

***PRELIMINARY
INDEPENDENT REVIEW***



GLEN INNES WIND FARM PROPOSAL

***Prepared for
NSW DEPARTMENT OF PLANNING
& ENVIRONMENT***

**8th August 2018
REF: 974-Z1-04
REVISION: Final**

O'Hanlon Design Pty Ltd
ABN 44 003 755 986
1/153 Victoria Road
Gladesville. NSW 2111
ohd@qoh.net.au

Phone: **(02) 9420 3633**
Fax: **(02) 9420 3655**

Overview

O'Hanlon Design Pty Ltd has been engaged by the NSW Department of Planning and Environment (DP&E) to review and comment on the quality and accuracy of the Landscape and Visual Impact Assessment (LVIA) report for the proposed Modification 4 (Mod 4) of the Glen Innes Wind Farm (GIWF), provided as part of the Environmental Impact Statement (EIS) submitted for development approval by Glen Innes Windpower Pty Ltd (the Proponent).

The engagement specifies the provision of an independent expert review report providing advice and commentary on the:

- LVIA [including methodology, assumptions and assessment of impacts [including impact ratings provided at each residence/public viewpoint], including cumulative impacts of the White Rock Wind Farm and if relevant, the Sapphire Wind Farm] and if necessary, identify gaps in the documentation to be addressed by the Applicant to ensure it accords with all relevant guidelines; and
- suitability of the proposed mitigation and management measures, if required.

Our methodology for preparation of this review has included a two day site visit, visits to selected individual residences, a desktop review of remaining residences and potential viewing locations, DP&E guidelines, the proponent's Modification 4 Environmental Assessment (EA) and Landscape & Visual Impact Assessment (LVIA), as well as previous Modification documents and other reports referenced within these documents. We have also analysed topographic maps for the study area and wider areas to identify possible local issues and potential cumulative or regional issues. The purpose of these reviews was to provide background information, a reference for the methodology and depth of assessment that could be considered reasonable for determination of the individual impacts.

Introduction

The Modification 4 of Glen Innes Wind Farm project as submitted in the LVIA July 2017 proposes 25 Wind turbines. to be located within the Glen Innes Severn region, situated approximately 10 kilometers west of Glen Innes. Modification 4 proposes the same number (25) of turbines as the previously approved under modification 2, however modification 4 proposes an increase in overall height of each turbine from 150m to a maximum of 180m.

Key Modification Statistics:

- The previous total of 25 turbines remains unchanged.
- Overall Height (top of tip): 180m increased from 150m of Modification 2 (20% increase)
- Hub Height: 110m increased from 89m (24% increase)
- Rotor Diameter: 140m increased from 122m (15% increase)
- Other than the GIWF there are two existing/approved wind farms in the region. White Rock Wind Farm (WRWF) arcs around the Southern and western edges of GIWF and is located approximately 3.5km to the west and up to 4km to the south of the GIWF. Sapphire Wind Farm (SWF) is located 9.5km north/north east of the GIWF.

Conceptual Framework

In setting a conceptual framework for the review of the project we have identified 4 clusters of residences within which each residence has similar location characteristics with individual height and screening variations that result in potentially similar turbine impacts from related groups of turbines. The tables contained in the **Section 3** provide a framework that allows for:

- comment on the visual impact at each residence and comparison between this, the Mod 4LVIA, and the Mod 2 LVIA by Aurecon;
- comment on residences or major public viewpoints with significant visual impact; and
- a summary of significant visual issues.

Section 2 Discussion of Key Elements & Review of Methodology

2.0 Review of Methodology

In general, the LVIA incorporates key elements of a standard visual assessment. The LVIA methodology is consistent with many similar, widely used methodologies based on professional opinion and assessment. The following is a summary of areas where the LVIA may require more depth of consideration.

2.1 General Methodology and Baseline Data

In reviewing the report, it is apparent that the assessment pertains only to what the proponent describes as 'residual effects'. This term is used repeatedly throughout the assessment and refers to the difference in visual effects caused only by the changes proposed in Modification (Mod) 4 when compared to the previously approved effects of Mod 2. Whilst this may be an acceptable method of assessing the visual effects for the purpose of this application approval, this assessment method relies on the original assessment of Mod 2. The Mod 2 Assessment was not carried out by Green Bean P/L, but Aurecon and it is clear from the quote below that the Mod 4 assessment has made no attempt to evaluate the accuracy of the previous assessment.

"This VIA has not undertaken as [sic] assessment to verify the visual ratings determined in the approved GIWF Mod-2 application."

It is important to note that all ratings in the Mod 4 LVIA are unchanged from their Mod 2 rating by Aurecon. It is unclear how the assessment has concluded that there is no change to any of the visual ratings if the original rating was not checked for degree and accuracy.

As a result of this methodology, further review shows that all 14 properties rated as high in the Mod 4 LVIA were already rated as high in the original LVIA submitted in 2008 when the maximum turbine height was 129m (51m below the Mod 4 height).

It should also be noted that we have identified a few discrepancies between reports when referencing the preceding report. For example, Within the Mod 2 report there are three properties recorded as having a medium approved rating, however these three properties (Nullagai, Wandsworth, and Balaclava A) are in fact rated as High in the original assessment. The Mod 4 assessment also attributes a number of visible hub and tip heights to the Mod 2 assessment that do not appear to be the same as those documented in the Mod 2 assessment.

2.2 Community and Stakeholder Values

When assessing the visual impact of any development it is generally recognised that the landscape values forming the basis of the assessment should reflect the values of local and regional stakeholders and should not be based solely on a professional opinion. The Mod 4 LVIA does not identify any research in relation to community and stakeholder values of the local and regional visual quality. The Mod 4 assessment and findings therefore do not appear to take into account the values of local residence. In addition the Mod 4 LVIA is based upon the findings of the Mod 2 LVIA that also appears to omit the use of community engagement as a tool to identify the local landscape values.

2.3 Night Lighting

There has been no assessment of the impacts that may be caused by night time lighting within the Mod 4 LVIA. As the assessment explains:

"An aviation hazard risk assessment is currently in preparation for GIWF. An assessment of potential visual impacts associated with obstacle lighting may be undertaken subject to confirmation for the requirement of night time obstacle lighting."

The increased height of the GIWF Mod 4 proposal may require obstacle lighting at night and times of reduced visibility. These requirements for obstacle lighting are set by the Civil Aviation Authority (CASA). As stated above, the Proponent has commissioned an independent report to understand the number of obstacle lights and their layout that may be considered acceptable by CASA, but this has not yet been published. Whilst this report would be useful in understanding the possible requirements of obstacle lighting, it is important to note that CASA has not yet released their advice for the Project. Best practice dictates that at this stage, visual impacts should be assessed on a 'worst case' scenario. It is apparent then that the assessment should at least consider a scenario where the Proponent may be required to place obstacle lighting on each of the proposed turbine.

The Civil Aviation Safety Authority (CASA) is currently undertaking a safety study into the risk to aviation posed by wind farms and is planning to develop a new set of guidelines to replace a previous wind farm lighting advisory circular that was withdrawn in 2008. Below is an excerpt from the withdrawn document, whilst withdrawn it is relevant to understanding the limitations of what acceptable shielding may be.

10.4 To minimise the visual impact on the environment, some shielding of the obstacle lights is permitted, provided it does not compromise their operational effectiveness.

(a) Shielding may be provided to restrict the downward component of light to either, or both, of the following:

*(i) Such that no more than 5% of the nominal intensity is emitted at or below 5 degrees below horizontal; and
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(ii) Such that no light is emitted at or below 10 degrees below horizontal.

Roughly calculated, on a property located at the same elevation as the base of a turbine, these mitigation measures would:

- (i) Partially shield properties within 1.8km of that turbine [95% shielding of the nominal intensity].
- (ii) Fully shield properties within 900m of that turbine.

Given that most of the properties fall outside of these distances, it is evident that this level of shielding would do little to overcome the visual impact of the obstacle lighting.

It is generally accepted that in order to maintain scenic integrity of the desired landscape character the landscape alterations must remain visually subordinate to the landscape character. In the event that night lighting is required at GIWF it is difficult to envisage a scenario where these lights remain subordinate to the existing evening/ night time landscape character of the area. Thus, it can be reasonably concluded that at night, obstacle lights would change the overall landscape character from the existing dark pastoral landscape to that of a wind farm/industrial landscape.

It is our opinion that the addition of night lighting in any form would significantly increase visual impact of the Project and that even the limited lighting would significantly increase the impact levels described in the tables in **Section 3** of this report. Obstacle lighting is likely to be considered as significantly obtrusive in the night environment and would further contribute to the overall cumulative effects for most viewers.

2.3 Cumulative Impacts

Whilst the LVIA has attempted to assess the relative cumulative impacts of the project, no specific quantifiable results have been documented in relation to either public locations or individual residences other than the claim that *“potential for the amended Mod-4 wind turbines to result in any additional significant cumulative visual effect is considered to be low.”*

In coming to the conclusion that the overall cumulative effects are low, the LVIA references the White Rock Wind Farm Landscape and Visual Assessment Report V8 March 2011 (by Green Bean P/L) in which the cumulative effects of the relevant wind farms are discussed. Whilst the findings of the White Rock Report (2011) are relevant to some extent, this report was based on turbine heights as at 2011. The table below shows the differential between the proposed heights in 2011 and the proposed heights of those wind farms at the time of the GIWF LVIA (July 2017).

Wind Farm	Tip Height March 2011	Tip Height July 2017
Glen Innes	129m	180m
Sapphire	146m/157m	200m
White Rock	140m	140m

As cumulative effects are only discussed within the Mod 4 assessment in an overarching fashion it is impossible to understand the potential for cumulative impacts at any one view point or residence. Whilst the Mod 4 LVIA states that it has not used the Multiple Wind Turbine Tool included in the Guidelines due to their understanding that it is not applicable to a modification application, this tool would have been useful in understanding cumulative impacts at each of the residences. Our review has included an approximate sector analysis.

Also, of note in relation to cumulative impacts is the LVIA's reliance on ratings contained in previous reports (discussed in **Section 2.1**). This reliance on previous ratings results in the omission of individual cumulative effects for each residence as cumulative effects were not discussed in either the Mod 2 (by Aurecon) or the original LVIA (by Connell Wagner now Aurecon) assessments.

2.4 Mitigation measures

Whilst mitigation measures are discussed within the report, the proposed mitigation measures and any commitment to these are not clearly set out. The LVIA does not specify where screening will occur, no mapping or details of plantings have been provided, only comment that mitigation may be provided. Therefore, the potential reduction of impact, feasibility, effectiveness and reliability of proposed mitigation measures cannot be determined.

The successful visual mitigation of any wind farm relies heavily on the individual location of residences and turbines as well as the surrounding topography. Whilst mitigation has been considered possible in the past, it has become increasingly difficult to shield turbine structures that have significantly increased height due to technological advancement. The optimal conditions for successful mitigation are created when closely clustered turbines, placed at similar relative levels are viewable at a reasonable distance. Due to the geography, layout and location of the GIWF, it is unlikely that mitigation will be successful for many of the residences.

A number of residences within the project area have considerable cumulative effects when GIWF is considered in conjunction with WRWF and to a lesser extent SWF. Areas with high cumulative effects are unlikely to achieve meaningful screening without heavy planting along much of the residential curtilage. Whilst extensive curtilage planting may screen views to surrounding turbines, it will also screen many of the views from that property. This type of screening can lead to a sense of enclosure in or around the residence as views to the immediate and distant landscapes become significantly reduced, whilst this type of planting is unlikely to influence the broader landscape character, it does restrict established views to that landscape. Residences within the Wester Cluster (**Section 3.4**) would likely require heavy screening along much of their curtilage to create meaningful mitigation and this would considerably affect the visual amenity.

Turbines situated close to residences and/or elevated above residences are also difficult to successfully mitigate. The height of the vegetation that would be needed to screen a turbine in such a location is difficult to attain and may take more than 10 years to achieve. Added to this, tall 'one off' screening is only relevant to one given viewing point on the property and the effect of the screen may be negated by the repositioning of the viewer within the site.

3.0 Residence Key

This review includes reviews of residences compiled from a variety of data and site information. A number of residences, identified in the proponent's VIA and considered as significantly impacted, were visited and individually assessed. The VIA assessed impacts for many of the remaining residences were reviewed from viewpoints on adjacent public roads. A lesser number of residences were considered with only a desktop review.

When reviewing the tables set out below it is important to note:

- Any residence that received a high rating in the Green Bean modification 2 assessment have remained unchanged in the Modification 4 assessment. This creates the impression that the overall impacts of these residences have not changed. In fact, in most cases an increase of 20% in turbine height would increase the impacts at these residences and this is evident in the increase of viewable tips and hubs from these residences. However, as these residences are already rated at high and the rating system does not allow for any rating in excess of high, their ratings have remained unchanged. Were the rating system used more finely grained, it could be expected that at least some of these residences would see an increase in their overall visual impact rating.

An example of this lack of refinement in the rating system can be seen in the table immediately following **(Section 3.1)**. Girraheen was previously rated as high in the Mod 2 assessment. In Mod 4 the height of turbines has increased by 20% (30m). This has resulted in an increase from 14 to 22 visible hubs whilst the Mod 4 LVIA rating for this property remains at high as there is no potential to increase past this rating.

- Ratings that have remained unchanged from the MOD 2 Aurecon review are noted in the Mod 4 LVIA Column with U/C (unchanged).
- The information attributed to the Aurecon assessment in the following tables is presented as it is recorded in the Mod 4 LVIA assessment. * indicates where a discrepancy has been recorded.
- The number of affected sectors has been measured to 8km as described in the Wind Energy: Visual Assessment Bulletin (2016). Further, to standardize the review of cumulative effects across the project we have reviewed affected sectors using the following methodology; For each residence the start of the first sector falls upon the first viewable turbine clockwise from north.
- The Wind Energy: Visual Assessment Bulletin (2016) indicates a Visual Influence Zone 1 limit at 1.9km for 180m turbines and states that for Visual Influence Zone 1 turbines should be avoided or justification should be provided for turbines in this area. The Mod 4 LVIA identifies several residences as falling within the Visual Influence Zone 1 but makes no justification to demonstrate why the turbines influencing the Visual Influence Zone 1 categorisation should be retained, or why it is reasonable to increase the height of those turbines further.
- As a background to any review of any visual impacts using the Wind Energy: Visual Assessment Bulletin (2016), an assessment of the scenic Quality of the overall landscape is an important building block. In accordance with the Wind Energy: Visual Assessment Bulletin (2016) we have rated the Scenic quality of the Study area as Moderate using the techniques of the bulletin as a basis. A more refined assessment could identify specific areas of higher Scenic Quality. We note the Mod 4 LVIA has also rated the Scenic Quality of the area as Moderate.

3.1 Northern Cluster

This cluster is located at the northern edge of the proposed turbine layout with residences at levels between RL 1110 and RL 1180. The residences have views predominantly south toward the proposed wind farm.

		<i>Aurecon MOD 2 assessment (as recorded in GB 2017)</i>		<i>Green Bean Assessment 2017</i>			<i>OHD Turbine Review 2018</i>			<i>WF</i>
Residence	Dist km	Mod 2 Ass.	Hubs (Tips) Vis. Mod 2	VIZ	Mod 4 Ass.	Hubs (Tips) Vis. Mod 4	VIZ	Ass.	Comments	
Girrahween	2.1	High	* 12 [14]	2	U/C	12 [22]	2	High	• 95° view of GIWF turbines. [2 Sectors]	39
Rivoli	1.8	Mod	3 [4]	1	U/C	4 [5]	1	Mod	• T1, T2, T3, T4 are within the VIZ 1 landscape [2km] • This property has significant existing screening • 14° view of GIWF turbines. and another 23° of White Rock [2 Sectors]	40 41
Wattle Vale	1.9	High	* 15 [22]	1	U/C	18 [25]	1	High	• Only T1 sits within the VIZ 1 landscape [2km] and is in full view. • T1, T2, T3, and T4 have their hubs visible within 4km • 14° view of GIWF turbines. [1 Sector]	42
Rosefield	3.6	-	-	2	-	-	2	Low - Mod	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • 50° view of GIWF turbines. [1 Sector]	-

Beaufort	3.5	-	-	2	-	-	2	Low	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • 45° view of GIWF turbines. (1 Sector)	-
Safari	3.3	-	-	2	-	-	2	Low	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • 25° view of GIWF turbines. (1 Sector)	-
Malboona	3.4	-	-	2	-	-	2	Low	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • 25° view of GIWF turbines. (1 Sector)	-
Sinclair Lookout (non-residential)	0.3	-	-	-	-	-	-	High	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • Public viewpoint • T1 is only 300m from this turbine in full view.	-

U/C = The rating for this property has remained unchanged from the Modification 2 by Aurecon to the Modification 4 assessment by Green Bean.

* = Differs from the numbers provided in Aurecon's Mod 2 assessment.

Note on Sectors: For each residence the start of the first sector falls upon the first viewable turbine clockwise from north.

Of note in the area of this cluster is the public viewpoint of Sinclair Lookout, situated only 200m from Turbine 1. Significantly increased magnitude effects will be imposed on this established public viewpoint and its access road by the proposed increase in height from 150m to 180m (20%). In addition, the lookout already has views to stage 1 of the White Rock Wind Farm at a distance of approximately 7km. Given the proximity of a number of turbines to this lookout and the categories of users, both visitors and locals, we consider that the surrounding landscape will change from its current character of a pastoral landscape to that of a windfarm/pastoral Landscape

The properties of Girraheven and Wattle Vale are both significantly visually impacted with views to multiple elevated turbines. Due to this elevation screening is not likely to meaningfully mitigate these impacts.

3.2 Eastern Cluster

This cluster is located at the eastern edge of the proposed turbine layout with residences at levels between RL 1080 and RL1130. The residences have views west and north west toward the proposed wind farm.

		<i>Aurecon MOD 2 assessment (as recorded in GB 2017)</i>		<i>Green Bean Assessment 2017</i>			<i>OHD Turbine Review 2018</i>			<i>WF</i>
Residence	Dist km	Mod 2 Ass.	Hubs (Tips) Vis. Mod 2	VIZ	Mod 4 Ass.	Hubs (Tips) Vis. Mod 4	VIZ	Ass.	Comments	
Nullagai	2.1	Mod	1 (3)	2	U/C	1 (5)	2	Mod	• 24° view of GIWF turbines. and another 23° of White Rock (2 Sectors)	8 9
Wandsworth	2.5	Mod	13 (16)	2	U/C	15 (19)	2	Mod - High	• 69° view of GIWF turbines. and another 20° of White Rock (3 Sectors)	12 13
Cherry Tree	1.9	High	* 13 (15)	1	U/C	14 (15)	1	High	• T11b, T12b, T12c, T14b, T13, T13b, T15, T16c, T16b, T17, T19, T20b, T21b, T22b are all visible within 4 km (T11 is also visible outside of 4km). • The hubs of T11b, T12b, T12c, T14b, T13, T13b, T15, T16c, T16b, T17, T19, T20b, T21b, T22b are all visible • T19 and T22B sit within the VIZ 1 landscape (2km). • Has 95° view of GIWF turbines. and another 15° of White Rock (3 Sectors)	18 19
Highfields	1.5	High	* 14 (17)	1	U/C	17 (17)	1	High	• 115° view of GIWF turbines. (2 sectors) • T15, T16b, T16c, T17, T19, T21b, T22b are all within 2km with hubs visible. • T19, T21b, T22b are all in full view within 2km.	20
Lombardy	2.2	High	12 (15)	2	U/C	13 (15)	2	High	• 83° view of GIWF turbines. (2 Sectors) and another 17° view of WRWF turbines. in distance. Total of 100° (3 Sectors)	25 26

Mayvona #	1.1	High	8 (8)	1	U/C	8 (8)	1	High	• Hubs of T20b, T21b, T22b are all visible within 1.3km. • 94° view of GIWF turbines. and another 15° of White Rock (3 Sectors).	31 32
Glengarry	2.8	Mod	2 (4)	2	U/C	3 (4)	2	Mod	• 21° view of GIWF turbines. (1 Sectors) and another 18° view of WRWF turbines. in distance. Total of 39° (1 Sector)	37 38
Elm Vale	3.2	-	-	2	-	-	2	Mod	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • T20, T21b, T22b are in full view around 3.4km • See WFs 31 and 32 for Mayvona for reference • 77° view of GIWF turbines (2 Sectors)	-
Lecole Pas	3.2	-	-	2	-	-	2	Mod	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • T20, T21b, T22b are in full view around 3.4km • See WFs 31 and 32 for Mayvona for reference • 70° view of GIWF turbines. another and 10° White Rock turbines (2 Sectors)	-
Moonarie	3.3	-	-	2	-	-	2	Mod	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • T20, T21b, T22b are in full view around 3.4km • See WFs 31 and 32 for Mayvona for reference • 65° view of GIWF turbines. another and 10° White Rock turbines (2 Sectors)	-
Nevada Park	3.3	-	-	2	-	-	2	Mod	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • T20, T21b, T22b are in full view around 3.4km • See WFs 31 and 32 for Mayvona for reference • 75° view of GIWF turbines. another and 10° White Rock turbines (2 Sectors)	-

U/C = The rating for this property has remained unchanged from the Modification 2 by Aurecon to the Modification 4 assessment by Green Bean.

* = Differs from the numbers provided in Aurecon's Mod 2 assessment.

Vacant surrounding residence

Note on Sectors: For each residence the start of the first sector falls upon the first viewable turbine clockwise from north.

The seven most eastern turbines (T15, T16c, T16b, T17, T19, T20b, T21b, T22b) create the majority of visual impacts on the residences within this cluster. All these turbines are at an elevation greater than 1200AHD whilst most of these properties sit below this at around 1090 AHD. The proximity of these turbines creates high magnitude impacts while the broken longitudinal layout causes several residences to have views across multiple sectors.

3.3 Southern Cluster

This cluster is located at the south eastern edge of the proposed turbine layout with residences at levels between RL 1110 and RL 1120. The residences have views predominantly north west toward GIWF as well as south west toward WRWF

		<i>Aurecon MOD 2 assessment [as recorded in GB 2017]</i>		<i>Green Bean Assessment 2017</i>			<i>OHD Turbine Review 2018</i>			<i>WF</i>
Residence	Dist km	Mod 2 Ass.	Hubs (Tips) Vis. Mod 2	VIZ	Mod 4 Ass.	Hubs (Tips) Vis. Mod 4	VIZ	Ass.	Comments	
Furracabad Station	3	Mod	* 5 (10)	2	U/C	7 (12)	2	Mod	• 24° view of GIWF turbines. and another 43° view of WRWF turbines. Total of 67° (2 Sectors)	1 2
Klossie	2.1	Mod	4 (10)	2	U/C	7 (12)	2	Mod – High	• Green Bean WF shows 61° view of GIWF turbines. and another 17° view of WRWF turbines. Total of 78° (2 Sectors). OHD measure shows approx. 25° of GIWF turbines. and another 17° of White Rock for a total of 42° (2 Sectors) • Behind T19; T15, T16b, T16c have hubs just visible above landform creating a high clutter effect.	3 4
Green House #	1.9	Mod	5 (8)	1	U/C	7 (8)	1	Mod – High	• T19 is in full view at 1.9km • Behind T19; T15, T16b, T16c have hubs just visible above landform creating a high clutter effect. • 31° view of GIWF turbines. (1 Sector)	5

U/C = The rating for this property has remained unchanged from the Modification 2 by Aurecon to the Modification 4 assessment by Green Bean.

* = Differs from the numbers provided in Aurecon's Mod 2 assessment.

Vacant surrounding residence

Note on Sectors: For each residence the start of the first sector falls upon the first viewable turbine clockwise from north.

Green House and Klossie are the most effected of this cluster with views north west toward the GIWF turbines. Causing much of the magnitude for these residences is the proximity of turbine 19 at only 2km and in an elevated position. The removal of turbine 19 would reduce the magnitude effect but would not reduce the number of affected sectors. This would result in the OHD ratings of all three residences in this cluster reducing to moderate.

3.4 Western Cluster

This cluster is located at the western edge of the proposed turbine layout with residences at levels between RL 930 and RL 1010. The residences have views predominantly east toward GIWF, south toward WRWF and west toward WRWF.

		<i>Aurecon MOD 2 assessment (as recorded in GB 2017)</i>		<i>Green Bean Assessment 2017</i>			<i>OHD Turbine Review 2018</i>			<i>WF</i>
Residence	Dist km	Mod 2 Ass.	Hubs (Tips) Vis. Mod 2	VIZ	Mod 4 Ass.	Hubs (Tips) Vis. Mod 4	VIZ	Ass.	Comments	
Green Valley	2.5	Mod	* 15 (18)	2	U/C	17 (18)	2	Mod- High	• 61° view of GIWF turbines. and another 170° view of WRWF turbines. Total of 231° (5 Sectors)	6 7
Ilparran A	1.5	High	11 (14)	1	U/C	11 (16)	1	High	• View angle of 90° to Glen Innes turbines plus another 45° of WRWF turbines. Total of 135° (5 sectors) • T17 (1.5km), T16b (1.6km), T16c (1.6km), T15 (1.5km), T13 (1.7km), T13b (1.6km) all within 2km of property (VIZ 1). All are in full view. • 60° of turbines in full view within 2km of property.	10 11
Minamurra C	2.5	High	22 (25)	2	U/C	23 (25)	2	High	• 90° view of GIWF turbines. and another 140° view of WRWF turbines. Total of 230° (5 Sectors)	14 15
Minamurra A	2.3	High	21 (23)	2	U/C	23 (25)	2	High	• 95° view of GIWF turbines. and another 148° view of WRWF turbines. Total of 243° (5 Sectors)	16 17

Minamurra B	2	High	20 (21)	2	U/C	21 (23)	2	High	• 105° view of GIWF turbines. and another 135° view of WRWF turbines. Total of 240° (5 Sectors)	21 22
Ilparran B #	1.3	High	8 (10)	1	U/C	10 (11)	1	High	• 95° view of GIWF turbines. and another 120° view of WRWF turbines. Total of 215° (5 Sectors)	24
Kalanga C #	2.3	High	21 (25)	2	U/C	23 (25)	2	High	• 98° view of GIWF turbines. and another 140° view of WRWF turbines. Total of 238° (5 Sectors)	27 28
Kalanga A	2.1	High	19 (25)	2	U/C	21 (25)	2	High	• 98° view of GIWF turbines. and another 140° view of WRWF turbines. Total of 238° (5 Sectors)	29 30
Kalanga B	2.3	High	21 (25)	2	U/C	24 (25)	2	High	• 107° view of GIWF turbines. and another 116° view of WRWF turbines. Total of 223° (5 Sectors)	33 34
Balaclava A	2.8	Mod	22 (25)	2	U/C	24 (25)	2	High	• This property is listed as a local heritage item on the Glen Innes Severn Local Environmental Plan 2012 LEP. • 105° view of Glen Innes turbines (2 sectors) and another 140° view of White Rock turbines • 105° view of Glen Innes turbines, 140° view of White Rock turbines and another 10° view of Sapphire turbines. Total of 255° (5 Sectors)	35 36
Balaclava B	3.1	-	-	-	-	-	2	High	• This property is listed as heritage on the Glen Innes Severn Local Environmental Plan 2012 LEP. • Not Listed in Mod 4 Green Bean Assessment. • 105° view of Glen Innes turbines (2 sectors) and another 140° view of White Rock turbines • 100° view of Glen Innes turbines, 105° view of White Rock turbines and another 10° view of Sapphire turbines. Total of 215° (5 Sectors)	NA

Caloola B	3	-	-	2	-	-	2	Mod-High	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • 75° view of GIWF turbines. an another 180° of White Rock (5 sectors)	NA
Talarook	3.6	-	-	2	-	-	2	Mod	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • 70° view of GIWF turbines. an another 180 of White Rock (6 sectors)	NA
Caloola A	3.2	-	-	2	-	-	2	Mod	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • 40° view of GIWF turbines.	NA
Waterloo	3.5	-	-	2	-	-	2	Low - Mod	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • This property is listed as a local heritage item on the Glen Innes Severn Local Environmental Plan 2012 LEP • 45° view of Glen Innes turbines, 35° view of White Rock turbines and another 10° view of Sapphire turbines. Total of 90° (3 Sectors)	NA
Willow Glen	3.7	-	-	-	-	-	2	Mod-High	• Not assessed by Aurecon in Mod 2. • No rating given in Mod 4. • 85° view of Glen Innes turbines, 75° view of White Rock, 10° view of Sapphire (5 sectors)	NA
Fassifern	3.8	-	-	-	-	-	2	Mod	• Not assessed by Aurecon in Mod 2. • No Clear rating given in Mod 4. • 45° view of Glen Innes turbines, 25° view of White Rock turbines and another 10° view of Sapphire turbines. Total of 80° (3 Sectors)	NA

U/C = The rating for this property has remained unchanged from the Modification 2 by Aurecon to the Modification 4 assessment by Green Bean.

* = Differs from the numbers provided in Aurecon's Mod 2 assessment.

Vacant surrounding residence

Note on Sectors: For each residence the start of the first sector falls upon the first viewable turbine clockwise from north.

This cluster has a large number of properties rated by both Green Bean and OHD as Highly affected. The majority of properties in this area have broad views towards the wind turbines of both Glen Innes Wind Farm and White Rock Wind Farm with many residences affected across more than two sectors and some residences are affected across all 6 sectors. The proximity and elevation of the turbines on both the East (from Glen Innes) and West (from White Rock) coupled with the cumulative effect of these turbines creates a landscape dominated by turbines and will transform this landscape from its current character of pastoral to that of a wind farm/ pastoral landscape.

It is important to note that the Green Bean Mod 2 assessment had already assessed 8 of the 16 properties in this cluster as being highly affected and that all of these ratings have remained unchanged despite an increase in height of 30m (20%). This increase in height has resulted in an increase of visible tips and hubs across a number of properties in this cluster, however these increased impacts are not reflected in the LVIA's residential impact ratings as the rating system is not sufficiently fine grained.

4.0 Conclusions & Recommendations

In general, the Mod 4 LVIA incorporates 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. There are however some gaps in methodology. These have been considered in **Section 2** of this review.

The Mod 4 LVIA has, in its ratings focused solely on the differential between what has already been approved and the Mod 4 application. Whilst this differential equates to a 20% increase (30m), all the ratings for properties that were previously rated in the Mod 2 application have remained the same. It is plausible that an increase of 20% could result in a large number of unchanged ratings, however it is unlikely. The fact that all these ratings have remained unchanged may be in part due to the methodology of the Mod 4 LVIA. The Mod 4 methodology has taken the ratings of the Mod 2 assessment prepared by Aurecon and used this data as their baseline from which to gauge any change in visual effect. Whilst this may be a valid method, the mod 4 LVIA states *"this VIA has not undertaken as [sic] assessment to verify the visual ratings determined in the approved GIWF Mod-2 application"* meaning that they have not validated the data from which they have gauged any change.

The unchanged ratings are also a result of the use of a rating system with only three possible outcomes (Low, Medium, High). Many of the properties had already received a rating of high in the Mod 2 assessment upon which this LVIA was based. Even if these properties were to see a large increase in the effects on their visual amenity, there is no ability for this to be reflected in an increased rating. Were the rating system used more finely grained it could be expected that at least some of these assessments would receive an increased rating.

The stepped approval process of the Glen Innes Wind Farm has resulted in a number of properties that received a rating of High in the original 2008 LVIA by Aurecon, based on a turbine height of 129m still received a rating of High in this Mod 4 LVIA despite an increased height of over 50m.

As noted in the introduction, whilst part of a separate application, the Glen Innes turbines will form part of the overall landscape character and the visual continuum of the wider area. As such they have significant accumulation effects on the existing cumulative impacts. Some residences have over 5 sectors of affected view meaning there will be little relief from the visual presence of a windfarm from their property. This level of enclosure will, on completion of all approved construction, completely change the overall character of the landscape. The Mod 4 proposed increase in height will further exacerbate this effect.

The requirements for aviation obstacle lighting set by CASA has the potential to significantly increase the overall visual impact of the proposal. The effects of lighting will cause disruption to the current character of the area at night due to an increase in observable duration and increase night time prominence of the wind farm, both of which will significantly increase the cumulative impact of the proposal as an identifiable element in the landscape.



Edward O'Hanlon RAIA

Director

O'Hanlon Design Pty. Ltd