ID	• Corresponding Rye Park receiver viewpoint	• Associated or non associated	• Approximate distance to closest Bango and Rye Park wind turbine (metres)	• Approximate view angle between Bango and Rye Park wind turbines (degrees)	• Direct or indirect view between Bango and Rye Park wind farm turbines	• Bango visual impact rating	• Bango and Rye Park visibility	• Cumulative visual impact
175	R271	Non associated	Bango: 3.7 km Rye Park: 2.7 km	North 156 South 40	Indirect	Bango: Low Rye Park: High-moderate	Bango and Rye Park wind turbine inter-visibility would be restricted by undulating landform and trees within proximity, and between the residential dwelling and the Bango Wind Farm site.	Sensitivity: High Magnitude: Low **Cumulative impact: Nil/Low**
025	R69	Non associated	Bango 3.8 km Rye Park 3.0 km	North 132 South 67	Indirect	Bango: Low Rye Park: Moderate	Bango and Rye Park wind turbine inter-visibility would be restricted by undulating landforms and trees within proximity and beyond the residential dwelling, including trees alongside	Sensitivity: High Magnitude: Low **Cumulative impact: Nil/Low**

Table 5 Area A Assessment Matrix – residential dwellings within 5 km of Bango and Rye Park wind turbines

• Bango receiver viewpoint ID	• Corresponding Rye Park receiver viewpoint	• Associated or non associated	• Approximate distance to closest Bango and Rye Park wind turbine (metres)	• Approximate view angle between Bango and Rye Park wind turbines (degrees)	• Direct or indirect view between Bango and Rye Park wind farm turbines	• Bango visual impact rating	• Bango and Rye Park visibility	• Cumulative visual impact
							the Rye Park Dalton Road corridor.	
105	R71	Non associated	Bango 3.7 km Rye Park 3.5 km	North 125 South 72	Indirect	Bango: Low Rye Park: Moderate	Bango and Rye Park wind turbine inter-visibility would be restricted by trees within proximity and beyond the residential dwelling.	Sensitivity: High Magnitude: Low **Cumulative impact: Nil/Low**
035	R303	Non associated	Bango 3.1 km Rye Park 4.6 km	North 111 South 78	Indirect	Bango: Low Rye Park: Moderate	Bango and Rye Park wind turbine inter-visibility would be restricted by trees within proximity to, and beyond the	Sensitivity: High Magnitude: Low **Cumulative impact: Nil/Low**

Table 5 Area A Assessment Matrix – residential dwellings within 5 km of Bango and Rye Park wind turbines

• Bango receiver viewpoint ID	• Corresponding Rye Park receiver viewpoint	• Associated or non associated	• Approximate distance to closest Bango and Rye Park wind turbine (metres)	• Approximate view angle between Bango and Rye Park wind turbines (degrees)	• Direct or indirect view between Bango and Rye Park wind farm turbines	• Bango visual impact rating	• Bango and Rye Park visibility	• Cumulative visual impact
							residential dwelling.	
022	R76	Non associated	Bango: 4.7 km Rye Park: 3.7 km	North 61 South 71	Indirect	Bango: Low Rye Park: Moderate-low	Bango and Rye Park wind turbine inter-visibility would be restricted by undulating landforms and trees within proximity and beyond the residential dwelling.	Sensitivity: High Magnitude: Low **Cumulative impact: Low**
129	R298	Non associated	Bango: 5.0 km Rye Park: 3.2 km	North 45 South 129	Indirect	Bango: Low Rye Park: Moderate-	Bango and Rye Park wind turbine inter-visibility would be restricted by undulating landforms and trees within	Sensitivity: High Magnitude: Low **Cumulative impact:**

Table 5 Area A Assessment Matrix – residential dwellings within 5 km of Bango and Rye Park wind turbines

• Bango receiver viewpoint ID	• Corresponding Rye Park receiver viewpoint	• Associated or non associated	• Approximate distance to closest Bango and Rye Park wind turbine (metres)	• Approximate view angle between Bango and Rye Park wind turbines (degrees)	• Direct or indirect view between Bango and Rye Park wind farm turbines	• Bango visual impact rating	• Bango and Rye Park visibility	• Cumulative visual impact
						low	proximity and beyond the residential dwelling.	**Low**
128	R79	Non associated	Bango: 4.1 km	North 89	Indirect	Bango: Nil/Low	Bango and Rye Park wind turbine inter-visibility would be restricted by tree planting surrounding the dwelling and landform rising to the west of the dwelling.	Sensitivity: High Magnitude: Low **Cumulative impact: Low**
			Rye Park: 4.3 km	South 113		Rye Park: Moderate-low		

12 Assessment Matrix Summary

- The Area A Assessment Matrix included a total of 18 receiver locations identified within 5 km of wind turbines of the Bango and Rye Park projects.
- One receiver location (221) was determined to be uninhabitable and has not been included in the Assessment Matrix. Residential dwellings located within 5 km of both Bango and Rye Park wind turbines were determined to have a range of cumulative visual impacts from nil to moderate-low.
- An assessment of each potential residential receiver location determined:
- 2 of the 18 receiver locations would have a **moderate-low cumulative visual impact**
- 8 of the 18 receiver locations would have a **low cumulative visual impact**
- 8 of the 18 receiver locations would have a **nil to low cumulative visual impact**

Overall, the potential for cumulative visual effects to occur at residential dwellings assessed in the Bango Wind Farm LVIA is considered to be low, primarily as a result of:

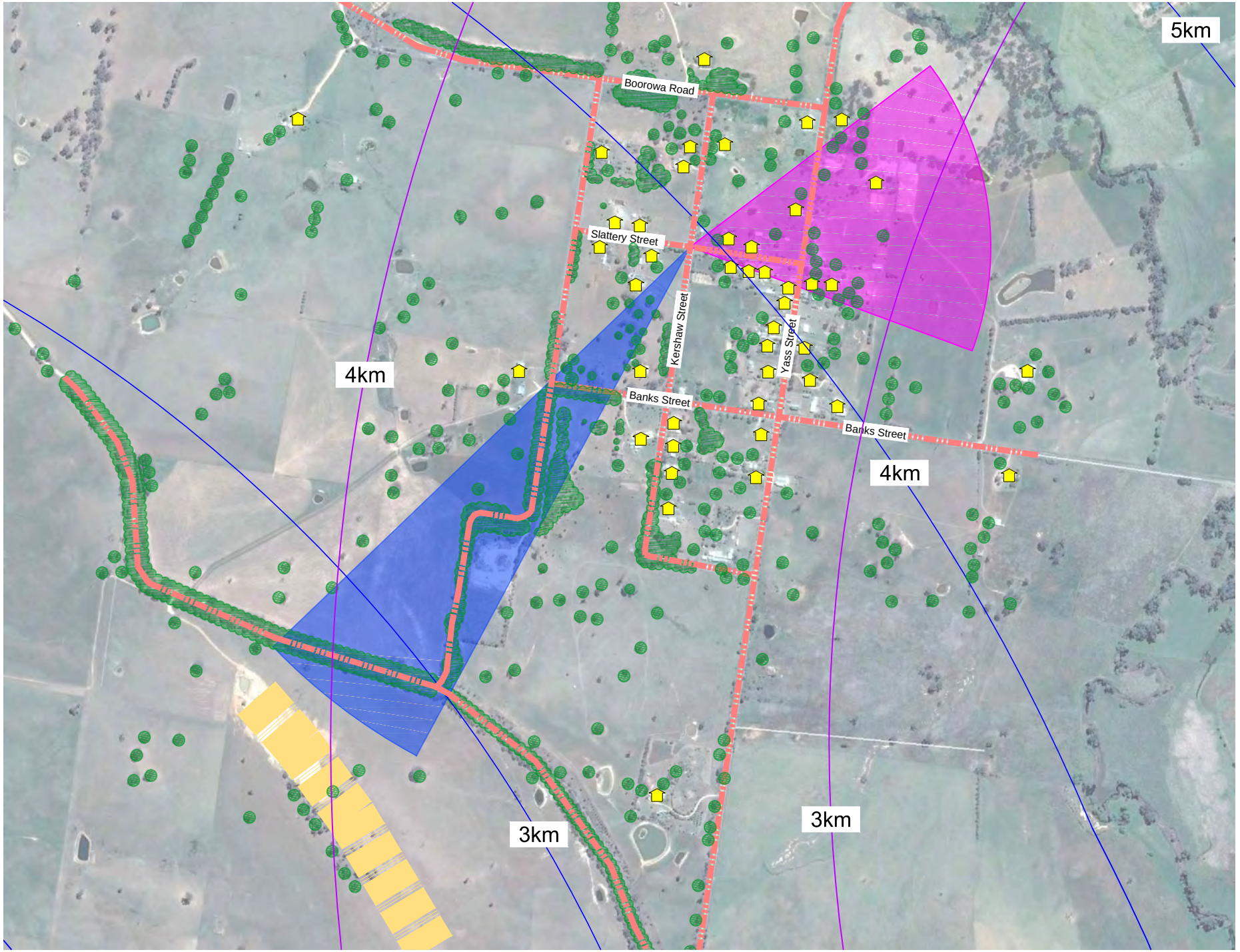
- a combination of low and low to moderate individual visual impacts from the Bango and Rye Park LVIA
- the extent and distribution of tree cover, including trees surrounding residential dwellings
- the screening influence of localised landform features (low hills and undulating landforms) which extend beyond the residential dwellings, toward and across the wind farm sites.

13 Rye Park Village

- Residential dwellings within Rye Park village would be located within 5 km of both the Bango and Rye Park wind turbines. The Bango Wind Farm LVIA concluded that the Bango wind turbines would be largely screened by undulating landform, vegetation as well as the distance between the wind turbines and residential dwellings within the village. This supplementary CLVIA considers that existing tree cover within and surrounding the village would generally restrict views toward the Bango wind turbines.
- Whilst some residential dwellings (generally to the west of Kershaw Street) would gain views toward wind turbines within the Rye Park Wind Farm project, opportunities to gain views toward wind turbines within both projects would be limited. The Rye Park village locality and extent of surrounding tree cover is illustrated in **Figure 8**.

14 Assessment of dwellings within Area B

There are twenty six residential dwellings within 5 km of a Bango wind turbine, but beyond 5 km of a Rye Park wind turbine. Six of the residential dwellings are associated with the Bango Wind Farm project. The dwellings are located off sections of the Boorowa Road, the Tangmangaroo Road and the Wargeila Road. A small number of dwellings were noted as uninhabited during the Bango Wind LVIA site inspection.



Legend

- Rye Park residential dwelling
- Local road
- Approximate distance from nearest Bango wind turbine
- Approximate distance from nearest Rye Park wind turbine
- Tree cover with screening potential
- Hill top landform with screening potential toward Bango wind turbines
- Indicative viewshed toward closest Rye Park wind turbines
- Indicative viewshed toward closest Bango wind turbines

Figure B8 -
Cumulative Landscape and Visual Assessment
Rye Park Village

BANGO WIND FARM

0m 250m

cwp Renewables

GREEN BEAN DESIGN
landscape architects

Residential dwellings in Area B were assessed to have a low or moderate-low potential visual impact with regard to the Bango Wind Farm. Visibility from these dwellings toward the Rye Park Wind Farm is considered to be partially restricted given the influence of existing tree cover surrounding dwellings, as well as tree cover alongside road corridors and the gently undulating nature of the landform. The Rye Park Wind Farm would not be expected to significantly increase the determination of cumulative visual effects for these residential dwellings in association with the Bango Wind Farm.

15 Assessment of dwellings within Area C

Forty two dwellings within 5 km of a Rye Park wind turbine, but beyond 5 km of a Bango wind turbine were considered identified in the CLVIA assessment. Sixteen of these are associated with the Rye Park Wind Farm. The dwellings are located off sections of the Rye Park Rugby Road, the Rye Park Frogmore Road, the Rye Park Cemetery Road, the Rye Park Dalton Road and the Flakney Creek Road.

Residential dwellings in Area C were assessed to have a low potential visual impact with regard to the Bango Wind Farm. Visibility from these dwellings toward the Rye Park Wind Farm is considered to be partially restricted given the influence of existing tree cover surrounding residential dwellings, as well as tree cover alongside road corridors and the gently undulating characteristics of the landform. The Rye Park Wind Farm would not be expected to significantly increase the determination of cumulative visual effects for these residential dwellings in association with the Bango Wind Farm.

16 Assessment of dwellings within Area D (north and south)

Twenty five residential dwellings located within Area D (beyond 5 km of both the Bango and Rye Park wind turbines) were identified in this CLVIA assessment. Ten of the residential dwellings are located within Area D (north) and around 15 within Area D (south) of the study area. All twenty five residential dwellings are non-associated with both the Bango and Rye Park Wind Farms.

The Bango Wind Farm LVIA determined that residential dwellings beyond 5 km of the Bango wind turbines would be unlikely to experience a moderate or high visual impact from the project. The residential dwellings are located within and on a gently undulating landform with scattered tree cover. Partial and mostly indirect views may extend toward wind turbines within the Bango and Rye Park Wind Farms; however, the Rye Park Wind Farm would not be expected to significantly increase the determination of visual impacts for these residential dwellings in association with the Bango Wind Farm.

17 Cumulative visual effects from public roads

Views from vehicles travelling along the Hume Highway, Lachlan Valley Way and other local roads are dynamic and transitory. The tendency for short duration views from vehicles travelling through landscapes without a high degree of visual amenity will usually result in a lesser degree of visual impact.

The Bango Wind Farm LVIA noted that:

A local road network extends roughly parallel to the main ridgelines and hills within the project area and provides a variety of direct and indirect view opportunities toward the wind farm turbines. Tree planting alongside road corridors to the west of the project area tends to restricts views to partial and glimpsed opportunities (including views from the Lachlan Valley Way and the Wargeila Road). A greater range of open views tend to occur along minor roads to the east of the site. This LVIA did not identify any formalised or designated public lookout points within the Bango wind farm 10 km viewshed.

Views toward wind turbines within both the Bango and Rye Park Wind Farms would be influenced by direction of travel as well as road cuttings and reasonably extensive tree cover alongside the Hume Highway and local road corridors. Views toward wind turbines from roads located between the Bango and Rye Park Wind Farms, including the Rye Park Dalton and Wargeila Roads, would be restricted by landform and reasonably extensive roadside tree planting.

18 Supplementary CLVIA summary

This supplementary CIVA has considered the potential cumulative landscape and visual effects which may result from the construction and operation of both Bango and Rye Park Wind Farm, as well as broader influences of proposed and approved wind farms located up to 30 km from Bango Wind Farm.

The CLVIA has been prepared with reference to contemporary landscape and visual impact assessment guidelines.

The 345 km^2 CLVIA study area extending from Bango and Rye Park Wind Farms has been assessed, and is considered reasonable and in proportion to the likely significant cumulative effects from the two projects.

The baseline for cumulative landscape and visual effects has been established by reference to the individual Bango and Rye Park LVIA reports which determined landscape and visual impacts for receiver locations within a 10 km region for each project.

The potential and theoretical visibility toward wind turbines within each project has been established through preparation of ZTV diagrams of visibility to the tip of blade and the hub height of both projects.

This supplementary CLVIA determined that:

- the potential for cumulative landscape effects would be limited by the extent of similar landscape characteristic surrounding both wind farm sites, as well as the influence of land use modifications which have occurred through the establishment of a predominantly industrial agricultural occupation. Similar land use and landscape patterns extend widely beyond both wind farm sites. Whilst the cumulative landscape effect would extend the perception of a ‘wind farm’ landscape, this is likely to be contained within a local landscape context given distances between other wind farm developments;

- the potential to significantly increase visual impacts for residential dwellings included in the Bango LVIA (within 5 km of a Bango and Rye Park wind turbine) would be minimised by the screening influence of local low undulating landforms and tree cover, which may not necessarily be illustrated in the ZVT diagram;
- the potential to significantly increase the visual impacts for residential dwellings included in the Bango LVIA (within 5 km of the Bango wind turbines but beyond 5 km of the Rye Park wind turbines) would be limited by the screening influence of local low undulating landforms and tree cover surrounding and beyond residential dwellings;
- the potential to significantly increase the visual impact for residential dwellings included in the Bango LVIA (beyond 5 km of both the Bango and Rye Park wind turbines) would be largely minimised by the screening influence of local low undulating landforms, tree cover surrounding and beyond residential dwellings and the potential influence of an increasing view distance reducing the overall magnitude of visual effect; and
- the potential cumulative visual effect of the Bango and Rye Park wind turbines from vehicles travelling along the Hume Highway, Lachlan Valley Way and other local roads would be minimised by:
    - the temporary and short term nature of views from moving vehicles
    - areas of tree cover alongside local road corridors
    - undulating landforms extending beyond and above local road corridors.