Uninvolved residential dwelling R45- Existing view west to north. Photo coordinate Easting:682827 Northing:6165276 (MGAz55)


Uninvolved residential dwelling R45- Proposed view through 95°. Approximate distance to closest visible wind turbine 1,486 m

## Notes

Composite panorama photograph taken with a Nikon D90 digital SLR camera with 50 mm prime lens.

Individual panorama photograph coordinate map datum is MGAz55 to ± 5 m.

Extent of potential wind turbine visibility and directional bearing illustrated on each photomontage is indicative only.

The Nikon D90 digital SLR camera has a crop factor of 1.6. A single photograph taken with a 50mm lens will result in a view angle equivalent to a single 35mm SLR camera photograph taken with a 75mm lens.

Refer Figure 28 for residential dwelling locations

Indicative extent of a single frame photograph (in landscape format) taken with the Nikon D90 digital SLR camera with a 50mm lens

**Figure 55**
**Uninvolved residential dwelling photomontage R45**

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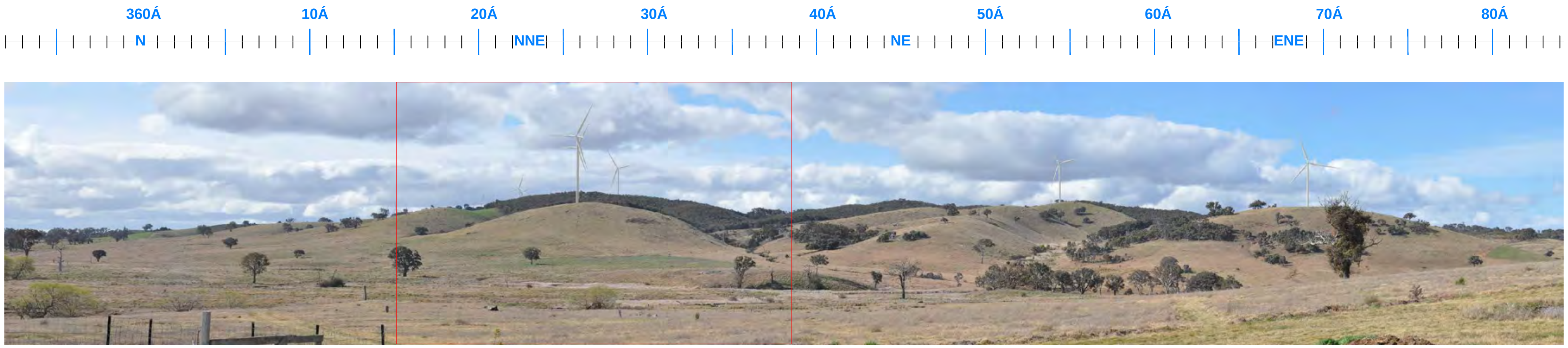
# RYE PARK WIND FARM

Uninvolved residential dwelling R47- Existing view north to east. Photo coordinate Easting:680217 Northing:6163011 (MGAz55 )




Uninvolved residential dwelling R47- Proposed view through 100°. Approximate distance to closest visible Rye Park wind turbine 1,100 m

## Notes

Composite panorama photograph taken with a Nikon D90 digital SLR camera with 50 mm prime lens.

Individual panorama photograph coordinate map datum is MGAz55 to ± 5 m.

Extent of potential wind turbine visibility and directional bearing illustrated on each photomontage is indicative only.

The Nikon D90 digital SLR camera has a crop factor of 1.6. A single photograph taken with a 50mm lens will result in a view angle equivalent to a single 35mm SLR camera photograph taken with a 75mm lens.

Refer Figure 28 for residential dwelling locations

Indicative extent of a single frame photograph (in landscape format) taken with the Nikon D90 digital SLR camera with a 50mm lens

**Figure 56**
**Uninvolved residential dwelling photomontage R47**

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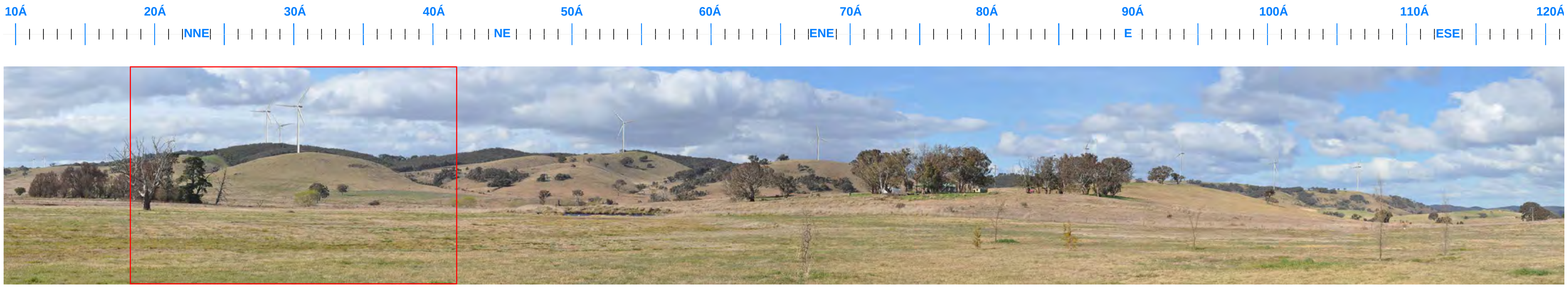
# RYE PARK WIND FARM

Uninvolved residential dwelling R48- Existing view north to south east. Photo coordinate Easting:679826 Northing:6162660 (MGAz55)




Uninvolved residential dwelling R48- Proposed view through 120°. Approximate distance to closest visible wind turbine 1,236 m

## Notes

Composite panorama photograph taken with a Nikon D90 digital SLR camera with 50 mm prime lens.

Individual panorama photograph coordinate map datum is MGAz55 to ± 5 m.

Extent of potential wind turbine visibility and directional bearing illustrated on each photomontage is indicative only.

The Nikon D90 digital SLR camera has a crop factor of 1.6. A single photograph taken with a 50mm lens will result in a view angle equivalent to a single 35mm SLR camera photograph taken with a 75mm lens.

Refer Figure 28 for residential dwelling locations

Indicative extent of a single frame photograph (in landscape format) taken with the Nikon D90 digital SLR camera with a 50mm lens

**Figure 57**
**Uninvolved residential dwelling photomontage R48**

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# RYE PARK WIND FARM

Uninvolved residential dwelling R53- Existing view south east to west south west. Photo coordinate Easting:680904 Northing:6160886 (MGAz55 )


Uinvolved residential dwelling R53- Proposed view through 110°. Approximate distance to closest visible Rye Park wind turbine 1,574 m

## Notes

Composite panorama photograph taken with a Nikon D90 digital SLR camera with 50 mm prime lens.

Individual panorama photograph coordinate map datum is MGAz55 to ± 5 m.

Extent of potential wind turbine visibility and directional bearing illustrated on each photomontage is indicative only.

The Nikon D90 digital SLR camera has a crop factor of 1.6. A single photograph taken with a 50mm lens will result in a view angle equivalent to a single 35mm SLR camera photograph taken with a 75mm lens.

Refer Figure 28 for residential dwelling locations

Indicative extent of a single frame photograph (in landscape format) taken with the Nikon D90 digital SLR camera with a 50mm lens

**Figure 58**
**Uninvolved residential dwelling photomontage R53**

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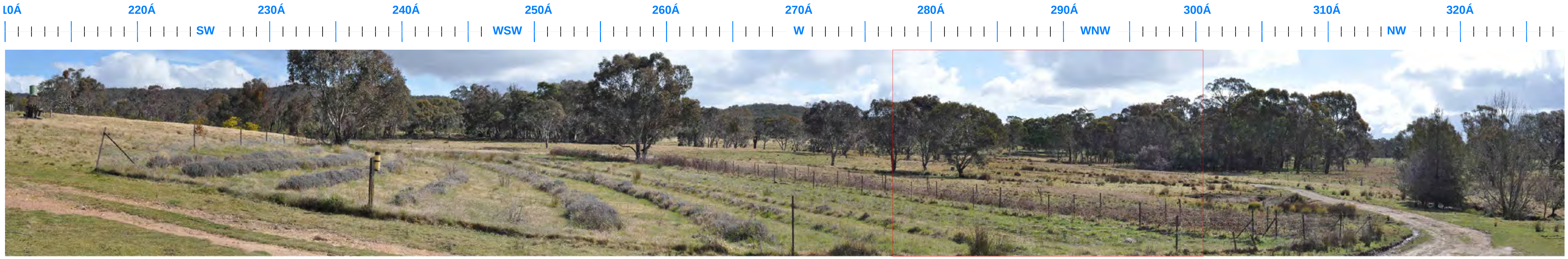
# RYE PARK WIND FARM

Uninvolved residential dwelling R55- Existing view south west to north west. Photo coordinate Easting:689373 Northing:6154185 (MGAz55)




Uninvolved residential dwelling R55- Proposed view through 120°. Approximate distance to closest visible wind turbine 2,420 m

## Notes

Composite panorama photograph taken with a Nikon D90 digital SLR camera with 50 mm prime lens.

Individual panorama photograph coordinate map datum is MGAz55 to ± 5 m.

Extent of potential wind turbine visibility and directional bearing illustrated on each photomontage is indicative only.

The Nikon D90 digital SLR camera has a crop factor of 1.6. A single photograph taken with a 50mm lens will result in a view angle equivalent to a single 35mm SLR camera photograph taken with a 75mm lens.

Refer Figure 28 for residential dwelling locations

Indicative extent of a single frame photograph (in landscape format) taken with the Nikon D90 digital SLR camera with a 50mm lens

**Figure 59**
**Uninvolved residential dwelling photomontage R55**

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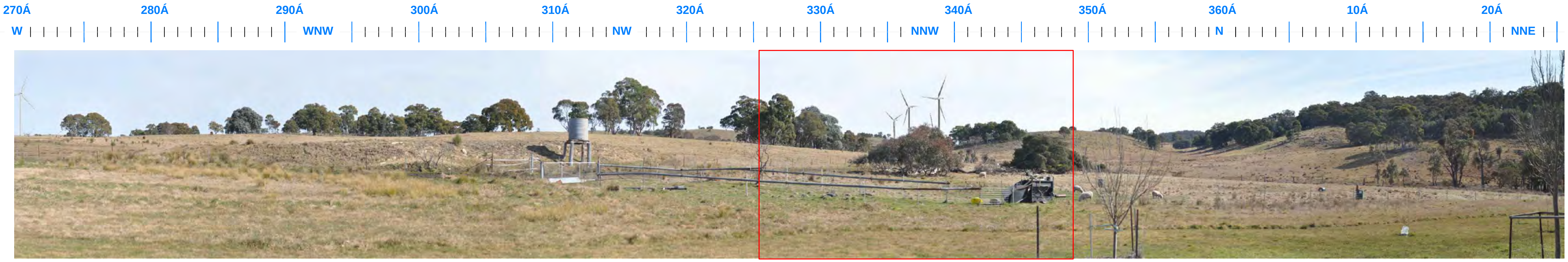
# RYE PARK WIND FARM

Uninvolved residential dwelling R56- Existing view west to north north east. Photo coordinate Easting:686542 Northing:6153137 (MGAz55)




Uninvolved residential dwelling R56- Proposed view through 120°. Approximate distance to closest visible wind turbine 1,364 m

## Notes

Composite panorama photograph taken with a Nikon D90 digital SLR camera with 50 mm prime lens.

Individual panorama photograph coordinate map datum is MGAz55 to ± 5 m.

Extent of potential wind turbine visibility and directional bearing illustrated on each photomontage is indicative only.

The Nikon D90 digital SLR camera has a crop factor of 1.6. A single photograph taken with a 50mm lens will result in a view angle equivalent to a single 35mm SLR camera photograph taken with a 75mm lens.

Refer Figure 28 for residential dwelling locations

Indicative extent of a single frame photograph (in landscape format) taken with the Nikon D90 digital SLR camera with a 50mm lens

**Figure 60**
**Uninvolved residential dwelling photomontage R56**

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# RYE PARK WIND FARM

Uninvolved residential dwelling R62- Existing view west to north east. Photo coordinate Easting:684017 Northing:6149081 (MGAz55)


Uninvolved residential dwelling R62- Proposed view through 95°. Approximate distance to closest visible wind turbine 1,978 m

## Notes

Composite panorama photograph taken with a Nikon D90 digital SLR camera with 50 mm prime lens.

Individual panorama photograph coordinate map datum is MGAz55 to ± 5 m.

Extent of potential wind turbine visibility and directional bearing illustrated on each photomontage is indicative only.

The Nikon D90 digital SLR camera has a crop factor of 1.6. A single photograph taken with a 50mm lens will result in a view angle equivalent to a single 35mm SLR camera photograph taken with a 75mm lens.

Refer Figure 28 for residential dwelling locations

Indicative extent of a single frame photograph (in landscape format) taken with the Nikon D90 digital SLR camera with a 50mm lens

**Figure 61**
**Uninvolved residential dwelling photomontage R62**

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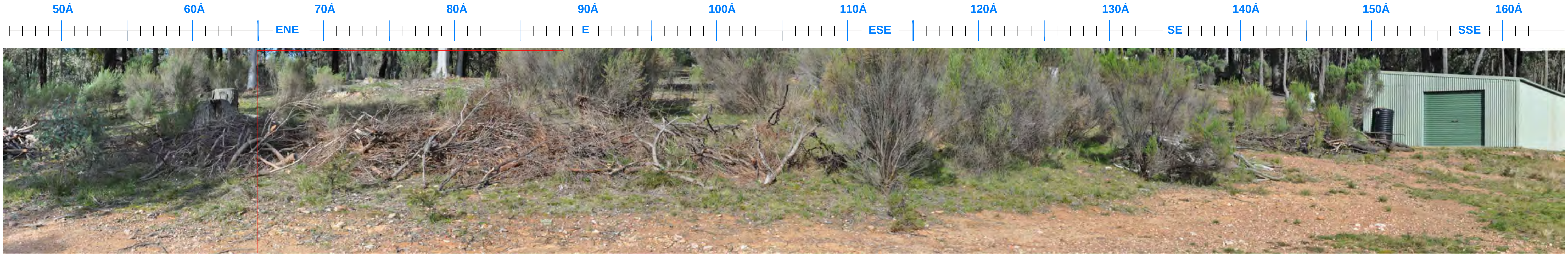
# RYE PARK WIND FARM

Views toward Rye Park wind turbines screened by
tree and shrub planting beyond residential dwelling




Uninvolved residential dwelling R65- Existing and proposed view through 120°. Photo coordinate Easting:676671 Northing:6179681

## Notes

Composite panorama photograph taken with a Nikon D90 digital SLR camera with 50 mm prime lens.

Individual panorama photograph coordinate map datum is MGAz55 to ± 5 m.

Extent of potential wind turbine visibility and directional bearing illustrated on each photomontage is indicative only.

The Nikon D90 digital SLR camera has a crop factor of 1.6. A single photograph taken with a 50mm lens will result in a view angle equivalent to a single 35mm SLR camera photograph taken with a 75mm lens.

Refer Figure 28 for residential dwelling locations

Indicative extent of a single frame photograph (in landscape format) taken with the Nikon D90 digital SLR camera with a 50mm lens

**Figure 62**
**Uninvolved residential dwelling photomontage R65**

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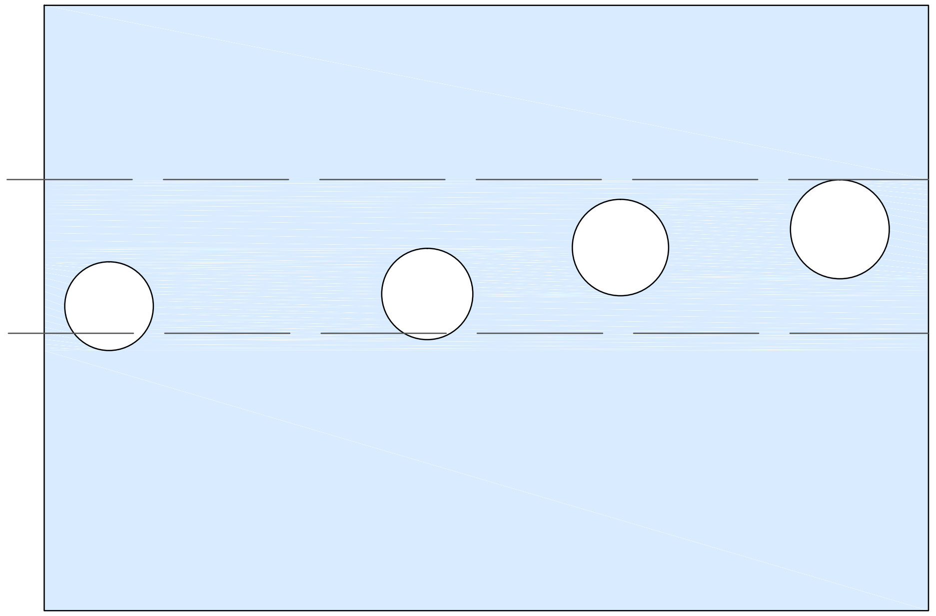
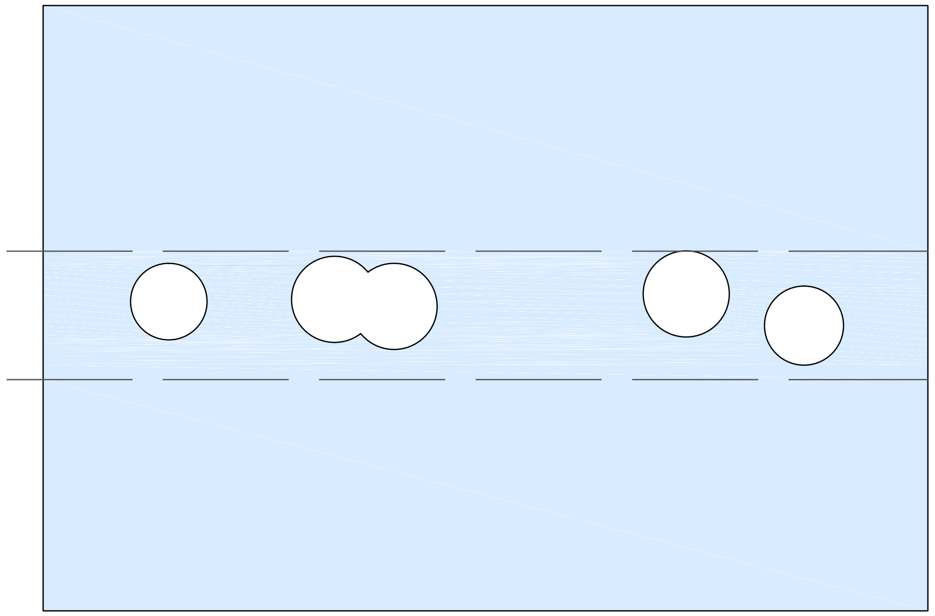
# RYE PARK WIND FARM



Proposed Rye Park wind farm photomontage.

Public view location PM 4 Maryvale Road - Existing view south south west to north west.
Photo coordinate Easting:684522 Northing:6183167 (MGAz55) Approximate distance to closest visible wind turbine 3,900 m
Composite panorama photograph taken with a Nikon D700 digital SLR with a 50mm lens (equates to a 35mm SLR camera with a 50mm lens).

Rye Park wind turbine photomontage- comparative rotor swept area
Wind turbine 152 m tip height (101 m tower with 56 m rotor length)



Existing view toward the operational Gunning wind farm from Gunning Road.

Existing view north east to east. Photo coordinate Easting:711091 Northing 6157317 (MGAz55). Approximate distance to closest visible wind turbine 4,200 m
Composite panorama photograph taken with a Nikon D700 digital SLR with a 50mm lens (equates to a 35mm SLR camera with a 50m lens).

Gunning wind turbine photograph- comparative rotor swept area
Wind turbine 120 m tip height (80 m tower with 40 m rotor length)

**Figure 63**
**Comparison of operational and photomontage wind turbines**

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# RYE PARK WIND FARM

Existing Cullerin wind turbines

Photo 1 - View toward operational Cullerin wind farm turbines

View distance to closest wind turbine is approximately 2.9 km. Height of wind turbine is approximately 125 m to tip of blade.

Single frame photo taken with a Pentax K10D digital SLR camera with a 50mm lens. The camera crop factor of 1.6 equates to a 35mm full frame SLR camera with a 75mm lens.

Proposed Rye Park wind turbines (photomontage)

Photo 2 - View toward proposed Rye Park wind turbines at reduced height of 124 m to tip of blade.

View distance to closest wind turbine is approximately 1.8 km. Height of wind turbine is approximately 124 m to tip of blade.

Single frame photo taken with a Nikon D90 digital SLR camera with 50mm lens. The camera crop factor of 1.6 equates to 35mm full frame SLR camera with a 75mm lens.

Existing Capital wind turbines

Photo 3 - View toward operational Capital wind farm turbines

View distance to closest wind turbine is approximately 1.5 km. Height of wind turbine is approximately 124 m to tip of blade.

Single frame photo taken with a Pentax K10D digital SLR camera with a 50mm lens. The camera crop factor of 1.6 equates to 35mm full frame SLR camera with a 75mm lens.

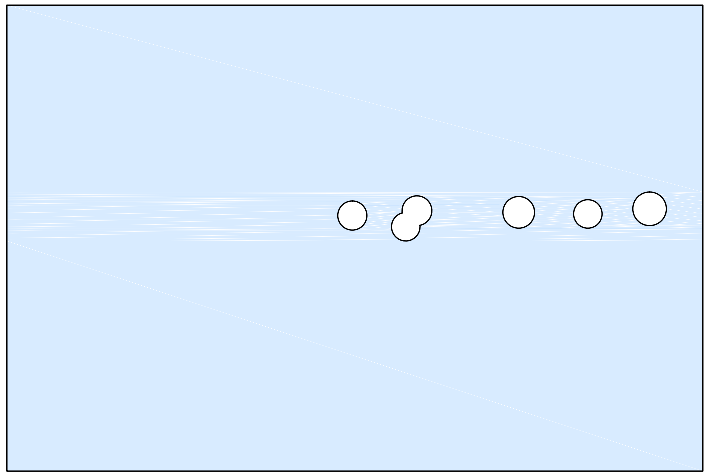
Existing Capital wind turbines

Photo 4 - View toward operational Capital wind turbines.

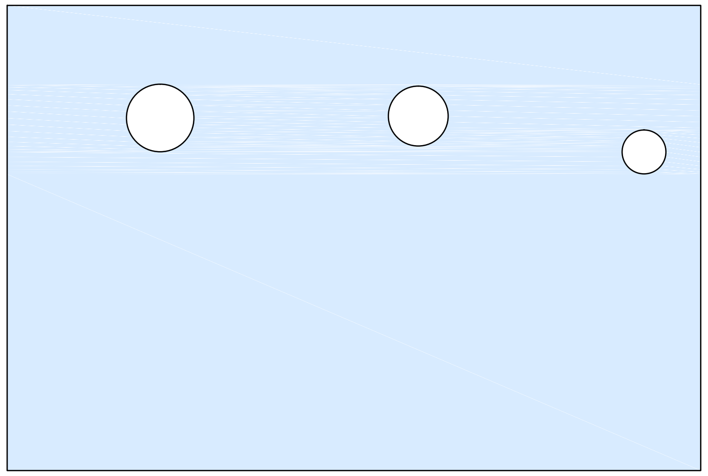
View distance to closest wind turbine is approximately 1.0 km. Height of wind turbine is approximately 124 m to tip of blade.

Single frame photo taken with a Pentax K10D digital SLR camera with 50mm lens. Camera crop factor of 1.6 equates to 35mm full frame SLR camera with a 75mm lens.

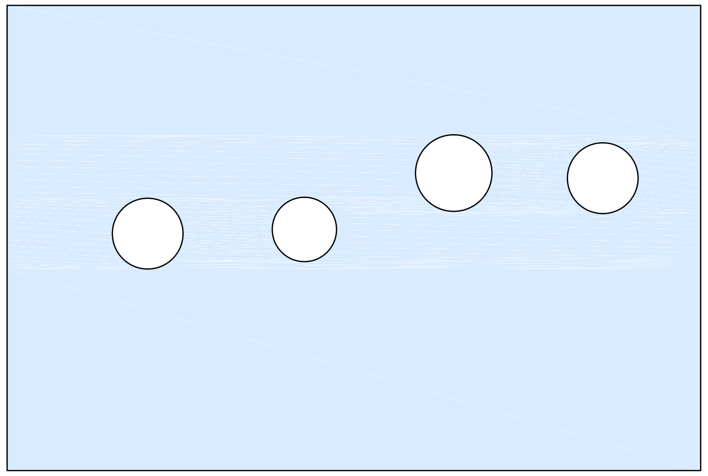
Rotor swept path area at 2.9 km



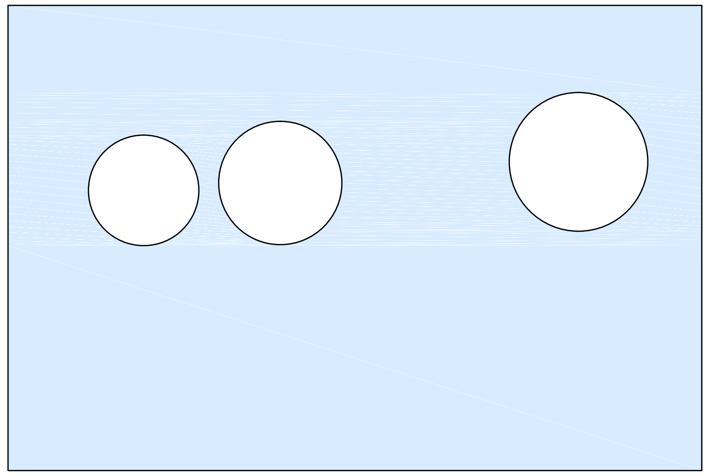
Rotor swept path area at 1.8 km



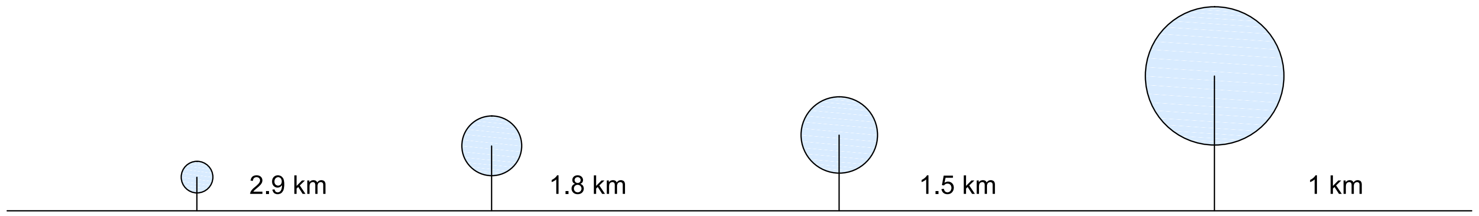
Rotor swept path area at 1.5 km



Rotor swept path area at 1 km



Relative comparison of distance effect on perceived wind turbine rotor swept path area




Relative comparison of distance effect on perceived wind turbine height

**Figure 64**
**Comparison of operational and photomontage wind turbines**

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# RYE PARK WIND FARM

# Night time lighting Section 11

## 11.1 Introduction

Although not currently proposed, the Rye Park 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 impacts 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 impact 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 65, 66** and **67**. 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.

## 11.2 Existing light sources

A small number of existing night time light sources occur within the Rye Park 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.

## 11.3 Potential light sources

The main potential light sources associated with the Rye Park 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 impact 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.

### 11.4 Potential view locations and impact

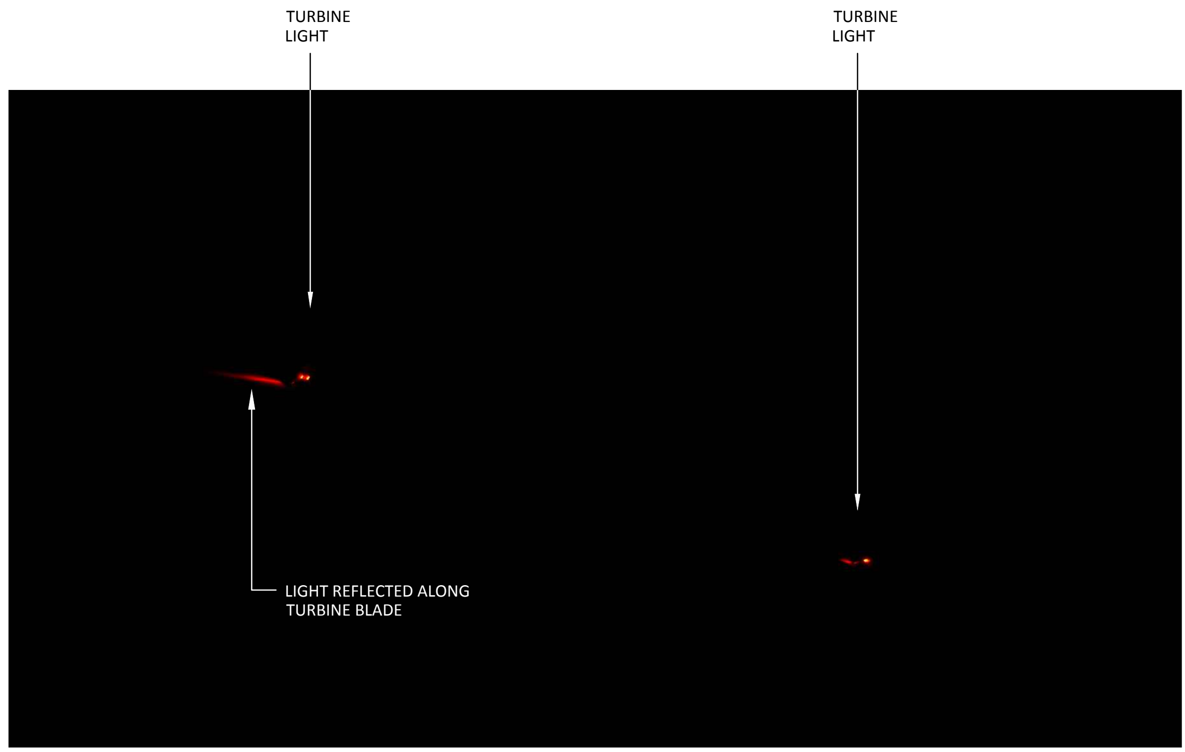
The categories of potential view locations that could be impacted by night time lighting generally include residents and motorists.

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 Rye Park 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 65**
**Night lighting Cullerin wind farm at 500m**

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

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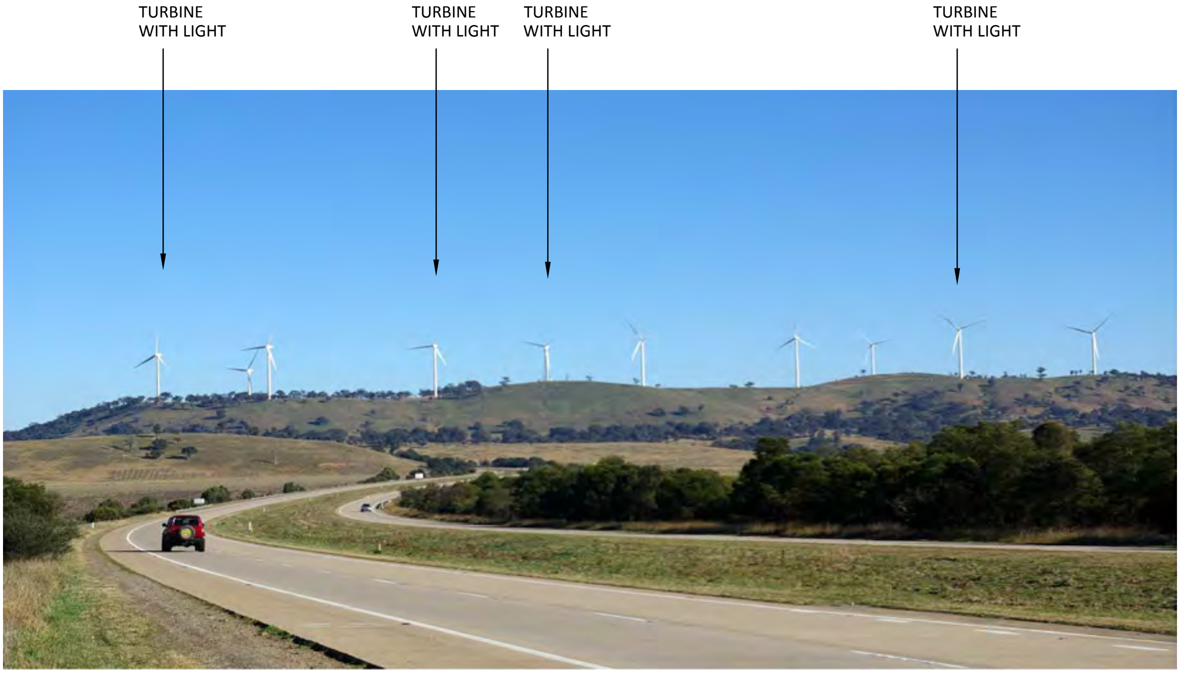
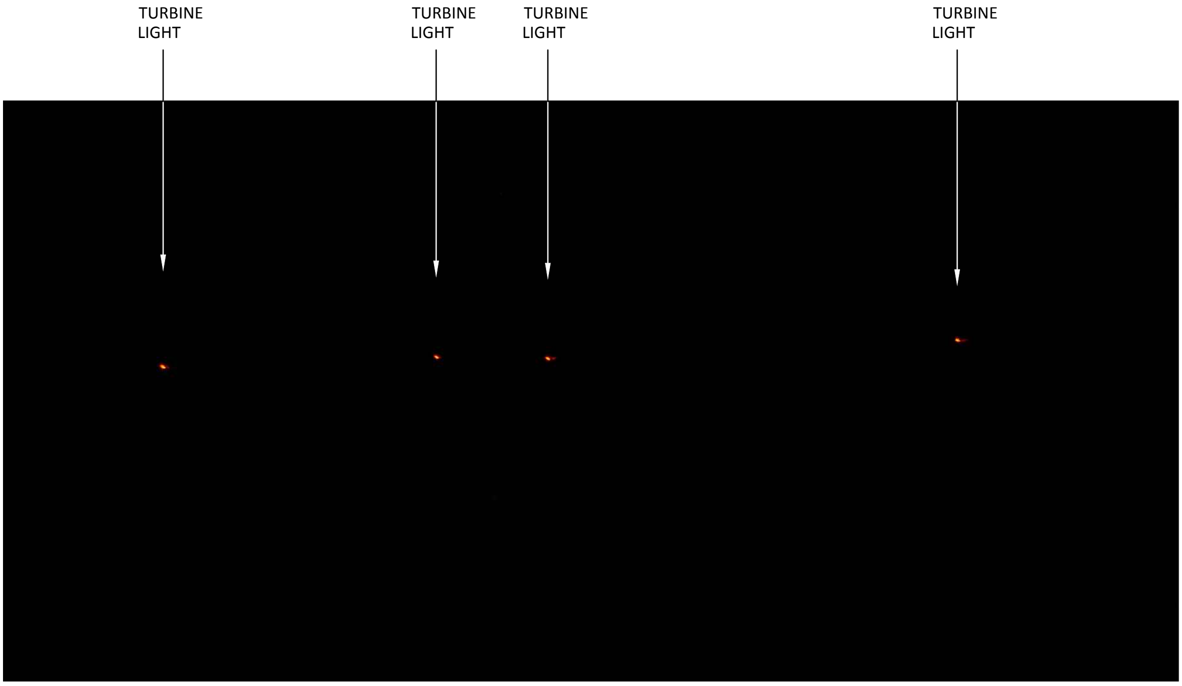
# RYE PARK WIND FARM



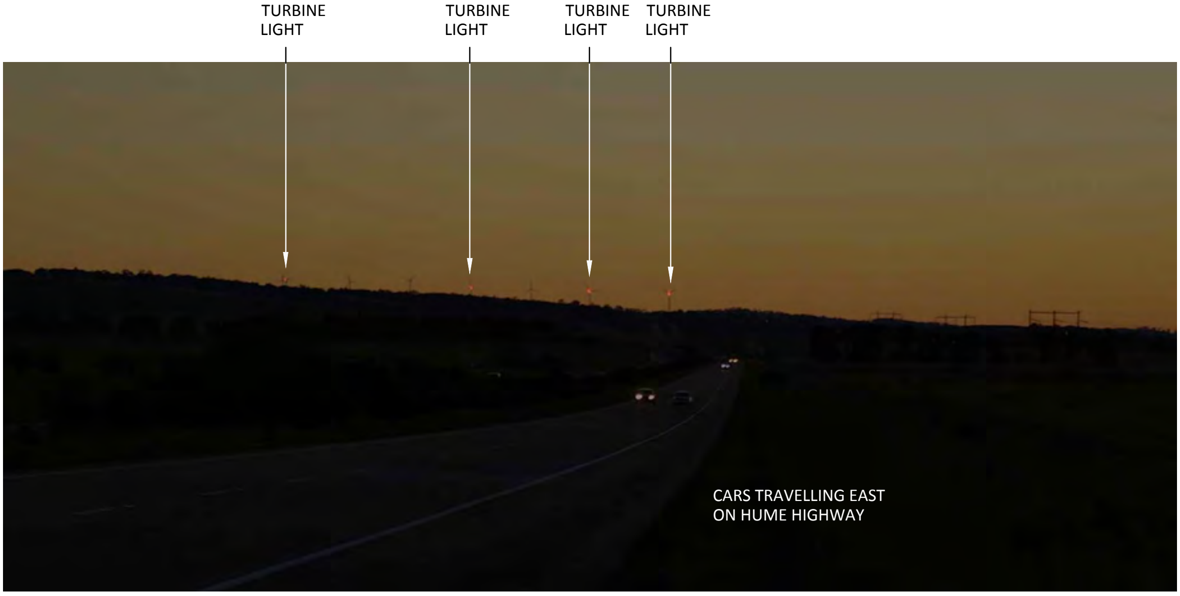

Day time view from Hume highway toward Cullerin wind farm at around 3.5km



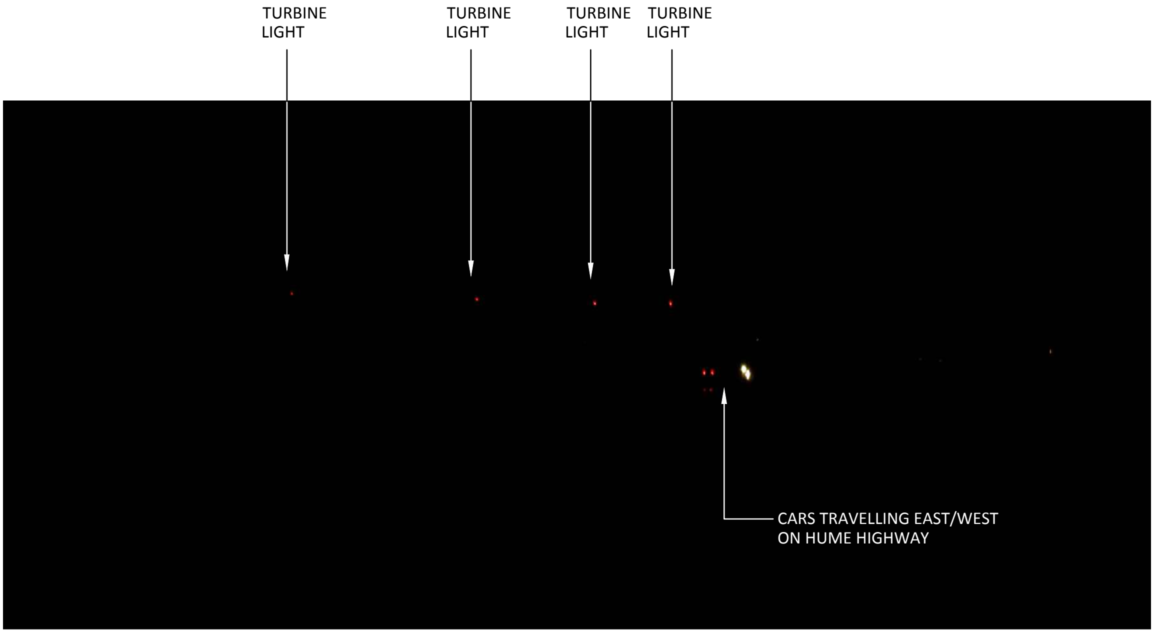

Night time view from Hume highway toward Cullerin wind farm at around 3.5km

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

**Figure 66**
**Night lighting Cullerin wind farm at 3.5 km**




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 67**
**Night lighting Cullerin**
**wind farm at 17 km**

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# RYE PARK WIND FARM

# Electrical works

Section 12

## 12.1 Introduction

The Rye Park 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:

- 2 collection substations and 1 connection substation;
- a double circuit 330 kV powerline;
- generator transformers; and
- underground and overhead electrical and control cables.

The general arrangement for the proposed electrical works is illustrated in **Figures 68a** and **68b**.

A typical design for a wind farm 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 folded plate double circuit supporting structure and angle poles is presented in **Plate 8**. 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 7*** – Typical wind farm collector substation

***Plate 8*** – Typical illustration of a 330 kV supporting structure and angle poles

## 12.2 Substations

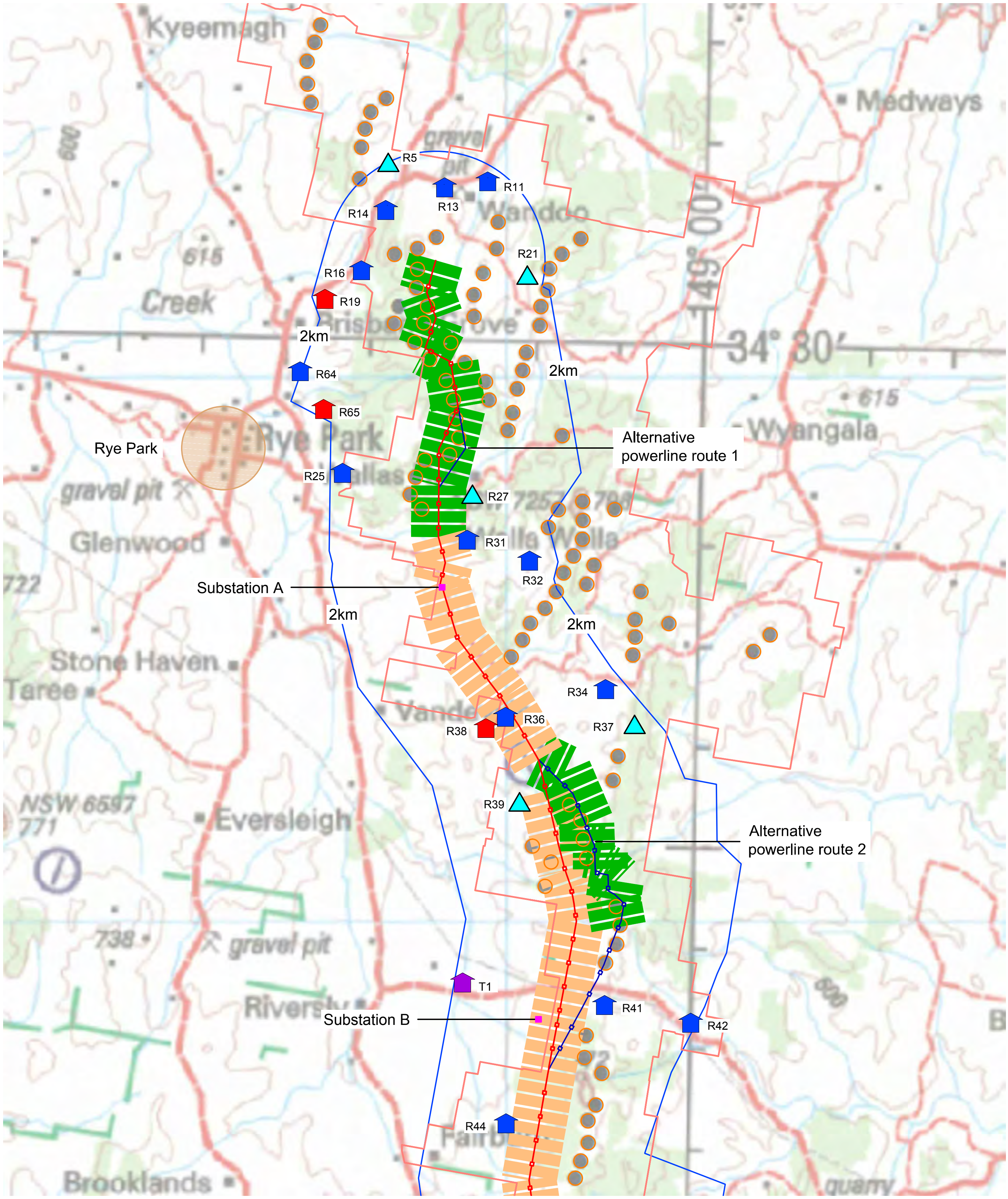
The substation locations are illustrated in **Figures 68a** and **68b**. Final locations would be selected subject to detail engineering design. The layout of the proposed substation will be developed at the detailed design stage. However, the main visual components of a typical wind farm switchyard substation would likely comprise:

- 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;
- lighting for security and maintenance; and
- security fencing including a palisade fence and internal chainmesh fence.

The substation locations would not be significantly visible from areas to the west or east of the project area, and would be largely screened by landform and scattered tree 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 impact from surrounding view locations.

## 12.3 Powerline structure

Electricity generated by the Rye Park wind farm would be connected to the grid via an overhead double circuit 330 kV powerline extending north to south for around 40 km through the central portion of the site. The preferred 330 kV powerline route illustrated in **Figure 68a** and **68b** includes 5 alternative powerline routes which may be utilised subject to detailed site assessment work. The proposed powerline would connect to the existing 330 kV TransGrid powerline extending through the southern boundary of the Rye Park wind farm project area.




## Legend

- Rye Park wind farm site boundary
- Preferred 330 kV powerline route
- Alternative 330 kV powerline route
- Existing powerline
- Proposed Rye Park wind turbine (indicative layout)
- Involved residential dwelling within 2 km of proposed powerline and wind turbine
- Involved residential dwelling within 2 km of proposed powerline but not wind turbine
- Uninvolved residential dwelling within 2 km of proposed powerline and wind turbine
- Uninvolved residential dwelling within 2 km of proposed powerline
- Proposed substation (indicative location)

Visual Absorption Capability (VAC)

- High
- Medium
- Low

0 km 1 km

**Figure 68a**
**Proposed 330 kV powerline route and VAC**

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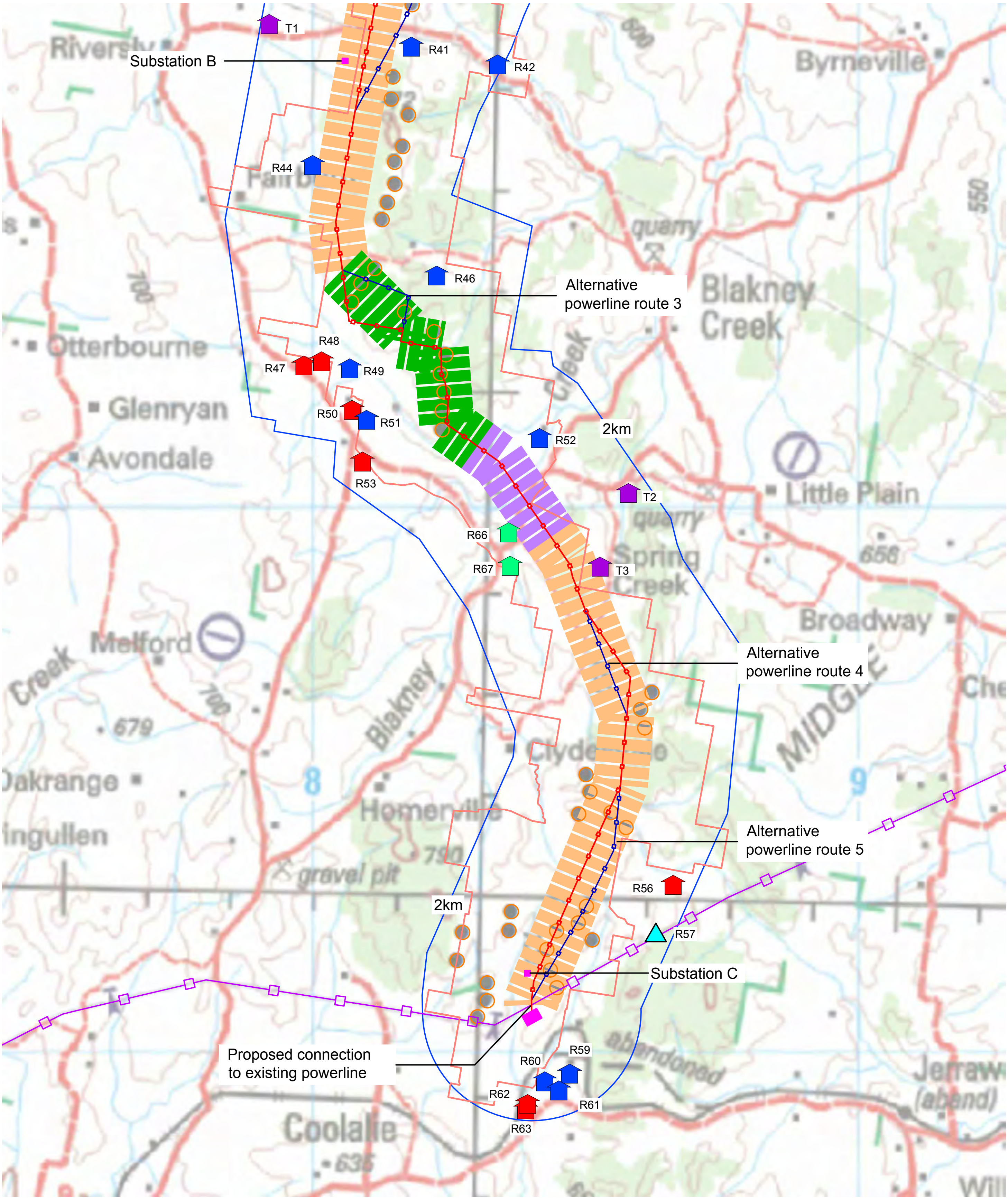


**Legend**

- Rye Park wind farm site boundary
- Preferred 330 kV powerline route
- Alternative 330 kV powerline route
- Existing powerline
- Proposed Rye Park wind turbine (indicative layout)
- Involved residential dwelling within 2 km of proposed powerline and wind turbine
- Involved residential dwelling within 2 km of proposed powerline but not wind turbine
- Uninvolved residential dwelling within 2 km of proposed powerline and wind turbine
- Uninvolved residential dwelling within 2 km of proposed powerline
- Proposed substation (indicative location)

Visual Absorption Capability (VAC)

- High
- Medium
- Low

0 km 1 km

**Figure 68b**
**Proposed 330 kV powerline route and VAC**

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The key visual components of the 330 kV powerline would comprise:

- single tapered steel poles up to 50 m high;
- aluminium alloy 330 kV conductors; and
- an aerial earth wire and communications link.

### 12. 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 330 kV powerline route is illustrated in **Figures 68a** and **68b**.

### 12. 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 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. Areas of lower VAC would occur over cleared ridgelines as well as sections spanning road corridors and access tracks. Whilst the portions of the 3 alternative 330 kV powerline routes would be located closer to two of the involved residential dwellings, views toward the powerline would occur below the hill and ridgeline to the east of the dwellings, increasing the overall VAC and reducing visual significance.

The overall moderate 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 impacts to occur where views toward the existing powerline included views toward proposed electrical infrastructure elements.


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### 12.6 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 impact 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 21** presents the view location matrix for electrical infrastructure. Involved and uninvolved residential dwelling locations within 2 km of the electrical infrastructure are illustrated in **Figures 68a** and **68b**.

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.


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## 12.7 Visual significance matrix (electrical infrastructure)

**Table 21 –** Visual significance matrix (Refer **Figure 68a** and **68b** for residential view locations)

| View location (Refer to Figure 68 a/b) | 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 |
|---|---|---|---|---|---|---|---|
| R5 | Non residential structure | N/A | N/A | N/A | N/A | N/A | N/A |
| R11 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 1,800 m | High | High | Long distance views south to south west from the residential dwelling location toward the proposed powerline is blocked by tree shelter belt planting. | Nil |
| R13 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 1,450 m | High | High | Long distance views south to south west from the residential dwelling location toward the proposed powerline is blocked by tree planting. | Nil |
| R14 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 1,370 m | High | High | Long distance views south east from the residential dwelling location toward the proposed powerline are blocked by a combination of landform and tree planting. | Nil |
| R16 | Involved | Very low | 1,270 m | High | High | Long distance views east to south east from the residential | Nil |

**Table 21 –** Visual significance matrix (Refer **Figure 68a** and **68b** for residential view locations)

| View location (Refer to Figure 68 a/b) | 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 |
|---|---|---|---|---|---|---|---|
| | landowner<br>Residential dwelling<br>High sensitivity | | | | | dwelling location toward the proposed powerline are blocked by a combination of landform and tree planting. | |
| R19 | **Uninvolved landowner**<br>Residential dwelling<br>High sensitivity | Very low | 1,875 m | High | High | Long distance views east to south east from the residential dwelling location toward the proposed powerline are blocked by a combination of landform and tree planting. | Nil |
| R21 | Non residential structure | N/A | N/A | N/A | N/A | N/A | N/A |
| R64 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 2,324 m | High | High | Long distance views east from the residential dwelling location toward the proposed powerline will be blocked by topography and tree cover. | Nil |
| R27 | Non residential structure | N/A | N/A | N/A | N/A | N/A | N/A |
| R65 | **Uninvolved landowner** | Very low | 2,229 m | High | High | Long distance views east from the residential dwelling location | Nil |

**Table 21 –** Visual significance matrix (Refer **Figure 68a** and **68b** for residential view locations)

| View location (Refer to Figure 68 a/b) | 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 |
|---|---|---|---|---|---|---|---|
| | Residential dwelling<br>High sensitivity | | | | | toward the proposed powerline, alternative route 1, and the substation A location, will be blocked by topography and tree cover. | |
| R25 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 1,761 m | High | High | Long distance views east from the residential dwelling location toward the proposed powerline, alternative route 1, and the substation A location, will be blocked by topography and tree cover. | Nil |
| R31 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 500 m | High | Medium | Medium distance views south east from the residential dwelling location toward the proposed powerline, and the substation A location, will be blocked by topography and tree cover. | Nil |
| R32 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 1,580 m | High | Medium | Long distance views south east from the residential dwelling location toward the proposed powerline, and the substation A location, will be blocked by topography and tree cover. | Nil |
| R34 | Involved landowner | Very low | 1,712 m | High | Medium | Long distance views north west to south west will be obstructed by rising and undulating landform to the west of the dwelling. There | Nil |

**Table 21 –** Visual significance matrix (Refer **Figure 68a** and **68b** for residential view locations)

| View location (Refer to Figure 68 a/b) | 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 |
|---|---|---|---|---|---|---|---|
| | Residential dwelling<br>High sensitivity | | | | | will be no views toward any of the proposed substation locations. | |
| R36 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 260 m | High | Medium | Short distance views north east to south east will extend toward short sections of the powerline; however, views will be partially obstructed by rising and undulating landform to the east of the dwelling. There will be no views toward any of the proposed substation locations. | Low |
| R37 | Non residential structure | N/A | N/A | N/A | N/A | N/A | N/A |
| R38 | **Uninvolved landowner**<br>Residential dwelling<br>High sensitivity | Very low | 650 m | High | Medium | Medium distance views north east to south east will extend toward short sections of the powerline; however, views will be partially obstructed by rising and undulating landform to the east of the dwelling together with tree cover surrounding the residential dwelling. There will be no views toward any of the proposed substation locations. | Low |
| R39 | Non residential structure | N/A | N/A | N/A | N/A | N/A | N/A |
| T1 | **Uninvolved** | Very low | 1,600 m | High | Medium | Long distance views north east to south east will extend toward | Low |

**Table 21 –** Visual significance matrix (Refer **Figure 68a** and **68b** for residential view locations)

| View location (Refer to Figure 68 a/b) | 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 |
|---|---|---|---|---|---|---|---|
| | **landowner**<br>Residential dwelling<br>High sensitivity | | (to alternative powerline route 1) | | | sections of the powerline; however, views will be partially obstructed by rising and undulating landform to the east of the dwelling together with tree cover surrounding the residential dwelling. Views toward the proposed substation B location will be blocked by topography and tree cover to the east of the residential dwelling. | |
| R41 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 790 m | High | Medium | Medium distance views north west to south west from the residential dwelling toward the powerline and substation B location will be partially screened by landform and scattered tree cover. | Low |
| R42 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 2,388 m | High | Medium | Long distance views north west to south west from the residential dwelling toward the powerline and substation B location will be largely screened by landform and scattered tree cover. | Nil |
| R44 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 380 m | High | Medium to High | Short distance views north east to south east toward the proposed powerline will be filtered to some extent by scattered tree cover beyond the residential dwelling. Views toward the proposed substation B location will be screened by ridgeline landform and dense tree cover. | Low |

**Table 21 –** Visual significance matrix (Refer **Figure 68a** and **68b** for residential view locations)

| View location (Refer to Figure 68 a/b) | 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 |
|---|---|---|---|---|---|---|---|
| R46 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 1,145 m | High | High | Long distance views south to west toward the proposed powerline and alternative route 3 will be screened by topography and tree cover. | Nil |
| R47 | **Uninvolved landowner**<br>Residential dwelling<br>High sensitivity | Very low | 1,165 m | High | High | Long distance views within proximity to the residential dwelling will extend east to north east toward the proposed powerline. Views of the powerline will be partially screened by a low undulating landform below the main wind farm ridgeline, and by scattered to denser areas of tree cover on hillside slopes beyond the ridgeline. Strategic planting to the north and north east of the dwelling would potentially screen portions of the powerline from views surrounding the dwelling. There will be no views toward the proposed substation locations. | Low |
| R48 | **Uninvolved landowner**<br>Residential dwelling<br>High sensitivity | Very low | 919 m | High | High | Medium distance views within proximity to the residential dwelling will extend east to north east toward the proposed powerline. Views of the powerline will be partially screened by a low undulating landform below the main wind farm ridgeline, and by scattered to denser areas of tree cover on hillside slopes beyond the ridgeline. Strategic planting to the north and north east of the dwelling would potentially screen portions of the powerline from | Low |

**Table 21 –** Visual significance matrix (Refer **Figure 68a** and **68b** for residential view locations)

| View location (Refer to Figure 68 a/b) | 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 |
|---|---|---|---|---|---|---|---|
| | | | | | | views surrounding the dwelling. There will be no views toward the proposed substation locations. | |
| R49 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 1,075 m | High | High | Long distance views within proximity to the residential dwelling will extend east to north east toward the proposed powerline. Views of the powerline will be partially screened by a low undulating landform below the main wind farm ridgeline, and by scattered to denser areas of tree cover on hillside slopes beyond the ridgeline. Strategic planting to the north and north east of the dwelling would potentially screen portions of the powerline from views surrounding the dwelling. There will be no views toward the proposed substation locations. | Low |
| R50 | **Uninvolved landowner**<br>Residential dwelling<br>High sensitivity | Very low | 1,565 m | High | High | Long distance views within proximity to the residential dwelling will extend east to north east toward the proposed powerline. Views of the powerline will be partially screened by a low undulating landform below the main wind farm ridgeline, and by scattered to denser areas of tree cover on hillside slopes beyond the ridgeline. Strategic planting to the north and north east of the dwelling would potentially screen portions of the powerline from views surrounding the dwelling. There will be no views toward the proposed substation locations. | Low |
| R51 | Involved landowner | Very low | 1,474 m | High | High | Long distance views within proximity to the residential dwelling will | Low |

**Table 21 –** Visual significance matrix (Refer **Figure 68a** and **68b** for residential view locations)

| View location (Refer to Figure 68 a/b) | 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 |
|---|---|---|---|---|---|---|---|
| | Residential dwelling<br>High sensitivity | | | | | extend east to north east toward the proposed powerline. Views of the powerline will be partially screened by a low undulating landform below the main wind farm ridgeline, and by scattered to denser areas of tree cover on hillside slopes beyond the ridgeline. Strategic planting to the north and north east of the dwelling would potentially screen portions of the powerline from views surrounding the dwelling. There will be no views toward the proposed substation locations. | |
| R52 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 854 m | High | Low to medium | Medium distance views south west to west from the residential dwelling toward the proposed powerline will be screened by existing tree planting to the west of the dwelling. There will be no views toward the proposed substation locations from the dwelling. | Nil |
| R53 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 1,708 m | High | Medium | Long distance views north to north east toward the proposed alternative powerline route will be partially screened by tree cover within the property as well as trees along the Rye Park Dalton Road corridor. | Low |
| R66 | Involved landowner<br>Residential | Very low | 606 m | High | Low | Medium distance views north to east from the involved residential dwelling will extend toward the powerline as it descends toward, and spans, the Rye Park Dalton Road corridor. There will be no | Medium |

**Table 21 –** Visual significance matrix (Refer **Figure 68a** and **68b** for residential view locations)

| View location (Refer to Figure 68 a/b) | 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 |
|---|---|---|---|---|---|---|---|
| | dwelling<br>High sensitivity | | | | | views toward the proposed substation locations. | |
| R67 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 956 m | High | Low to medium | Medium distance views north east to east from the residential dwelling toward the preferred powerline are largely screened by a low ridgeline descending in a north westerly direction to the east of the residential dwelling. There will be no views toward the proposed substation locations. | Low |
| T2 | **Uninvolved landowner**<br>Residential dwelling<br>High sensitivity | Very low | 1,620 m | High | Low/High | Potential long distance views west to south west from the residential dwelling toward the proposed powerline route will be screened by tree cover surrounding and beyond the residential dwelling. | Nil |
| T3 | **Uninvolved landowner**<br>Residential dwelling<br>High sensitivity | Very low | 538 m | High | Medium to high | Short to medium distance views west to south west toward the proposed preferred powerline will be significantly screened by a low ridgeline and hills to the west of the residential dwelling. There will be no views toward the proposed substation locations. | Low (potentially Nil) |
| R57 | Non residential structure | N/A | N/A | N/A | N/A | N/A | N/A |

**Table 21 –** Visual significance matrix (Refer **Figure 68a** and **68b** for residential view locations)

| View location (Refer to Figure 68 a/b) | 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 |
|---|---|---|---|---|---|---|---|
| R56 | **Uninvolved landowner**<br>Residential dwelling<br>High sensitivity | Very low | 1,260 m<br>(to alternative powerline route 5) | High | Medium | Long distance views north to south west toward the proposed preferred powerline route and the closer alternative powerline route 5 will be screened by a combination of undulating landform and tree cover to the west of the residential dwelling. | Nil |
| R59 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 1,500 m | High | Medium | Long distance views north toward the proposed powerline and substation C location are largely screened by a low undulating landform, including a low ridgeline above the Main Northern Railway line cutting. | Low |
| R60 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 1,460 m | High | Medium | Long distance views north toward the proposed powerline and substation C location are largely screened by a low undulating landform, including a low ridgeline above the Main Northern Railway line cutting. | Low |
| R61 | Involved landowner<br>Residential dwelling<br>High sensitivity | Very low | 1,865 m | High | Medium | Long distance views north toward the proposed powerline and substation C location are largely screened by a low undulating landform, including a low ridgeline above the Main Northern Railway line cutting, as well as tree cover to the north of the dwelling. | Low |

**Table 21 –** Visual significance matrix (Refer **Figure 68a** and **68b** for residential view locations)

| View location (Refer to Figure 68 a/b) | 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 |
|---|---|---|---|---|---|---|---|
| R62 | **Uninvolved landowner**<br>Residential dwelling<br>High | Very low | 1,863 m | High | Medium | Long distance views north toward the proposed powerline and substation C location are screened by a low undulating landform, including a low ridgeline above the Main Northern Railway line cutting, as well as tree cover to the north of the dwelling. | Nil |
| R63 | **Uninvolved landowner**<br>Residential dwelling<br>High | Very low | 1,996 m | High | Medium | Long distance views north toward the proposed powerline and substation C location are screened by a low undulating landform, including a low ridgeline above the Main Northern Railway line cutting, as well as tree cover to the north of the dwelling. | Nil |

## 12.8 Summary of visual significance (electrical infrastructure)

A total of 41 potential dwellings have been identified within a 2 km offset from the preferred and alternative 330 kV powerline routes. Six of the potential dwellings have been determined to be non residential structures. Eighteen of the residential dwellings are involved and nine and uninvolved residential dwellings. As assessment of visual significance for the proposed powerline and substations determined that:

- 18 of the 35 residential dwellings would have a Nil visual significance;
- 16 of the 35 residential dwellings would have a Low visual significance;
- 1 of the 35 residential dwellings would have a Medium visual significance.

The proposed powerline would span a small number of local unsealed and sealed roads including Lagoon Creek Road, Flakney Creek/Pudman Lane and the Rye Park Dalton Road. These roads carry a low volume of traffic, and transitory views from vehicles travelling along these roads would be unlikely to result in a significant level of impact.

Overall, this LVIA has determined that the electrical infrastructure associated with the Rye Park wind farm project would be unlikely to have a significant visual impact on surrounding private residential dwelling view locations, including both involved and uninvolved dwellings.

Whilst the alternative route alignments are closer to a number of involved and uninvolved residential dwellings than the preferred route, the alternative routes would be located away from ridgeline areas and therefore have the potential to be less visible from the surrounding landscape.

The three substation locations would be located away from uninvolved residential dwellings and largely visually contained within private land by an undulating landform and tree cover.

The undulating nature of local landform, and distribution of tree cover along the preferred and alternative powerline routes, would also tend to limit the potential for direct visibility toward existing high voltage powerline infrastructure within the surrounding landscape.

**Figure 69** illustrates a photomontage from the Rye Park-Dalton Road looking toward the proposed wind turbines and preferred 330 kV powerline route.

Public view location PM8 Rye Park Dalton Road - Existing view north north west to east. Photo coordinate Easting:680991 Northing:6161071 (MGAz55)

Public view location PM8 Rye Park Dalton Road- Proposed view toward proposed wind turbines and 330 kV transmission line.

## Notes

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

Individual panorama photograph coordinate map datum is MGAz55 to ± 5 m.

Extent of potential wind turbine visibility and directional bearing illustrated on each photomontage is indicative only.

The Nikon D700 digital SLR camera with a 50mm lens results in a single photograph with a view angle equivalent to a 35mm film photograph taken with a 50mm lens.

Refer Figure 31 for public view locations

**Figure 68**
**PM 10 View toward proposed 330 kV transmission line from Rye Park Dalton Road**

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# RYE PARK WIND FARM

# Pre-construction and construction

Section 13

## 13.1 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 24 months, although the extent and nature of pre-construction and construction activities would vary at different locations within the project area.

**Plate 10** and **11 -** Illustrating typical general construction activities during turbine construction

**Plate 12** - Illustrating general construction activities at the Capital wind farm site, including views toward cranes, partial construction of towers and laydown areas.

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.


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# Perception and public consultation Section 14

## 14.1 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 opinions and perception of individuals from the local community and broader area were sought and provided through a range of consultation activities. These included:

- public open day;
- meetings of the Community Consultation Committee
- dedicated project web site including feedback provisions; and
- individual stakeholder meetings.

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.


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### 14.2 Public consultation

A public open day was held at the Rye Park Memorial Hall on the 26th July 2012. The 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 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.

A single questionnaire was completed with a range of relevant and pertinent observations and detailed a number of points, which it would be reasonable to assume, could be reflected across a broader section of the local community. The key observations noted:

- landscape attributes of open space, peace and quiet, rolling hills, flora and fauna and a sparse population;
- landscape orientated recreational activities (gardening, fishing, shooting and walking);
- importance of views from local roads including Little Plains Road;
- lookouts or viewpoints are not necessary as views across the landscape can be gained from many locations in the locality including homes and farms;
- changes in the landscape have occurred as a result of subdivision with some land becoming degraded and weed infested on absentee landholders blocks, or additional vegetation has been added to the landscape such as shelter belts.

Whilst the respondent believes that the wind farm will have a negative impact on the landscape they also note that '*as an industrial complex I believe the wind farm will have a more minimal impact on the landscape and be better to look at than other alternatives*'.

### 14.3 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 impact of distance between turbines and view locations.

## 14.4 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 Rye Park 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 15

### 15.1 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.

## 15.2 Summary of mitigation measures

A summary of the mitigation measures available for the wind farm and powerline infrastructure is presented in **Tables 22** and **23**.

**Table 22** - 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 | | | ✓ | ✓ |

**Table 22** - Mitigation measures summary

| Safeguard | Implementation | | | |
|---|---|---|---|---|
| | Design | Site Preparation | Construction | Operation |
| structures, except those required for safety purposes. | | | | |
| If necessary, design and construct site control building and facilities 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 | ✓ | ✓ | ✓ | |

**Table 22** - Mitigation measures summary

| Safeguard | Implementation | | | |
|---|---|---|---|---|
| | Design | Site Preparation | Construction | Operation |
| where required in consultation and agreement with landholders. | | | | |

**Table 23** – 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 16

### 16.1 Summary

This LVIA has determined that the Rye Park wind farm would have an overall medium visual significance on the majority of uninvolved and involved residential dwellings within the projects 10 km viewshed. The Rye Park wind farm would have a slightly lower visual significance on views from surrounding road corridors and public spaces.

This LVIA has determined that the project would have a high visual significance for two residential dwellings within 2 km of the Rye Park wind turbines, one involved and one uninvolved. GBD understand that the uninvolved residential dwelling is involved with the neighbouring Rugby wind farm project.

This LVIA has also determined that the project will have a medium to high significance for seventeen residential dwellings within 2 km of the proposed turbines. Nine of these dwellings are uninvolved and eight involved.

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.

The project would be visible from a number of local roads such as Wargeila Road, Rye Park-Dalton Road, Little Plains Road, Maryvale Road, Boorowa Road and the Rye Park-Rugby Road. This LVIA has determined that views toward the Rye Park wind turbines would generally result in a low impact for the majority of motorists travelling through the area due to the short duration and transitory nature of effects.

This LVIA has determined that the construction of the project would result in some ‘direct’, ‘indirect’ or ‘sequential’ cumulative impacts when considered in addition to existing or proposed wind farm developments, including the proposed Bango and Rugby wind farm projects. The potential for ‘direct’ and ‘indirect’ cumulative visual impacts 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 substation locations and preferred and alternative powerline routes are unlikely to result in a significant visual impact for the majority of surrounding residential or public view locations. A combination of distance, undulating landform and tree cover between substation and powerline components 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 impact 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 impact 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 Glen Innes 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 impacts 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 impact 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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Visual Assessment of Windfarms: Best Practice. Scottish Natural Heritage Commissioned Report F01AA303A, University of Newcastle 2002.

Wind Farms in New South Wales, Wind in the Bush, David Clarke 2011: (http://www.geocities.com/daveclarkecb/Australia/WindNSW.htlm)

Wind Farms and Landscape Values National Assessment Framework, June 2007, Australian Wind Energy Association and Australian Council of National Trusts.

## Limitations

GBD has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of Epuron Australia 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 5th April 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 May 2012 and April 2013 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 – Civil Aviation Safety Authority Advisory Circular AC139-18(0) July 2007 (Withdrawn)

Australian Government
Civil Aviation Safety Authority

# Advisory Circular

## AC 139-18(0) SEPTEMBER 2004

# OBSTACLE MARKING AND LIGHTING OF WIND FARMS

CONTENTS



## 1. REFERENCES

- CASR Part 139, Subpart 139.E, and in particular
  - ◊ 139.365 Structures 110 metres or more above ground level.
  - ◊ 139.370 Hazardous objects etc.
- MOS-Part 139 Chapter 7 – Obstacle Restrictions and Limitations.
- MOS-Part 139 Section 8.10 – Obstacle Marking.
- MOS-Part 139 Section 9.4 – Obstacle Lighting.

## 2. PURPOSE

This Advisory Circular (AC) provides general information and advice on the obstacle marking and lighting of Wind Farms (including single wind turbines), where CASA has determined that the wind farm is, or will be, a hazardous object to aviation.

## 3. STATUS OF THIS AC

This is the first AC to be issued on this subject.

***Advisory Circulars are intended to provide recommendations and guidance to illustrate a means but not necessarily the only means of complying with the Regulations, or to explain certain regulatory requirements by providing interpretative and explanatory material.***

***Where an AC is referred to in a 'Note' below the regulation, the AC remains as guidance material.***

***ACs should always be read in conjunction with the referenced regulations***

## 4. GENERAL

**4.1** This AC applies specifically to horizontal-axis wind turbines, which are the only type installed, or known to be proposed for installation, in Australia, at the date of issue of this document.

**4.2** This AC applies to:

(a) a single wind turbine; or

(b) a group of wind turbines, referred to as a wind farm, which may be spread over a relatively large area.

**4.3** The height of a wind turbine is defined to be the maximum height reached by the tip of the turbine blades.

**4.4** Australian standards and recommended practices for the marking and lighting of obstacles and objects assessed as being hazardous to aviation, are consistent with international standards and recommended practices as published by the International Civil Aviation Organisation (ICAO) in Annex 14 Volume 1 (Aerodrome Design and Operations). The general requirements are:

(a) marking is used to make objects conspicuous to pilots, by day.

(b) lighting is used to make objects conspicuous to pilots, by night;

(c) lights are located as close as practicable to the top of the objects, and at other locations so as to indicate the general definition and extent of the objects.

**4.5** Wind turbines pose a particular practical problem in that their highest point is not a fixed structure, and therefore lights can not be appropriately located. The highest fixed part of the turbine where lights can conveniently be located is the top of the generator housing, sometimes known as the nacelle, and this is typically of the order of 2/3 the maximum height of the turbine.

**4.6** ICAO has not yet published standards and recommended practices specifically suited to wind turbines. The advice in this document has been derived by allowing some variations to standards and recommended practices to accommodate the specific practical difficulties associated with wind turbines and wind farms, and taking into consideration the practices of some overseas countries.

## 5. WIND TURBINES IN THE VICINITY OF AN AERODROME

**5.1** CASA strongly discourages the siting of wind turbines in the vicinity of an aerodrome.

**5.2** A wind turbine located sufficiently close to an aerodrome so that it penetrates an obstacle limitation surface (OLS) of the aerodrome, is defined by MOS-Part 139 Section 7.1, to be an obstacle.

**5.3** If the aerodrome is to be used at night, an obstacle that penetrates an OLS should be lighted, in accordance with MOS-Part 139 Section 9.4. The top lights are required to be arranged so as to at least indicate the points or edges of the object highest above the obstacle limitation surface. For a wind turbine, these lights may be located on a separate supporting structure adjacent to the wind turbine, to overcome the difficulty associated with the highest point of the obstacle being the (moving) blades of the turbine.

*Note:* *Obstacle limitation surfaces are a complex of imaginary surfaces associated with an aerodrome. They vary depending on number and orientation of runways, and the instrument-approach type of the runway(s). Some surfaces can extend to 15 km from an aerodrome. Aerodrome operators can provide details for their particular aerodrome.*

## 6. WIND TURBINES WITH A HEIGHT OF 110 m OR MORE

**6.1** CASR 139.365 requires a person proposing to construct a building or structure, the top of which will be 110 m or more above ground level, to inform CASA of that intention and the proposed height and location of the proposed building or structure.

**6.2** CASA will conduct an aeronautical study to determine if the wind turbine will be a hazardous object to aviation, in accordance with CASR 139.370.

**6.3** If, as a result of the aeronautical study CASA finds that a proposed wind turbine will penetrate an OLS of an aerodrome, the proposal will be dealt with in accordance with 5 above.

**6.4** The aeronautical study may find that even though the proposed wind turbine will not penetrate any OLS of an aerodrome, it will be a hazardous object to aviation.

**6.5** The hazard that an object poses to aviation can be reduced by indicating its presence by appropriate marking and/or lighting.

*Note:* *The marking and/or lighting does not necessarily reduce operating limitations which may be imposed by an obstacle or hazardous object.*

**6.6** The advice, in 7 and 8 below, on marking and lighting of wind turbines, should be suitable for wind turbines that do not penetrate an OLS, in most cases. However, because of the variations in configurations and layout of turbines in wind farms, the aeronautical study may indicate that a variation to that advice would be appropriate for a particular wind farm. In such a case, CASA may offer suggestions for variations to the normal advice provided in 7 and 8 below.

## 7. MARKING OF WIND TURBINES

**7.1** Experience with wind turbines installed to date, indicates that they are sufficiently conspicuous by day, due to their shape, size, and colour.

**7.2** Wind turbines that are of basically a single colour, and visually conspicuous against the prevailing background, do not require to be painted in obstacle marking colours and/or patterns.

## 8. LIGHTING OF WIND TURBINES

**8.1** In the case of a single wind turbine:

(a) two flashing red medium intensity obstacle lights should be mounted on top of the generator housing;

(b) the light fixtures should be mounted at a horizontal separation to ensure an unobstructed view of at least one of the lights by a pilot approaching from any direction;

(c) both lights should flash simultaneously; and

(d) the characteristics of the obstacle lights should be in accordance with MOS-Part 139 subsection 9.4.7.

**8.2** In the case of a wind farm, sufficient individual wind turbines should be lighted to indicate the extent of the group of turbines:

(a) the interval between obstacle lights should not be less than the current extensive object standard of 900 metres, and at a distance that minimises the number of lighted wind turbine generators without diminishing appropriate aviation safety;

(b) in addition, the most prominent (highest for the terrain) turbine(s) should be lighted, if not included amongst the turbines lighted in accordance with (a) above; and

(c) the lighting of individual turbines should be in accordance with 8.1 above.

*Note:* *There is an overseas proposal that all lighting provided at a wind farm should flash simultaneously. This proposal is still to be validated and accepted. It is suggested that wind farm operators bear in mind that the simultaneous flashing of all lights at a wind farm could become accepted practice some time in the future.*

**8.3** On completion of the project, CASA may choose to conduct a flight check to determine the adequacy of the obstacle lighting. This may result in a change (either more or fewer) to the number of obstacle lights required, to ensure the development remains conspicuous.

**8.4** Where obstacle lighting is to be provided, it is recommended a monitoring, reporting and maintenance procedure be put in place to ensure outages are reported through the NOTAM system and repairs are implemented.

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Bill McIntyre
Executive Manager
Aviation Safety Standards

## Appendix B – Andrew Homewood, curriculum vitae

**Areas of Expertise**

Landscape and Visual Impact Assessment

Landscape Design and Contract Documentation

Independent Verification & Landscape Management

**Education**

University of Sheffield, Graduate Diploma Landscape Management, 1996

University of Sheffield, BSc (Dual Hons), Landscape Architecture & Archaeology, 1995

Writtle College, National Diploma Amenity Horticulture, 1989

**Registration & Memberships**

Registered Landscape Architect , Australian Institute Landscape Architects (AILA)

Member Environmental Institute Australia and New Zealand (MEIANZ)

Member of the Landscape Research Group (UK)

**Selected Project Experience**

***Landscape and Visual Impact Assessment***

***Wind and Solar Farms***

**BP Moree Solar Power Station,** Status: Approved

LVIA for the Solar Flagship Moree Solar Farm site in northern New South Wales.

**Boco Rock Wind Farm EA, (Wind Prospect CWP Pty Ltd)** Status: Approved

LVIA for the proposed construction of up to 125 wind turbine generators in the NSW Southern Tablelands Monaro sub region, including coordination for supply of photomontage, ZVI and flicker assessment.

**Sapphire Wind Farm EA (Wind Prospect CWP Pty Ltd)** Status: Approved

LVIA for the proposed construction of up to 174 wind turbine generators in the NSW New England region, including coordination for supply of photomontage, ZVI and flicker assessment.

**Silverton Wind Farm EA Stages 1 & 2 (Epuron Pty Ltd)** Status: Approved

LVIA for a 1000MW wind farm at Silverton in the Unincorporated Area of western NSW, for up to 600 wind turbines including a 25km length of 220kV transmission line between the wind farm and Broken Hill.

**Conroy's Gap Wind Farm (Epuron Pty Ltd)** Status: Approved

LVIA for a DA modification for additional wind turbines to an approved development located in the southern highlands NSW.

**Bango Wind Farm (Wind Prospect CWP Pty Ltd)**

LVIA for the proposed construction of up to 100 wind turbines located in the southern highlands NSW.

**Liverpool Range Wind Farm Stage 1 (Epuron Pty Ltd)**

LVIA for the proposed construction of up to 200 wind turbines located in the Warrumbungle and Upper Hunter Shire Councils approximately 370 km north of Sydney, and a 60 km length of 330 kV line connecting to the Ulan mine site.

**Rye Park Wind Farm, (Epuron Pty Ltd)**

LVIA for the proposed construction of up to 120 wind turbines adjoining multiple wind farm sites in the New South Wales southern highlands.

**Deepwater Wind Farm (Epuron Pty Ltd)**

LVIA for the proposed construction of up to 7 wind turbines at Deepwater in north NSW.

**Port Kembla Wind Farm (Epuron Pty Ltd)**

LVIA for the proposed construction of up to 7 wind turbines within the Port Kembla industrial facility at Wollongong.

**Eden Wind Farm, (Epuron Pty Ltd)**

LVIA for the proposed construction of up to 7 wind turbines within the SEFE woodchip facility on the south coast of New South Wales.

**Paling Yards Wind Farm EA, (Union Fenosa Pty Ltd)**

LVIA for the proposed construction of up to 59 wind turbines including night lighting, cumulative impact assessment, detailed field assessment for shadow flicker and preparation of photomontages.

**Collector Wind Farm EA, (APP/RATCH)**

LVIA for the proposed construction of up to 68 wind turbines adjoining the operation Cullerin wind farm project including a detailed cumulative impact assessment.

**Willatook Wind Farm EES Referral, (Wind Prospect WA Pty Ltd)**

Preliminary LVIA for the proposed construction of up to 190 wind turbines within Moyne Shire Council (Victoria) including a detailed cumulative impact assessment, photomontage location selection and community consultation.

**Birrema Wind Farm EA (Epuron Pty Ltd)**

LVIA for the proposed construction of up to 75 wind turbines adjoining the proposed Yass Valley wind farm project development including a detailed cumulative impact assessment, photomontage location selection and community consultation.

**White Rock Wind Farm EA, (Epuron Pty Ltd)**

LVIA for the proposed construction of up to 100 wind turbines adjoining the proposed Sapphire and approved Glen Innes wind farm projects including a detailed cumulative impact assessment, photomontage location selection and community consultation.

**Crookwell 3 Wind Farm EA, (Union Fenosa Wind Australia)**

LVIA for the proposed construction of up to 35 wind turbines adjoining the approved Crookwell 2 wind farm development including a detailed cumulative impact and night time lighting assessment.

***Electrical Infrastructure***

**22kV transmission line (Country Energy)**

LVIA for a short section of electrical distribution line through central New South Wales.

**Wagga North 132kV substation (TransGrid)**

LVIA for a proposed 132/66kV substation and installation of transmission line connections at Wagga Wagga New South Wales.

**Lismore to Dumaresq 330kV transmission line (TransGrid)**

LVIA for a proposed 330kV transmission line through northern New South Wales.

**Manildra to Parkes 132kV transmission line (TransGrid)**

LVIA for a proposed 132kV transmission line through central New South Wales.

**Mount Macquarie Communication Tower (TransGrid)**

LVIA and preparation of visual simulations for proposed 80m high microwave communication tower in rural New South Wales, adjacent to the Blayney Wind Farm.

**Broken Hill to Red Cliffs 220kV transmission line duplication (Epuron Pty Ltd)**

LVIA for approximately 300km of 220kV transmission line duplication for the Silverton Wind Farm Concept Approval application.

**Molong to Manildra 132kV transmission line (TransGrid)**

View catchment mapping and visual assessment for a 28 km section of 132kV transmission line through rural landscape in central western New South Wales.

***Power Generation***

**Dalton Gas fired Power Plant (AGL Energy)**

LVIA for gas turbine peaking power station, valve station and communication tower in rural NSW. Preparation of photomontage and 3D modelling.

**Herons Creek Peaking Power Station (International Power)**

LVIA for 120MW distillate-fired peaking power station in rural landscape setting. Visual assessment included preparation of visual simulations to model each of the three 40MW generating units in the existing landscape.

**Parkes Peaking Power Station (International Power)**

LVIA for 120MW distillate-fired peaking power station in central New South Wales, including provision of photomontages.

**Buronga Peaking Power Station (International Power)**

LVIA for 120MW distillate-fired peaking power station in far west New South Wales.

**Leafs Gully Peaking Power Plant (AGL Energy Pty Ltd)**

LVIA and landscape master plan for gas turbine peaking power station in south-west Sydney.

**Bio Energy Project (SEFE)**

LVIA for a 5MW bio fuel power plant located on the south of Two Fold Bay, Eden.

## Professional History

Green Bean Design, Principal Landscape Architect 2006 -

URS Australia Pty Ltd, Practice Leader Landscape Architecture 2005 - 2006

URS Australia Pty Ltd, Associate Landscape Architect 2003-2005

URS Australia Pty Ltd, Senior Landscape Architect, 2002 - 2003

URS Australia Pty Ltd, Landscape Planner, 2001-2002

URS, Contract Landscape Architect, 2000-2001

Blacktown City Council, Contract Landscape Planner, 2000-2001

Knox & Partners Pty Ltd, Landscape Architect, 1996-2000

Brown & Associates, Landscape Architect, 1996

Philip Parker & Associates, Graduate Landscape Architect, 1994-1995

Rendel & Branch, Landscape Assistant, 1989-1991

National Trust, Horticulturalist, 1987-1988

English Nature, Species Protection Warden, 1985-1986

Essex Wildlife Trust, Botanist, 1984-1985

Royal Society for the Protection of Birds, Voluntary Warden, 1983-1984