



Viewpoint WF15: Kevin Wheatly VC Rest Area



Photograph cropped from Viewpoint WF15.

VIEWPOINT WF15		DESCRIPTION:	COMMENTS:
Location	Federal Highway	View from the Kevin Wheatley VC Rest Area, accessed off the Federal Highway looking east across Lake George. The landscape is characterised by a flat open expanse which continues across to the ridge lines associated with the Study Site. The existing turbines of the Capital I Wind Farm are visible in the distance along these ridge lines. The Federal Highway runs along the base of the Lake George Range which can be seen in the far right of the photograph.	From this viewpoint the proposed wind turbines will be visible along the eastern edge of Lake George. The proposed turbines will be sited on the low lying, flat topography at the base of ridge lines associated with the existing wind turbines. A combination of distance to the site and land use results in this viewpoint being assessed as having a low visual sensitivity. The visual effect is low, due to the existing landscape character established by the Capital I Wind Farm. The overall potential visual impact has been assessed as low. A photomontage from this viewpoint has been prepared to illustrate the overall visual impact. Refer to Photomontage 1 (Included as Plate 1 of this report).
Coordinates	S 35° 04.051' E 149° 22.462'		
Elevation	689m		
LCU	Lake George Plain		
Viewing Distance (to nearest proposed turbine)	9.4km		
Landuse	Rest Area		
Visual Sensitivity	Low		
Potential Visual impact	Low		





Viewpoint WF16: Peter Badcoe VC Rest Area



Photograph cropped from Viewpoint WF16.

VIEWPOINT WF16		DESCRIPTION:	COMMENTS:
Location	Federal Highway	View from the Peter Badcoe VC Rest Area, off the southbound lane of the Federal Highway. The photograph is taken in a generally south east direction across Lake George towards Bungendore and the existing Capital I Wind Farm. The landscape is flat and open utilised for grazing. The ridge lines associated with the eastern edge of Lake George are visible in the background. The existing wind turbines associated with Capital I Wind farm are visible along these ridge lines, however they are obscured by distance. On the far right of the photograph the escarpment of the Lake George Range is visible with the Federal Highway at its base.	The proposed turbines of the Capital II Wind Farm will be visible from this viewpoint. The extension of Capital Wind Farm would blend with the existing landscape character which has been established by the existing wind turbines. Due to the distance from the Site and the angle of viewing, the visual sensitivity of the viewpoint would be assessed as low. The visual effect would be assessed as low as the proposed turbines would be obscured by distance. The overall potential visual impact has been evaluated as low.
Coordinates	S 35° 02.123' E 149° 22.684'		
Elevation	700m		
LCU	Lake George Plain		
Viewing Distance (to nearest proposed turbine)	10.2km		
Landuse	Rest Area		
Visual Sensitivity	Low		
Potential Visual impact	Low		





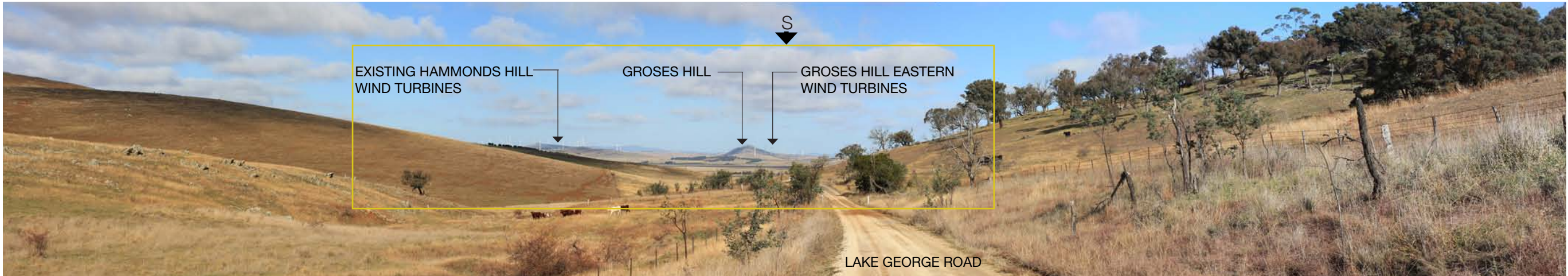
Viewpoint WF17: Panoramic photograph looking south down Lake George Road.



Photograph cropped from Viewpoint WF17.

VIEWPOINT WF17		DESCRIPTION:	COMMENTS:
Location	Lake George Road	View from an isolated rural property at the end of Lake George Road looking directly south towards the proposed wind farm site. The landscape of the area is generally undulating with mostly cleared grazing land. Wind turbines associated with the existing Capital I Wind Farm are visible in the distance. A sparse coverage of exotic and native vegetation associated with the property in the foreground of the photograph slightly buffers views to the Capital I Wind Farm. A portion of the northern extent of Lake George is visible beyond the rise in topography in the foreground of the photograph.	The proposed Capital II wind turbines will be visible from this viewpoint. However as they are sited on low lying topography, views of the majority of proposed turbines will be obscured by ridge lines. The northern extent of turbines sited SSE of this viewpoint will be visible beyond the ridge line in the foreground of the photograph though slightly buffered by existing foreground vegetation. The visual sensitivity of the viewpoint is assessed as moderate and the visual effect is assessed as low resulting in an overall potential visual impact assessment of low.
Coordinates	S 35° 02.158' E 149° 28.484'		
Elevation	717m		
LCU	Lake George Road		
Viewing Distance (to nearest proposed turbine)	2.9km		
Landuse	Rural access road		
Visual Sensitivity	Moderate		
Potential Visual impact	Low		Refer to Photomontage 2. (Included as Plate 2 of thie report)





Viewpoint WF18: Panoramic photograph taken along Lake George Road, looking south towards the Study Site.



Photograph cropped from Viewpoint WF18.

VIEWPOINT WF18		DESCRIPTION:	COMMENTS:
Location	Lake George Road	View looking generally south down Lake George Road towards the study site. Lake George Road is an unsealed access road which is used by the small number of homesteads located to the north of Lake George. The topography of the land between this viewpoint and the study site consists of undulating, cleared grazing land. A sparse coverage of native woodland vegetation occurs along ridge lines. Existing wind turbines associated with Grosses Hill and Hammonds Hill can be seen in the distance. The topography obscures views towards Lake George and the eastern groups of existing wind turbines associated with the Groses Hill Group.	From this viewpoint the proposed central group of turbines will be visible to the west of the existing eastern group of Groses Hill wind turbines. The proposed northern group of turbines sited along the low lying topography of Lake George will be visible yet obscured by topography and vegetation. The visual sensitivity from this viewpoint is assessed as being low, the visual effect is also assessed as low. The visible turbines will appear as an extension of the existing Capital One wind farm, and from this viewpoint will have a low visual impact.
Coordinates	S 35° 00.909' E 149° 29.546'		
Elevation	760m		
LCU	Lake George Road		
Viewing Distance (to nearest proposed turbine)	4.6km		
Landuse	Rural access road		
Visual Sensitivity	Low		
Potential Visual impact	Low		



# 7.0 Visual Impact (contd.)

## 7.2.3 Overview of Viewpoint Analysis

As it was discussed in the rationale for the viewpoint selection process, these viewpoints are representative of the worst case scenario. For each viewpoint, the potential visual impact was analysed through the use of a combination ZVI and topographic maps as well as on site analysis.

The visual sensitivity and visual effect of each viewpoint have been assessed which, when combined, result in an overall visual impact for the viewpoint (Refer to Tables 1 & 2). A summary of these results has been included in Table 7.

Of the 18 viewpoints assessed as part of this VIA, the wind turbines would be visible from all 18 viewpoints. Of the 18 viewpoints from which the wind turbines would be visible, 15 of these have been assessed as having a low visual impact, 3 have been assessed as having a moderate visual impact and none were assessed as having a high visual impact.

In addition to an assessment of the visual impact, a table summarising the potential visual prominence of the proposed development was assessed and the results are included in Table 8.

Generally, the further the viewpoint is from the proposed development the more wind turbines would be visible. The entire development can be seen from vantage points along the Federal Highway, however the distance is quite far which results in a low visual prominence. In contrast, viewpoints located close to the proposed wind turbines (eg. Taylors Creek Road) have a large vertical angle, yet generally a much smaller percentage of the turbines are visible due to obstruction by topography and existing vegetation.

It is important to note these rankings are used to make a comparison between viewpoints and do not necessarily reflect the actual visual impact.

VIEWPOINT	VISUAL SENSITIVITY	VISUAL EFFECT	VISUAL IMPACT
WF01	Low	Low	Low
WF02	Moderate	Moderate	Moderate
WF03	Moderate	Moderate	Moderate
WF04	Low	Moderate	Low
WF05	Low	High	Moderate
WF06	Low	Moderate	Low
WF07	Low	Moderate	Low
WF08	Low	Low	Low
WF09	Moderate	Low	Low
WF10	Low	Low	Low
WF11	Low	Low	Low
WF12	Low	Moderate	Low
WF13	Low	Moderate	Low
WF14	Low	Moderate	Low
WF15	Low	Low	Low
WF16	Low	Low	Low
WF17	Moderate	Low	Low
WF18	Low	Low	Low

Table 7: Viewpoint Visual Impact Summary.

# 7.0 Visual Impact (contd.)

VIEW-POINT	VIEWSHED Based on distance	DISTANCE To nearest proposed turbine	POTENTIAL VISUAL PROMINENCE Based on distance	VERTICAL ANGLE Based on nearest proposed turbine	VISUAL PROMENENCE Based on vertical angle	NUMBER OF VISIBLE EXISTING TURBINES Capital I Wind Farm	NUMBER OF VISIBLE PROPOSED TURBINES Proposed Capital II	CUMULATIVE PERCENTAGE OF VISIBLE TURBINES Capital I & II	POTENTIAL SCREENING FACTORS
WF01	Sub-regional	4.3km	Potentially noticable	2°	Potentially noticable	34	14	40%	Screen planting & topography
WF02	Sub-regional	2.2km	Potentially noticable	3.90°	Potentially Dominant	24	16	40%	Screen planting & topography
WF03	Local	1.6km	Potentially dominant	5.36°	Potentially Dominant	6	14	20%	Topography
WF04	Sub-regional	4.6km	Potentially noticable	1.87°	Potentially noticable	14	24	40%	Topography
WF05	Sub-regional	2.8km	Potentially noticable	3.07°	Potentially Dominant	10	11	20%	Topography & vegetation
WF06	Local	0.2km	Potentially dominant	36.87°	Potentially Dominant	67	55	100%	-
WF07	Local	0.7km	Potentially dominant	12.09°	Potentially Dominant	3	24	20%	-
WF08	Sub-regional	5.0km	Potentially noticable	1.72°	Potentially noticable	32	16	40%	Screen planting & topography
WF09	Sub-regional	6.2km	Potentially noticable	1.39°	Potentially noticable	29	24	60%	Screen planting & topography
WF10	Regional	7.5km	Potentially noticable	1.15°	Potentially noticable	13	24	40%	Screen planting & topography
WF11	Regional	7.6km	Potentially noticable	1.13°	Potentially noticable	25	24	60%	Topography
WF12	Sub-regional	5.2km	Potentially noticable	1.65°	Potentially noticable	67	41	100%	Topography
WF13	Sub-regional	5.7km	Potentially noticable	1.51°	Potentially noticable	58	55	100%	Topography
WF14	Regional	8.9km	Potentially noticable	0.97°	Potentially noticable	67	55	100%	-
WF15	Regional	9.4km	Potentially noticable	0.91°	Potentially noticable	67	55	100%	-
WF16	Regional	10.2km	Visibility Diminishing	0.84°	Potentially noticable	67	55	100%	-
WF17	Sub-regional	2.9km	Potentially noticable	2.96°	Potentially Dominant	51	17	60%	Screen planting & topography
WF18	Sub-regional	4.6km	Potentially noticable	1.87°	Potentially noticable	42	18	60%	Screen planting & topography

\*Please note the Viewpoint Visibility Assessment Summary is based on the visiibty assessment crietria outlined in Section 3.4 of this report.

Table 8: Viewpoint Visibility Assessment Summary.



# 7.0 Visual Impact (contd.)

## 7.3 Photomontages

Photomontages of the proposed Wind Turbines within the existing context were prepared to assist in the impact assessment of the proposed Capital II Wind Farm. The photomontages seek to convey the final visual image of the proposal from typical vantage points. Considerable effort was made to obtain photos in clear weather conditions tgo ensure that the photomontages would represent the worst case scenario.

The photomontages are based on worst case scenario without the inclusion of the proposed mitigation methods. Additional photomontages are provided showing measures to mitigate the impact of the solar farm and how they reduce the determined impact.

### 7.4.1 Photomontage Development Process

Photomontages are representations of the Wind Farm that are superimposed onto a photograph of the Site. The process for generating these images involves computer generation of a wire frame perspective view of the Wind Turbines and the topography from each viewpoint.

The photo simulations based on photography from typical sensitive viewpoints are included within the following analysis section. The images that the photo simulations have been based on have been captured with a Canon 40D SLR digital camera with a lens of 50mm which closely represents the central field of vision of the human eye.

The process for photomontage development is demonstrated in the following example:

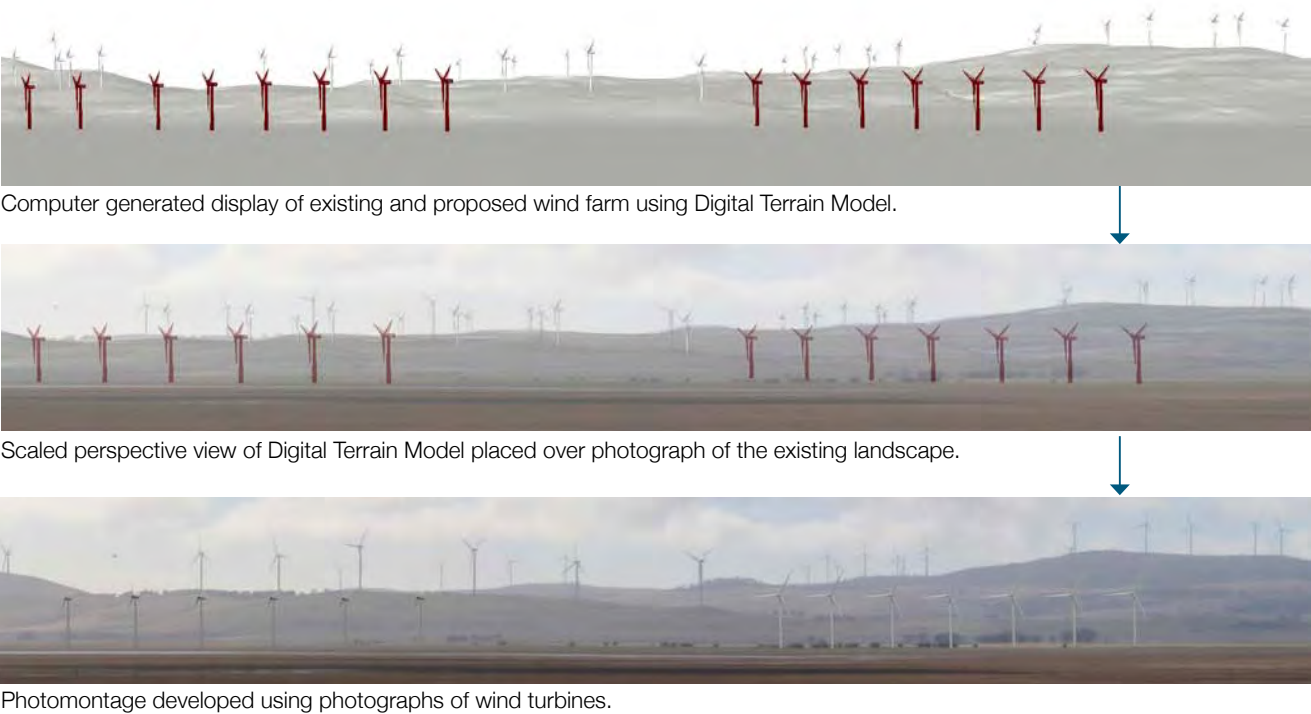


Figure 14: Photmontage process.

### 7.4.2 Photomontage Viewpoint Locations

A variety of indicative photomontage viewpoints have been included for the preparation of photomontages to best represent a range of distances as well as locations with differing views. Six viewpoints including: VP01, VP05, VP08, VP12, VP15, VP17 were selected for the production of photomontages.

Locations of the photomontages are shown in Figure 14.

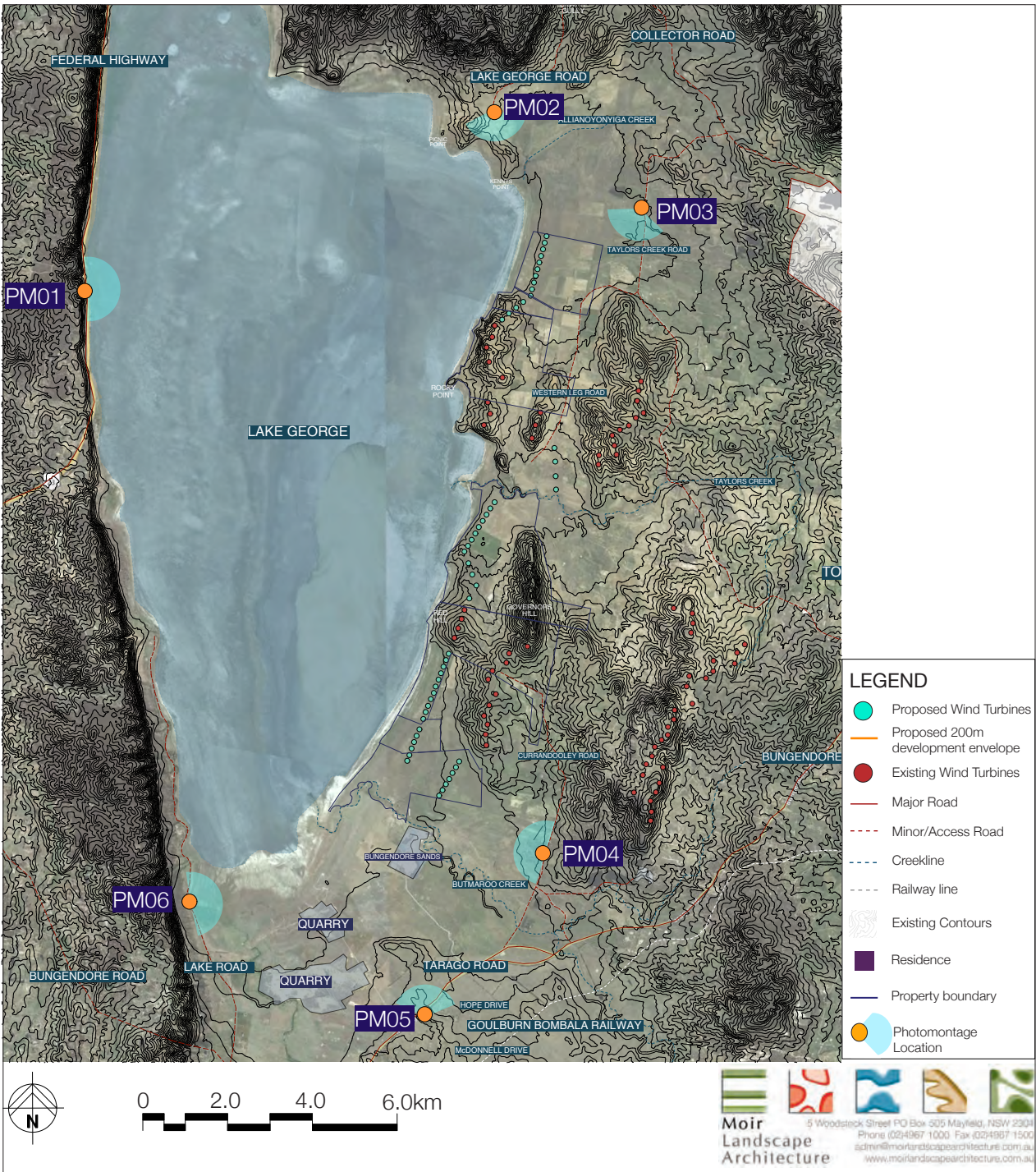


Figure 15: Photmontage Viewpoint Locations.



# 7.0 Visual Impact (contd.)



Photograph of existing view from Wheatley VC Rest Area on the Federal Highway.



Photomontage of proposed view from Wheatley VC Rest Area on the Federal Highway.



Plate 1: Photomontage from Wheatley VC Rest Area- Federal Highway. Refer to Viewpoint WF14.



# 7.0 Visual Impact (contd.)



Photograph of existing view towards the Site from Lake George Road.



Photomontage of proposed view of the Wind Farm from Lake George Road.



Plate 2: Photomontage from Lake George Road. Refer to Viewpoint WF17.



# 7.0 Visual Impact (contd.)



Existing view of the Site from Taylors Creek Road.



Photomontage of proposed view of the Wind Farm from Lake George Road.



Plate 3: Photomontage from Taylors Creek Road. Refer to Viewpoint WF02.



# 7.0 Visual Impact (contd.)



Photograph of existing view from Currandooley Road.



Photomontage of proposed view of the Wind Farm from Currandooley Road.



Plate 4: Photomontage from Currandooley Road. Refer to Viewpoint WF05.



# 7.0 Visual Impact (contd.)



Photograph of existing view towards the Site from Tarago Road.



Photomontage of proposed view of the Wind Farm from Tarago Road.



Plate 5: Photomontage from Tarago Road. Refer to Viewpoint WF08.



# 7.0 Visual Impact (contd.)



Photograph of existing view towards the Site from Lake Road.



Photomontage of proposed view of the Wind Farm from Lake Road.



Plate 6: Photomontage from Lake Road. Refer to Viewpoint WF12.



# 7.0 Visual Impact (contd.)

## 7.4 Culmulative Visual Impact

Cumulative landscape and visual effects result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it) or actions that occurred in the past, present or are likely to occur in the foreseeable future (The Landscape Institute et al 2008). Cumulative effects may also affect the way a landscape is experienced and can be positive or negative. Where they compromise benefits, they may be considered to form part of the mitigation measures.

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

The landscape and visual assessment for the proposed Capital II wind farm, (essentially an extension of the completed Capital I Wind Farm), needs to consider the cumulative effects on the immediate and broader regional context it is part of. The extension need to take into account change of scale and the potential for the receiving landscape to accommodate the larger composite feature.

The review of the cumulative impact has several dimensions:

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

### 7.4.1 Existing development in the region

#### CAPITAL I WIND FARM

The Capital I Wind Farm is recognised as the initial stage of the Capital Wind Farm, and is comprised of 67 wind turbines. The existing wind farm is spread over 35 square kilometres on the ridge lines immediately east of Lake George. The Capital I Wind Farm has been in operation since October 2009. The proposed Capital II Wind Farm is an extension of Capital I located predominately to the west the existing turbines.

#### WOODLAWN ECO-PRECINCT: WOODLAWN BIOREACTOR

The Woodlawn Bioreactor is located in a disused 25 million cubic metre open cut mine, off Collector Road north east of the Study Site. The Woodlawn Bioreactor has been in operation since 2005 and has since processed over 600,000 tonnes of waste predominately from Sydney. As a consequence,

plans are now underway to produce green energy using the methane created by this waste. This development in addition to the approved Woodlawn Wind Farm (see section 7.7.2) forms apart of the ‘Woodlawn Eco-precinct’.

#### QUARRYING

A number of quarries and sand mining operations occur within the area surrounding the Site. The cumulative visual impact of the quarries and sand mining activities in addition to the wind farm would be limited to dust creation during the construction phase.

#### INFRASTRUCTURE

Existing infrastructure in the area includes:

- 330,000 volt Kangaroo Valley to Canberra line which passes through the wind farm site.
- 66,000 volt lines that pass from north to south through the Site.

The proposed Capital II Wind Farm will connect to the existing 330,000 volt transmission line which extends from the Capital sub-station. This minimises the required amount of additional infrastructure which in turn reduces the extent of cumulative visual impact.

### 7.4.2 Proposed local developments

In addition to the Capital II project there are a number of projects approved and awaiting approval, that may commence works in the near future.

Proposed projects in the area (as of October, 2010), include:

- Woodlawn Wind Farm
- Capital Solar Farm

A plan showing the location of these projects is included as Figure 16 of this report.

#### WOODLAWN ECO-PRECINCT: WOODLAWN WIND FARM

The approved (not yet constructed) Woodlawn Wind Farm is located approximately half way between Taylors Creek Road and Tarago/Bugendore Road, 6km to the east of the Grosse Hill group of the existing Capital I Wind Farm. The approved project consists of 23 2.1MW wind turbines with a hub height of 80m and a rotor diameter of up to 88m. The proposed development forms apart of the ‘Woodlawn eco-precinct’.

#### CAPITAL SOLAR FARM

Infigen has proposed the development of a photovoltaic Solar Farm, located approximately 6.5km northwest of Bungendore off Tarago Road. The proposal is located to the south of the existing Capital I Wind Farm. The solar farm is a low-lying development which covers an area of approximately 60ha. In comparison to the scale of the existing and proposed wind farms, the cumulative impact of the proposed development of the solar farm is minimal.



# 7.0 Visual Impact (contd.)

## 7.4.3 Cumulative effects of existing and proposed wind farms in the region

The main cumulative impact of the multiple wind farm developments of the area is likely to be related to the visual impact. The visual impact will be greater at vantage points from which more than one development is visible.

The Capital II Wind Farm is essentially an extension of the Capital I Wind Farm. The layout of the proposed extension has been sited to ensure it appears as continuation of the existing wind farm as opposed to a separate entity. Being located on the foothills of the ridge line associated with existing wind turbines, the most direct cumulative visual impact is likely to be seen from the west of the Site, along the western shores of the Federal Highway, however this is at considerable distance.

The Woodlawn Wind Farm is proposed to be located approximately 6km to the east of the existing Capital I Wind Farm. The largest combined presence of wind turbines would be likely to be apparent from dwellings and public areas located between the existing Grosse Hill Capital 1 turbines and the Woodlawn wind farm, as they will appear as two separate farms. Due to the location of the Capital 2 turbines which are situated predominantly on the lower slopes to the west of the ridgelines associated with Grosse Hill and Hammonds Hill the contribution of the Capital 2 turbines to this cumulative impact would be negligible.

## 7.4.4 Limitations on broad scale expansion

The landscape of the area allows for optimum harvest of wind energy. There are minimal obstructions in the landscape and smooth topography and easy access to the grid which is beneficial to the output of a wind farm. However it is conceivable that if wind farms in the local area were to become more prevalent, the spatial and landscape separation between the farms would decrease, resulting in limitations for continued development.

The factors which will potentially constrain wind farm development include:

- Topography
- Great Dividing Range
- Lake George Range (due to zoning under the Local Environment Plan)
- Lake George as an area of cultural significance
- Existing wind farms
- National Parks

Considering all the sustainable energy proposals for this region, including proposals for the Woodlawn Wind Farm, Capital Solar Farm and methane production at the Woodlawn Bioreactor, the area is evolving into a showcase for renewable energy. The proposed expansion of the Capital Wind Farm adds to the overall renewable energy precinct. When implemented with appropriate environmental management, the development of wind farms can be undertaken with low impact on the surrounding environment whilst providing positive local, regional and national benefits.

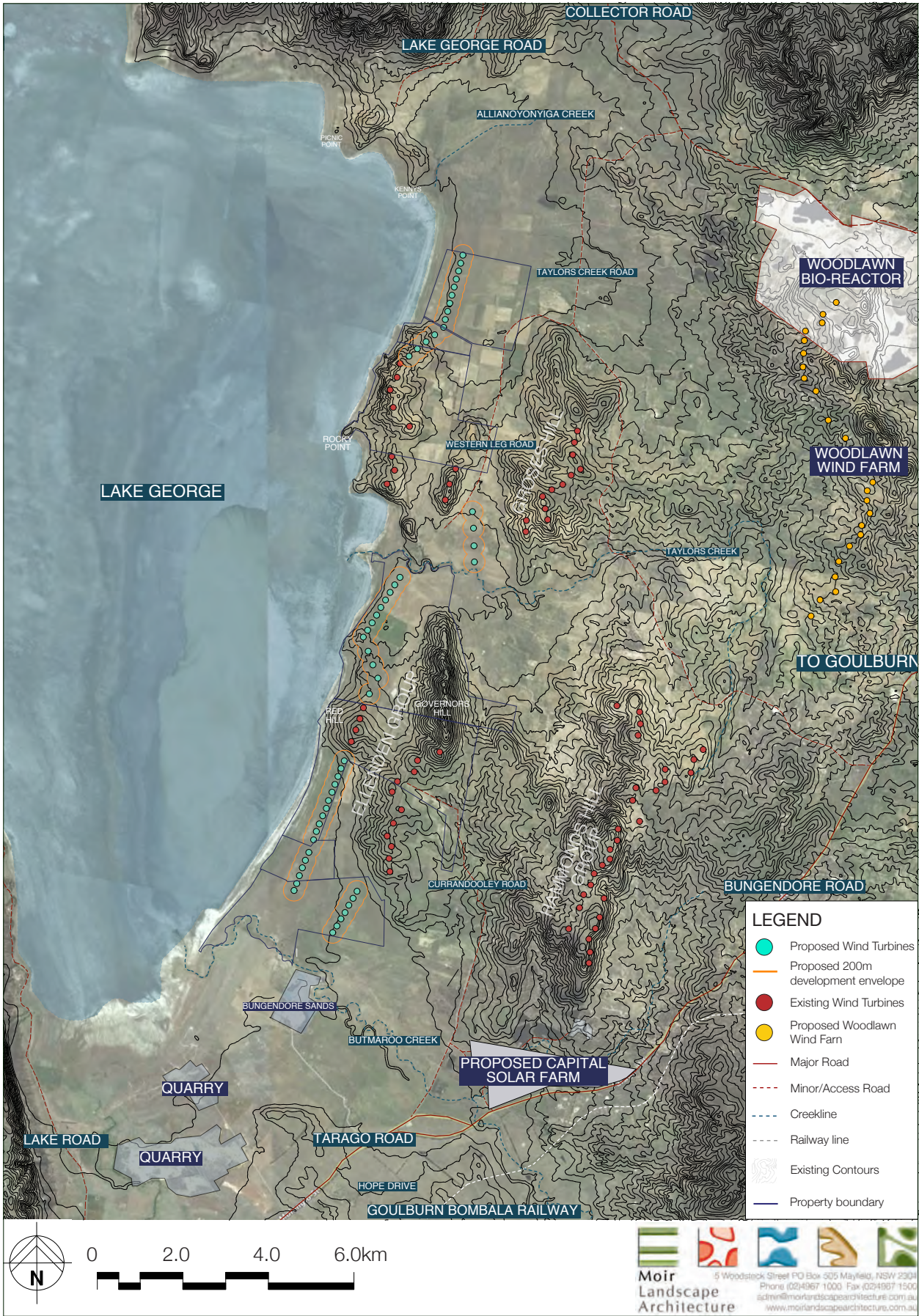


Figure 16: Cumulative visual impact.