Crookwell 3 Wind Farm

Landscape & Visual Impact Assessment Supplementary Report

Response to Independent Expert Review
Ref: 918-Z-02, Dated August 2013

Prepared by:

GREEN BEAN DESIGN
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Green Bean Design – Capability Statement

Green Bean Design (GBD) is an experienced landscape architectural consultancy specialising in landscape and visual impact assessment. As an independent consultancy GBD provide professional advice to a range of commercial and government clients involved in large infrastructure project development.

GBD owner, and Principal Landscape Architect Andrew Homewood, is a Registered Landscape Architect and member of the Australian Institute of Landscape Architects and the Environmental Institute of Australia and New Zealand. Andrew has over 20 years continuous employment in landscape consultancy and has completed numerous landscape and visual impact assessments for a range of large scale and State significant infrastructure and renewable energy projects, including wind energy and solar power developments. GBD has been commissioned for over 20 wind energy projects across New South Wales, Victoria, South Australia, Queensland and Tasmania, including assessments for:

• Silverton WF	• Boco Rock WF	• Collector WF
• Crookwell 3 WF	• Sapphire WF	• Willatook WF
• Eden Wind Farm	• Birrema Wind Farm	• Rye Park WF
• Paling Yards WF	• Port Kembla WF	• Bango WF
• Deepwater WF	• White Rock WF	• Liverpool Range WF
• Conroy's Gap (Mod 4)	• Mt Emerald WF	• Granville Harbour WF

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1 Introduction

The Crookwell 3 Landscape and Visual Impact Supplementary Report (LVIA-SR) has been prepared by Green Bean Design (GBD) in response to an Independent Expert Review (IER) of the Crookwell 3 Wind Farm Landscape and Visual Impact Assessment (Crookwell 3 LVIA). The IER was commissioned by the New South Wales Department of Planning and Infrastructure (DoP&I) and prepared by O'Hanlon Design (August 2013)

The IER terms of reference required specific regard be given to:

- *the appropriate documentation provided by the Department with regard to the Director General's Requirements for the EA, the supplementary Director General Requirements for the EA, relevant planning guidelines with particular regard to the Departments of Planning and Infrastructures NSW Planning Guidelines – Wind Farms, (Draft), industry standards and legislation,*
- *the Landscape and Visual Impact Assessment prepared by Green Bean Design, July 2012 (LVIA). The findings of this report are summarised in Chapter 9 of the EA and the report is included as Appendix 6 of the EA including Chapter 22 of the EA which assess cumulative impacts (specifically 22.4 for cumulative visual impacts),*
- *the Response to Submissions (RtS) by the proponent, specifically in relation to visual impacts and turbine locations, and*
- *preparation of an independent expert review report providing expert advice and commentary on the;*
    - *proponents landscape & visual impact assessment (including methodology, assumptions and assessments of impacts including cumulative impacts), and if necessary, identify gaps in the documentation to be addressed by the Proponent to ensure it accords with all relevant guidelines;*
    - *suitability of how stakeholder and community issues are assessed in the EA and in the land and visual assessment report;*
    - *suitability of the proposed mitigation, management and/or protection measures if required;*
    - *applicability of the approach taken and assumptions made in the assessments; and*
    - *acceptability of landscape impacts at both the local and regional scales.*

The DoP&I also requested the IER give consideration to the Draft NSW Planning Guidelines for Wind Farms; however, neither the Crookwell 3 Wind Farm DGR's nor the Supplementary DGR's required consideration to be given to the Draft NSW Planning Guidelines in the preparation of the Crookwell 3 LVIA. GBD are aware of DoP&I correspondence sent to the Proponent, dated 18 April 2012, encouraging (but not requiring) the Proponent to adopt relevant provisions of the draft guidelines.

The Crookwell 3 LVIA addressed a significant number of the planning draft guideline provisions including the preparation of photomontages from non involved residential dwellings within 2 km of the proposed Crookwell 3 wind farm turbines.

The IER has, to some degree, drawn comparisons and relied upon conclusions between the review of the approved Crookwell 2 Wind Farm EIS (prepared by Scenic Spectrums Pty Ltd, 2005) and the Crookwell 3 LVIA. The IER assumption that the Scenic Spectrum Review (SSR) provides comparable data and assessments to those provided in the Crookwell 3 LVIA is tenuous. The reasons for this include:

- a seven year gap between the compilation of data and assessment of the approved Crookwell 2 wind farm and the proposed Crookwell 3 wind farm;
- anthropogenic changes to the landscape and distribution of receptors over the seven year period;
- planning consent for the Crookwell 2 wind farm;
- planning consent for the Gullen Range wind farm;
- updates and amendments to assessment guidelines; and
- changes to the regulatory framework and assessment criteria for wind farm developments.

The IER has also reviewed and applied guidance from the Wind Farms and Landscape Values and National Assessment Framework (Australian Wind Energy Association and Australian Council of National Trusts June 2007). The Framework was referenced as a Relevant Guideline (For Reference) in the DGR's and was addressed in the Crookwell 3 LVIA. It should be noted that the Framework states that it 'is a framework rather than a set of detailed prescribed methods, tools or techniques'.

Following the Crookwell 3 LVIA submission and public exhibition a single wind turbine (A19) was removed from the project. Whilst the removal of this wind turbine results in a reduction in the number of visible wind turbines, it has not altered the assessment and determination of landscape and visual impacts for the residential and public areas identified in the Crookwell 3 LVIA.

Specifically this LVIA-SR has reviewed and responded to the IER Section 5 Summary of Acceptability and Recommendations and notes that DoP&I raise particular attention be given to the need for an enhanced cumulative impact assessment for the wind farm development for residential dwellings within 2 km of the Crookwell 3 wind turbines.

2 SSR Preferences and conditions

Given the IER reliance upon the SSR prepared for the approved Crookwell 2 wind farm, it is necessary to outline the SSR preferences which Scenic Spectrums considered conditional for the approval of the Crookwell 2 wind farm. The SSR preferences included conditions such as:

- '*to establish a 500m setback from the Crookwell Goulburn Road*;
- *'special individual colouring of wind turbines to reduce their visual contrast and impact, allowing them to better blend into the landscape'; and*
- *for 'planting of intervening ridges, gullies and the Wollondilly River Valley to achieve vegetative screening and scenic enhancement'.*

These conditions were not adopted by the DoP&I in the determination of planning consent for the approved Crookwell 2 wind farm. With specific regard to the Crookwell 3, none of the proposed Crookwell 3 wind turbines are located within 1 km of the Crookwell Goulburn Road or within 750 m of the Woodhouselee Road. There are also no non involved residential dwellings located within 1 km of the proposed Crookwell 3 wind turbines.

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3 IER Recommendations

Section 5.1 of the IER suggests recommendations following a review of the Crookwell 3 LVIA and Environmental Assessment. In the opinion of the IER there are several key areas where the current Crookwell 3 LVIA and Environmental Assessment require modification to comply with the DGR's. These include areas such as:

- community consultation;
- assessment of Landscape and Visual Impact Assessment;
- cumulative impact;
- mitigation measures; and
- night lighting.

The IER recommendations are presented in Table 1. Additional detailed responses to the IER recommendations are provided in the following sections of this LVIA-SR.

Table 1 – IER Comments/Recommendations and Responses

Aspects and issues identified within the O'Hanlon Design IER	GBD Response
Community Consultation	
Prior to any amendment of the LVIA the proponent identify the community and stakeholder values of the local and regional visual amenity and quality, and perceptions of the project, based on surveys and consultation.	The Proponent has complied with the DGR's and provided a comprehensive assessment of the landscape character and values and scenic or significant vistas of the area potentially affected by the project. This assessment has **described** community and stakeholder values of the local and regional visual amenity, and perceptions of the project based on surveys and consultation.
Assessment of Landscape and Visual Impact The LVIA be amended with a justified methodology, to incorporate:	
• an assessment of the effect of proposed turbine height on dominance and required setbacks in the study area landscape	• Ongoing development and planning for the Crookwell 3 wind farm, subsequent to the preparation of the Crookwell 3 LVIA, has determined that the Crookwell 3 wind turbines will be less than 157m in height (to tip of blade) and more are likely to be around 130m in

Table 1 – IER Comments/Recommendations and Responses

Aspects and issues identified within the O'Hanlon Design IER	GBD Response
	height (to tip of blade), which is similar to the height of wind turbines within the approved Crookwell 2 wind farm development. • The dominance of the proposed Crookwell 3 wind turbines will be no greater than the approved Crookwell 2 or Gullen Range wind turbines. • GBD are not aware of any required mandatory setbacks in the study area landscape. GBD are cognisant of an advisory 2 km setback outlined in the Upper Lachlan Shire Council DCP and the Draft NSW Planning Guidelines – Wind Farms (December 2011).
• a review of the viewer and scenic quality sensitivity parameters incorporating a justification of the selected viewer characteristics and user numbers on roads and at public locations	• a review of the viewer and scenic quality sensitivity parameters has been undertaken and a justification of the selected viewer characteristics and user numbers on roads and at public locations provided in the following section of this LVIA-SR.
• an assessment of impacts on St. Stephens Church, the Pejar Creek underbridge and Pejar Dam recreation area, and	• An assessment of the potential impact of the Crookwell 3 wind farm **on people** at the St Stephen's Church and Pejar Dam recreation area was determined in the Crookwell 3 LVIA. • The Crookwell 3 wind farm will not have any significant impact upon the Pejar Creek underbridge.
• the outcomes of community consultation and amended visual parameters on the original LVIA assessments and produce a revised LVIA for consideration	• The Proponent has complied with the DGR's and undertaken community consultation prior to, and during, the public exhibition of the Crookwell 3 wind farm Environmental Assessment. The results from community

Table 1 – IER Comments/Recommendations and Responses

Aspects and issues identified within the O'Hanlon Design IER	GBD Response
	consultation and surveys were incorporated into the Crookwell 3 LVIA.
Cumulative impact The cumulative impact assessment in the LVIA is to be amended to:	
• Provide a justified methodology and assessment of the cumulative impacts of Crookwell 3 combined with Crookwell 1, 2 and Gullen Range including both approved and proposed elements	• A justified methodology and assessment of cumulative impacts of the Crookwell 3 combined with Crookwell 1, 2 and Gullen Range is provided in the following section of this LVIA-SR.
• Clearly identify any likely changes to the landscape character of the region resulting from the combination of the regional projects and identify the regional community perceptions of the resultant cumulative impacts based on surveys and consultation, and	• Likely changes to the landscape character of the region resulting from the combination of the regional projects is provided in the following section of this LVIA-SR.
• Include assessments of the cumulative impact of the regional projects on public viewing locations, heritage items and individual residences, particularly residences within 2 km of any proposed Crookwell 3 wind turbine.	• An assessment of cumulative impacts, and particularly cumulative impacts on non involved residential dwellings within 2 km of the Crookwell 3 wind farm turbines has been provided in following sections of the LVIA-SR.
Mitigation measures	
The proponent to provide a clear commitment of any planting proposed to be provided to screen the development from public locations with a description of the location and an assessment of feasibility, effectiveness and likely reliability of the proposed screening.	• The Proponent will consult with the Upper Lachlan Shire Council if specifically requested to undertake screen planting on public land administered by Council. • The location and assessment of feasibility, effectiveness and likely reliability cannot be determined until such time that the final location and extent of planting has been agreed by the Proponent and Council. It would be

Table 1 – IER Comments/Recommendations and Responses

Aspects and issues identified within the O'Hanlon Design IER	GBD Response
	unusual and unrealistic to expect this level of detail to be provided prior to consent being given.
Night lighting	
The proponent to provide an assessment of the likely impact of effectiveness of proposed mitigation measures for night lighting identified in the Response to Submission.	• Ongoing development and planning for the Crookwell 3 wind farm, subsequent to the preparation and exhibition of the Crookwell 3 LVIA, has determined that the Crookwell 3 wind turbines will be less than 150 m in height (to tip of blade). As such, and in accordance with current CASA guidelines, the Crookwell 3 wind turbines will not require obstacle lighting. • The Proponent does not intend to undertake any additional lighting assessment over and above that already provided in the Crookwell 3 LVIA and Environmental Assessment.

4 Approved Crookwell 2 and proposed Crookwell 3 Review and Comparison

As previously noted, the IER report has drawn heavily upon the Review of Crookwell 2 Wind Farm EIS Summary (working document) prepared by Scenic Spectrums Pty Ltd (January 2005).

Whilst the DoP&I has not adopted the SSR as a methodology for conducting wind farm landscape and visual impact assessment, GBD concur with the IER that, in general terms, the proximity of the approved Crookwell 2 and proposed Crookwell 3 wind farms merit some comparisons.

Specifically, and as a barometer to local community and stakeholder attitudes and perceptions toward each project (both separately and combined), a comparison has been made between submissions received during public exhibition of the approved Crookwell 2 and proposed Crookwell 3 wind farm projects. If, as the IER surmises, the Crookwell 3 wind farm will result in an unacceptable level of visual impact, then it is reasonable to expect this to be reflected in submissions received for the Crookwell 3 project.

The following table outlines information from submissions received during the public exhibition of the approved Crookwell 2 and proposed Crookwell 3 wind farm projects.

Table 2 – Approved Crookwell 2 and proposed Crookwell 3 submissions

Crookwell 2		Crookwell 3	
Number of submissions received during public exhibition	48	Number of submissions received during public exhibition	37
Number of submissions received from private households, individuals or companies	47	Number of submissions received from private households, individuals or companies	26
Number of submissions from Government Agencies	1	Number of submissions from Government Agencies	11
Number of submissions citing visual as a primary objection	39	Number of submissions citing visual as a primary or significant objection	12

A review and comparison of submissions received during public exhibition for the approved Crookwell 2 wind and proposed Crookwell 3 wind farm projects indicate:

- the total number of submission in response to the Crookwell 3 EIS public exhibition decreased by eleven when compared to approved Crookwell 2 submissions;

- the total number of submissions received from private households, individuals and companies in response to the Crookwell 3 EIS public exhibition decreased by twenty one when compared to the approved Crookwell 2 submissions;
- the number of submissions received from Government Agencies in response to the Crookwell 3 EIS public exhibition increased by ten when compared to approved Crookwell 2 submissions; and
- the number of Crookwell 3 submissions compared to Crookwell 2 submissions citing visual as a primary of significant issue decreased by twenty seven.

The public exhibition of the Crookwell 3 wind farm EIS resulted in a lower number of submissions, and a 55% decrease in submissions from private households, individuals or companies. Submissions for the Crookwell 3 wind farm also indicate a 31% decrease in the number of submissions citing visual as a primary or significant objection.

5 Response to IER Summary of Acceptability of Impacts

SSR community study

GBD note the IER determination that the Crookwell 3 wind farm project is likely to be considered an acceptable impact as a standalone element in the landscape; however, is highly unlikely to be acceptable on the basis of potential cumulative impacts and the resulting undesirable change to the 'pastoral character' of the landscape. The desirable nature of the 'pastoral landscape' was established in the SSR community study for the approved Crookwell 2 wind farm project.

The SSR states that '*consultations with the community were undertaken selectively based on DoP&I (formerly Department of Infrastructure and Natural Resources – DIPNR) lists of property owners. The lists were limited to those who had made EIS submissions and whose properties may be visually affected by the proposed development'.*

Altogether fourteen property owners were contacted by telephone and site visits made to sixteen properties.

Forty seven individuals (coincidentally the same number of private household, individuals or companies that made a submission) attended the Crookwell 2 workshop.

Given a population of around 2,840 people (Australian Bureau of Statistics Census 2011) in the Bannister and Crookwell State Suburbs (which broadly extend across, and locally beyond, the Crookwell 1, 2 and 3 wind farm project areas), the SSR determination of desirable landscape characteristics has been based upon the opinion of around 1.6% of the population surrounding the Crookwell 1, 2 and 3 wind farm sites.

Given the extremely low sample size, confidence in the formulation of scenic assessment guidelines and reliability of the conclusions of the SSR community study for the approved Crookwell 2 wind farm, does not appear to be high.

In addition, sampling opinions from individuals that made an EIS submission, and primarily those from people who may be visually affected by the proposed development, will possibly introduce some degree of bias into the overall community study results.

Notwithstanding the limitations of the SSR community study, GBD consider that the desirable nature of the broader 'pastoral landscape' has already been influenced and modified by existing and approved wind farm developments such as Crookwell 1, Crookwell 2 and Gullen Range. We also note that these projects are located in a landscape designated by the NSW Government for the development of renewable (and specifically) wind farm projects.

Cumulative impact

The IER states that *'the wider question of acceptability of the cumulative impacts can be answered **only** by the identification and determination of the desirable landscape character. If, as noted in the SSR, the desirable character is to maintain the pastoral landscape character then using the guidelines set in the SSR for assessment, the cumulative impacts are highly likely to be unacceptable'.*

As previously noted the SSR determination of the desirable 'pastoral landscape' character has been based on the opinion of around 1.6% of the surrounding population. It is not apparent that the determination of the desirable landscape character is reliable or reflects the opinion of the majority of the population. GBD do not consider that the determination of desirable landscape character is the **only** criteria by which to determine acceptability of cumulative impacts.

The IER has recommended that the LVIA-SR adopt the National Assessment Framework as a suitable methodology for the assessment of cumulative impact. GBD note that the National Assessment Framework cumulative assessment methodology does not state that the acceptability of the cumulative impacts can be answered **only** by the identification and determination of the desirable landscape character. Given the IER has conducted a simplistic analysis it is difficult to determine how the IER has reached the conclusion that:

- cumulative impacts are highly likely to be unacceptable; and
- (the wind farm) would be an unacceptable cumulative impact on a large number of residences.

In our opinion the IER has not provided enough information or undertaken any form of assessment (subjective or professional); in order provide a determination of potential visual cumulative impact, let alone reach an overall conclusion of acceptability or unacceptability.

The IER states that *"the location of the Crookwell 3 South component fills in the visual catchment between the Gullen Range wind farm and Crookwell 2".* This statement does not generally correspond with the information provided in the Crookwell 3 LVIA and GBD note:

- the Crookwell 3 South turbine group comprises a small number of wind turbines, eight in total – the same number of wind turbines in the Crookwell 1 development;
- the Crookwell 3 South wind turbines are located to the south of the approved Crookwell 2 wind turbines and do not extend beyond the western extent of the Crookwell 2 wind turbines; and
- the nearest Crookwell 3 South and approved Crookwell 2 wind turbines to the approved Gullen Range wind turbines are located at a similar distance (around 8.3 km).

The IER goes on to state that the Crookwell 3 East turbine group *"extends the visual impacts across Woodhouselee Road to the east".* This statement does not generally correspond with the information provided in the Crookwell 3 LVIA and we note:

- visual impact to the east of the Crookwell 3 East turbine group is significantly influenced and restricted by topography and tree cover between the wind farm and Middle Arm Road;
- views toward the approved Crookwell 2 wind turbines from residential dwellings along Woodhouselee Road (which are proximate to the Crookwell 3 East wind turbines), are partially contained by rising landform (to Pigmans Hill) and or vegetation to the west of Woodhouselee Road.

The IER also states that the *'overall effect is a significant extension of the extent of wind farms in the visual catchment of a large number of residences. This is demonstrated in LVIA Figure 24 ZVI: Diagram 6 'Cumulative Crookwell 1, 2, 3 and Gullen Range'.*

GBD note that the cumulative ZVI included in the Crookwell 3 LVIA:

- are used to identify theoretical areas of the landscape from which turbines may be visible;
- represent views toward 'tip of blade' i.e. any view toward a turbine including the very tip of a blade beyond a hill or ridgeline;
- do not include the screening influence of any above ground structures or vegetation in the landscape including tree planting around residential dwellings.

Whilst the cumulative tip of blade ZVI illustrates a very conservative assessment of wind turbine visibility GBD note that the LVIA Figures 3 and 4 demonstrate significant reductions in visibility between views toward tip of blade and the rotor face.

6 Response to the IER Recommendations

The following responses are provided to the IER recommendations provided in Section 5.1 of the IER.

Recommendation 1 - Community Consultation

Prior to any amendment of the LVIA the proponent identify the community and stakeholder values of the local and regional visual amenity and quality, and perceptions of the project, based on surveys and consultation.

The Crookwell 3 LVIA addressed the requirements of the DGR's which state the Proponent *'provide a comprehensive assessment of the landscape character and values and any scenic or significant vistas of the area potentially affected by the project. This should describe community and stakeholder values of the local and regional visual amenity and quality, and perceptions of the project based on surveys and consultation'.*

GBD note the Crookwell 3 LVIA DGR's require the Proponent to **describe** community and stakeholder values of the local and regional and regional visual amenity and quality and not to **identify** them as directed in the IER.

The Crookwell 3 LVIA has **described** community and stakeholder values of the local and regional visual amenity through surveys and consultation. Surveys reviewed for the Crookwell 3 LVIA included the:

- Community Attitudes to Wind Farms in New South Wales, September 2010, AMR Interactive http://www.environment.nsw.gov.au/climatechange/reprecinctresources.htm
- Gullen Range Wind Farm Report on Community Perceptions toward Wind Farms in the Southern Tablelands, New South Wales, October 2007, Gullen Range Wind Farm Pty Ltd

  https://majorprojects.affinitylive.com/public/f4a606455eaba6e1d36b3bfce560cbf1/Environmental%20Assessment_attachment%201_2.3_perceptions%20survey.pdf
- Community Engagement Research for the Collector Wind Farm, November 2010, Ratch Australia Pty Ltd

  https://majorprojects.affinitylive.com/public/0a482914933e03f2be40f391d8bc8ed0/Appendix%20D%20-%20Community%20Attitudes%20Survey.pdf

The Gullen Range Community Perception Study, conducted between July and August 2007, canvassed the opinion of 300 people across an extensive area of the Southern Tablelands. This area included the sites and surrounding areas of the proposed Crookwell 3 wind farm.

In addition the LVIA-SR has reviewed the Community Engagement Research for the Collector Wind Farm (recommended for approval by the DoP&I and subsequently approved by the Planning Assessment Commission in December 2013) conducted in November 2010. The Collector wind farm survey canvassed the opinion of 400 people residing within a 50 km radius of the Collector Wind Farm. This survey area captures the study area of Crookwell 3 wind farm.

The LVIA-SR does not intend to re-list the detailed and individual findings set out in each of the surveys; however, GBD note that there is a similarity between wider community attitudes which indicate support for wind farm development within the Southern Tablelands at 70% to 80% of individuals surveyed. The level of support drops to around 60% to 65% for multiple wind farm developments or wind farm developments within 1 to 2 km distance from residential dwellings.

What do wind farm surveys indicate?

- some people like wind farms, finding them visually attractive and an important contributor to Australia's renewable energy future;
- some people are generally ambivalent to the idea of wind farm developments and have no opinion one way or the other; and
- some people dislike wind farms, finding them ugly and an industrialisation of the rural/agricultural landscape.

Consultations were carried out for the Crookwell 3 wind farm to gain an understanding of project perceptions, as well as reviews of regional surveys carried out for wind farm developments within the Crookwell 3 region, and state survey carried out across the New South Wales Renewable Energy Precincts.

- Door knocking within the Crookwell 3 wind farm 3 to 5km viewshed;
- Leaflet drops and local media presentations;
- Dedicated project web site including feedback provisions;
- Individual stakeholder meetings; and
- Community Information Day.

The Proponent carried out a door knock exercise within the Crookwell 3 wind farm 5 km viewshed which involved visiting around one hundred and ten non involved residential dwellings. The door knock consultation conducted a general survey which canvassed opinions on a range of issues associated with the Crookwell 3 wind farm development, including a determination of concern for potential landscape and visual impact.
GBD attended an information day session held on the 12th December 2012 during the public exhibition period. The open day provided an opportunity to engage in direct discussions with local residents as well as property owners and residents in the broader regional landscape.
GBD prepared photomontage from seventeen residential (and proposed residential dwelling locations) within 2 km of the Crookwell 3 wind turbines. Visitation for preparation of photographic base images included discussions with property owners with regard to existing visual amenity and perceptions of the project.

GBD note that the IER has stated that *"based on the documents I have reviewed, particularly the SSR with its community study, resultant scenic assessment and guidelines, it is my opinion that Crookwell 3 as a standalone element is likely to be considered an acceptable impact".* In order for this statement to be accurate, and as a

non cumulative impact, the Crookwell 3 community consultation has complied with the requirements of the DGR's.

Recommendation 2 - Assessment of Landscape and Visual Impact Assessment

The LVIA be amended with a justified methodology, to incorporate:

- ***an assessment of the effect of proposed turbine height on dominance and required setbacks in the study area landscape***

The effect of proposed turbine height on dominance in the Crookwell 3 LVIA was informed by the initial findings indicated in the Sinclair-Thomas Matrix (2001) included in the Scottish Natural Heritage 2002 Visual Assessment of Wind Farms: Best Practice report. These findings have been modified to account for degrees of professional judgement based on reviews of wind farm developments and field inspections carried out by GBD at a number of constructed and operational wind farm developments within Australia.

With an increase in distance the proportion of a person's horizontal and vertical view cone occupied by a visible turbine structure, or group of turbine structures, will decline. In order to demonstrate this a series of single frame photographs have been taken from pre-set distances (1.5 km, 4 km, 7 km and 10 km) toward wind turbines at the Capital wind farm in New South Wales. The photographs, illustrated in **Figure SR1**, demonstrate the degree to which the apparent visible height of a wind turbine decreases with increasing distance (in a negative exponential relationship), and the increasing amount of horizontal skyline visible with an increasing distance.

Whilst GBD do not dispute Bishops findings in the determination of thresholds of visual impact, GBD consider that professional judgement based on field inspections at multiple wind farm developments is as valid as the interrogation of sixty one Melbourne University students and staff viewing computer simulations.

It is not apparent that the proposed Crookwell 3 DGR's, or supplementary DGR's, state a requirement for setbacks in the study area landscape, and GBD note that the proposed SSR setbacks were not adopted or implemented by the DoP&I in the Crookwell 2 wind farm consent. It is not apparent on what basis the IER has determined the requirement for setbacks or what form of delegated authority has been agreed with the DoP&I for the IER to do so.

- ***a review of the viewer and scenic quality sensitivity parameters incorporating a justification of the selected viewer characteristics and user numbers on roads and at public locations***

GBD have reviewed the viewer and scenic quality sensitivity parameters outlined in the Crookwell 3 LVIA and it is our opinion that these represent a professionally prepared methodology that is consistent with many similar methodologies based on professional opinion and assessment. Our opinion concurs with that of the IER.

GBD note the IER concurrence with the SSR that a total of 75 vehicles per day is a reasonable assessment and criteria by which to determine a high level of impact for motorists travelling along local roads. Given that there are 1,750 vehicles per day travelling along the Crookwell Goulburn Road (URS Traffic Assessment, September

Capital Wind Farm - View distance 1.5 km

Capital Wind Farm - View distance 4 km

Capital Wind Farm - View distance 7 km

Capital Wind Farm - View distance 10 km

Capital Wind Farm turbines: Suzlon88,
80 m hub height, 88 m rotor diameter, tip height 124 m

Photographs: Pentax K10D, 50mm lens

Figure SR1
Distance effect

CROOKWELL 3 WIND FARM

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2012), the IER has established that it requires around 4.3% of total vehicle trips per day along the Crookwell Goulburn Road to result in a high level of visual impact for motorists. This appears to be an unreasonably low number of vehicle movements to establish a high impact, and if this is to be accepted, the IER should also state how many vehicles per day will constitute a moderate and low level of visual impact.

It is GBD's professional opinion that the criteria adopted for the Crookwell 3 LVIA are both appropriate and relevant to the determination of potential landscape and visual impacts associated with the proposed development.

GBD note that the IER has stated that *"based on the documents I have reviewed, particularly the SSR with its community study, resultant scenic assessment and guidelines, it is my opinion that Crookwell 3 as a standalone element is likely to be considered an acceptable impact".* In order for this statement to be accurate, and as a non cumulative impact, GBD consider that the assessment of landscape and visual impacts has complied with the requirements of the DGR's.

- ***an assessment of impacts on St. Stephens Church, the Pejar Creek under bridge and Pejar Dam recreation area***

St. Stephens Church and the Pejar Dam recreation area have been assessed in the Crookwell 3 LVIA.

St. Stephens Church (identified as view location R39 in the LVIA) was determined to be a low impact receptor location. The closest Crookwell 3 South wind turbine was determined to be around 2.3 km from the Church and the closest Crookwell 3 East wind turbine at around 5.1 km from the Church. Views toward the Crookwell 3 wind turbines would be restricted to those in the South portion of the wind farm development, with those in the East screened by rising and undulating landform extending north east of the Church location. The Crookwell 3 wind farm will not have a significant impact upon visitors to the Church or the Church's heritage values. Our review and assessment of the potential impact of the Crookwell 3 wind farm on St Stephen's Church concurs with the determination of impact set out in the Crookwell 3 LVIA.

The Pejar Dam recreation area (identified as view location R15 Pejar Dam picnic area in the LVIA) was determined to be a low impact receptor location. The closest Crookwell 3 South wind turbine was determined to be around 1.4 km from the picnic area. Views toward the Crookwell 3 South wind turbines will be partially screened by landform, vegetation and the dam wall to the west/north west of the picnic area. Views toward the Crookwell 3 East wind turbines will be screened by rising and undulating landform to the north east and east of the picnic area. Our review and assessment of the potential impact of the Crookwell 3 wind farm on St Stephen's Church concurs with the determination of impact set out in the Crookwell 3 LVIA.

The Pejar Creek under bridge is located on the abandoned Crookwell Goulburn railway line spanning Pejar Creek to the east of the Pejar Creek road bridge on Woodhouselee Road.

The following information has been provided by Dr Jennifer Lambert Tracey (personal communication Dr J.L Tracey 29 October 2013), Heritage Advisor to the Upper Lachlan Shire Council. "The Pejar Dam under bridge was an example of technology transfer from the USA, and one of five surviving timber deck trusses of the post-

Whitton era constructed during the period of Public Works Department railway construction branch. John Whitton was constrained by an 1861 government decree to use more local hardwood for bridges rather than imported iron bridges. After his retirement his successor, Henry Deane, worked under the budget constraints of an economic depression and pioneer line policy, so huge amounts of hardwood continued to be used for transom-top openings and for timber trusses. For the latter the American 'Howe Truss' was adapted from Percy Allan`s road bridge trusses".

The Pejar Dam underbridge is partially screened by tree cover alongside Pejar Creek and is not regarded as a significant visible element in the wind farm viewshed. The closest Crookwell 3 East wind turbine is located around 1.4 km to the north east of the under bridge. Wind turbines within the Crookwell 3 South wind turbine cluster will not be visible from the vicinity of the Pejar Dam underbridge. The Crookwell 3 wind farm will not have a significant impact upon the heritage values of the Pejar Dam underbridge.

- ***the outcomes of community consultation and amended visual parameters on the original LVIA assessments and produce a revised LVIA for consideration***

This IER comment has been considered in our response to Recommendation 1.

Recommendation 3 - Cumulative impact

The cumulative impact assessment in the LVIA is to be amended to:

- ***Provide a justified methodology and assessment of the cumulative impacts of Crookwell 3 combined with Crookwell 1, 2 and Gullen Range including both approved and proposed elements;***
- ***Clearly identify any likely changes to the landscape character of the region resulting from the combination of the regional projects and identify the regional community perceptions of the resultant cumulative impacts based on surveys and consultation, and***
- ***Include assessments of the cumulative impact of the regional projects on public viewing locations, heritage items and individual residences, particularly residences within 2 km of any proposed Crookwell 3 wind turbine.***

The potential cumulative landscape and visual effects of the proposed Crookwell 3 wind farm have been considered in the context of other approved and operational wind farms within the Crookwell 3 wind farm viewshed as well as wind farms in the broader extent of the ACT/NSW Border Renewable Energy Precinct.

The Crookwell 3 LVIA included a cumulative impact assessment which:

- identified categories of cumulative impact;
- illustrated the location of proposed, approved and operational wind farm within a regional context;
- illustrated the location of proposed, approved and operation wind farms within a local context;
- identified wind farm developments, their status and number of turbines within a regional context;

- identified wind farm developments, their status and number of wind turbines (including wind turbines within the Crookwell 3 wind farm view shed);
- illustrated cumulative ZVI Diagrams between:
  - Crookwell 1 and Crookwell 3;
  - Crookwell 2 and Crookwell 3;
  - Gullen Range and Crookwell 3; and
  - Crookwell 1, 2, 3 and Gullen Range.
- illustrated the location and extent of wind turbines within the twenty one photomontages prepared for the Crookwell 3 wind farm. The photomontages illustrated wind turbines within the Crookwell 1, Crookwell 2, Crookwell 3 and the Gullen Range wind farm developments.

The LVIA-SR has provided additional information with regard to potential landscape and visual cumulative effects and has not adopted the IER recommendation to adopt the methodology set out in the National Assessment Framework. Whilst these guidelines present a general overview of cumulative assessment there are more contemporary and detailed guidelines available such as the 'Guidelines for Landscape and Visual Assessment (Landscape Institute and Institute of Environmental Management and Assessment 2013)'.

The methodology for the assessment and determination of potential cumulative landscape and visual effects (justified or not) has been based on the Guidelines for Landscape and Visual Assessment (2013). The methodology includes:

- identification and scoping of wind projects;
- cumulative study area and visual receptors;
- identifying types of cumulative effect;
- baseline assessment;
- identification of landscape effects and assessment of significance;
- identification of visual effects and assessment of significance; and
- illustrative maps and photomontages.

Identification and scoping of wind project

The cumulative assessment has included the scoping of wind proposals in accordance with the DGR's which state the 'Environmental Assessment must assess the worst case as well as representative impact for all key issues considering cumulative impacts, as applicable, from the surrounding Crookwell 1 Wind Farm (existing), other approved wind farms in the viewshed of the project, and the Crookwell 2 Wind Farm (approved) including associated key ancillary components.' The Gullen Range Wind Farm (approved and under

construction) is the only other wind farm development (proposed, approved or operating) with turbines within the Crookwell 3 wind farm viewshed.

The following Tables (included in the Crookwell 3 LVIA) outline the relative location and general details of the Crookwell 1, Crookwell 2 and Gullen Range wind farm projects:

Table 3 – Wind Farms within the Crookwell 3 wind farm viewshed

Wind Farm	Proponent	Status	Number of turbines
Crookwell 1	Eraring Energy	Operational	8
Crookwell 2	Crookwell Development	Approved	46
Gullen Range	Gullen Range Wind Farm Pty Ltd	Under construction	73

Table 4 – Other wind farm turbines within the Crookwell 3 wind farm viewshed

Wind Farm	Approximate number of turbines within Crookwell 3 10km viewshed	Approximate distance between closest Crookwell 3 South wind turbine and other wind farm turbine	Approximate distance between closest Crookwell 3 East wind turbine and other wind farm turbine
Crookwell 1	8	6km	7.6km
Crookwell 2	46	2.7km	2.2km
Gullen Range	22	8.5km	16.5km

Cumulative study area and visual receptors

The cumulative study area has been defined by reference to the Crookwell 3 DGR's which identifies 'the assessment of worst case as well as representative impact for all key issues considering cumulative impacts from the surrounding operational Crookwell 1 wind farm, other approved wind farms in the viewshed of the project, and the approved Crookwell 2'.

The assessment and determination of potential visual cumulative impacts has identified visual receptors from the desktop and field work as detailed in the Crookwell 3 LVIA. These include residential receptors within the Crookwell 3 wind farm viewshed and specifically those located within 2 km of the Crookwell 3 wind turbines and views from vehicles travelling along the Crookwell Goulburn Road and Woodhouselee Road.

Types of cumulative effect

The assessment and determination of potential landscape and visual cumulative effects has considered and addressed different types of cumulative landscape and visual effects that may arise. Types of cumulative effect are identified and discussed in the following Table.

Table 5 – Cumulative Effects

Type of cumulative effect	Potential cumulative effect
Effects of an extension to an existing development, or the location of a new development which may extend the landscape or visual effects of the first development.	The Crookwell 3 wind farm is proximate to the approved Crookwell 2 wind farm and is considered to extend the landscape and visual effect of the approved wind farm. The extent of visual and landscape effects will be limited within the general influence of the approved Crookwell 2 wind farm project.
The 'filling' of an area with either the same or different types of development over time, such that it may be judged to have substantially altered the landscape resource and views or visual amenity.	The Crookwell 3 wind farm is not considered to 'fill' any significant extent of the landscape surrounding the approved Crookwell 2 wind farm, and will not substantially alter the landscape resource or visual amenity.
Interactions between different type of development, each of which may have different landscape and/or visual effects and where the total effect is greater than the sum of the parts.	The Crookwell 3 wind farm is visually contiguous with the approved Crookwell 2 wind farm and likely to utilise wind turbines similar in dimension, colour and overall design.
The temporal effects of simultaneous and/or successive projects over an extended period of time which may impact local communities	The Crookwell 3 wind farm will potentially be constructed and operated within a generally simultaneous period to the approved Crookwell 2 wind farm and, given the size of the Crookwell 3 wind farm, will not be expected to result in significant impacts for local communities.
Effects of development which may have indirect effects on other development.	The Crookwell 3 wind farm is very unlikely to enable or result in indirect effects on other developments.
Landscape and/or visual effects resulting from a future action that removes something from the existing landscape which may have consequences for	The construction of the Crookwell 3 wind farm will be unlikely to remove any significant feature or element from the landscape which will have a consequence for

Table 5 – Cumulative Effects

Type of cumulative effect	Potential cumulative effect
other existing or proposed development.	other existing or proposed development.

The following Table outlines types of cumulative visual effects (summary based on Scottish National Heritage 2012, Assessing the cumulative impact of onshore wind energy development).

Table 6 – Types of cumulative effects

Generic	*Specific*	*Characteristics*
Combined Occurs where the observer is able to see two or more developments from one viewpoint	In combination	Where two or more developments are or would be within the observer's arc of vision at the same time without moving her/his head.
	In succession	Where the observer has to turn her/his head to see the various developments – actual and visualised.
Sequential Occurs when the observer has to move to another viewpoint to see the same or different developments. Sequential effects may be assessed for travel along regularly used routes such as major roads or popular paths.	Frequently sequential	Where the features appear regularly and with short time lapses between instances depending on speed of travel and distance between the viewpoints.
	Occasionally sequential	Where longer time lapses between appearances would occur because the observer is moving very slowly and/or there are larger distances between the viewpoints.

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Baseline for cumulative landscape and visual assessment

The baseline for the cumulative impact assessment has adopted the landscape character assessment from the Crookwell 3 LVIA which the IER recognises as a justified methodology based on a widely used system. As well as adopting the Crookwell 3 LVIA landscape character assessment; this LVIA-SR has also considered the determination of landscape character assessment from the approved Crookwell 2 and Gullen Range landscape and visual impact assessments.

The landscape and visual impact assessment for the approved Crookwell 2 wind farm concluded that the 'visual character of the rural area in which the wind farm would be located is a cultural landscape that has been fundamentally altered to establish rural land uses and is therefore not a natural landscape of high visual quality'.

The Gullen Range landscape and visual impact assessment concluded that the 'site is in a man modified landscape. The landscape units in the viewshed are well represented across the area of the Southern Tablelands. Agricultural activity, associated structures and other signs of human intervention have also created a landscape that can absorb other changes'.

The baseline for the assessment of cumulative visual effects is considered to be the same as for the visual effects assessment determined in the Crookwell 3 LVIA as the relevant receptors and view locations have remain unchanged including those within 2 km of the proposed Crookwell 3 wind turbines.

Identifying landscape effects and assessing their significance

Cumulative landscape effects may potentially include effects:

- on the fabric of the landscape as a result of removal of or changes in individual elements or features of the landscape and/or the introduction of new elements or features;
- on the aesthetic aspects of the landscape, e.g. its scale, sense of enclosure, pattern and colour; and
- on the overall character of the landscape as a result of changes in the landscape fabric.

The cumulative landscape effects of the Crookwell 3 wind farm are unlikely to have a significant impact on the landscape within and surrounding the project area when combined and considered against the approved and operating wind farms within the Crookwell 3 wind farm viewshed.

The wind farm projects are largely compatible when considered in relation to existing landscape characteristics and the broad nature of both scale and pattern across the regional landscape.

The Crookwell 3 LVIA, as well as landscape character assessments undertaken for the approved Crookwell 2 and Gullen Range wind farms, has concluded that the landscape of the Southern Tablelands is generally robust and capable of absorbing changes associated with multiple wind farm developments.

The landscape surrounding the Crookwell 3 wind farm viewshed, as well as the Crookwell 1, 2 and Gullen Range wind farms, does not include any internationally, national or locally designated landscapes such as National Parks, State Forests, State Conservations Areas, State Recreation Areas or Nature Reserves.

GBD note that previous consultation with a very small section of the local community has resulted in ratings of moderate to moderate/high scenic quality within the Upper Wollondilly District landscape, as well as a high scenic quality rating for the Pejar Dam and Mt Wayo landscape features.

Whilst there is little doubt that some people within proximity to existing or proposed wind farm developments will have a significant high regard to the landscape and features or elements within it, GBD are aware that the issue of landscape (and visual) effects may form part of a wider objection which may include perceived issues such noise and depreciation of land value.

The overall scale and size of the Crookwell 3 wind farm development does not lend itself to the potential for significant cumulative impacts. The eight wind turbines in the south portion of the Crookwell 3 project area and twenty one in the east, represent a relatively small wind farm development when compared to existing or planned wind farm development. Even if the Crookwell 3 wind farm is considered as an extension to the approved Crookwell 2 wind farm, the total number of wind turbines is comparable to the approved Gullen Range wind farm, and less than larger proposed wind farm developments such as Rye Park and Bango within the broader extent of the New South Wales Southern Tablelands.

With a defined operational life, the cumulative impacts of wind farm developments are considered to be reversible upon decommissioning, removal and rehabilitation of project works.

The most significant cumulative landscape effects are likely to be those which give rise to landscape changes of a magnitude that transform the overall regional landscape character. Whilst GBD do not consider the size and design of the Crookwell 3 wind farm to have any significant cumulative impact in the regional landscape, GBD note that the NSW Government has designated the Upper Lachlan Shire Council area as Precinct 4 (ACT/NSW Border East) of the Renewable Energy Precincts.

http://www.environment.nsw.gov.au/climatechange/renewableprecincts.htm

As one of six renewable energy precincts, the ACT/NSW Border East is an area where, according to the NSW Government, significant renewable energy development – especially wind farms – is expected with the aim of giving local communities a voice and a stake in renewable energy development.

Identifying visual effects and assessing their significance

The following assessment considers and determines the potential cumulative visual effects for people at residential dwellings within 2 km of the Crookwell 3 wind turbines. The cumulative visual effects have been determined in addition to the potential visual impacts determined in the Crookwell 3 LVIA. The potential cumulative visual effects and are not intended to amend or alter the visual impact determined for the Crookwell 3 wind farm as a standalone element.

The parameters used to evaluate the magnitude of cumulative visual effects at residential view locations includes consideration of:

- number of operational, approved or proposed wind farms that occur within the view;
- distance to wind turbines within operating, approved or proposed wind farms;
- visibility position (simultaneous, combined or successive)
- direction of operating, approved or proposed wind farm relative to the view location;
- horizontal angle of view occupied by each of the operating, approved or proposed wind farms;
- relative composition and scale of operating, approved or proposed wind farms.

The location of the residential dwellings within 2 km of the Crookwell 3 wind turbines are illustrated in **Figure SR2**.

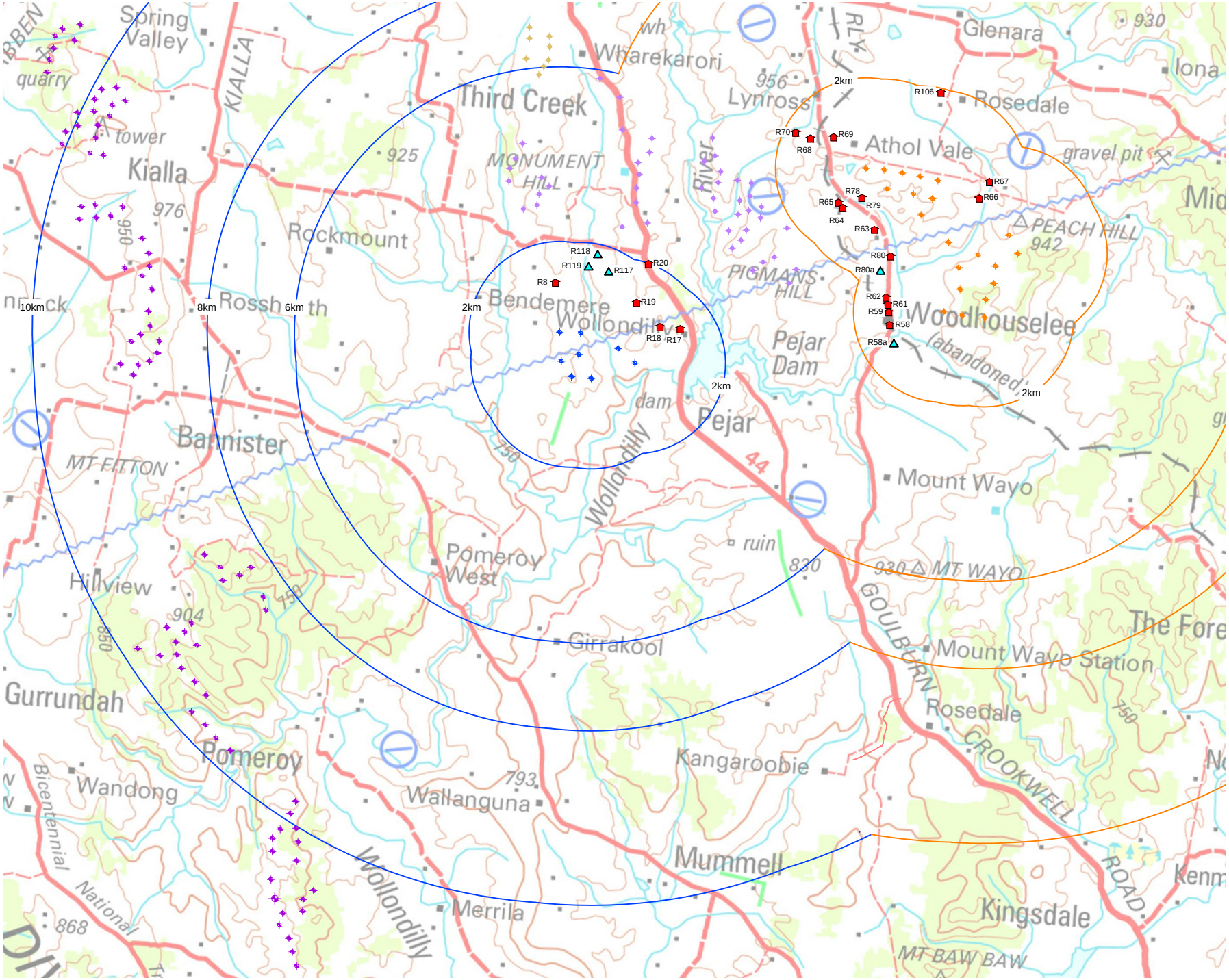

Figure SR2
Residence View Locations

Legend

- Residence - within 3km of proposed Crookwell 3 turbines
- Residence - between 3km and 5km of proposed Crookwell 3 turbines
- Residence - between 5km and 10km of proposed Crookwell 3 turbines
- Potential future or non-residential structure (included in Table 16 - Residential View Location Matrix)
- Proposed Crookwell 3 East Turbine
- Proposed Crookwell 3 South Turbine
- Approved Crookwell 2 Turbine
- Crookwell Turbine (Existing)
- Approved Gullen Range Turbine

0km 2km

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Table 7 - Residential dwelling ID R8 (non involved)

Residential dwelling name: **Narangi**

Refer Crookwell 3 LVIA Figures 28, 29 and 30 Photomontage Sheets B1, B2 and B3

Number of wind farms that occur within the view: 4 (Crookwell 1, Crookwell 2, Crookwell 3 and Gullen Range)

Residential dwelling ID R8					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	4.8 km	1.8 km	1.1 km	7.8 km	9.2 km
Direction	North	North to east	South to south east	East	North west to south east
Visibility position	Combined	Combined	Successive	Combined	Successive
Horizontal angle of view	6 degrees	113 degrees	40 degrees	25 degrees	98 degrees
Combined Crookwell 3 wind turbines		Crookwell 2 with Crookwell 3 East		Crookwell 3 East with Crookwell 2	
Combined horizontal angle of view		Combined view between approved Crookwell 2 and Crookwell 3 East wind turbines through 25 degrees.			
Composition and scale	Photomontage Sheet B1 illustrates views to the proposed Crookwell South and East wind turbines within the context of the approved Crookwell 2 wind farm (partial). The Crookwell 3 East wind turbines will be viewed as partial distant background to the approved Crookwell 2 and result in a low cumulative effect. There is a 41 degree angle of visual separation between distant views toward the Crookwell 3 East and Crookwell 3 South wind turbines. The Crookwell 3 South wind turbines will be viewed as partial foreground, with the southern portion of the Gullen Range wind farm in the distant background and result in a moderate cumulative effect. The Crookwell 3 South wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA).				

Table 8 - Residential dwelling ID R19 (non involved)

Residential dwelling name: **Wombat Hollow**

Refer Crookwell 3 LVIA Figures 31 and 32 Photomontage Sheets C1 and C2

Number of wind farms that occur within the view: 3 (Crookwell 2, Crookwell 3 and Gullen Range)

Residential dwelling ID R19					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	5.7 km	1.8 km	1 km	6.1 km	11 km
Direction	North	North to east	South to south east	East	North west to south east
Visibility position	Combined	Simultaneous	Simultaneous	Simultaneous and combined	Successive
Horizontal angle of view	5 degrees	133 degrees	68 degrees	33 degrees	89 degrees
Combined wind turbines		Crookwell 2 with Crookwell 3 East		Crookwell 3 East with Crookwell 2	
Combined horizontal angle of view		Combined view between approved Crookwell 2 and Crookwell 3 East wind turbines through 25 degrees.			
Composition and scale	Photomontage Sheet C1 illustrates views to the proposed Crookwell South wind turbines within the context of the distant background Gullen Range wind turbines. The Crookwell 3 South wind turbines will be viewed as foreground elements, with the southern portion of the Gullen Range wind farm in the distant background and result in a low to moderate cumulative effect. The Crookwell 3 East wind turbines will also be viewed (partial) as a background to the approved Crookwell 2 and result in a low cumulative effect. There is a 90 degree angle of visual separation between distant views toward the Crookwell 3 East and foreground Crookwell 3 South wind turbines. The Crookwell 3 South wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA).				

Table 9 - Residential dwelling ID R20 (non involved)

Residential dwelling name: **Normaroo**

Number of wind farms that occur within the view: 4 (Crookwell 1, Crookwell 2, Crookwell 3 and Gullen Range)

Residential dwelling ID R20					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	5 km	950 m	2 km	5.5 km	11 km
Direction	North west	North west to south east	South to south east	East	North west to south east
Visibility position	Simultaneous and combined	Simultaneous	Successive	Simultaneous and combined	Successive
Horizontal angle of view	7 degrees	164 degrees	45 degrees	33 degrees	86 degrees
Combined wind turbines		Crookwell 2 with Crookwell 3 East		Crookwell 3 East with Crookwell 2	
Combined horizontal angle of view		Combined view between approved Crookwell 2 and Crookwell 3 East wind turbines through 33 degrees.			
Composition and scale	The Crookwell 3 South wind turbines will be partially screened from the residential dwelling as foreground elements by screen planting surrounding the dwelling. Where visible Crookwell 3 South wind turbines will be viewed as foreground elements, with the southern portion of the Gullen Range wind farm in the distant background and result in a low to moderate cumulative effect. The Crookwell 3 East wind turbines will also be viewed (partial) as a background to the approved Crookwell 2 and result in a low cumulative effect. There is a 89 degree angle of visual separation between distant views toward the Crookwell 3 East and foreground Crookwell 3 South wind turbines. The Crookwell 3 South wind turbines have been determined to result in a Low to Moderate visual impact (Crookwell 3 LVIA).				

Table 10 - Residential dwelling ID R58 (non involved)

Residential dwelling

Number of wind farms that occur within the view: 2 (Crookwell 2, Crookwell 3 East)

Residential dwelling ID R58					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	Not visible	Not visible	1.3 km	Not visible
Direction	Not visible	Not visible	Not visible	North to north east	Not visible
Visibility position	Not visible	Not visible	Not visible	Singular	Not visible
Horizontal angle of view	Not visible	Not visible	Not visible	94 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Any substantive views toward wind turbines within the approved Crookwell 2 wind farm are blocked by Pigmans Hill. Similarly views toward wind turbines within the Crookwell 3 South portion are screened by landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. There are no significant cumulative visual effects for the residential dwelling. The Crookwell 3 East wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA) at this view location.				

Table 11 - Residential dwelling ID R59 (non involved)

Residential dwelling

Number of wind farms that occur within the view: 2 (Crookwell 2, Crookwell 3 East)

Residential dwelling ID R59					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	Not visible	Not visible	1.3 km	Not visible
Direction	Not visible	Not visible	Not visible	North to north east	Not visible
Visibility position	Not visible	Not visible	Not visible	Singular	Not visible
Horizontal angle of view	Not visible	Not visible	Not visible	98 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Any substantive views toward wind turbines within the approved Crookwell 2 wind farm are blocked by Pigmans Hill. Similarly views toward wind turbines within the Crookwell 3 South portion are screened by landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. There are no significant cumulative visual effects for the residential dwelling. The Crookwell 3 East wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA) at this view location.				

Table 12 - Residential dwelling ID R61 (non involved)

Refer Crookwell 3 LVIA Figures 55 and 56 Photomontage Sheets N1 and N2

Residential dwelling

Number of wind farms that occur within the view: 2 (Crookwell 2, Crookwell 3 East)

Residential dwelling ID R61					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	Not visible	Not visible	1.3 km	Not visible
Direction	Not visible	Not visible	Not visible	East	Not visible
Visibility position	Not visible	Not visible	Not visible	Singular	Not visible
Horizontal angle of view	Not visible	Not visible	Not visible	106 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Any substantive views toward wind turbines within the approved Crookwell 2 wind farm are blocked by Pigmans Hill. Similarly views toward wind turbines within the Crookwell 3 South portion are screened by landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. There are no significant cumulative visual effects for the residential dwelling. The Crookwell 3 East wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA) at this view location.				

Table 13 - Residential dwelling ID R62 (non involved)

Refer Crookwell 3 LVIA Figures 57 and 58 Photomontage Sheets O1 and O2

Residential dwelling: **Cottonwood**

Number of wind farms that occur within the view: 1 (Crookwell 3 East)

Residential dwelling ID R62					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	Not visible	Not visible	1.3 km	Not visible
Direction	Not visible	Not visible	Not visible	East	Not visible
Visibility position	Not visible	Not visible	Not visible	Successive	Not visible
Horizontal angle of view	Not visible	Not visible	Not visible	106 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Any substantive views toward wind turbines within the approved Crookwell 2 wind farm are blocked by Pigmans Hill. Similarly views toward wind turbines within the Crookwell 3 South portion are screened by landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. There are no significant cumulative visual effects for the residential dwelling. The Crookwell 3 East wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA) at this view location.				

Table 14 - Residential dwelling ID R63 (non involved)

Residential dwelling: **Rocky Corner**

Number of wind farms that occur within the view: 2 (Crookwell 2 and Crookwell 3 East)

Residential dwelling ID R63					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	2 km	Not visible	1.3 km	Not visible
Direction	Not visible	South west to north west	Not visible	North to south east	Not visible
Visibility position	Not visible	Successive	Not visible	Successive	Not visible
Horizontal angle of view	Not visible	62 degrees	Not visible	147 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Substantive views toward wind turbines within the approved Crookwell 2 wind farm are partially screened by landform and tree cover. Similarly views toward wind turbines within the Crookwell 3 South portion are screened by landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. Cumulative visual effects for the residential dwelling will be limited to successive views between partial views toward the Crookwell 2 and Crookwell 3 East wind turbines and result in a low cumulative visual effect. The Crookwell 3 East wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA) at this view location.				

Table 15 - Residential dwelling ID R64 (non involved)

Refer Crookwell 3 LVIA Figures 43 and 44 Photomontage Sheets H1 and H2

Residential dwelling: **Valdarman Hill**

Number of wind farms that occur within the view: 2 (Crookwell 2 and Crookwell 3 East)

Residential dwelling ID R64					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	2 km	Not visible	1.1 km	Not visible
Direction	Not visible	South west to north west	Not visible	North east to south east	Not visible
Visibility position	Not visible	Successive	Not visible	Successive	Not visible
Horizontal angle of view	Not visible	83 degrees	Not visible	105 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Substantive views toward wind turbines within the approved Crookwell 2 wind farm are partially screened by landform – views will extend toward portions of turbines within the east of the approved Crookwell 2 site. Views toward wind turbines within the Crookwell 3 South portion are screened by landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. Cumulative visual effects for the residential dwelling will be limited to successive views between partial views toward the Crookwell 2 and Crookwell 3 East wind turbines and result in a low cumulative visual effect. The Crookwell 3 East wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA) at this view location.				

Table 16 - Residential dwelling ID R65 (non involved)

Refer Crookwell 3 LVIA Figures 59 and 60 Photomontage Sheets P1 and P2

Residential dwelling: **Windalee**

Number of wind farms that occur within the view: 2 (Crookwell 2 and Crookwell 3 East)

Residential dwelling ID R65					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	1.3 km	Not visible	1 km	Not visible
Direction	Not visible	South west to north west	Not visible	North east to south east	Not visible
Visibility position	Not visible	Successive	Not visible	Successive	Not visible
Horizontal angle of view	Not visible	86 degrees	Not visible	97 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Substantive views toward wind turbines within the approved Crookwell 2 wind farm are partially screened by landform – views will extend toward portions of turbines within the east of the approved Crookwell 2 site. Views toward wind turbines within the Crookwell 3 South portion are screened by landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. Cumulative visual effects for the residential dwelling will be limited to successive views between partial views toward the Crookwell 2 and Crookwell 3 East wind turbines and result in a low cumulative visual effect. The Crookwell 3 East wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA) at this view location.				

Table 17 - Residential dwelling ID R66 (non involved)

Refer Crookwell 3 LVIA Figures 45 and 46 Photomontage Sheets I1 and I2

Residential dwelling: **Little Vale** (1)

Number of wind farms that occur within the view: 1 (Crookwell 3 East)

Residential dwelling ID R66					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	Not visible	Not visible	1 km	Not visible
Direction	Not visible	Not visible	Not visible	North east to south east	Not visible
Visibility position	Not visible	Not visible	Not visible	Singular	Not visible
Horizontal angle of view	Not visible	Not visible	Not visible	153 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Any substantive views toward wind turbines within the approved Crookwell 2 wind farm are blocked by local landform. Similarly views toward wind turbines within the Crookwell 3 South portion are screened by landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. There are no significant cumulative visual effects for the residential dwelling. The Crookwell 3 East wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA) at this view location.				

Table 18 - Residential dwelling ID R67 (non involved)

Residential dwelling: **Little Vale** (2)

Number of wind farms that occur within the view: 1 (Crookwell 3 East)

Residential dwelling ID R67					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	Not visible	Not visible	1 km	Not visible
Direction	Not visible	Not visible	Not visible	North east to south east	Not visible
Visibility position	Not visible	Not visible	Not visible	Singular	Not visible
Horizontal angle of view	Not visible	Not visible	Not visible	118 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Any substantive views toward wind turbines within the approved Crookwell 2 wind farm are blocked by local landform. Similarly views toward wind turbines within the Crookwell 3 South portion are screened by landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. There are no significant cumulative visual effects for the residential dwelling. The Crookwell 3 East wind turbines have been determined to result in a Moderate visual impact (Crookwell 3 LVIA) at this view location.				

Table 19 - Residential dwelling ID R68 (Involved – Crookwell 2 wind farm)

Residential dwelling: **Meadowvale**

Number of wind farms that occur within the view: 2 (Crookwell 2 and Crookwell 3 East)

Residential dwelling ID R68					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	1.7 km	Not visible	1.4 km	Not visible
Direction	Not visible	West to south	Not visible	North east to south east	Not visible
Visibility position	Not visible	Successive	Not visible	Successive	Not visible
Horizontal angle of view	Not visible	100 degrees	Not visible	34 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Substantive views toward wind turbines within the approved Crookwell 2 wind farm are partially screened by vegetation surrounding the dwelling. Views toward wind turbines within the Crookwell 3 South portion are screened by landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. There are limited successive cumulative visual effects for the residential dwelling that result in a low cumulative visual effect. The Crookwell 3 East wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA) at this view location.				

Table 20 - Residential dwelling ID R69 (non involved)

Refer Crookwell 3 LVIA Figures 63 and 64 Photomontage Sheets R1 and R2

Residential dwelling: **Atholvale**

Number of wind farms that occur within the view: 1 (Crookwell 3 East)

Residential dwelling ID R69					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	Not visible	Not visible	1 km	Not visible
Direction	Not visible	Not visible	Not visible	North east to south east	Not visible
Visibility position	Not visible	Not visible	Not visible	Successive	Not visible
Horizontal angle of view	Not visible	Not visible	Not visible	35 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Substantive views toward wind turbines within the approved Crookwell 2 wind farm are largely screened by vegetation to the west of the dwelling. Similarly, views toward wind turbines within the Crookwell 3 South portion are screened by tree cover, as are views toward the distant Gullen Range and Crookwell 1 wind farms. There are limited successive cumulative visual effects for the residential dwelling that result in a low cumulative visual effect. The Crookwell 3 East wind turbines have been determined to result in a Moderate to High visual impact (Crookwell 3 LVIA) at this view location.				

Table 21 - Residential dwelling ID R70 (non involved)

Refer Crookwell 3 LVIA Figures 65 and 66 Photomontage Sheets S1 and S2

Residential dwelling: **Snowgums**

Number of wind farms that occur within the view: 2 (Crookwell 2 and Crookwell 3 East)

Residential dwelling ID R70					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	1.5 km	Not visible	1.8 km	Not visible
Direction	Not visible	West to south	Not visible	South east to south	Not visible
Visibility position	Not visible	Successive	Not visible	Successive	Not visible
Horizontal angle of view	Not visible	106 degrees	Not visible	32 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Views toward wind turbines within the approved Crookwell 2 wind farm are partially screened by tree planting to the south west and south of the dwelling. Similarly, views toward wind turbines within the Crookwell 3 South portion are screened by tree cover, as are views toward the distant Gullen Range and Crookwell 1 wind farms. There are limited successive cumulative visual effects for the residential dwelling that result in a low cumulative visual effect. The Crookwell 3 East wind turbines have been determined to result in a Low visual impact (Crookwell 3 LVIA) at this view location.				

Table 22 - Residential dwelling ID R106 (non involved)

Refer Crookwell 3 LVIA Figures 47 and 48 Photomontage Sheets J1 and J2

Residential dwelling: **Rosedale**

Number of wind farms that occur within the view: 1 (Crookwell 3 East)

Residential dwelling ID R106					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	Not visible	Not visible	1.9 km	Not visible
Direction	Not visible	Not visible	Not visible	South west to south east	Not visible
Visibility position	Not visible	Not visible	Not visible	Singular	Not visible
Horizontal angle of view	Not visible	Not visible	Not visible	71 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Views toward wind turbines within the approved Crookwell 2 wind farm are screened by tree planting and landform to the south of the dwelling. Similarly, views toward wind turbines within the Crookwell 3 South portion are also screened by tree cover and landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. There are no cumulative visual effects for the residential dwelling. The Crookwell 3 East wind turbines have been determined to result in a Low visual impact (Crookwell 3 LVIA) at this view location.				

Table 23 - Potential future residential dwelling ID R80a (non involved)

Refer Crookwell 3 LVIA Figures 67 and 68 Photomontage Sheets T1 and T2

Residential dwelling: **Church**

Number of wind farms that occur within the view: 2 (Crookwell 2 and Crookwell 3 East)

Residential dwelling ID R80a					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	Not visible	1.9 km	Not visible	1.6 km	Not visible
Direction	Not visible	North west to west	Not visible	North to south east	Not visible
Visibility position	Not visible	Successive	Not visible	Successive	Not visible
Horizontal angle of view	Not visible	46 degrees	Not visible	130 degrees	Not visible
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Views will extend toward upper portions of turbines within the east section of the approved Crookwell 2 wind farm site. Partial views will also extend toward wind turbines within the Crookwell 3 South site with some screening by landform and tree cover. Views toward wind turbines within the Crookwell 3 South section are screened by landform, as are views toward the distant Gullen Range and Crookwell 1 wind farms. The successive views toward the approved Crookwell 2 wind farm and the Crookwell 3 East wind turbines will result in a low to moderate cumulative visual effect. The Crookwell 3 East wind turbines have been determined to result in a Moderate visual impact (Crookwell 3 LVIA) at this view location.				

Table 24 - Potential future residential dwelling ID R117 (non involved)

Refer Crookwell 3 LVIA Figures 69 and 70 Photomontage Sheets U1 and U2

Potential residential dwelling

Number of wind farms that occur within the view: 4 (Crookwell 1, Crookwell 2, Crookwell 3 South and Gullen Range)

Residential dwelling ID R117					
	Crookwell 1	Crookwell 2	Crookwell 3 South	Crookwell 3 East	Gullen Range
Distance	4.8 km	1.1 km	1.6 km	Not visible	10 km
Direction	North west	North west to north east	North to south east	Not visible	South east to north west
Visibility position	Combined	Combined	Combined	Not visible	Successive
Horizontal angle of view	7 degrees	74 degrees	56 degrees	Not visible	91 degrees
Combined wind turbines					
Combined horizontal angle of view	No combined field of view				
Composition and scale	Photomontage Sheet U1 illustrates views to the proposed Crookwell South wind turbines within the context of the approved Gullen Range and Crookwell 2 wind farm (partial). The Crookwell 3 East wind turbines and a portion of the approved Crookwell 2wind farm will be screened by landform to the north east and east of the potential residential dwelling location. The Crookwell 3 South wind turbines will be viewed as partial foreground, with the southern portion of the Gullen Range wind farm in the distant background and result in a moderate cumulative effect. The Crookwell 3 South wind turbines have been determined to result in a High visual impact (Crookwell 3 LVIA).				

Residential dwelling ID R78 (Involved)

Residential dwelling: **Leeston** (1)

As an involved residential dwelling an assessment of visual impact or potential cumulative impact has not been determined.

Residential dwelling ID R79 (Involved)

Residential dwelling: **Leeston** (2)

As an involved residential dwelling an assessment of visual impact or potential cumulative impact has not been determined.

Residential dwelling ID R80 (Involved)

Residential dwelling: **Hillview Park**

As an involved residential dwelling an assessment of visual impact or potential cumulative impact has not been determined.

Residential dwelling ID 17 (involved)

Name: **Wollondilly** (1)

As an involved residential dwelling an assessment of visual impact or potential cumulative impact has not been determined.

Residential dwelling ID 18 (involved)

Name: **Wollondilly** (2)

As an involved residential dwelling an assessment of visual impact or potential cumulative impact has not been determined.

Sequential views – Crookwell Goulburn Road

The Crookwell 3 South wind turbines together with some of the approved Crookwell 2 turbines and Crookwell 1 wind turbines will be visible in succession from around 15 km of the Crookwell Goulburn Road from vehicles travelling north and south. Distant views toward the Gullen Range wind turbines may be possible from elevated and open sections of the road corridor; however, views will be predominantly glimpsed and partial and have no significant cumulative effect.

Localised cumulative views will be determined by view direction and will include direct and indirect views. Views from the Crookwell Goulburn road corridor to the west and north of the Pejar Dam will be contained by road cutting and tree cover. The posted speed limit of 100 km per hour will result in a total view period around nine minutes over the 15 km distance. The very short term duration of view, combination of view directions, variable viewing distances and the relatively small number of wind turbines within the Crookwell 3 South site will result in an overall low cumulative visual effect.

Sequential views – Woodhouselee Road

Cumulative visual effects will be limited by restricted views toward the Crookwell 2 wind turbines from the Woodhouselee road corridor. Landform rising to the west of the road corridor, toward a low ridgeline north and south of Pigmans Hill will obscure the majority of Crookwell 2 wind turbines. The cumulative visual effect of the Crookwell 3 East site will be very low.

Illustrative maps and photomontages

The illustrative maps and photomontages are presented in the Crookwell 3 LVIA and included in the project documentation placed on public exhibition from the 1st November 2012 to the 6th February 2013. The Crookwell 3 LVIA included the following cumulative ZVI Diagrams:

- Diagram 3, Crookwell 3 and Crookwell 1 ZVI cumulative tip of blade;
- Diagram 4, Crookwell 3 and Crookwell 2 ZVI cumulative tip of blade;
- Diagram 5, Crookwell 3 and Gullen Range ZVI cumulative tip of blade; and
- Diagram 6, Crookwell 1, 2, 3 and Gullen Range ZVI cumulative tip of blade.

The cumulative ZVI diagrams are illustrated in **Figures 21** to **24** within the Crookwell 3 LVIA.

The cumulative ZVI Diagrams indicate those areas where one or more wind farms may be visible and, to reiterate information included in the Crookwell 3 LVIA, we note that the cumulative ZVI Diagrams are conservative and should be qualified on the following basis:

- a significant area of landscape within the cumulative ZVI from which wind turbines may be visible comprises agricultural land where the general public do not appear to exercise regular access;
- the cumulative ZVI extend across and indicate visibility toward multiple wind farm projects from areas of tree cover where there is no or limited public use and where trees may obscure or partially restrict views toward the Crookwell 3 and other wind farm developments;
- the cumulative ZVI do not account for the effects of screening and filtering of views as a result of landscape features such as buildings and trees;
- the cumulative ZVI do not account for the potential orientation of the viewer including people travelling in vehicles.

The combined effects of these limitations results in a tendency to overestimate the extent of area visibility and degree to which wind turbines may be visible from different view locations. The ZVI Diagrams do not represent the visual impact of the proposed Crookwell 3 wind farm project.

Recommendation 4 - Mitigation measures

The proponent to provide a clear commitment of any planting proposed to be provided to screen the development from public locations with a description of the location and an assessment of feasibility, effectiveness and likely reliability of the proposed screening.

The Proponent has provided a commitment to consult with the Upper Lachlan Council in relation to the placement and maintenance of roadside tree planting and GBD note Council's concern with regard to roadside tree planting and ongoing maintenance issues for Council. The Proponent does not intend to provide a landscape planting plan to identify particular planting locations alongside road corridors prior to consulting with the Upper Lachlan Shire Council.

Tree planting is an effective and reliable form of mitigation to minimise the potential visual impact of wind turbines along road corridors and, depending on planting density and the characteristics of the species selected, can provide complete or partial filtered views.

Plate 1 – Example of trees providing partial filtered views toward the Cullerin wind turbines – Lerida Road north

Recommendation 5 - Night lighting

The proponent to provide an assessment of the likely impact of effectiveness of proposed mitigation measures for night lighting identified in the Response to Submission.

Ongoing development and planning for the Crookwell 3 wind farm, subsequent to the preparation and exhibition of the LVIA, has determined that the Crookwell 3 wind turbines will be no greater than 150 m in height (to tip of blade). As such, and in accordance with current CASA guidelines, the Crookwell 3 wind turbines will not require obstacle lighting.