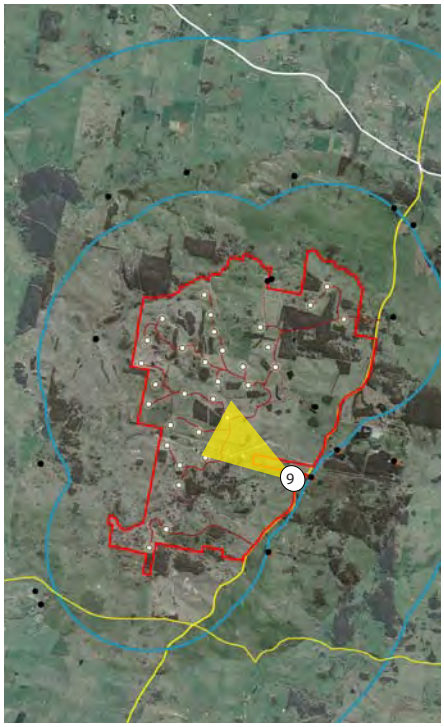
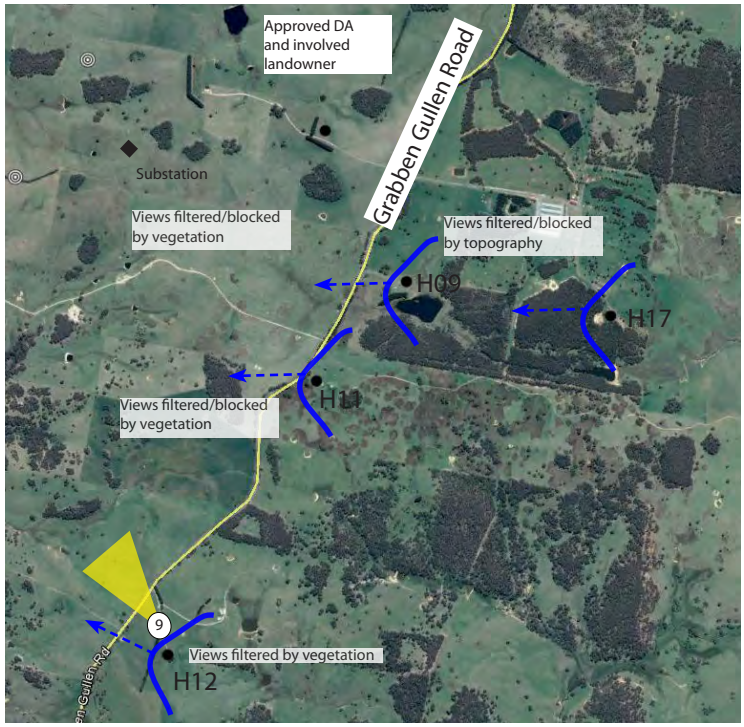
CLOUSTON associates

PRIVATE RECEPTOR VIEWPOINT 9



Viewpoint location



Area plan

Photo 9

Location	Type	Nearest WTG	No. of properties	Receptors
Off Grabben Gullen Road	Dwelling	1.9km	4	Residents of properties off Grabben Gullen Road (H09, H11, H12 and H17).

Current view	Expected Visual Impact
As shown in Photo 9, these 4 properties are generally surrounded by some tree and shrub planting, limiting views to the west. A low ridgeline blocks the majority of long distance views west from properties on the eastern side of Grabben Gullen road.	The level of visual impact on individual properties in these locations will depend on their orientation, local topography and level of screening vegetation present - potentially reducing the level of visual impact experienced. All 4 properties are surrounded by tree planting. The most extensive views of the Proposal are likely to be from driveways. Refer Photomontage 8 and 9 within Section 8 of this report for spatially accurate existing and proposed views from H12 and H11.

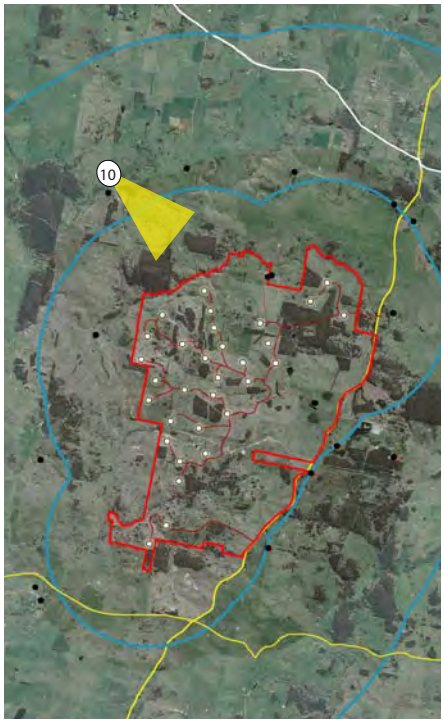
RECEPTOR IDENTIFICATION	RECEPTOR SENSITIVITY	MAGNITUDE				
		DISTANCE	QUANTUM OF VIEW	PERIOD OF VIEW	MAGNITUDE OF CHANGE	SUMMARY OF RATINGS
9	H	H	L	M	L	L

Overall Visual Impact Rating	MODERATE

From Table 03 using a combination of sensitivity and magnitude ratings.

CLOUSTON associates

PRIVATE RECEPTOR VIEWPOINT 10



Viewpoint location

Area plan

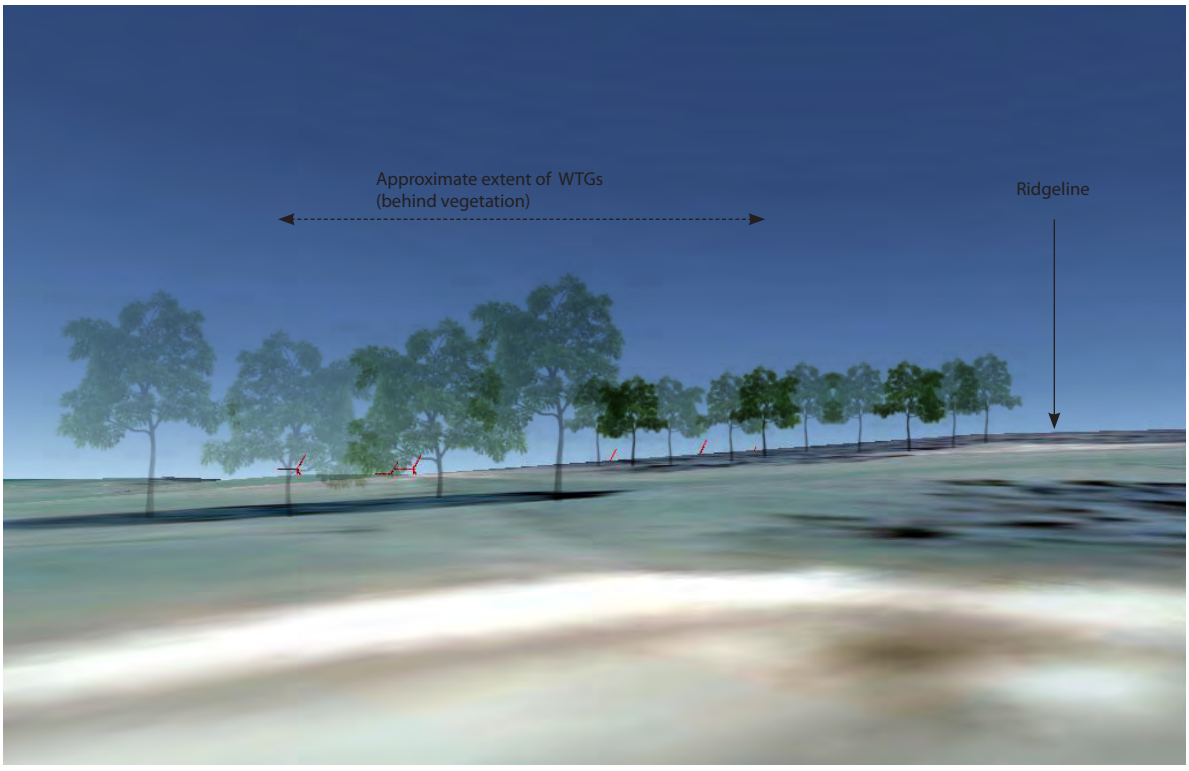


Photo 10 - simulated view

Location	Type	Nearest WTG	No. of properties	Receptors
Off Sapphire Road	Dwelling	2.6km	1	Residents of dwelling H04

Current view	Expected Visual Impact
Access was not possible and so a simulated view from this property has been created using Google Earth and 3D modelling software - as shown in Photo 10. This property is surrounded by a moderate quantity of screening vegetation and undulating topography, which rises up to low ridgeline in the south.	The study of topography and vegetation indicates that this property is highly unlikely to have visual accessibility to any full WTGs. The tops (hub height or above) of 6 WTGs may be visible, although these will be heavily filtered or blocking by vegetation. Views of additional WTGs may be visible from some parts of the extensive driveway, although topography and vegetation will again block many views.

RECEPTOR IDENTIFICATION	RECEPTOR SENSITIVITY	MAGNITUDE				
		DISTANCE	QUANTUM OF VIEW	PERIOD OF VIEW	MAGNITUDE OF CHANGE	SUMMARY OF RATINGS
10	M	M	L	L	L	L

Overall Visual Impact Rating	MODERATE/LOW

From Table 03, using a combination of sensitivity and magnitude ratings.

4.7 VISUAL IMPACT SUMMARY

From the analysis of visual receptors in the foregoing section, the summary of qualitative and quantitative visual impacts of the proposal are:

Receptor Identification	Receptor Type	Location	Receptor Sensitivity	MAGNITUDE					Overall Impact Rating
				Distance	Quantum of View	Period of View	Magnitude of Change	Summary of Magnitude	
Public Receptors									
1	Major Road	Biala Gurrundah Road, looking north west	M	M	M	L	M	M	MODERATE
2	Minor Road	Sapphire Road, looking esat	L	M	L	L	L	L	LOW
3	Major Road	Grabben Gullen Road, looking west	M	H	M	L	M	M	MODERATE
4	Major Road	Grabben Gullen Road, looking west	M	H	H	L	M	M	MODERATE
Private Receptors									
5	Dwelling	Properties off Biala Gurrundah Road H13, H14 + H15	H	M	M	M	M	M	MODERATE/ HIGH
6	Dwelling	Properties off Church Lane H03	H	M	H	M	H	M	MODERATE/ HIGH
7	Dwelling	Properties off Grabben Gullen Road H06 + H07	M	H	M	M	M	M	MODERATE
8	Dwelling	Property off Grabben Gullen Road H05	H	M	L	L	L	L	MODERATE/ LOW
9	Dwelling	Properties off Grabben Gullen Road H09, H11, H12, H17	H	H	L	M	L	L	MODERATE
10	Dwelling	Property off Sapphire Road H04	M	M	L	L	L	L	MODERATE/ LOW

Table 07 - Summary of visual impacts of the Proposal across the study area

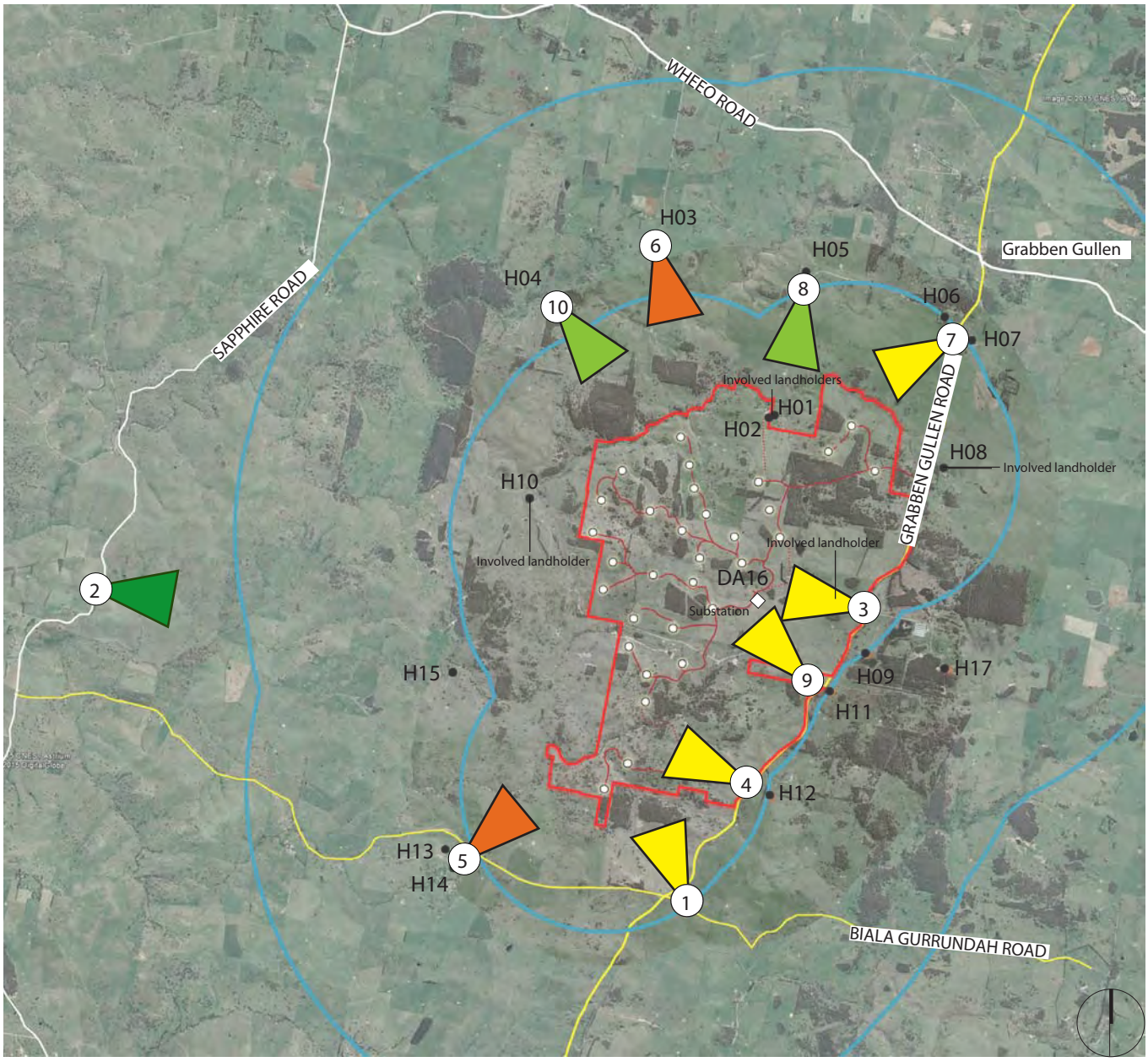


Figure 10 - Summary of visual impacts of the Proposal across the study area

- Main Roads
- Minor Roads
- 2 and 5km WTG offset
- Project area
- Dwelling
- WTG
- Access roads

- Negligible Impact
- Low Impact
- Moderate/Low Impact
- Moderate Impact
- Moderate/High
- High Impact

4.7.1 Public Receptors
The visual impacts of the Proposal on the public viewpoints studied range from low to moderate (refer Table 07 and Figure 10). One viewpoint received an impact rating of low and three of moderate.

The low visual sensitivity of many of the public receptors has helped reduce the level of visual impact experienced. The minor roads that traverse the study area such as Sapphire Road and Wheeo Road are lightly trafficked and mostly used for accessing remote properties. Despite some of the turbines being in relatively close proximity to these roads, their low sensitivity to change and the short duration of views experienced ensures a low impact on visual amenity.

The greatest visual impact on public receptors (moderate) has been recorded on three viewpoints along the Grabben Gullen and Biala Gurrundah Road that run near the eastern and southern boundaries of the project area. The road passes in close proximity to the turbine clusters and has a higher sensitivity due to its increased traffic and importance as a major and scenic thoroughfare. Grabben Gullen Road sits on an elevated ridge line with occasional panoramic views across the surrounding landscape. The visual amenity of the driving experience may be moderately negatively impacted by the scale and proximity of the turbines along the road corridor.

Settlements within the study area are limited to the township of Grabben Gullen. The town is over 3.5km from the nearest turbine and views towards BWF are blocked by a combination of vegetation and topography.

It should be acknowledge that the Proposal may have the potential to impact people engaged in farming or recreational activities, where views toward wind turbines occur from surrounding agricultural areas. Ultimately the level of visual impact would depend on the degree to which scenic quality was central to that activity, level of screening provided by local landform or vegetation and the perception of the viewer.

4.7.2 Private Receptors
The visual impacts of the Proposal on the private viewpoints studied range from moderate/low to moderate/high (refer Table 05 and Figure 10):

- two viewpoints moderate/low (dwellings H05 and H04)
- two viewpoints moderate (dwellings H06, H07, H09, H11, H12, H17)
- two viewpoints moderate/high (dwellings H13, H14, H15 and H03).

Generally, the closer the proximity of the dwelling to the WTGs, the higher the visual impact, with the turbines becoming increasingly distinct and dominating the viewframe as viewing distance reduces. The remoteness of the turbines has assisted in reducing the level of visual impact on residential dwellings. Of the two viewpoints that recorded a visual impact rating of moderate/high, one is an elevated location with minimal screening (dwelling H03). At 2.4km from the nearest turbine, blade movement will be clearer and the turbines visually prominent within the landscape. The other viewpoint (dwellings H13, H14, H15) is at a lower elevation but will have clear partial views of numerous turbines.

Local vegetation and topography can significantly alter the visual impact experienced by individual properties. Many of the dwellings are surrounded by vegetation in the form of garden planting, nearby woodland or tall shelter belts. These may filter or block views of WTGs from the main part of a dwelling. The turbines, however, will often still be visible from other parts of the property (such as the driveway) and so a visual impact is still recorded.

4.8 ELECTRICAL WORKS

The majority of electrical connections between turbines will be in-ground and present no visual impact. The substation is a relatively small structure and located away from sensitive residential receptors. The nature of the local topography and vegetation effectively screens/blocks view of the substation and it is unlikely to have any level of visual impact.

4.9 CONSTRUCTION IMPACTS

Potential visual impacts may occur during the construction phases of the Proposal. The key construction activities that would be visible from areas surrounding the proposed wind farm include:

- ongoing detailed site assessment including sub-surface geotechnical investigations
- various civil works to upgrade local roads and access point
- construction facilities, including portable structures and laydown areas
- construction and directional signage
- mobilisation of rock crushing and one concrete batching plant
- excavation, earthworks and vegetation clearing
- various construction activities including erection of wind turbines, monitoring masts and substation with associated electrical infrastructure works.

The majority of the construction activities are generally temporary in nature and for the most restricted to various discrete areas within the study area. The cranes and concrete batching plant are likely to be the most visible construction elements although the majority of activities would be unlikely to result in an unacceptable level of visual impact given the relatively short duration of construction.

Typical construction activity

4.10 NIGHTTIME LIGHTING

The Proposal may require obstacle marking and lighting at night time or during periods of reduced visibility. The requirement for lighting of wind farms are subject to the advice and endorsement of the Civil Aviation Safety Authority (CASA). In May 2015, CASA issued a recommendation that obstacle lighting be installed on 18 of the turbines (refer Figure 10B).

CASA is currently undertaking a safety study into the risk to aviation posed by wind farms and may develop a new set of guidelines to replace the Advisory Circular with regard to lighting for wind turbines that was withdrawn by CASA in mid 2008. The following information has been provided in order to ensure that a full assessment was carried out in accordance with the SEAR's, even if night lighting is subsequently not required. Lighting for aviation safety may also be required prior to and during the construction period, including lighting for large equipment such as cranes.

Potential visual impacts associated with obstacle marking and lighting at night time have not been extensively researched or tested in New South Wales, although some site investigations have been carried out at existing wind farms in Victoria. Investigations have generally concluded that although night time lighting mounted on wind turbines may be visible for a number of kilometres from the wind farm project area, the actual intensity of the lighting appears no greater than other sources of night time lighting, including vehicle head and tail lights.

4.10.1 Existing Light Sources

A small number of existing night time light sources occur within the BWF viewshed including residential and general lighting around townships such as Grabben Gullen. Localised lighting is associated with a small number of dispersed homesteads but lighting is not visually prominent and does not emit any significant illumination beyond immediate areas surrounding residential and agricultural buildings. Lights from vehicles travelling along the local roads provide dynamic and temporary sources of light.

4.10.2 Potential Light Sources

The main potential light sources associated with the Proposal would include:

- night lights of control and auxiliary buildings
- night time obstacle lights mounted on some wind turbines.

The potential receptors that could be impacted by night time lighting include residents and motorists. Night time lighting associated with the wind farm is unlikely to have a significant visual impact on the majority of public view locations. Whilst obstacle lighting would be visible to motorists travelling along the local roads, the duration of visibility would tend to be very short and partially screened by undulating landform.

Night time obstacle lighting associated with the wind farm would be visible from a number of the residential view locations within the study area, although topography and screening vegetation would block or partially obscure many of the views.

Based on the foregoing overview, the overall night lighting (if installed) is expected to have a moderate/low impact on the viewpoints studied (refer night time photomontages within Section 8).

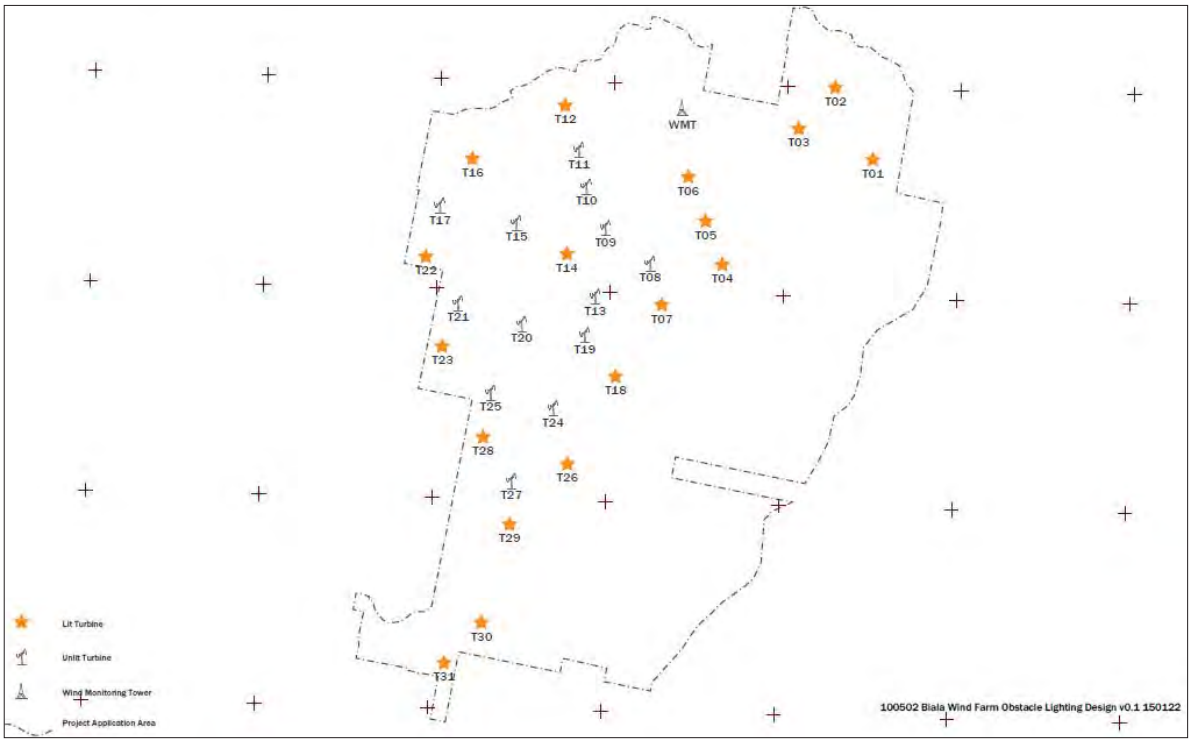


Figure 10B - Recommended lighting to BWF turbines Source: Aviation Projects

Typical WTG obstacle light

Typical WTG obstacle lighting

5

CUMULATIVE VISUAL IMPACTS

5.0 CUMULATIVE IMPACTS

5.1 DEFINITION

Cumulative impacts can be defined as the additional changes caused by a proposed development in conjunction with other similar developments or as the combined impact of a set of developments, taken together.

The cumulative impact of wind farm development on landscape and visual amenity is a product of:

- the distance between individual wind farms (or turbines)
- the distance over which they are visible
- the overall character of the landscape and its sensitivity to wind farms
- the siting and design of the wind farms themselves

5.2 ASSESSMENT OF CUMULATIVE VISUAL IMPACTS

Cumulative effects on visual amenity can be caused by 'combined visibility' and/or 'sequential effects':

5.2.1 Combined Visibility

Combined visibility occurs where the observer is able to see two or more developments from one viewpoint. Assessment considers the combined effect of all wind farms which are (or would be) visible from relevant viewpoints. Combined visibility may either be in combination (where several wind farms are within the observer's arc of vision at the same time) or in succession (where the observer has to turn to see the various wind farms).

5.2.2 Sequential Impacts

Sequential impacts occur when the observer has to move to another viewpoint to see different developments. Sequential impacts are assessed for travel along regularly-used routes like major roads, railway lines or popular paths etc. Sequential impacts can range from frequently sequential (the features appear regularly and with short time lapses between) to occasionally sequential (long time lapses between appearances) depending on speed of travel and distance between the viewpoints.

5.3 OTHER WIND FARMS WITHIN THE UPPER LACHLAN SHIRE AREA

The Department of Planning and Environment (DoPE) identifies 9 wind farms within the Upper Lachlan Shire that are either operational, approved or proposed - refer Figure 11A, B and Table 08.

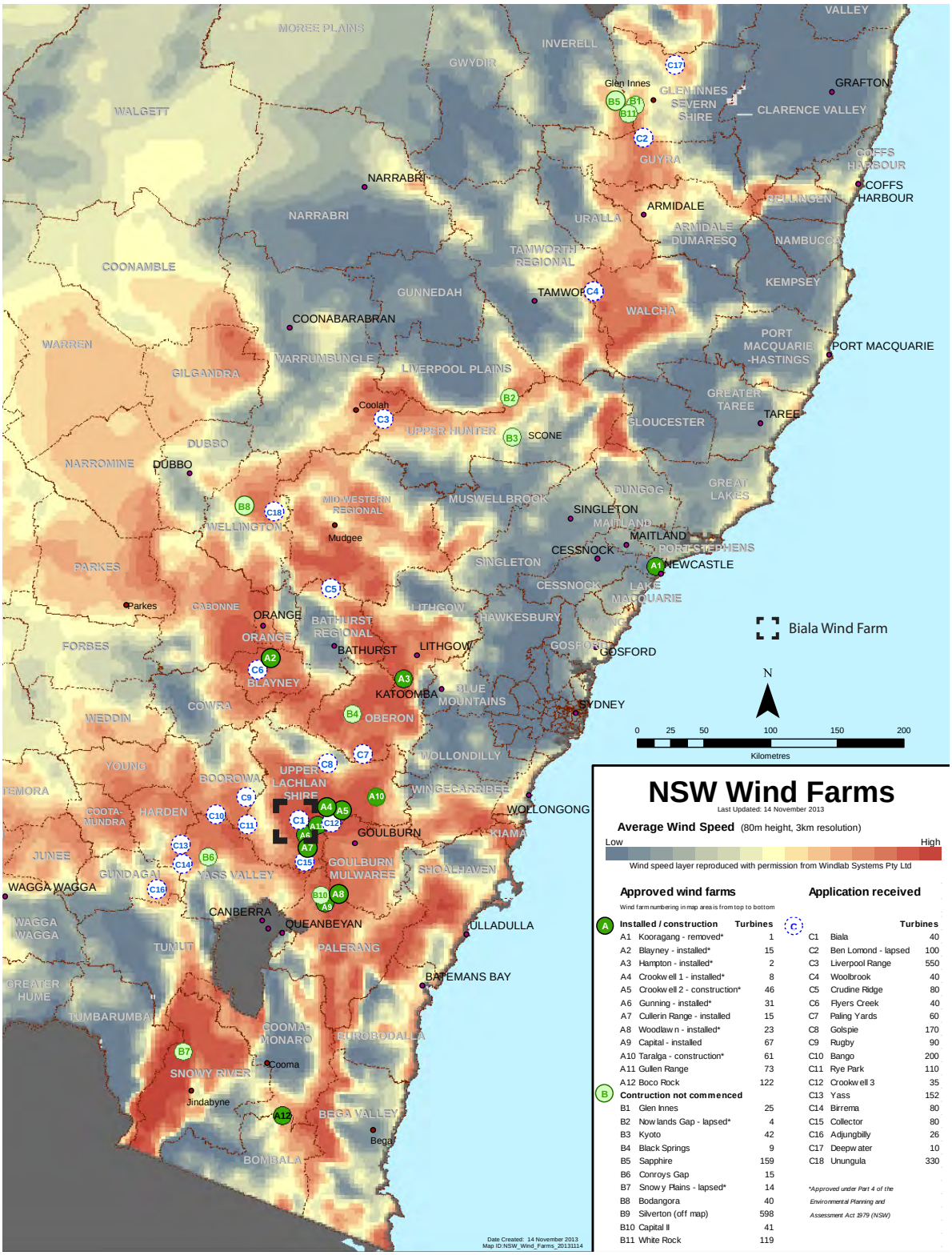


Figure 11A - Wind farm developments within NSW

Name	Status	Number of WTGS	Distance to BWF (nearest turbine)
Gullen Range	Operational	73	5.5km
Gunning	Operational	31	7.2km
Crookwell 1	Operational	8	16.1km
Crookwell 2	Construction	46	16km
Crookwell 3	Application received	35	15km
Cullerin Range	Operational	31	20.9km
Golspie	Application received	170	39km
Taralga	Construction	61	45.9km

Table 08 - Wind farm developments in close proximity to the BWF

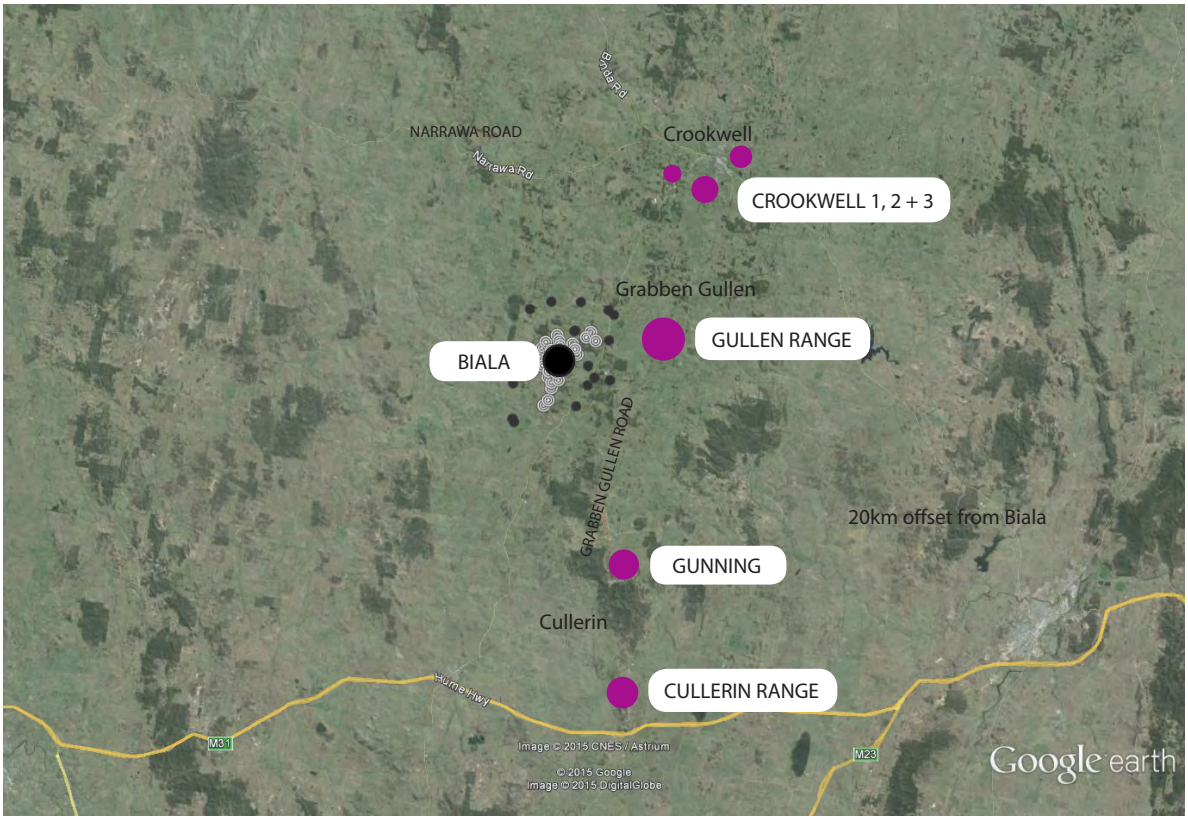
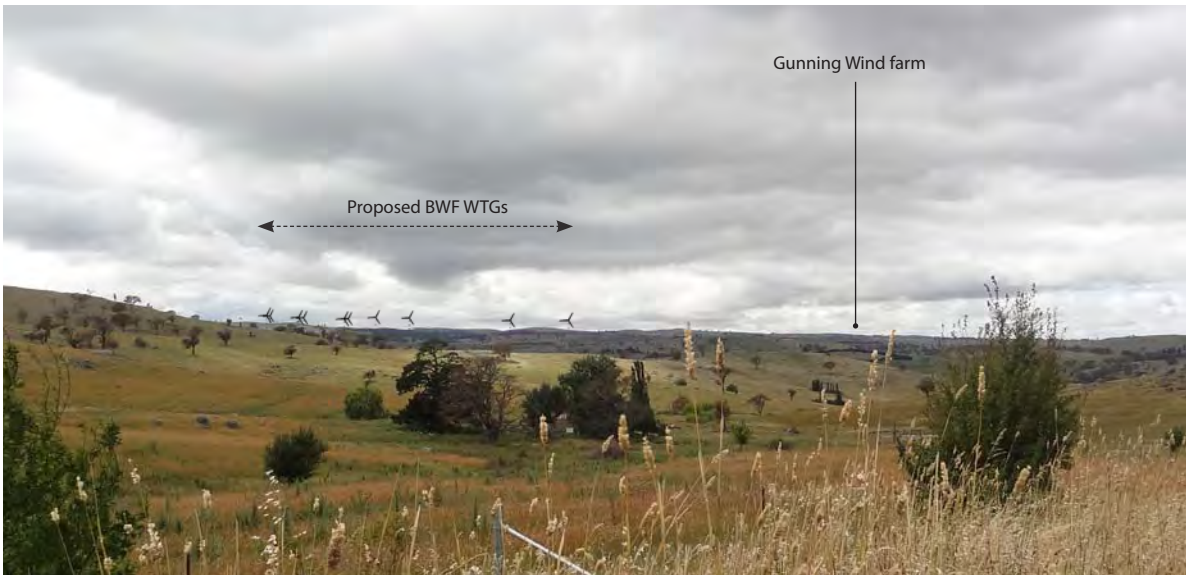


Figure 11B - Wind farm developments in close proximity to the BWF

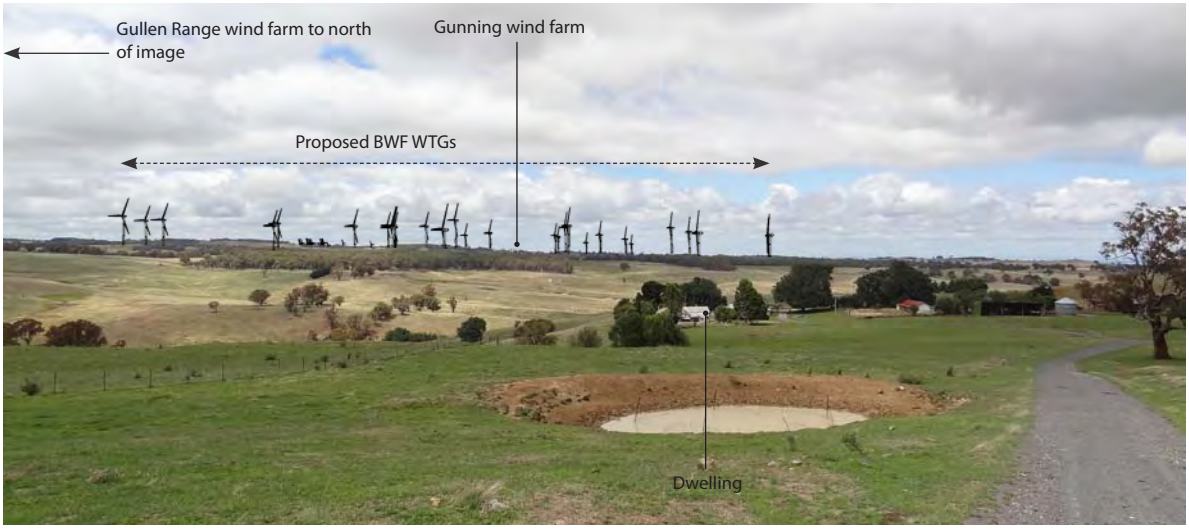
5.4 COMBINED AND SEQUENTIAL VISIBILITY

There is the potential for the Biala wind turbines to be visible combined or sequentially with the Crookwell 1, 2 (construction) and 3 (planning) wind farms, the Gullen Range wind farm and the Gunning wind farm. All other developments shown in Figure 11B are at a distance of over 20km from the BWF and are not deemed as forming a cumulative visual impact due to their distance. They have not been analysed further in this study.

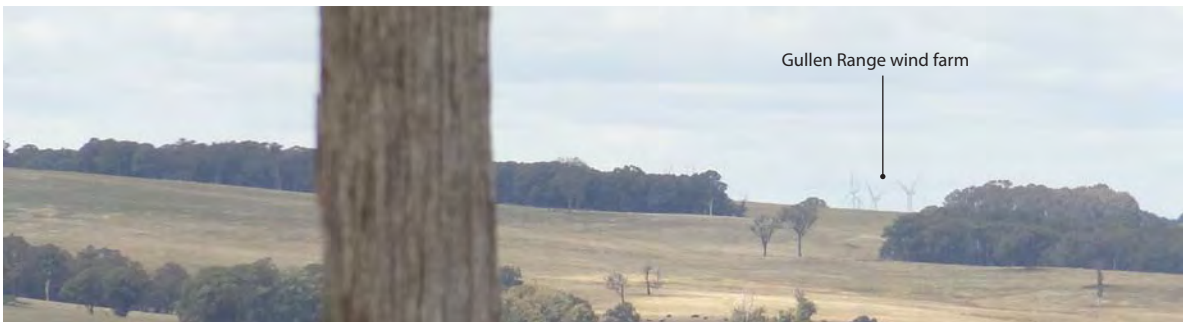
GUNNING (7.2km, 31 WTGs)		
VIEW TYPE	COMBINED VISIBILITY	SEQUENTIAL VISIBILITY
Public	The BWF and Gunning wind farms are visible together from a limited number of public viewpoints to the west of the the study area. These include sections of Sapphire Road (viewpoint 2). At a distance of over 14km - no cumulative increase in visual impact is expected from this road.	Occasional sequential views may to occur for motorists travelling along the Biala-Gurrundah Road.
Private	Properties with elevated panoramic views off Sapphire Road (viewpoint 2) and Church Lane (viewpoint 6) will have combined views of the Gunning and BWF. A very slight cumulative increase in visual impact may be expected for the properties off Church Lane (viewpoint 6), although at a distance of 16km the Gunning wind farm is not visually dominant and makes up a very small part of the overall viewframe.	Not applicable



Viewpoint 2



Viewpoint 6



Zoomed view of Gullen Range wind farm in proximity to viewpoint 6

GULLEN RANGE (5.5km, 73 WTGs)		
VIEW TYPE	COMBINED VISIBILITY	SEQUENTIAL VISIBILITY
Public	Gullen and BWF may be visible together from sections of Grabben Gullen Road, north of Grabben Gullen as well as some elevated sections of Wheeo Road and Sapphire Road. The topographical ridge along Grabben Gullen Road (south of Grabben Gullen village) prevents combined visibility from this section of the road. A major increase in visual impact is not expected.	Sequential views may occur for motorists travelling along Range Road and Grabben Gullen Road. Both wind farms are in close proximity to these roads, leading to a perceived sense of increased wind farm development in the area.
Private	Properties with elevated panoramic views off Church Lane (viewpoint 6) will have combined views of the Gullen and BWF. Gullen is visible from this location on a clear day and there may be a low cumulative increase in visual impact.	Not applicable

CROOKWELL 1,2,3 (16.1km, 16km, 15km 8, 46, 35 WTGs)		
VIEW TYPE	COMBINED VISIBILITY	SEQUENTIAL VISIBILITY
Public	At over 16km from the BWF, the Crookwell wind farms are at a considerable distance and any combined visual impacts are likely to be negligible.	Sequential views may to occur for motorists travelling along Grabben Gullen Road to or from Crookwell. They will be exposed to several wind farms within relatively close proximity to the road, leading to a perceived sense of increased development in the area.
Private	Properties with elevated panoramic views off Church Lane (viewpoint 6) may have visual accessibility to both the BWF and Crookwell developments although the distance to Crookwell from these properties (over 20km) will make any cumulative visual impact insignificant.	Not applicable

5.4 CUMULATIVE VISUAL IMPACT SUMMARY

There would be opportunities for combined views of BWF, Gullen Range and Gunning wind farms from a limited number of surrounding residential dwellings and local roads. Visibility toward these wind farms is restricted in the majority of locations within the study area by tree cover and undulating landform.

The relatively small size of the Gunning wind farm (31 WTGs) would minimise potential for significant cumulative visual impact. The Gullen Range wind farm is much larger with 73 WTGs. This development will be more visually prominent with the WTGs spread out along a series of ridgelines in a north-south direction. The distance between the impacted viewpoints and the two wind farms (over 14km), ensures that any cumulative impacts are relatively minor in nature. Gunning and Gullen Range appear as small features on the horizon as part of a wider panoramic view.

Sequential views of Biala, Gullen, Gunning and Collector wind farms would occur for motorists travelling along Grabben Gullen, Biala Gurrundah and Range Road. Despite the presence of additional wind farm development, motorists would experience a range of views extending toward and beyond wind turbines within the landscape. The roads follow the low undulating nature of a landform typical across much of the NSW Southern Tablelands, where views may extend over regional areas from highpoints and ridgelines, or be contained and compartmentalised by rising or sloping landforms together with timbered and vegetated areas.

The extent and overall visibility of turbines would be influenced by the direction of travel relative to the alignment of wind turbines as well as the relatively short travel time along the highway and local road network alongside and between the wind farm turbines.

This LCVIA has determined that the BWF is unlikely to result in any significant combined or sequential cumulative visual impacts resulting from associated views toward other operational wind farm developments within the study area. The BWF may, however, slightly increase the perceived density of wind farm development within this section of the Southern Tablelands. Any future developments in the area should consider the BWF within any cumulative impact assessment.

6 MITIGATION MEASURES

6.0 MITIGATION MEASURES

6.1 FORMS OF MITIGATION

The purpose of mitigation is to avoid, reduce, or where possible remedy or offset any significant adverse effects on the environment arising from the proposed development. Table 09 summarises the mitigation recommendations and rates the likely feasibility, reliability and effectiveness of the options.

6.1.1 Wind turbines

The design of the turbine structures has been highly refined to maximise their efficiency. The height of the supporting towers and dimensions of the rotors are defined by engineering efficiency and design criteria. Consequently, modification of the turbine design to mitigate potential visual impacts is not considered a realistic option. Visual impacts could be reduced using a smaller overall turbine size although this may impact the functionality of the Proposal.

The potential visual impact of the Proposal from specific view locations could be mitigated by planting vegetation close to the view locations. For instance, tree or large shrub planting close to a dwelling can screen potential views to individual or groups of turbines. Similarly roadside tree planting can screen potential views of turbines from particular sections of road provided the turbine is not located some distance from the road.

The location and design of screen planting used as a mitigation measure is site specific and requires detailed analysis of potential views and consultation with surrounding landowners during the detailed design phase. Planting vegetation would not provide effective mitigation in all circumstances and can reduce the extent of existing views available from dwellings and public areas.

Colour choice can provide an opportunity to reduce visual contrast between the turbine structures and the background against which they are viewed. The white colour that is used on a majority of turbine structures provides the minimum level of visual contrast with a sky background.

The use of an appropriate off white or grey colour for the turbines where the visual contrast would be reduced when viewed against a background of landscape may be possible. The final colour selection would, however, be subject to the availability of turbine models on the market at the time.

6.1.2 Access roads

The potential visual impacts of vehicular tracks providing access for construction and maintenance can be mitigated by;

- minimising the extent of cut and fill in the track construction - following contours where possible
- re-vegetating disturbed soil areas immediately after completion of construction works with local native vegetation
- using local materials as much as possible in track construction to minimise colour contrast.

6.1.3 Substation

The potential visual impacts of the substation can be mitigated by;

- locating substation to take advantage of natural topographical and vegetation screening
- ensuring materials are non-reflective and colours assist with blending facility with local context
- planting additional screening vegetation

6.2 RESIDUAL IMPACTS

WTGs are by their nature tall and visually intrusive. The turbine design and location is limited by functional requirements and minor changes such as colour choice and reflectivity are unlikely to alter any of the impact ratings recorded within this report.

Whilst sceen planting can be highly effective in blocking or filtering views, the impact is often of a highly local nature and can remove parts of the view that may still be considered desirable. New screen planting around affected dwellings would likely reduce some of the visual impact ratings recorded within this report but may not be acceptable to landowners.

The most effective mitigation measures will involve siting, design and screening of ancillary facilities such as the substation and access roads.

Project Element	Mitigation Measure	Feasibility	Reliability	Effectiveness
WTGs	Consider colour options for turbines	High	High	Moderate/ Low
WTGs	Avoid use of advertising, signs or logos mounted on turbine structures, except those required for safety purposes	High	High	Moderate
WTGs	Consider options for planting screening vegetation in vicinity of nearby dwellings and along roadsides to screen potential views of turbines. This should be done in consultation with landowners.	High	Moderate	Moderate
Substation	Site substation to take advantage of natural topographical screening	Moderate	High	High
Substation	Ensure materials are non reflective and colours assist with blending facility with local context	High	High	Moderate
Access roads	Minimise cut and fill for site tracks and revegetate disturbed soils as soon as possible after construction	High	High	High
Access roads	Use local materials as much as possible in track construction to minimise colour contrast	High	High	Moderate
All	Maximise revegetation of disturbed areas to ensure effective cover is achieved	High	Moderate	Moderate
All	Restrict the height of stockpiles to minimise visibility from outside the site	High	High	Moderate
All	Select storage areas for materials or plant with minimum visibility from dwellings and roads with screening where necessary	High	High	High

Table 09 - Summary of mitigation recommendations

6.3 MICRO-SITING

Future iterations of the BWF turbine layout may provide the opportunity to relocate some of the WTG's to positions where their visual impact is lessened. As previously mentioned, turbine location is limited by functional requirements. Wind velocity's tend to be at their greatest on elevated hillsides and ridges, locations which usually correlate to high visibility.

Figure 12 indicates locations within the project area where turbines would be the least visible, based on a study of topography and receptor locations.

Generally, the closer the proximity of the dwelling to the WTGs, the higher the visual impact, with the turbines becoming decreasingly distinct and dominating the viewframe less as viewing distance increases. Receptors are sparsely spread across the study area, with the highest concentration to the east, along Grabben Gullen road. Positioning the turbines to the western edge of the project area would increase the viewing distance from these receptors, potentially reducing the impact on visual amenity.

The undulating nature of the topography means that some turbines are partially obscured by low ridge lines and hillsides. The potential exists to move turbines into areas of lower elevation where the topography is more likely to block views of the full structure. Areas with lower elevations are unlikely to be practical, however, due to reduced wind speeds.

Overall, due to the nature of the terrain and low density of receptors, micro-siting of individual turbines is unlikely to have any significant impact on the level of visual intrusion. Relocated turbines may reduce the visual impact on one receptor, only to increase it for another. As long as separation distances are similar to the current layout, moving WTG's along ridgetops is unlikely to alter the impact ratings outlined within Section 4 of the LCVIA.

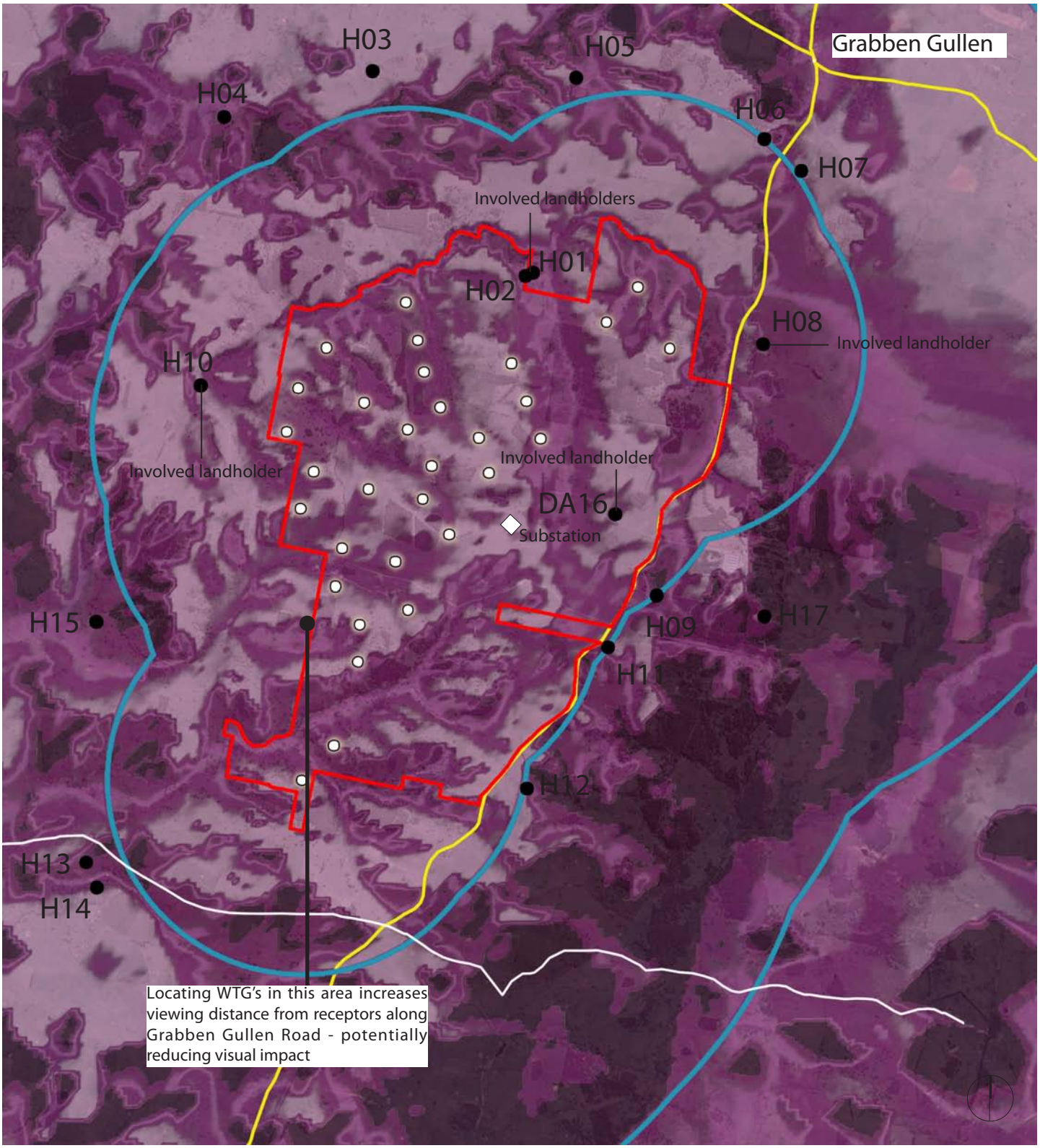
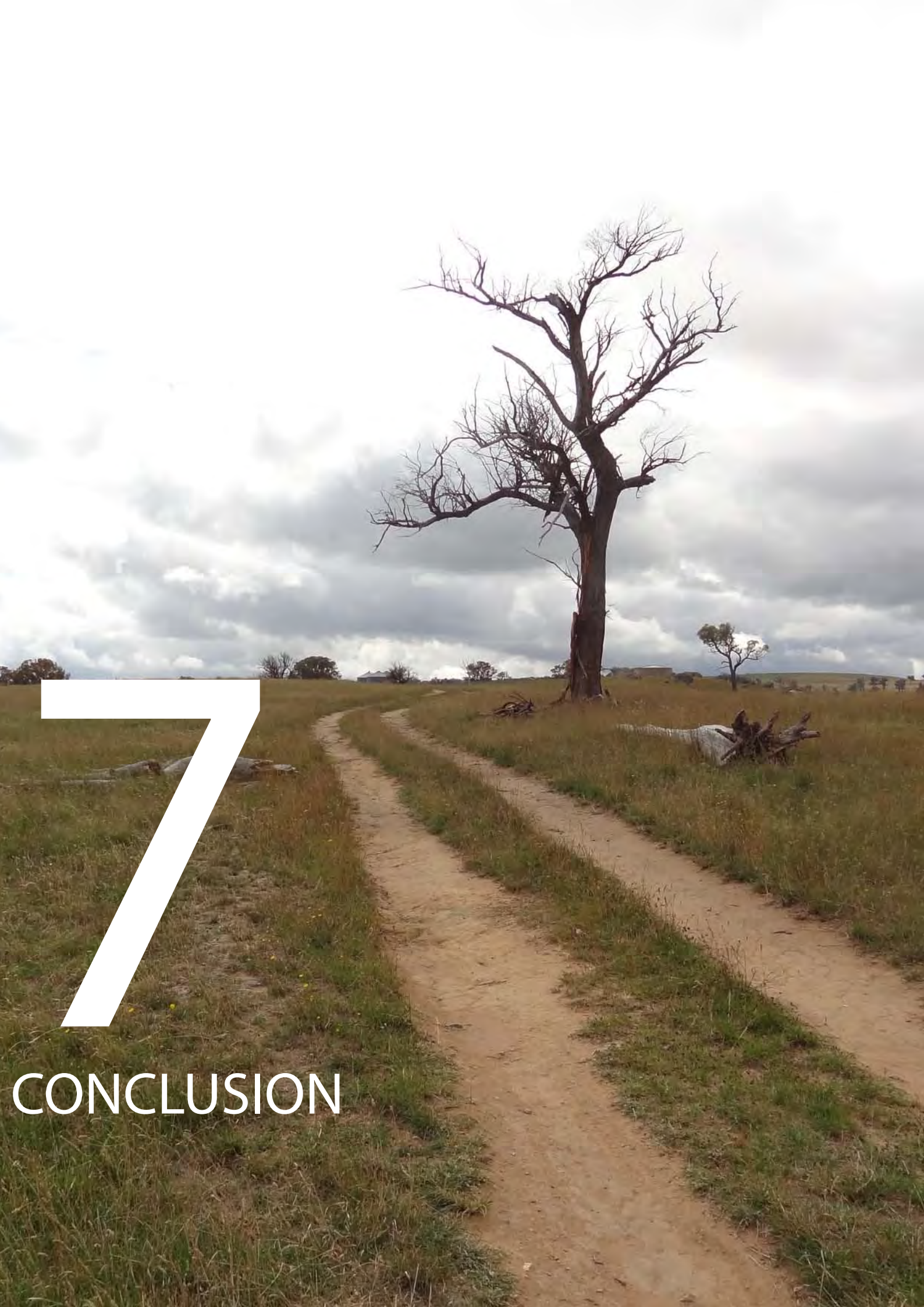


Figure 12 - Micro-siting potential for reducing visual impacts

Main Roads
Minor Roads
2 and 5km WTG offset
Project area
Dwelling
WTG
Access roads
Substation

TOPOGRAPHICAL ANALYSIS

Lower potential visual impact
Similar potential visual impact
Higher potential visual impact



7

CONCLUSION

7.0 CONCLUSION

A comprehensive LCVIA of the Proposal and the surrounding area has been conducted. The assessment has identified and evaluated landscape character zones, key viewpoints, distance zones, viewer sensitivity and cumulative impacts using best practice methodology.

In summary, this LCVIA concludes that the BWF has a relatively limited visual catchment and overall moderate to moderate/low visual impact due to:

- the limited number of sensitive residential dwellings in proximity to the project area
- the limited number of public viewers on roads and limited quantity of public open space
- topography that limits views of the project area, blocking many views of the turbine clusters from distances of over 3km
- dense stands of tree planting, windbreaks and garden plantings (associated with individual properties) that block or filter views towards the Proposal.

The low density of residential viewer locations within the BWF 12km viewshed ensures that moderate/high visual impacts are limited to dwellings within 2-3kms of the turbines. The viewpoints that have received the highest visual impact ratings are either located on elevated ground with panoramic views over the surrounding rural landscape or in a position where many WTGs are visually accessible. The lack of tall built form within the study area has acted to increase the visual prominence of the turbines from these locations.

Public viewpoints are mostly limited to the minor local road network and two main thoroughfares that traverse the study area. These view locations are dynamic with motorists travelling along the roads relatively quickly, reducing the duration of the view and hence the severity of the visual impact.

The BWF will not impact the character of Grabben Gullen village, where views toward the wind farm are blocked by tree cover and landform.

Ancillary structures such as the access roads and temporary concrete batching plant are unlikely to result in any significant additional visual impact for surrounding residential or public view locations.

If required, night time obstacle lighting would have the potential to be visible from surrounding view locations, as well as areas beyond the 12km viewshed. The level of visual impact would, however, be low and diminish when viewed from more distant view locations.

The BWF is unlikely to result in any significant combined or sequential cumulative visual impacts resulting from associated views toward other operational wind farm developments within the study area. The BWF may, however, slightly increase the perceived density of wind farm development within this section of the Southern Tablelands. Any future developments in the area should consider the BWF within any cumulative impact assessment.

Although some mitigation measures are considered appropriate to minimise the visual effects of the Proposal, it has been acknowledged that the degree to which the wind turbines would be visually mitigated is limited by their scale and position within the landscape relative to surrounding view locations. The extent and nature of appropriate mitigation measures for private receptors would be subject to consultation and agreement with individual property owners.

8 PHOTOMONTAGES

8.0 PHOTOMONTAGES

8.1 METHODOLOGY

Photomontages developed for this assessment have been created within the guidelines of the Draft NSW Planning Guidelines for Wind Farms (December 2011) and the Clean Energy Council Best Practice Guidelines (2013), as well as the Scottish Natural Heritage Visual Representation of Windfarms (2006).

The process of creating a realistic photomontage of a wind farm begins with taking clear accurate photos. For the BWF Fulcrum3D travelled to site and took panoramic photos using a Nikon 610 full frame DSLR camera and tripod. Weather conditions ideally need to be clear, and bearing and GPS co-ordinates are recorded.

Detailed mapping contours of the wind farm site and surroundings, as well as the wind turbine layout are inserted into industry standard DNV-GL software 'WindFarmer'. WindFarmer then creates a digital-terrain-map (DTM) by interpolating between contours to get an accurate three dimensional model of the wind farm site. Physical turbine characteristics and dimensions are placed within this model, and viewpoints from photomontage locations are created. Camera settings such as aperture size, bearing, roll and elevation are set within this viewpoint so that the photos taken at site are matched with the DTM. The sun position and shadows for each viewpoint are also configured by using the time and date of the photos used for each viewpoint.

WindFarmer then outputs a high resolution image of the wind farm turbines correctly matched to the photos taken at site. Photoshop is then used to include the effect of vegetation screening which is not included within the DTM. If there are multiple clouds in the sky and it is deemed necessary, Photoshop is now used to remove clouds and simulate a clear sky. This will show a more conservative view, as the colour of clouds can minimise the impact of wind turbines. The photos are then stitched together both including and not including the wind turbine layout to provide photomontage and existing view images. Images are then cropped to show the desired field of view and bearing required.

Whilst a photomontage can provide an image that illustrates a photo realistic representation of a wind farm in relation to its proposed location and scale relative to the surrounding landscape, it is acknowledged that it is never 100% accurate due to the fact that a flat image does not allow the viewer to perceive any information relating to depth or distance. To gain a perceptually accurate view of the photomontages they will need to be printed and viewed at A1/A0 sized sheets and held at arms length.

8.1.1 Site Visit

Photos for the proposed BWF were taken on 5 March 2015. The weather was fairly cloudy in the morning but cleared up as the day progressed. Photos were taken at 10 viewpoints in total (5 private viewpoints and 5 public viewpoints) - refer Figure 13.

A Nikon D610 with a 50mm fixed lens was used at all viewpoints. All photos were taken in portrait mode, and stitched together. To keep the photomontages consistent, the horizontal and vertical FOV was cropped the same for all viewpoints. The horizontal FOV has been set to 120^{0} and the vertical FOV has been set to 30^{0}. 'Turbine FOV' gives turbine bearing location within the photomontage and includes turbines hidden by vegetation. A summary for each viewpoint is included above the image.

8.1.2 Night Photomontages

Night photomontages have also been prepared to demonstrate the typical visual impact of turbine lighting on key viewpoints. These images have been prepared using the day time montages as a base and overlaying red dots to approximate the level of light emitted by the safety light affixed to selected turbines. The night montages are indicative only - the actual level of visible light from each lit turbined will be affected factors such as weather conditions, levels of ambient light and moon phasing.

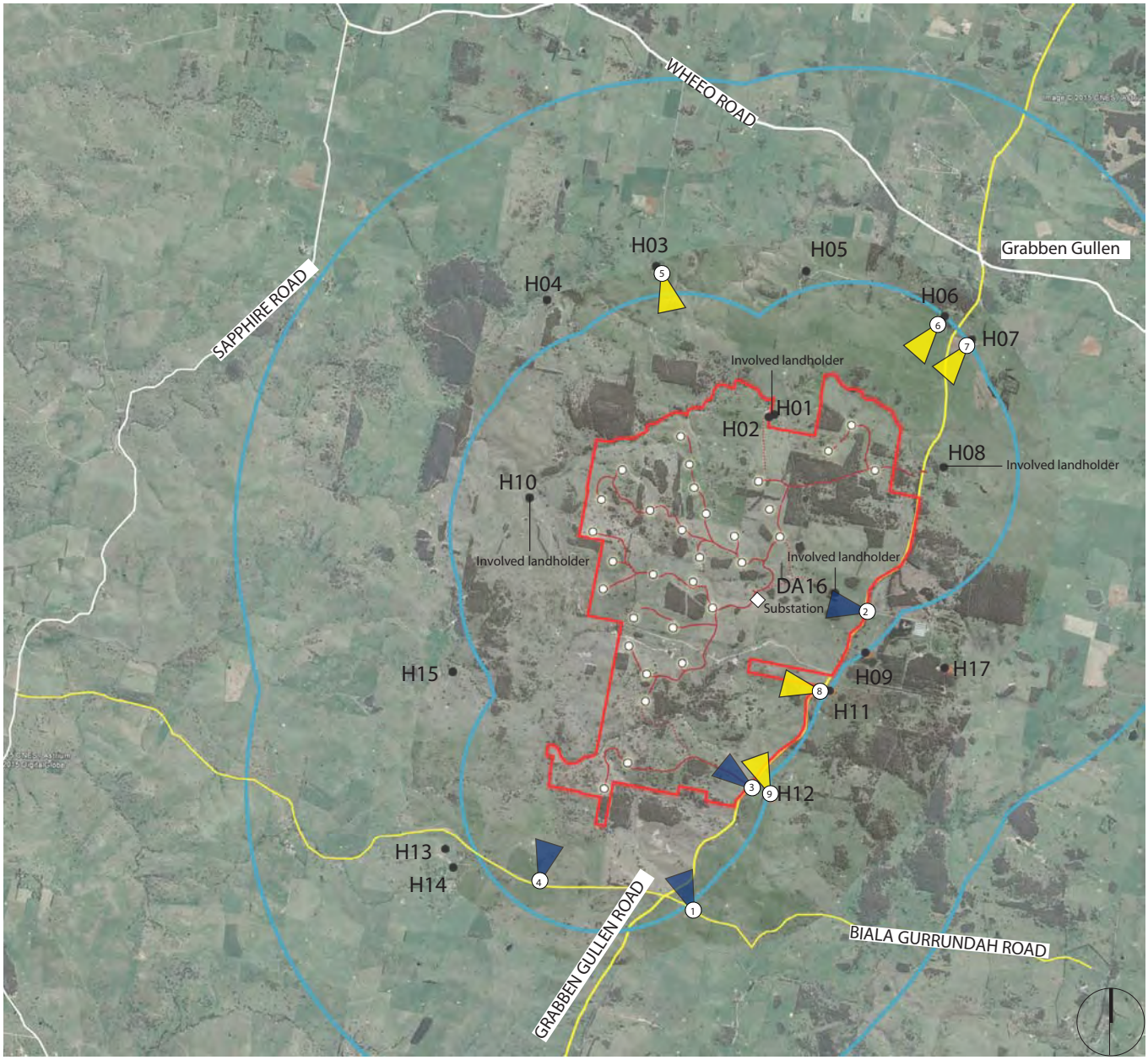


Figure 13 - Photomontage locations

Main Roads
Minor Roads
2 and 5km WTG offset
Project area
Dwelling
WTG
Access roads
Substation
Private viewpoint
Public viewpoint

PUBLIC
PHOTOMONTAGE 1
Location: Biala Gurrundah Road

Start Bearing: 304°
End Bearing: 64°
Turbine FOV: 325° - 22°
Closest turbine: T31
Distance to closest turbine: 2.05km

Existing

Proposed - day

PUBLIC
PHOTOMONTAGE 1 - NIGHT
Location: Biala Gurrundah Road

Proposed - night (indicative only)

PUBLIC
PHOTOMONTAGE 2
Location: Grabben Gullen Road

Start Bearing: 247°
End Bearing: 7°
Turbine FOV: 251° to 3°
Closest turbine: T04
Distance to closest turbine: 1.61km

Existing

Proposed - day

PUBLIC

PHOTOMONTAGE 2 - NIGHT

Location: Grabben Gullen Road

Proposed - night (indicative only)

PUBLIC
PHOTOMONTAGE 3
Location: Grabben Gullen Road

Start Bearing: 264°
End Bearing: 24°
Turbine FOV: 264° to 20°
Closest turbine: T30
Distance to closest turbine: 1.83km

Existing

Proposed - day

PUBLIC

PHOTOMONTAGE 3 - NIGHT

Location: Grabben Gullen Road

Proposed - night (indicative only)