INDEPENDENT EXPERT REVIEW

PROPOSED CROOKWELL 3 WIND FARM DEVELOPMENT

Prepared for
NSW DEPARTMENT OF PLANNING & INFRASTRUCTURE

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Section 1 *Report Overview*

1.1 Introduction

O'Hanlon Design Pty Ltd has been engaged by the NSW Department of Planning and Infrastructure (DPI) to review and comment on the quality and accuracy of the landscape and visual assessment report for the Crookwell 3 Wind Farm, provided as part of the Environmental Assessment (EA) and submitted for development approval by Union Fenosa July 2012 (the Proponent).

The engagement specifies the expert review is to include consideration of:

- the appropriate documentation provided by the Department with regard to the Director-General's requirements for the EA, the supplementary Director-General's Requirements for the EA, relevant planning guidelines with particular regard to the Department of Planning and Infrastructures *NSW Planning Guidelines - Wind Farms, (Draft),* industry standards and legislation,
- *The Landscape & Visual Impact Assessment* prepared by Green Bean Design, July 2012 (LVIA). The findings of this report are summarized in chapter 9 of the EA and the report is included as Appendix 6 of the EA including chapter 22 of the EA which assesses 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 independent expert advice and commentary on the;
    - Proponent's landscape & visual impact assessment (including methodology, assumptions and assessment 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 addressed in the EA and in the land and visual impact 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.

1.2 Relevant Documents

During preparation of this report we have reviewed and taken into consideration the following documents:

- *Crookwell 3 Wind Farm Environmental Assessment (EA)*

  Union Fenosa Wind Australia: July 2012
- *Landscape and Visual Impact Assessment (LVIA)*

  Green Bean Design: July 2012
- *NSW Planning Guidelines – Wind Farms (Draft)*

  NSW Dept of Planning & Infrastructure: December 2011
- *Review of Crookwell 2 Wind Farm EIS Summary* (working document)

  Scenic Spectrums Pty Ltd: January 2005

- *Wind Farms and Landscape Values-National Assessment Framework*

  Under the auspices of the Council of National Trusts and Auswind: 27 June 2007

- *Crookwell 3 Wind Farm – Traffic Impact Assessment*

  URS Australia Pty Ltd September 2010

1.3 Methodology

The methodology for preparation of this review has included a site visit and review of viewing locations, a desk review of statutory plans, DOPI guidelines, the proponent's Environmental Assessment, resident's submissions and the proponent's Response to Submissions. We have also reviewed topographic maps for the study area and wider areas of impact to identify local issues and potential cumulative or regional issues.

In addition to the documents available on the notification website we have accessed a number of other Environmental Assessment documents for wind farms including a review of the Crookwell 2 Wind Farm EIS and the National Assessment Framework document. The purpose of these reviews was to provide background information and a reference for the methodology and depth of assessment that could be considered reasonable. Further information on individual regional wind farms was sourced where possible from the individual wind farm web sites.

1.4 Terms and Abbreviations

Terms and abbreviations used throughout the text of the report are shown in **Table 1.1** below

Table 1.1 Terms and Abbreviations

Term / Abbreviation	Meaning
AHD	Australian Height Datum
Crookwell	The study areas in and around Crookwell and adjacent residential properties
DGR's	Director General's Requirements
DP&I	NSW Department of Planning & Infrastructure
DIPNR	Former NSW Department of Infrastructure, Planning and Natural Resources. (now NSW Dept of Planning and Infrastructure)
EA	Environmental Assessment Report – Union Fenosa Wind Australia
EP&A Act 1979	NSW Environmental Planning and Assessment Act 1979
km	Kilometre
LGA	Local Government Area
LVIA	Landscape and Visual Impact Assessment – prepared by Green Bean Design
m	Metre
NAF	Wind Farms and Landscape Values - (National Assessment Framework)
Pastoral wind farm landscape	As defined in the Scenic Spectrums Review 2006 (refer p12 section 2.4.4)
The Guidelines	NSW Planning Guidelines – Wind Farms (draft)
RtS	Response to Submissions
RL	Relative level
SSR	Scenic Spectrums Review
SS VEM (tm)	Scenic Spectrums Visual

Section 2 Review of Relevant Documents

2.0 General

The Director General's Requirements (DGR's) for the project were issued on 7 April 2010. The DGR's have several requirements to be meet in relation to the visual assessment as noted in the table below.

The DGR's for the project are a reflection of best practice in visual impact assessment requiring a very high level of local and regional community consultation.

2.1 Director General's Requirements for the EA.

Amongst a range of other requirements the relevant DGR's for Crookwell 3 fall into two groups, General Requirements and Key Assessment Requirements for visual impacts. In addition to an assessment of general representative impacts for key issues the DGR's require an assessment of cumulative visual impacts including Crookwell 1 and 2.

Table 2.1 **Director General's Requirements Summary**

Location	**Requirements**	
General Requirements	• *Location, dimensions of all components (incl. map coordinates and AHD)*	
	• *Supporting maps and plans identifying existing environmental elements.*	
	• *Assess worst case as well as representative impacts for all key issues and in relation to cumulative impacts for both Crookwell 1 and Crookwell 2.*	
	• *A draft statement of commitments*	
Key Assessment Requirements	**Visual Impacts** – The DGR's require that the EA must:	
	• *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;*	
	• *assess the impact of shadow 'flicker', blade 'glint' and night lighting from the wind farm;*	
	• *identify the zone of visual influence (no less than 10 kilometres) and assess the visual impact of all project components on this landscape;*	
	• *provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented.*	

In addition to these requirements the Director General issued 'Supplementary Requirements' dated 16th August 2011. These require amongst other matters, a *'comprehensive, detailed and genuine community consultation ….'* and further *'the Environmental Assessment must state how the communities issues have been responded to.'*

2.2 NSW Planning Guidelines – Wind Farms (draft)

The NSW Planning Guidelines – Wind Farms (The Guidelines) is currently issued as a draft document dated December 2011. Section 1, Part C (p.4) and Section 3.2 on (p.14) set the overall guidelines with particular focus on assessing impacts at neighbouring houses within 2 km of a proposed wind turbine.

Section 1 Part C requires a comprehensive assessment of visual impacts of the proposed wind farm on the landscape character, landscape values, visual amenity or any scenic or significant vistas to be undertaken. The Guidelines identify that the assessment should particularly focus on any neighbours' houses within 2km of a proposed wind turbine that do not host the wind farm. These assessment criteria are repeated as part of Appendix A (p.18). The Guidelines recommend that the assessment of visual impact include:

2.2.1 Assessment Methodology

- *a description of the assessment methodology and a clear justification of it including discrete justification of the methodology for assessing impacts at neighbours' houses within 2km of a proposed wind turbine.*

2.2.2 Project Description

- *A description of all relevant components of the project, including turbine heights and layout- where micro-siting or a range of turbines is proposed, the assessment should be based on the 'worst case' layout and turbine height.*

2.2.3 Landscape Description

- *A description of the landscape including key features.*

2.2.4 Visibility

- *A description of the visibility of the development.*

2.2.5 Photomontages

- *Photomontages of the project and associated transmission lines taken from:*
    - *potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights) within 2km of a proposed wind turbine or other associated infrastructure (note that the number of photomontages may be reduced in less sensitive landscapes such as industrial areas),*
    - *urban settlements, and*
    - *significant public view points including roads, lookout points and walkways.*

2.2.6 Zones of Visual Influence

- *Identification of the zone of visual influence of the wind farm (no less that 10km)*

2.2.7 Landscape Character

- *A description of the significance of the landscape values and character in a local and regional context.*

2.2.8 Stakeholder Values

- *A description of community and stakeholder values of the local, regional visual amenity and quality and perceptions of the project based on surveys and consultation.*

2.2.9 Cumulative Impacts

- *Assessment of cumulative impacts on the landscape and any cumulative visual impacts from transmission line infrastructure and any surrounding approved or operational wind farms in the locality.*

2.2.10 Potential Change to Landscape

The visual impact of a wind farm depends on the extent of the change to the landscape caused by the development, taking into account:

- *the visibility of the development*
- *the locations and distances from which the development can be viewed*
- *landscape values and their significance*
- *the sensitivity of the landscape features to change.*

2.2.11 Contributing Factors to Visual Impact

The visual impact of the development relates to:

- *the number, height, scale, spacing, colour and surface reflectivity of the wind turbines*
- *the quantity and characteristics of lighting, including aviation obstacle lighting (subject to CASA requirements and advice)*
- *potential or visual clutter caused by turbine layout and ability to view through a cluster or array (visually well ordered series) of turbines in an orderly manner*
- *the removal or planting of vegetation*
- *the location and scale of other buildings and works including transmission lines and associated access roads*
- *proximity to sensitive areas, and*
- *proximity to an existing or proposed wind farm, having regard to cumulative visual effects.*

2.2.12 Landscape Features

The features of the landscape include:

- *the topography of the land*
- *the amount and type of vegetation*
- *natural features such as waterways, cliffs, escarpments, hills, gullies and valleys*
- *visual boundaries between major landscape types*
- *the type, pattern, build form, scale and character of development, including roads and walking tracks*
- *flora and fauna habitat*
- *cultural heritage sites*
- *the skyline*

2.2.13 Mitigation of Impacts

The NSW Guidelines offer possible mitigation measures stating:

Examples of mitigation measures that proponents can use to reduce the visual impact of a proposed wind farm include:

- *where possible, locate turbines;*
    - *away from areas with high scenic values*
    - *away from areas with high visibility from local residents*
- *select turbines that:*
    - *look the same, have the same height and rotate the same way*
    - *are off-white or grey colouring*
- *minimize the removal of vegetation*
- *plant vegetation to provide a visual screen*
- *reduce impacts of night and obstacle lighting by*
    - *limiting lighting on towers to that required for safe operation and aviation safety and*
    - *use of lighting design which minimizes glare*
- *underground electricity wires where practicable*
- *use alternative transmission line pole designs to minimize visual impact.*

2.2.14 Social Issues

Several of the issues identified as 'Social Issues' in Appendix A of the NSW Guidelines relate to visual impacts.

Social issues include:

- *noise (from wind turbines, substation, construction, traffic and vibration)*
- *blade glint*
- *shadow flicker*
- *electromagnetic interference*
- *night lighting*
- *electromagnetic fields*
- *other health issues.*

Appendices A and E of the Guidelines has an extensive and detailed list of elements that require identification and assessment. The key headings are tabulated below.

Table 2.2 **NSW Planning Guidelines *Appendices A and E* - Summary**

Location	**Description of surrounding environment**	
Appendix A	• Landscape and Visual Amenity	
	• Assessing Landscape and Visual Amenity impacts	
	• Mitigating Landscape and Visual Amenity impacts	
	• Blade Glint	
	• Shadow Flicker	
	• Night Lighting	

	• Cumulative impacts	
	• Construction Issues	
Appendix E	Micro Siting of Turbines	

2.3 Wind Farms and Landscape Values – National Assessment Framework

An assessment of several other documents was carried out as part of the desktop review for this report. The first assessment was of the document titled 'Wind Farms and Landscape Values' - a National Assessment Framework (NAF), June 2007. The NAF was the product of a national project to develop agreed methodologies for landscape assessment of wind farm location and design. The project was produced under the auspices of the Australian Council of National Trusts and Auswind (now the Clean Energy Council). It is a National Trust/industry produced and agreed document, formatted to create an acceptable and objective methodology applicable throughout Australia.

2.3.1 NAF Summary Table

Attached to this report as **Appendix A** is a copy of the NAF Summary Table (p.7) of the NAF Report, and copies of the detailed pages for Step 1B of the NAF, the compilation of a full landscape assessment.

The NAF highlights that in order to provide a full landscape assessment that addresses the range of landscape values and to evaluate the strength and significance of those values, direct community input is essential. The detailed tasks of the NAF for Landscape Assessment in Step 1B.3 require gathering of *Natural and Cultural Information*.

Further Step 1B.4 of the NAF requires development of a methodology to facilitate identification of community held landscape values. The NAF indicates it is essential for direct community and stakeholder involvement in the identification of the landscape values of the study area and the communities who value it. The NAF seeks to ensure that:

- communities have direct involvement in assessment and setting of landscape values, and
- each following step including the assessment of impacts and review of measures to avoid impacts has direct community involvement. (*refer Consultation – Steps 2, 3 and 4*)

2.3.2 Cumulative Impact Assessment

In Section 3.3 of the full text, the NAF identifies that approaches for understanding how affected communities perceive cumulative changes to the landscape are not well developed however direct consultation can be useful. The NAF identifies key factors to be addressed in identifying potential cumulative impacts.

The proponent will describe cumulative landscape impacts, including those arising from:

- *adding to or expanding an existing wind farm (where relevant);*
- *the occurrence of two or more wind farms visible from one location;*
- *the effect of seeing two or more wind farms along a single journey, (e.g. a major route between two towns, identified tourism trail or walking track);*
- *the visual compatibility of different wind farms in the same vicinity (e.g. are they of the same design and style?);*
- *perceived or actual change in land use across a landscape character type or region; and*
- *loss of characteristic element (e.g. a sense of openness, or a specific landscape feature) across a landscape character type caused by multiple developments across that character type.*

The proponent should also consider the cumulative impacts of the wind farm in combination with other developments (e.g. industrial, urban, large-scale agricultural) in the study area or region.

In considering cumulative impacts, information should be sought from local regulatory authorities about developments in the region which have been approved but not yet built.

The NAF notes key factors for identifying and describing impacts on landscape values by:

- *identifying specific features of the development which impact on identified landscape values,*
- *describing the degree to which the value is lost or altered by the development,*
- *obtaining community input about perceived impacts, and*
- *rating the scale, nature, duration and reversibility of impacts.*

The NAF also notes that the proponent should identify any positive landscape benefits of the wind farm, including those described by community-stakeholders.

The NAF clarifies that:

In making statements about level of impact the proponent will consider:

- *the significance of the value that is being impacted as defined in Step 1B* ***(refer Appendix A)*** *(i.e. its strength within the community which defines it; and the extent to which it is held by one or more communities at a local, regional, state or national scale);*
- *the degree to which the value is lost or altered (e.g. completely / substantially / partially / negligibly);*
- *the duration and reversibility of the impact;*
- *evaluation by communities and stakeholders, ideally those involved in identification of values of the subject landscape; and*
- *the availability and practicality of mitigation measures.*

It is clear therefore that the NAF requires the community held landscape values identified by Step 1B of the NAF methodology to be evaluated and considered as part of the assessment of cumulative impacts.

2.4 Crookwell 2: Scenic Spectrums Review

The second document considered was of an independent review of the Crookwell 2 Wind Farm EIS by Scenic Spectrums Pty Ltd, January 2005. Given the proximity of Crookwell 3 to the previously approved Crookwell 2 project a review of the relative assessments of existing landscape values and potential impacts provides comparable data and assessments to those provided in the LVIA.

The Scenic Spectrums report was written by Dennis N. Williamson. Williamson is a noted assessor of Landscape and Visual Impacts with over 20 years experience and a number of published reports on visual quality including a paper titled “Scenic Perceptions of Australian Landscapes” (Landscape Australia 1979).

The Crookwell 2 Review was prepared by Scenic Spectrums Pty Ltd as an independent review for DIPNR. The review included a series of telephone and on site interviews with selected property owners as well as a DIPNR workshop in Crookwell on November 30th 2004.

2.4.1 Community Perceptions and Scenic Quality

The Scenic Spectrums Review (SSR) focused heavily on community perceptions and attitudes to scenic quality, landscape character and developed specific visual performance standards.

Some of the findings and outcomes in relation to community perceptions noted in Section 3 of the SSR based on workshop feedback were:

- *most people consulted believe the Upper Wollondilly area is of very high scenic quality*
- *those consulted especially value the pastoral character, peacefulness and tranquility of the area, the very wide horizon lines and panoramic views afforded by the tablelands location on the Great Dividing Range (the 'big sky' quality), and local landmark features (e.g. Monument Hill, Pigman's Hill, Table Mount, Pejar Dam and it's backdrop). These factors, combined with their perceived sense of pastoral heritage/history, strongly form their sense of place in the landscape.*
- *Consultations with individuals supporting and opposing the proposed wind far indicate that different people do have different perceptions and attitudes toward wind farms and wind turbines, as indicated elsewhere in the EIS but that the community appears to be fairly evenly divided in their attitudes.*
- *Some think the wind turbines are elegant, graceful and beautiful cultural features, while others think that they are a monstrously imposing blight on the landscape that connote an industrial or distractingly busy landscape.*

In relation to landscape character and scenic quality the SSR concluded that:

Aside from the pastoral nature of the area, panoramic, long distance views and wide horizon lines are a special attribute of the study area. This is due to its location near the top of the Great Dividing Range and the extensively open grassland cover, which may be similar to the natural grassland cover that existed on the basalt tablelands prior to European settlement (Robertson, pers. Com., 2004 and Eddy et. Al. c.2003). In relation to this, a number of local hills are important to the horizon line profile and scenic character of this area, forming landmarks and/or visual focal points that draw viewers attention to visually important backdrops or complementary elements of high scenic quality features such Mount Wayo and Pejar Dam. Local hills within the proposed development area that meet this description are indicated on Figure 2 (of the SSR) and include:

- *Monument Hill*
- *Park Hill*
- *Pejar Hill*
- *Pigman's Hill*
- *Table Mount*

As a result of these assessments the SSR concluded that the study area had a *Moderate/Moderate to High Scenic Quality*, with areas around Pejar Dam rated as *High Scenic Quality.*

2.4.2 Scenic Quality Sensitivity

The SSR uses a Viewer Sensitivity Level Classification of Travel Routes adapted by Williamson and Calder in 1979 and based on the sensitivity tables used by the United States Dept. of Agriculture – Forest Services (refer **Appendix B; Table 3**). The USDA Forest Service tables were formulated in the 1970s for use in forest and rural planning assessment and have been a bench mark to viewer sensitivity in visual impact assessment since that time. The tables are often adapted to suit individual projects and regional variations. The SSR tables are divided into High, Moderate, Low and Very Low sensitivity levels. The widespread adaptation of these tables tends to set a comparable standard for viewer sensitivity related to user numbers, and factors into the assessment the likelihood of recreational use of the place or travel route. This refinement of sensitivity is based on the early studies showing that recreational users, regular road users and residents have higher sensitivity to visual change and visual quality than general commuters.

Of significance to the Crookwell 3 assessment are the SSR Viewer Sensitivity Tables allowance for traffic volumes in the table reproduced in **Appendix B**. The sensitivity level is set to define a level of relative concern for scenic quality. Using these Viewer Sensitivity Tables to derive the sensitivity related to volume and user type, the SSR rates the Goulburn-Crookwell Road, Pejar Dam Picnic Area and the Crookwell Wind Farm viewing area as *High Sensitivity* with most other local roads as *Moderate Sensitivity*.

2.4.3 Visual Significance Assessment

Using the SS-VEM ™ model the SSR concluded that the Goulburn-Crookwell Road corridor was a *Visual Significance Zone 1* travel route and Table 6 of the SSR outlined a range of Recommended Visual Performance Standards. These standards set some justifiable guidelines for assessment of impacts in the Crookwell Study Area. The key SSR recommendations for the *Visual Significance Zone 1* were:

SSR Table 6: ***Recommended Visual Performance Standards*** *(Source: Scenic Spectrums 2006)*

Performance Issue	***Visual Significance Zone 1***
Desired Landscape Character	*Predominantly Open Pastoral Tablelands and Valleys, particularly for areas viewed from the Goulburn-Crookwell Road, from the Goulburn-Crookwell Heritage Railway and from rural residences and properties with High Viewer Sensitivity levels.*
Scenic Integrity	*Moderate – Partial Retention. Landscapes where the valued landscape character "appears slightly altered". Noticeable landscape alterations must remain visually subordinate to the landscape character being viewed.*
Scenic Quality	*Maintain as a perceived moderate scenic quality by most viewers.*
Distance/Visual Magnitude	*No turbines within 1 km from Level 1 travel routes, public viewpoints and private residences/driveways with high viewer sensitivity levels.*
Horizon Line & Panoramic Views	*Maintain significant portion (say 80%) of horizon line views or panoramas free from wind turbines as viewed from level 1 travel routes, public viewpoints and private residences/driveways with high viewer sensitivity levels*
Cumulative Visual Effect	*Avoid significant extension of the visual effect and Wind Farm Pastoral Character created by the existing wind turbines beyond their centre points. Tight clusters with smaller numbers of turbines are preferable. Provide a significant visual gap between turbine clusters on a local basis and between wind farm projects on a regional basis.*
Key Landscape Features	*Avoid locating wind turbines on or near major and notable local landform, water form, vegetation or cultural features that have visual prominence or are focal points (refer Fig. 2) Also avoid interruption of views to such features or focal points by wind turbines.*
*High Sensitivity Residential Viewpoints***	*Avoid visual dominance of rural residential houses and driveways by wind turbines located within 1 km distance or within 2 km where ridge top turbine positions may visually exaggerate the visual dominance.*

2.4.4 Landscape Character

In SSR table 6 (and Section 3.3 of the SSR) in *'Desired Landscape Character'* it is important to note that the SSR identifies that the desired character identified by community consultation at the DIPNR workshop is one of predominantly open pastoral tablelands and valleys. In contrast when considering *'Cumulative Visual Effect'* the SSR identifies a landscape character identified by local consultation that is to be avoided. The SSR describes the undesirable effect as the "Wind Farm Pastoral Character" and defines this character on p.22 in Table 7 as *"Pastoral Wind Farm – Landscape Character expressing dominant wind farm uses that exert a strong visual influence over the character of the landscape primarily in the form of tall wind turbines with moving blades, access roads substations and supporting infrastructure."*

2.4.5 Cumulative Visual Effect

In SSR table 6 *"Cumulative Visual Effect"* the SSR identifies that to avoid extension of the "pastoral wind farm character" and undesirable cumulative effects the SSR considers it is important to cluster the turbines and provide a significant visual gap between turbine clusters on a local basis and between wind farm projects on a regional basis.

The SSR recommendations noted under *"Horizon Line & Panoramic Views"* are significant in relation to the cumulative effects along the Crookwell-Goulburn Road and for several of the individual residences. They set parameters to assess the likelihood of significant cumulative impacts that could arise from further development. The SSR parameters set a goal level of around 80% of the horizon line view or panorama to be free of wind farm elements. This proposed 80% is of a visual field for the naked eye of around 180^{o} to 200^{o}, effectively setting a goal level of impact on less than half of the view or panorama at High Viewer Sensitivity locations.

2.4.6 Distance and Visual magnitude

Of equal significance is the setting of the parameters for *"High Sensitivity Residential Viewpoints"* and the notes under *"Distance/visual magnitude".* The SSR identifies visual dominance of turbines will occur at distances of 1km from rural residential houses and driveways or within 2km of the residences where ridge top turbine positions exaggerate the visual dominance. Notably this assessment is based on wind turbines with a proposed overall height limited to 100m extrapolated from overseas perception studies of 76m turbines (refer **comments in 2.4.4**)

Having set the visual performance standards and having reviewed the options for Scenic Integrity Levels the SSR recommended that *Visual Significance Zone 1* (SSR-VSZ1) be given a performance standard to maintain moderate scenic quality and defined moderate scenic quality as:

SSR Table 8 ***Scenic Integrity Level Frame of Reference*** *(partial copy)*

Scenic Integrity Level	***Visual Quality Objective***	***Visual Dominance of Modifications***	***Frame of Reference***
Moderate	*Partial Retention*	*Slightly Modified (Slightly apparent Modification)*	*Landscapes where the valued landscape character 'appears slightly altered.' Noticeable landscape alterations must remain visually subordinate to the landscape character being viewed.*

I interpret Tables 6 and 8 of the SSR as a determination that to maintain a moderate Scenic Integrity Level the landscape alterations must remain visually sub-ordinate to the original landscape character being viewed. I consider that this is a correct assessment and that if the overall change is not subordinate to the landscape character then the character will change from the desired landscape character to the "pastoral wind farm" character.

I consider these observations and the conclusions of the SSR in relation to the SSR-VSR1 areas are valid and comparable to the LVIA for Crookwell 3.

2.4.7 Wind Turbine Visibility

The SSR also reviewed several studies into the visual magnitude of wind turbines and concluded for VS1 and VS2 (lower rated) elements:

Based on these findings, performance standards that call for a setback of 1 km from high sensitivity travel routes and residential viewpoints within 1000m and 500m from residences within VSZ2 would appear to be reasonable.

Notable in forming that conclusion were the observations of Geoffrey Sinclair of Environmental Information Services in the United Kingdom – Sinclair's relevant observations are as follows;

- *wind turbines up to 100m tall will have a high visual magnitude and create significant visual impacts up to 4 km distance;*
- *100 m tall turbines have medium-high visual magnitude and significant visual impact from 4-8 km;*
- *100 m turbines have medium visual magnitude and potential contributing significant impact from 13-18 km distance;*

These finds were supported by Dennis Williamson and are comparable with research by Dr Ian Bishop (2001) It is highly significant these findings apply to wind turbines with an overall height of 100m and were extrapolated from perception research results for wind turbines with an overall height of 76m (50m to the nacel and 26m blades). Sinclair's observations do not account for atmospheric lighting contrast conditions, however Bishop's findings allow adjustment for atmospheric conditions and the relevant observations can be summarized as follows;

Visual Impact Threshold (Distance at Which 50% of Viewers Assessments of Visual Impact Exceed the Midpoint Position between Low and High Visual Impact Level Ratings) of White Wind Turbines:

- *Visual impact drops rapidly at approx. 4km and is <10% at its highest level @ 6 km in clear atmospheric conditions*
- *Visual impact drops rapidly 4 km and is <10% of its highest level @ 5 km in light haze.*

I consider these observations are valid and comparable to the constraints set in the LVIA for Crookwell 3 but will require adjustment for the increased turbine height at Crookwell 3. Taller turbines are likely to require increased set back distances to avoid impacts that reduce Scenic Integrity.

2.5 Summary of the Relevant Document Reviews

Our review of the relevant documents has revealed a number of complimentary requirements and key components of the various methodologies.

2.5.1 Community Assessment

The DGR's require, and both the SSR and NAF provide, a framework that relies on extensive community involvement. The Guidelines require a description of community values based on surveys and consultation. The NAF identifies stakeholder involvement in setting landscape values and reviewing impacts as essential. The SSR uses a methodology based on initial scenic perception studies of the local community and assessment of the scenic quality that is identified by community research.

As noted in the SSR this area of community input has been the subject of very little research. As a result, the landscape values and sensitivity levels identified in the visual assessments of most projects are narrowly based on professional assessments or expert opinions, not on wider community based researched values. In placing the emphasis on community based researched values the DGR's set a "best practice" standard which seeks to provide greater objectivity and potentially more closely reflect community values of the landscape.

I consider the DGR's and the Guidelines requirements would be met by using the methodologies identified in either the NAF or the SSR.

2.5.2 Cumulative Impacts

The DGR's and Guidelines require an assessment of cumulative impacts. To assess those impacts the NAF relies on community input and requires a clear rating of the impact value, duration and reversibility. The SSR identifies a landscape character and sets performance standards to maintain the desired landscape character as part of the individual assessment and as part of the cumulative impact assessment.

I consider that community input into the setting of values, as required by the DGR's and NAF, is a significant issue particularly in relation to cumulative impact assessment.

2.5.3 Turbine Height

It is important to note that the turbine height that forms the basis of the SSR review is 100m overall height and the SSR assessment of impacts and distances is based on extrapolation of a 76m turbine height. It is reasonable to conclude that the impacts of a 157m *(Union Fenosa EA Chapter 9 Section 9.1 worst case height)* high turbine would exceed those of smaller turbines particularly in visual dominance of the landscape.

Section 3 REVIEW OF THE CROOKWELL 3 LVIA

3.0 General

To meet the requirements of the engagement outlined in **1.1 Introduction**, I have separated the review of the Crookwell Landscape and Visual Impact Assessment (LVIA) into components that match the details of the engagement. I have identified my opinion of the suitability of the methodology, compliance and/or validity of the LVIA to the statutory documents and have determined a number of detailed relevant areas of the LVIA for review or comparable assessment.

In general the LVIA is professionally prepared and incorporates all the key elements of a standard visual assessment. The LVIA methodology is consistent with many similar widely used methodologies based on professional opinion and assessment.

In this case the DGR's have set a 'best practice' standard by requiring that the landscape values forming the basis of the assessment reflect the values of local and regional stakeholders and are not based solely on a professional opinion.

3.1 Director General's Requirements

The table provided in **Section 2.1** is replicated below with comments on compliance with the requirements.

Table 3.1 **Director General's Requirements: Compliance Table**

Location	Requirements	Compliance of the EA	Reason
General Requirements	• *Location, dimensions of all components (incl. map coordinates and AHD)*	Compliant	Provided
	• *Supporting maps and plans identifying existing environmental elements.*	Compliant	Provided
	• *Assess worst case as well as representative impacts for all key issues and in relation to cumulative impacts for both Crookwell 1 and Crookwell 2.*	Partly Non Compliant	The worst case impacts have been identified however in relation to cumulative impacts no justified methodology has been documented to formulate the assessment of the impact or the outcome of the assessment in relation to either public locations or individual residences.
	• *A draft statement of commitments*	Partly Non Compliant	The LVIA commits to various measures in the document however proposed screening commitments are not specific but generic and rely on further consultation. The LVIA does not appear to set bench mark standards similar to those set in the SSR in Table 6 against which any such commitments can be tested or considered to determine the effectiveness of commitments to reducing impacts.

Key Assessment Requirements	***Visual Impacts*** *– The DGR's require that the EA must:*		
	• *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;*	Non Compliant	The LVIA does not identify any research in relation to community and stakeholder values of the local and regional visual quality. The assessment and findings in relation to landscape character are not based on local surveys or consultations. Significant vistas and scenic quality identified in the SSR are not identified or noted as differing from other areas. In particular the potentially higher scenic value of areas along the Goulburn-Crookwell Road, around Pejar Dam or the heritage item: St Stephen's Church is not identified.
	• *assess the impact of shadow 'flicker', blade 'glint' and night lighting from the wind farm;*	Partly Non Compliant	The actual effect of night lighting mitigation measures is not clearly defined and not assessed.
	• *identify the zone of visual influence (no less than 10 kilometres) and assess the visual impact of all project components on this landscape;*	Partly Non Compliant	The zone of visual influence is mapped and elements are identified however without the required assessment of character based on survey or consultation the assessment of visual impact could be inaccurate.
	• *provide an assessment of the feasibility, effectiveness and reliability of proposed mitigation measures and any residual impacts after these measures have been implemented.*	Non Compliant	The proposed mitigation measures are not clearly set out as a statement of commitment. The LVIA does not specify where screening will occur, only that it may provide mitigation. Therefore the potential reduction of impact, feasibility, effectiveness and reliability of proposed mitigation measures cannot be determined.

In addition to these assessments the Director General issued 'Supplementary Requirements' dated 16th August 2011. These require amongst other matters a *'comprehensive, detailed and genuine community consultation ….'* And further *'the Environmental Assessment must state how the communities' issues have been responded to.'*

I consider that genuine community consultation must include identification of local and regional stakeholder values and community perceptions of the impacts both individual and cumulative. This is a key requirement that determines the validity of the methodology. The LVIA does not meet the DGR's for this element of community consultation.

3.2 NSW Planning Guidelines – Wind Farms (draft)

The individual requirements of the NSW Guidelines have been considered below under the headings identified in Section 2.2 of this review. Relevant text from the NSW Guidelines is shown in italics and our comments related to the Crookwell 3 LVIA follow each heading.

3.2.1 Assessment Methodology

- *a description of the assessment methodology and a clear justification of it including discrete justification of the methodology for assessing impacts at neighbours' houses within 2km of a proposed wind turbine.*

The LVIA has provided a clear description of the methodology

The LVIA has provided a discrete justification of the methodology for assessing impacts at neighbour's residences within 2km of a turbine however the LVIA has not provided a justified assessment methodology for considering cumulative impact for those residences.

3.2.2 Project Description

- *A description of all relevant components of the project, including turbine heights and layout- where micro-siting or a range of turbines is proposed, the assessment should be based on the 'worst case' layout and turbine height.*

The LVIA and the EA have provided a clear description of the relevant components of the project and has based the assessments on a worst case scenario.

3.2.3 Landscape Description

- *A description of the landscape including key features*

The LVIA has provided a description of the landscape character areas of the study zone. The LVIA and EA have identified most key features including the various high points and the Pejar Dam. The LVIA description does not identify several key features including the Pejar Dam Recreation Area, St Stephen's Pejar Anglican Church (listed in the local LEP refer **Appendix C**) and the Pejar Creek Underbridge (listed under the NSW Heritage Act, refer **Appendix C**).

3.2.4 Visibility

- *A description of the visibility of the development*

The LVIA provides a Zone of Visual Influence Assessment and an assessment of climatic and other visibility factors.

The LVIA does not have a justified methodology to assess turbines of differing heights up to 157m nor does it assess the effect on the spatial dominance or required set backs due to the potential height of the turbines at 157m.

3.2.5 Photomontages

- *Photomontages of the project and associated transmission lines taken from:*
    - *potentially affected residences (including approved but not yet developed dwellings or subdivisions with residential rights) within 2km of a proposed wind turbine or other associated infrastructure (note that the number of photomontages may be reduced in less sensitive landscapes such as industrial area),*
    - *urban settlements, and*
    - *significant public view points including roads, lookout points and walkways.*

The LVIA includes a wide range of photomontages for affected locations and residences. The methodology used for production of the photomontages is widely accepted and assuming the methodology was followed the results would be indicative of the likely potential views.

3.2.6 Zones of Visual Influence

- *Identification of the zone of visual influence of the wind farm (no less that 10km)*

The LVIA identifies zones of visual influence. The LVIA does not differentiate for greater turbine height or identify the changes in dominance.

3.2.7 Landscape Character

- *A description of the significance of the landscape values and character in a local and regional context*

The LVIA assesses the landscape character however the assessment is not based on local community values but on professional opinion.

3.2.8 Stakeholder Values

- *A description of community and stakeholder values of the local, regional visual amenity and quality and perceptions of the project based on surveys and consultation.*

The LVIA does not describe the stakeholder values of the local visual amenity and quality using a methodology based on surveys or consultation of the local community.

3.2.9 Cumulative Impacts

- *Assessment of cumulative impacts on the landscape and any cumulative visual impacts from transmission line infrastructure and any surrounding approved or operational wind farms in the locality.*

In relation to public viewing points, the LVIA has identified and mapped the range of surrounding wind farms within the visual catchment of the Crookwell 3 project and has identified a number of wind farms which may contribute to 'sequential' views during the course of a journey. The LVIA relies primarily on photomontages to demonstrate and assess the cumulative impacts. The LVIA does not provide a justified methodology for the assessment of those cumulative impacts.

For residential locations the LVIA is silent on potential cumulative impacts. My simplistic assessment indicates that a number of residences are currently affected by wind turbines that are visible to an extent in excess of 90^{o} of the total visual catchment (360^{o}). The location of the Crookwell 3 turbines would in several cases increase the percentage of the visual catchment affected by turbines to in excess of 200^{o} and in many cases in excess of the 80% of horizon line view. This is significantly in excess of the guidelines for 80% of horizon line view set in *Table 6* of the SSR "*Horizon Lines and Panoramic Views"*. Depending on orientation, setback and dominance this could change the character around the residences from 'pastoral' to 'pastoral wind farm' as described in the SSR.

The cumulative impact of wind farms on individual residences is partly portrayed in the photomontages however the limited visual field of the photomontage does not inform the reader of the potential sense of enclosure nor provide a justifiable assessment of the overall cumulative impact.

3.2.10 Potential Change to Landscape

The visual impact of a wind farm depends on the extent of the change to the landscape caused by the development, taking into account:

- *the visibility of the development*
- *the locations and distances from which the development can be viewed*
- *landscape values and their significance*
- *the sensitivity of the landscape features to change.*

The LVIA has taken into account these factors however the assessment is limited by the lack of community consultation, assessment and description noted in 2.2.4, 2.2.6, 2.2.7 and 2.2.8 above.

3.2.11 Contributing Factors to Visual Impact

The visual impact of the development relates to:

- *the number, height, scale, spacing, colour and surface reflectivity of the wind turbines*
- *the quantity and characteristics of lighting, including aviation obstacle lighting (subject to CASA requirements and advice)*
- *potential or visual clutter caused by turbine layout and ability to view through a cluster or array (visually well ordered series) of turbines in an orderly manner*
- *the removal or planting of vegetation*
- *the location and scale of other buildings and works including transmission lines and associated access roads*
- *proximity to sensitive areas*
- *proximity to an existing or proposed wind farm, having regard to cumulative visual effects.*

In addition to comments in section 3.2 above the LVIA has taken some of these factors into account however the potential for visual clutter and the cumulative impacts due to greater dispersion of larger turbines and proximity to several other wind farms with different size and clustering of turbines, have not been assessed with a justified methodology. In addition the impact of the greater turbine height is not assessed in a justified methodology.

3.2.12 Landscape Features

The features of the landscape include:

- *the topography of the land*
- *the amount and type of vegetation*
- *natural features such as waterways, cliffs, escarpments, hills, gullies and valleys*
- *visual boundaries between major landscape types*
- *the type, pattern, build form, scale and character of development, including roads and walking tracks*
- *flora and fauna habitat*
- *cultural heritage sites*
- *the skyline*

The LVIA has taken most of these factors into account but has omitted to consider the cultural heritage sites – St Stephen's Church and The Pejar Creek under bridge, (refer **Appendix C**) and the main recreational site at Pejar Dam the effect of the proposal on the views, to and from those items and their associated curtilage. The St Stephen's Church and Pejar Dam area is identified as a High Scenic Value in the SSR in contrast to the lower rating in the LVIA.

The effect of the location of the turbines on ridges, the relative heights to viewers, the resultant dominance and effect on the skyline do not appear to be considered.

3.2.13 Mitigation of Impacts

The NSW Guidelines offers possible mitigation measures stating:

Examples of mitigation measures that proponents can use to reduce the visual impact of a proposed wind farm include:

- *where possible, locate turbines;*

- *away from areas with high scenic values*
- *away from areas with high visibility from local residents*

- *select turbines that:*
  - *look the same, have the same height and rotate the same way*
  - *are off-white or grey colouring*
- *minimize the removal of vegetation*
- *plant vegetation to provide a visual screen*
- *reduce impacts of night and obstacle lighting by*
  - *limiting lighting on towers to that required for safe operation and aviation safety and*
  - *use of lighting design which minimizes glare*
- *underground electricity wires where practicable*
- *use alternative transmission line pole designs to minimize visual impact.*

The LVIA has considered and, where the proponent considers it reasonable, has adjusted the proposal to reduce impacts and mitigate residual impacts using some of these techniques. Proposed plantings are not specific and proposed Scenic Value Ratings require further review.

3.2.14 Social Issues

Several of the issues identified as 'Social Issues' in Appendix A of the NSW Guidelines relate to visual impacts.

Social issues that have a visual component include:

- *blade glint*
- *shadow flicker*
- *night lighting*

The LVIA has made assessment and provided expert comment on blade glint and shadow flicker and night lighting.

Appendix A has an extensive and detailed list of elements that require identification and assessment. The key headings and verification of compliance with the requirements is tabulated below.

Table 3.2 **NSW Planning Guidelines *Appendices A and E* – Assessment Table**

Location	**Description of surrounding environment**	**Comment**
Appendix A	• Landscape and Visual Amenity	Refer 3.2.3 and 3.2.7
	• Assessing Landscape and Visual Amenity impacts	Refer 3.2.10, 3.2.11 and 3.2.12
	• Mitigating Landscape and Visual Amenity impacts	Refer 3.2.13
	• Blade Glint	Assessed
	• Shadow Flicker	Assessed
	• Night Lighting	Assessed

	• Cumulative impacts	Refer 3.2.9
	• Construction Issues	Assessed
Appendix E	Micro Siting of Turbines	The LVIA identifies some micro siting of turbines will be required and commits to maintaining the minimum set back from residences.

3.3 National Assessment Framework

The Wind Farms and Landscape Values – NAF sets out a process for Landscape Assessment of a wind farm that requires 5 steps. For each step direct community involvement is considered essential. In the *Introduction* Section 1.2 of the LVIA states it has encompassed the general assessment framework of the NAF in the LVIA methodology. Whilst I agree the methodology used for the LVIA is based on general assessment framework of the NAF incorporating,

- analysis of landscape character,
- description of development,
- identification of impacts and
- consideration of mitigation measures,

the LVIA fails to incorporate the essential key element of the NAF – direct local community involvement in the process of setting landscape values and assessing impacts. The basis of the LVIA is therefore the professional opinion of the assessor and it is not identified that the assessor is informed by public perception or survey. Therefore the Crookwell 3 LVIA assessment of landscape character and potential impacts may not be a true reflection of the values of the potential stakeholders.

I consider that when the LVIA is considered against the methodology of the NAF and the DGR's it is reasonable to conclude the gathering of base data, analysis and description of development are adequate however the assessment of character and likely impacts do not meet the compliance standard set by the DGR's.

3.4 Crookwell 2: Scenic Spectrums Review

Section 2.3 of the review outlines the key issues and considerations identified in the SSR of the Crookwell 2 EIS and Visual Impact Assessment. This section reviews their relationship to the LVIA

3.4.1 Community Involvement

Whilst the SSR uses a slightly differing methodology to the LVIA the assessment is based on the same key elements, similar to those of the NAF.

In contrast to the lack of direct community involvement in the LVIA the SSR is based on a limited local community consultation primarily using a workshop process.

On the basis of those consultations the SSR concludes:

1) *the pastoral character of the landscape is highly valued*
2) *Pejar Dam has a high scenic value*
3) *The Goulburn-Crookwell Road and highly sensitive residential viewpoints are rated – Visual Significance Zone 1.*
4) *To maintain scenic integrity of the desired landscape character the landscape alterations must remain visually subordinate to the landscape character.*

It is notable that in the absence of direct community involvement the Crookwell 3 LVIA concludes that:

- *The scenic value of all areas is moderate and the Pejar Dam area and the Crookwell-Goulburn Road corridor have no higher significance.*
- *The scenic value of the study area is not devalued by the introduction of Crookwell 3.*

The LVIA does not provide a justified methodology for assessing cumulative visual impact based on community perceptions and therefore the conclusions reached in the LVIA may not be correct as they are subjectively based solely on a professional opinion of the landscape values.

3.4.2 Scenic Quality Sensitivity

In Section 7.3 of the LVIA the methodology for assessment of Landscape Sensitivity is set out. This is a justified methodology based on a widely used system. Again it is important to consider that this is based not on community perceptions but on the assessor's professional opinion and perceptions.

In Section 8.1 of the LVIA the visual impact criteria are outlined. Of specific interest in comparison to the SSR is Table 13 of the LVIA the *Viewer Location Assessment Criteria* (refer **Appendix D**). The initial section of Table 14 'the Visibility Criteria Matrix' does not differentiate for residential or recreational sensitivity of the viewer, that information follows in an ascending table (Table 15) however that ascending table does not appear to be a factor in the criteria matrix or the impact assessment. Also significant are the ratings for the number of viewers. These numbers contrast significantly with the number of viewers set as high, moderate or low in the SSR as based on the USDA Forest system. In the LVIA 500 people are required to reach a rating of High whereas in the SSR the High rating is reached on main sealed roads with 75 vehicles per day, a significantly lower level.

Also significant when considering cumulative impact are the "Period of View" ratings. A rating of "short term" can be gained with a duration up to 30 minutes i.e. 40-50 km travel by car. "Moderate term" is up to 2 hours or around 200 km.

When considering cumulative impact it is my opinion that viewers are likely to consider the landscape character is changed even by what is described in the LVIA as a very short term exposure of 10 minutes or 15-20 km. The synthesis of all these factors in LVIA Table 13 results in a volume of 250 people / day at a distance of 1 km for up to 10 minutes set as a low rating. Notably the SSR would allocate a high rating to that volume of traffic on a main sealed road such as the Crookwell - Goulburn Road.

Neither rating system is perfect but it does seem a reasonable assessment is higher that that set in the LVIA and the differences have affected the assessment of impacts.

3.4.3 Turbine Height and Visibility

The LVIA addresses the issue of visibility of the turbines with a systematic and justifiable methodology.

The LVIA does not appear to account for the relative height and scale of the turbines in assessing the degree of setback required to avoid spatial dominance particularly in relation to The Goulburn - Crookwell Road and highly sensitive residential viewpoints. Nor does it attempt to draw on any previous studies or data linking changes in height and scale to visibility and spatial dominance. Notably the LVIA selects setbacks to match those approved for Crookwell 2 and does not reach a conclusion as to appropriate set back based on the circumstances of this particular set of landscape and visual constraints despite the potentially increased height and dominance of the proposed turbines.

I conclude that no justified methodology for the assessment of the variation in impact of the greater turbine height appears in the LVIA, and that as a result no justification for the minimum set backs has been provided.

Section 4 Response to Submissions

4.0 General

In the Response to Submissions (RtS) dated April 2013 the proponent includes in the *Design Changes* Section 4 a summary of the changes during the EA process. The most critical are the relocation and removal of several turbines. The RtS then combines the responses to submissions in general groups to allow a single comprehensive response to significant issues.

4.1 Setbacks and Turbine Locations

In Section 6 the table identified Turbine Location as an issue noting:

C*ouncil's DCP required minimum 2km setback from dwellings non-involved with the development, or written consent from existing dwellings within 2km of proposed turbines.*

The response comments:

The limits in the DCP are not based on any scientific understanding of buffer distances required by noise and other negative characteristics of the wind farm. Nor do they take into account topography, prevailing wind patterns, landscape type or the characteristics of the turbine itself, all of which vary and should be reflected in buffer distances.

A preferable approach is to use the results of the specialist assessments and established standards to determine the most appropriate buffer distance based on the specific project under consideration.

We agree with the stated preferable approach for assessing the setbacks and note that the LVIA does not provide any specialist assessments of the effect of turbine size nor any established visual standards or published visual research to determine the setbacks from turbines of this size. We agree the characteristics of the landscapes and individual turbines should form part of the assessment.

It is not clear whether the LEP and DCP buffer guidelines, anticipated a specific turbine height nor if wind farms currently constructed and assessed for setback have assessed turbines in excess of 150m height.

The proponent refers several times to the unreasonable and arbitrary nature of the numerical limits of the Upper Lachlan Shire DCP (ULSDCP) and the considerations of a number of court actions.

The proponent does not identify that variation in turbine height may affect the assessment nor that a number of wind farms in surrounding areas, and most particularly Crookwell 1, upon which the local community are likely to base their visual quality assessment, have smaller turbines.

Table 4.1 **Regional Wind Farm Turbine Heights**

Windfarm	**Status**	**Overall Height (in the order of)**
Cullerin Range	Operational	126m
Gunning	Operational	120m
Capital, Bungendore	Operational	120m
Crookwell 1	Operational	70m
Crookwell 2	Approved	107m original assessment 128m amended
Crookwell 3	Proposed worst case	157m
Gullen Range	Under construction	Awaiting owner's response

The proposed turbine height at Crookwell 3 is more than twice the height at Crookwell 1 and 50% more than the original approved height at Crookwell 2. This increase must affect the overall dominance in the landscape. The 2km limit set in the ULSDCP may in fact be a suitable limit for a turbine of this size assessed on its merits for this landscape setting, as scale and dominance are key elements in the overall impact**.**

4.2 Response to Community Submissions

The responses by the proponent to the visual impact and amenity issues are contained on p.89 to p.99.

Under issues raised the RtS notes:

Concerns raised about impact to visual amenities, and loss of scenic enjoyment

The RtS proponent response includes:

Ultimately the level of visual impact would depend on the type of activities engaged in as well as the location of the activities together with the degree of screening provided by local landform or vegetation within individual properties.

Whilst views toward the turbines would occur from a wide area of surrounding rural and agricultural land, this LVIA has determined that the sensitivity of visual impacts is less for those employed or carrying out work in rural areas compared to potential views from residential dwellings.

We cannot identify where the LVIA distinguishes between the level of visual impacts dependant on the type of activity. Similarly we cannot identify any justified methodology to demonstrate differences in sensitivity between residential, recreational or work related viewers in the LVIA. These distinctions appear to be made on anecdotal evidence not on any published survey or local community assessed basis.

4.3 Wind Farm Design

In response to an issue raised:

Concern raised that the total number of wind turbines to be very excessive for the size of the land being requested.

The proponent response includes:

Modern wind farms are also very different to older projects by having greater distance between turbines and therefore having fewer turbines per site through the use of taller turbine models. This has been reflected in the evolution of the proposed Crookwell 3 Wind Farm, where earlier proposals included more turbines.

This comment does justify why some turbines were removed during the EA process. Notably this comment highlights the need for modern wind farms with taller turbines to be assessed with a justifiable methodology and for the setbacks to be based not on the previously approved setback distances of other Australian wind farms with potentially different landscape and turbine characteristics, but on the individual characteristics of this landscape and the proposed turbines.

Issue raised:

Concerns raised that photomontages may not be accurate representation of the final constructed wind farm.

The methodology for the preparation of photomontages is based on widely accepted guidelines.

Assuming the guidelines have been followed the comments by the proponent about accuracy appear to be consistent and reasonable.

4.4 Cumulative Impacts

The issue raised is noted as:

Concerns raised that there will be excessive cumulative impact in this region.

Proponent has responded with a copy of the cumulative impact assessment from the LVIA. The LVIA identifies a range of direct, indirect and sequential impacts and determined that there was an impact due to each type of impacts and noted the cumulative impact along the Goulburn-Crookwell-Taralga Road corridor.

No justified methodology is provided to support the following RtS statements.

1) *"there is unlikely to be a significant increase in visual impact arising from cumulative impacts".*

2) *"overall, the Crookwell 3 Wind Farm is not considered to significantly increase the magnitude of visual impact for the majority of residential view locations within the Crookwell 3 wind farm 10km viewshed."*

The RtS statements that follow related to screening appear to be generic as no proposal screening layouts or analysis of the mitigation of the impacts as required by the DGR's is provided.

4.5 Community Consultation

The RtS outlines the community consultation process and responds to concerns that attitudes to wind farms identified in the EA may not be valid.

It is important to note that none of the surveys noted in the RtS appear to deal specifically with local visual or regional values of amenity and quality or local perceptions of the project based on surveys or consultation as required by the DGR's and as noted in the NAF. In addition the survey data referred to does not appear to have been used in the production of the LVIA.

4.6 Commitment and Mitigation tasks

In the RtS p.149 to p.150 a number of commitments to mitigation measures are proposed. The commitment to treat all structures with an off white non reflective colour and matt finish with no advertising or logos on the structures is definable and the mitigation impact can be assessed.

Less clear are the general commitments to planting and screening. The extent of consultation and commitment to actual planting layouts is not identified. In fact there is no solid commitment to any planting only "*consultation and planting where the planting is seen as effective*". This does not provide any basis for determination of the extent, mitigation value, feasibility, reliability or identification of residual impacts. Therefore this does not appear to meet the Director General's Requirements.

Similarly the effect of any screening on cumulative impacts cannot be determined.

Commitment 5.5 identifies *"that night time lighting will be minimised low lux lighting designed with lights projecting inwards where necessary".*

Commitments 5.6 and 5.7 deal with night lighting. The commitments set specific angles for downward components of obstacle lighting. We cannot identify where the actual impact of that lighting falls, or if in fact it has any impact. The impact does not appear to be quantified with a justified methodology and the effect of the commitment cannot be determined.

No identification of the extent of light spill and its effect on individual properties is provided, as a result feasibility and effectiveness of this mitigation measure cannot be assessed.

Section 5 Summary of Acceptability and Recommendations

5.0 Acceptability of Impacts at Local and Regional Scales.

As a result of the lack of public consultation to inform the formulation of landscape values and the scenic perception study, the reliability of the conclusions of the LVIA does not appear to be high.

Based on the documents I have reviewed, particularly the SSR with its community study, resultant scenic assessment and guide lines, it is my opinion that Crookwell 3 as a stand alone element in the landscape is likely to be considered an acceptable impact. This is similar to the result of the studies of both Crookwell 1 and 2.

The significant difference for this assessment is the cumulative impact of Crookwell 3 with other regional wind farms. The cumulative impact falls mainly into two separate categories:

- The local and regional sequential views of motorists from public roads, and
- The primarily static views for individual residences.

The wider question of acceptability of the cumulative impacts can be answered only by 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.

If public consultation identifies that a change of landscape character to '*pastoral wind farm character'* is acceptable then the local and regional sequential view impacts created by Crookwell 3 are highly likely be acceptable in that context.

For static residential properties the cumulative impacts are potentially even more significant. The location of the Crookwell 3 - South component fills in the visual catchment between the Gullen Range wind farm and Crookwell 2, whilst Crookwell 3 – East extends the visual impacts across Woodhouselee Road to the East.

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 2VI: Diagram 6 'Cumulative Crookwell 1, 2, 3 and Gullen Range'.*

The zone of visual influence where all 4 wind farms fall into the visual catchment of many residences is potentially extensive. This is demonstrated in many of the photomontages in the LVIA including B, C, D, M, N and U. Note these photomontages are views of around 160^{o} however for many locations a similar view of wind farm infrastructure is also possible in the reverse direction of the photomontage.

It is my opinion that for many residences Crookwell 3 creates a sense of enclosure of the residence in a *'pastoral wind farm'* landscape, as the wind farm infrastructure becomes the dominant element of the surrounding landscape. In my opinion, when considered against the parameters set in the independently prepared SSR, the extent and dominance of wind farm infrastructure in the visual catchment is likely to result in an undesirable change of landscape character around many residences. It is my opinion that this would be an unacceptable cumulative impact on a large number of residences.

5.1 Recommendations

Following our consideration of the LVIA, and the relevant documents, it is my opinion that there are several key areas where the current Environmental Assessment and the LVIA require modification to comply with the Director General's Requirements. I recommend the proponent be requested to carry out the following actions to respond to the Director General's Requirements;

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.

2) 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,
   - 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,
   - an assessment of impacts on St Stephen's Church, the Pejar Creek under bridge and Pejar Dam recreation area, and
   - the outcomes of community consultation and amended visual parameters on the original LVIA assessments and produce a revised LVIA for consideration.

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.

   If required, guide to a suitable methodology and elements for assessment is contained in the NAF Section 3.3.

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.

5) Night Lighting.

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

Edward O'Hanlon

Director

O'Hanlon Design Pty. Ltd.

Assessment Documents

The attached assessment is based on the following documents

- *Crookwell 3 Wind Farm Environmental Assessment (EA)*

Union Fenosa Wind Australia: July 2012

- *Landscape and Visual Impact Assessment (LVIA)*

Green Bean Design: July 2012

- *NSW Planning Guidelines – Wind Farms (Draft)*

NSW Dept of Planning & Infrastructure: December 2011

- *Review of Crookwell 2 Wind Farm EIS Summary* (working document)

Scenic Spectrums Pty Ltd: January 2005

- *Wind Farms and Landscape Values-National Assessment Framework*

Under the auspices of the Council of National Trusts and Auswind: 27 June 2007

- *Crookwell 3 Wind Farm – Traffic Impact Assessment*

URS Australia Pty Ltd September 2010

- *1:25000 topographical and or/no photo map.*

  882 8-4N Woodhouselee

NSW Land and Property Management Authority 2011

Appendix A