

Landscape character areas

Section 6

6.1 Landscape character areas

A fundamental part of this LVIA is to understand and describe the nature and sensitivity of different components of the landscape within the project 10 km viewshed, and to assess the landscape character in a clear and consistent process. For the purpose of this LVIA, landscape character is defined as *'the distinct and recognisable pattern of elements that occur consistently in a particular type of landscape'* (The Countryside Agency and Scottish Natural Heritage 2002).

This LVIA has identified five Landscape Character Areas (LCA's), which occur within the project 10 km viewshed. The five LCA's represent areas that are relatively consistent and recognisable in terms of their key visual elements and physical attributes; which include a combination of topography/landform, vegetation/landcover, land use and built structures (including settlements and local road corridors).

The five LCA's have been identified through a desk top assessment and described during the landscape assessment fieldwork carried out for the LVIA. The LCA's are not considered to be discrete areas, and characteristics within one LCA may occur within adjoining or surrounding LCA's. For the purpose of this LVIA the LCA are:

- LCA 1 – Plateau;
- LCA 2 – Slopes and hills;
- LCA 3 – Cultivated agricultural land;
- LCA 4 – Timbered areas; and
- LCA 5 – Settlement.

6.2 Landscape sensitivity assessment

The British Landscape Institute describes landscape sensitivity as *'the degree to which a particular LCA can accommodate change arising from a particular development, without detrimental effects on its character'*.

The assessment of landscape sensitivity is based upon an evaluation of the physical attributes identified within each LCA, both singularly and as a combination that gives rise to the landscape's

overall robustness and the extent to which it could accommodate the wind farm development. The criteria used to determine landscape sensitivity are outlined in **Table 4** and based on current good practice employed in the assessment of wind farm developments. This LVIA draws on the Land Use Consultants report on landscape sensitivity for wind farm developments on the Shetland Islands (March 2009) as well as the Western Australian Planning Commission manual for Visual Landscape Planning (2007). Landscape sensitivity is a relative term, and the intrinsic landscape values of the surrounding landscape could be considered of a higher or lower sensitivity than other areas in the Atherton Tableland region.

Whilst the assessment of landscape sensitivity is largely based on a systematic description and analysis of landscape characteristics, this LVIA acknowledges that some individuals and other members of the local community would place higher values on the local landscape. These values could transcend preferences (likes and dislikes) and include personal, cultural as well as other parameters.

Table 4 – Landscape Sensitivity Criteria

Landscape Sensitivity Assessment Criteria			
Characteristic	Aspects indicating lower sensitivity to the wind farm development	↔	Aspects indicating higher sensitivity to the wind farm development
Landform and scale: patterns, complexity and consistency	<ul style="list-style-type: none"> • Large scale landform • Simple • Featureless • Absence of strong topographical variety 	↔	<ul style="list-style-type: none"> • Small scale landform • Distinctive and complex • Human scale indicators • Presence of strong topographical variety
Landcover: patterns, complexity and consistency	<ul style="list-style-type: none"> • Simple • Predictable • Smooth, regular and uniform 	↔	<ul style="list-style-type: none"> • Complex • Unpredictable • Rugged and irregular
Settlement and human influence	<ul style="list-style-type: none"> • Concentrated settlement pattern • Presence of contemporary structures (e.g. utility, infrastructure or industrial elements) 	↔	<ul style="list-style-type: none"> • Dispersed settlement pattern • Absence of modern development, presence of small scale, historic or vernacular settlement

Landscape Sensitivity Assessment Criteria			
Characteristic	Aspects indicating lower sensitivity to the wind farm development	↔	Aspects indicating higher sensitivity to the wind farm development
Movement	<ul style="list-style-type: none"> Prominent movement, busy 	↔	<ul style="list-style-type: none"> No evident movement, still
Rarity	<ul style="list-style-type: none"> Common or widely distributed example of landscape character area within a regional context 	↔	<ul style="list-style-type: none"> Unique or limited example of landscape character area within a regional context
Intervisibility with adjacent landscapes	<ul style="list-style-type: none"> Limited views into or out of landscape Neighbouring landscapes of low sensitivity Weak connections, self contained area and views Simple large scale backdrops 	↔	<ul style="list-style-type: none"> Prospects into and out from high ground or open landscape Neighbouring landscapes of high sensitivity Contributes to wider landscape Complex or distinctive backdrops

The landscape sensitivity assessment criteria set out in **Table 4** have been evaluated for each of the five LCA's by applying a professionally determined judgement on a sliding scale between 1 and 5.

A scale of 1 indicates a landscape characteristic with a lower sensitivity to the wind farm development (and would be more likely to accommodate the wind farm development). A scale of 5 indicates a landscape characteristic with a high level of sensitivity to the wind farm development (and less likely to accommodate the wind farm development).

The scale of sensitivity for each LCA is outlined in **Tables 5 to 9** and is set out against each characteristic identified in **Table 4**.

The overall landscape sensitivity for each LCA is a summation of the scale for each characteristic identified in **Tables 5 to 9**. The overall scale is expressed as a total out of 30 (i.e. 6 characteristics for each LCA with a potential top scale of 5). Each characteristic is assessed separately and the criteria set out in **Table 4** are not ranked in equal significance. The overall landscape sensitivity for each of the five LCA has been determined as either:

High (Scale of 24 to 30) – key characteristics of the LCA will be impacted by the proposed project, and will result in major and visually dominant alterations to perceived characteristics of the LCA which

may not be fully mitigated by existing landscape elements and features. The degree to which the landscape may accommodate the proposed project development will result in a number of perceived uncharacteristic and significant changes.

Medium to High (Scale of 16 to 23) – recognisable characteristics of the LCA will be altered by the proposed project, and result in the introduction of visually prominent elements that will alter the perceived characteristics of the LCA but may be partially mitigated by existing landscape elements and features within the LCA. The main characteristics of the LCA, patterns and combinations of landform and landcover will still be evident.

Medium (Scale 11 to 15) – distinguishable characteristics of the LCA may be altered by the proposed project, although the LCA may have the capability to absorb some change. The degree to which the LCA may accommodate the proposed project would potentially result in the introduction of prominent elements to the LCA, but may be accommodated to some degree.

Low Rating (Scale of 6 to 10) – the majority of the LCA characteristics are generally robust, and would be less affected by the proposed project. The degree to which the landscape may accommodate the wind farm would not significantly alter existing landscape character.

Very Low or Negligible Rating (Less than 6) the characteristics of the LCA will not be impacted or visibly altered by the proposed project.

6.3 Analysis of landscape sensitivity

The following section of this LVIA provides an analysis of landscape sensitivity within the viewshed of the wind farm development and considers each LCA.

6.3.1 LCA 1 Plateau

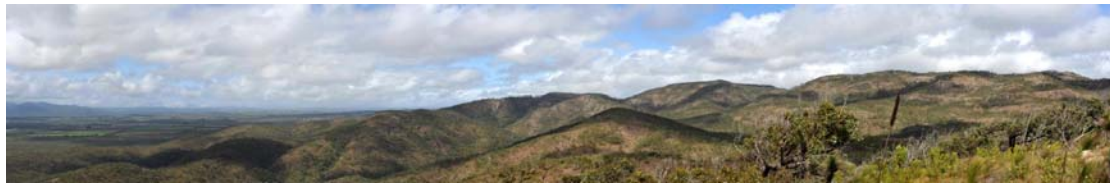


Plate 1 – Typical view toward plateau LCA

Table 5 – LCA 1 – Plateau -Landscape Sensitivity

	Lower Sensitivity		↔	Higher Sensitivity	
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Landform and Scale					
	The plateau area is a medium to large scale landscapes with a gentle to moderate undulating landform. The structure of the landform is simple containing few distinct features and has limited topographical elements.				
Landcover					
	Landcover across the plateau is predominantly simple and predictable with scattered tree and shrub cover forming the predominant visual backdrop.				
Settlement and human influence					
	There is an overall absence of modern development across the plateau landscape, excluding the existing transmission line and access tracks.				
Movement					
	There is very limited movement within the plateau LCA with very occasional traffic.				
Rarity					
	Areas of plateau occur within limited areas of the Atherton Tableland; however, the project site plateau is limited landscape type with a local area.				
Intervisibility					
	The plateau LCA appears as a simple backdrop in views from surrounding areas. Undulating landform within the LCA can retain and constrict views within the landscape, but generally contributes to views across the wider landscape.				
Overall Sensitivity Rating	Medium to High (Score 19 out of 30)				

6.3.2 LCA 2 Slopes and hills

**Plate 2** – Typical view across slopes and hills LCA**Table 6** – LCA 2 – Slopes and hills – Landscape Sensitivity

	Lower Sensitivity		↔	Higher Sensitivity	
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Landform and Scale					
	Slopes and hills are represented by a generally open and large scale landform with distant views available from elevated areas within this landscape. The landform is simple containing few distinct features and has a general absence of any strong topographical elements.				
Landcover					
	Landcover is predominantly simple and predictable within the context of similar areas across the Atherton Tableland. The overall landscape pattern within this landscape is smooth, regular and uniform, although mosaics of timbered areas on surrounding slopes and cultural planting surrounding dwellings create some diversity and contrast in pattern.				
Settlement and human influence					
	Settlement is occasional and dispersed within this landscape and does not generally occur along the top of ridgelines or on elevated and exposed slopes. The main influences of human activity are the effects of agricultural improvement within the landscape.				
Movement					
	A lack of any significant movement gives this landscape an overall still character.				
Rarity					
	Simple slopes and hills are generally well represented and a common feature across the broader regional area of the Atherton Tableland.				
Intervisibility					
	Intervisibility is limited as views from within this landscape are often contained by undulating or sloping landform rising to ridgelines, however, potential distant views do occur from elevated landform to provide links to adjoining landscape areas.				
Overall Sensitivity Rating	Medium to High (Score 17 out of 30)				

6.3.3 LCA 3 Cultivated agricultural land

**Plate 3** – Typical views across cultivated agricultural land LCA**Table 7** – LCA 3 – Cultivated agricultural land - Landscape Sensitivity

	Lower Sensitivity		↔	Higher Sensitivity	
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Landform and Scale					
	Cultivated agricultural land is generally located across gently sloping and level landform resulting in a moderate scale landform. The landform is simple containing few distinct features and has an absence of any strong topographical elements.				
Landcover					
	Landcover is predominantly simple and predictable within the context of widespread cultivated landscapes across the broader regional area of the Atherton Tableland. The overall landscape pattern created by farming within this landscape is smooth, regular and uniform, although occasional timbered stands along natural drainage lines create some diversity and contrast in pattern.				
Settlement and human influence					
	There is low density settlement within this landscape with a small and dispersed number of agricultural structures (some abandoned), minor access tracks and fences occurring throughout.				
Movement					
	Movement is generally limited to local roads and access tracks as well as agricultural activities across plantations and cultivated cropping areas.				
Rarity					
	Cultivated agricultural land is generally well represented and a common feature across the broader regional area of the Atherton Tableland landscape.				
Intervisibility					
	Intervisibility is limited as views from within this landscape are often contained by sloping landform and established tree cover surrounding and beyond cultivated areas.				
Overall Sensitivity Rating	Medium (Score 15 out of 30)				

6.3.4 LCA 4 Timbered areas

**Plate 4** – Typical view toward timbered LCA**Table 8** – LCA 4 – Timbered areas - Landscape Sensitivity

	Lower Sensitivity		↔	Higher Sensitivity	
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Landform and Scale					
	Timbered areas occur across a range of landform types that are generally defined by gently sloping or undulating landform resulting in a moderate scale landform.				
Landcover					
	Landcover is predominantly simple and predictable within the context of similar timbered areas across the Atherton Tableland. The overall landscape pattern created by timbered areas creates diversity and contrast to the smooth, regular and uniform cultivated areas within the landscape. The darker coloured foliage of timbered areas contrast against the surrounding backdrop of lighter toned pasture and cultivated areas.				
Settlement and human influence					
	Settlement is occasional and dispersed within timbered areas with the majority of dwellings visually screened from surrounding landscape areas. The main influences of human activity are the effects of agricultural improvement within the landscape.				
Movement					
	Movement is generally limited to local roads and access tracks.				
Rarity					
	Timbered areas are reasonably well represented and an established feature across broader regional areas of the Atherton Tableland.				
Intervisibility					
	The level of intervisibility between this landscape and adjoining areas is generally determined by the location and extent of timbered area relative to view locations, but on the whole is limited as views from within this landscape are constrained by vegetation, combined with sloping landform. Views from scattered or lightly timbered areas provide links to adjoining landscape areas.				
Overall Sensitivity Rating	Medium to High (Score 16 out of 30)				

6.3.5 LCA 5 Settlement



Plate 5 – Typical view along local road Walkamin

Table 9 – LCA 5 – Settlement - Landscape Sensitivity

	Lower Sensitivity		↔	Higher Sensitivity	
	Low	Low to Med	Medium	Med to High	High
Rating	1	2	3	4	5
Landform and Scale					
	Settlement extends across a range of landform types which include gently sloping and low undulating landform to steeper hills and slopes resulting in an overall small to moderate scale rural urban environment.				
Landcover					
	The overall landscape pattern is defined by human scale indicators including houses, shops and roads together with a variety of urban structures which create some diversity and contrast in pattern. There are generally no elements that result in the presence of strong topographical variety.				
Settlement and human influence					
	Dwellings are dispersed beyond town and village settlement areas and are generally associated with individual farms and rural structures.				
Movement					
	Movement is generally limited to local roads and access tracks.				
Rarity					
	Urban settlements are dispersed across the landscape, as well as the broader regional area of the Atherton Tableland.				
Intervisibility					
	Intervisibility is limited where views are partially contained by buildings and structures, although views from elevated areas of the settlement extend beyond and across adjoining landscape areas.				
Overall Sensitivity Rating	Medium to High (Score 17 out of 30)				

6.4 Summary

In terms of overall landscape sensitivity, this LVIA has determined that the landscape within the viewshed of the proposed Mount Emerald wind farm has a medium to high sensitivity to accommodate change, and represents a landscape that is reasonably typical of landscape types found in surrounding areas of the Atherton Tablelands.

As a landscape with an overall medium to high sensitivity to accommodate change, recognisable characteristics of the LCA will be altered by the proposed project, and result in the introduction of visually prominent elements that will alter the perceived characteristics of the LCA but may be partially mitigated by existing landscape elements and features within the LCA.

The main characteristics of the LCA, patterns and combinations of landform and landcover will still be evident. This capability is largely derived from the presence of predominantly large scale landscape across portions of the wind farm, together with the relatively low settlement density within the Mount Emerald viewshed.

Despite being 'naturalistic' in appearance large portions of the landscape have been heavily modified by agricultural improvement. Irrespective of the extent and nature of modifications to the landscape, it is not correct to assume that the landscape surrounding the wind farm should be any less valued as a result of modification. Physical change in the appearance of the landscape is an ongoing and constant process from both human and environmental influences and can result in both positive and negative effects.

Viewshed, zone of visual influence and visibility

Section 7

7.1 Introduction

A key component of this LVIA is defined by the description, assessment and determination of the viewshed, zone of visual influence and visibility associated with the wind farm. It is a combination of these issues that sets out the framework for determining the significance and magnitude of potential visual impact of the wind farm on view locations within the landscape.

In order to clarify and explain this component of this LVIA, the relationship between viewshed, zone of visual influence and visibility is outlined and defined in **Table 10**.

Table 10 – Definitions

	Definition	Relationship
Viewshed	An area of land surrounding and beyond the project area which may be potentially affected by the wind farm.	Identifies the majority of this LVIA study area that incorporates view locations that may be subject to a degree of visual impact.
Zone of Visual Influence (ZVI)	A theoretical area of landscape from which the wind farm structures may be visible.	Determines areas within a viewshed from which the wind turbines may be visible.
Visibility	A relative determination at which a wind turbine or cluster of wind turbines can be clearly discerned and described.	Describes the likely number and relative scale of wind turbines visible from a view location.

An overview of viewshed, zone of visual influence and visibility is discussed in the following sections.

7.2 Viewshed

For the purpose of this LVIA viewshed is defined as the area of land surrounding and beyond the project area which could be potentially affected by the wind farm. In essence, the viewshed defines this LVIA study area. The viewshed for the project has been divided into a series of concentric bands (at 2 km, 5 km and 10 km distance offsets) extending across the landscape from the wind turbines. The viewshed extent can vary between wind farm projects, and be influenced or informed by a number of criteria including the height of the wind turbines together with the nature, location and height of landform that could limit visibility.

It is important to note that the wind turbines would be visible from some areas of the landscape beyond the 10 km viewshed; however, within the general parameters of normal human vision, a wind

turbine at around 130.5 m to the tip of the rotor blade would occupy a relatively small proportion of a person's field of view from distances in excess of 10 km.

The viewshed is used as a framework and guide for visibility assessment, as the degree of visual significance would tend to be graduated with distance although there are unlikely to be any distinct or abrupt noticeable changes between the nominated distances.

7.3 Zone of Visual Influence

The ZVI diagrams are used to identify theoretical areas of the landscape from which a defined number of wind turbines, or portions of turbines, could be visible within the viewshed. They are useful for providing an overview as to the extent to which the project could be visible from surrounding areas.

ZVI diagrams have been prepared to include:

- ZVI Diagram 1 from tip of blade;
- ZVI Diagram 2 from hub height; and
- ZVI Diagram 3 toward the whole turbine.

The extent to which the wind turbines may be visible are illustrated in **Figure 10**, and the ZVI Diagrams in **Figures 11 to 13**.

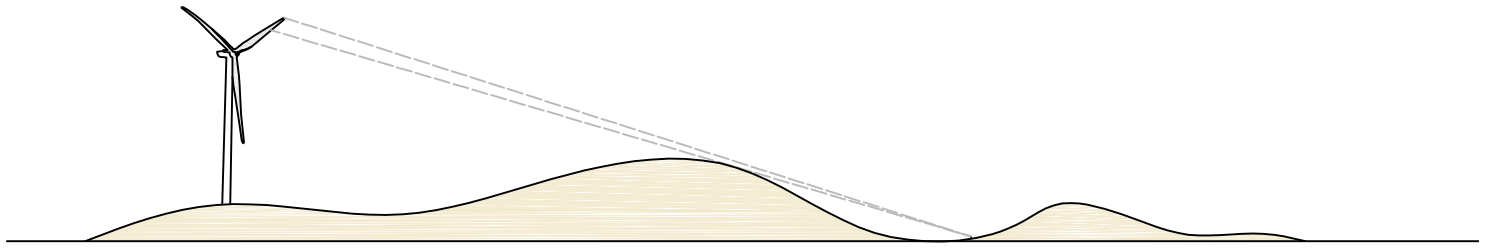
7.4 ZVI methodology

The methodology adopted for the ZVI is a purely geometric assessment where the visibility of the project is determined from carrying out calculations based on a digital terrain model of the site and the surrounding terrain.

Calculations have been made to determine the visibility of the wind turbines:

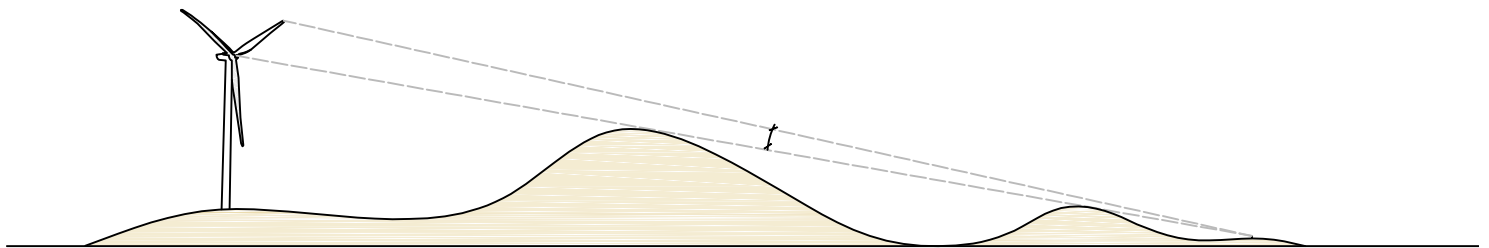
- to blade tips (essentially a view toward any part of the wind turbine rotor, including views toward the tips of blades above ridgelines);
- to hub height (essentially a view toward half the swept path of the wind turbine blades); and
- to the whole turbine (essentially a view toward the whole turbine).

The calculations also take into account the terrain relief and earth curvature.



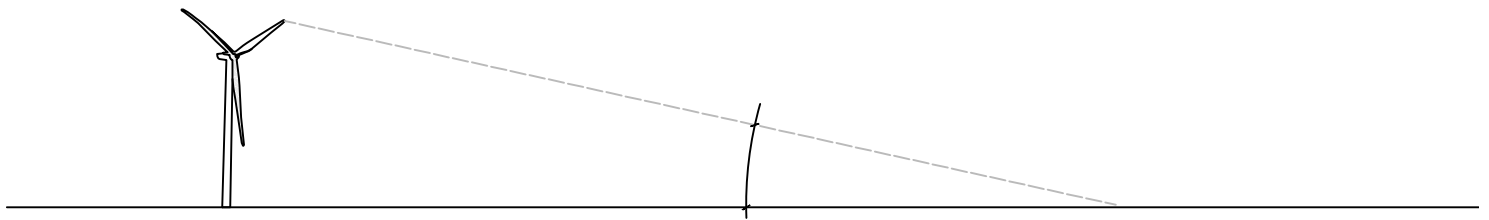
'Tip of blade'

View toward 'tip of blade' - where views extend toward the tip of blades above hill and ridgelines.



'Hub height'

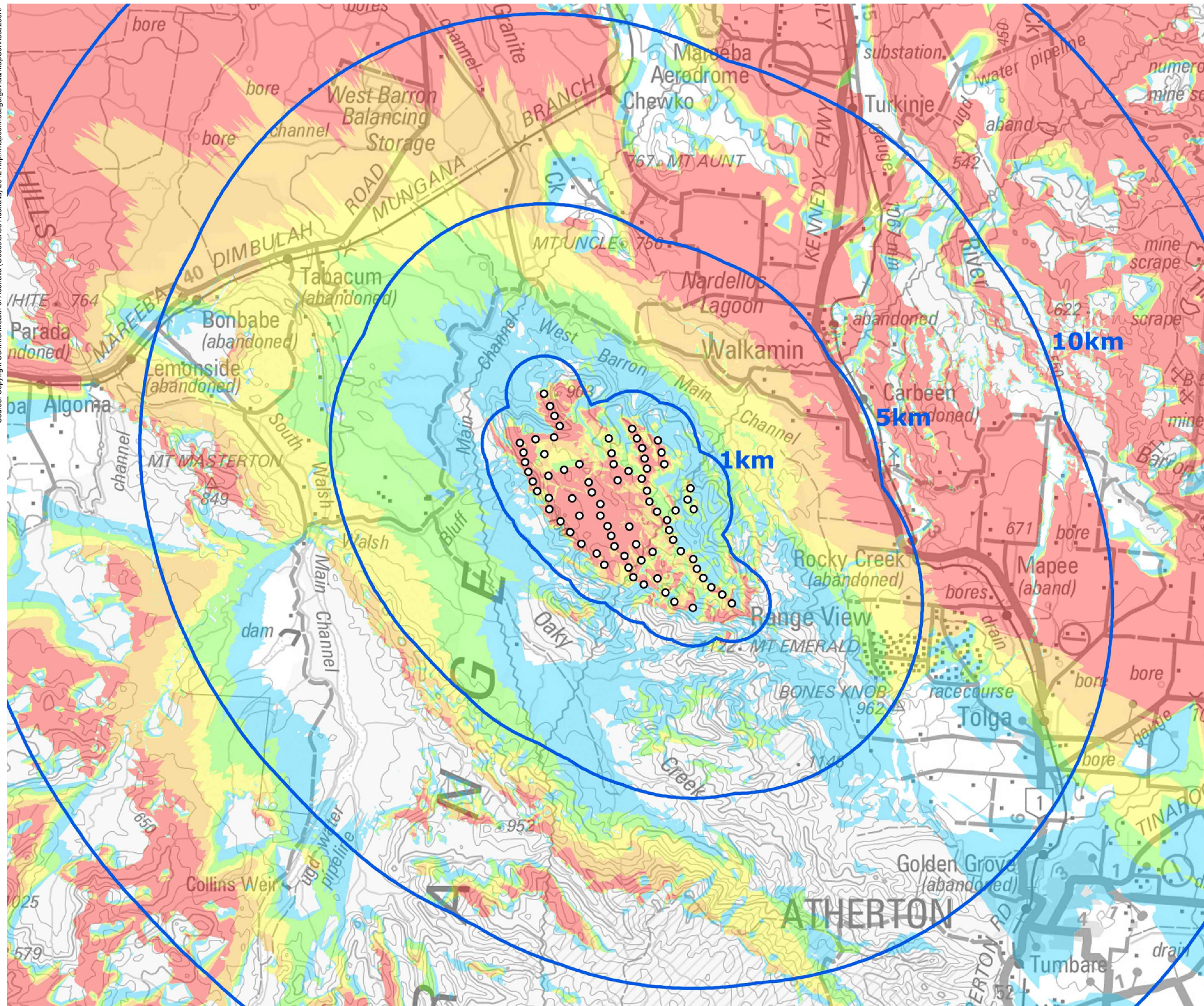
View toward 'hub height' - where views extend toward the upper half of the wind turbine rotor with views toward the lower half of the rotor face and tower screened by landform.



'Whole turbine'

View toward 'whole turbine' - where views extend from the base of the tower to the tip of the rotor blade.

Figure 10
ZVI visibility zones



NOTES:

The ZVI methodology is a purely geometric assessment where the visibility of the proposed Mount Emerald wind farm is determined from carrying out calculations based on a digital terrain model of the site and the surrounding terrain.

This assessment methodology is assumed to be conservative as the screening affects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not be visible at many of the locations indicated on the ZVI maps due to the local presence of trees, vegetation or other screening potential. While the ZVI maps are a useful visualisation tool, they are very conservative in nature.

Additionally, the number of turbines visible at any one time is also affected by the weather condition at the time. Inclement or cloudy weather tends to mask the visibility of the proposed wind project.

LEGEND:

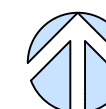
Number of wind turbine tip of blade visible

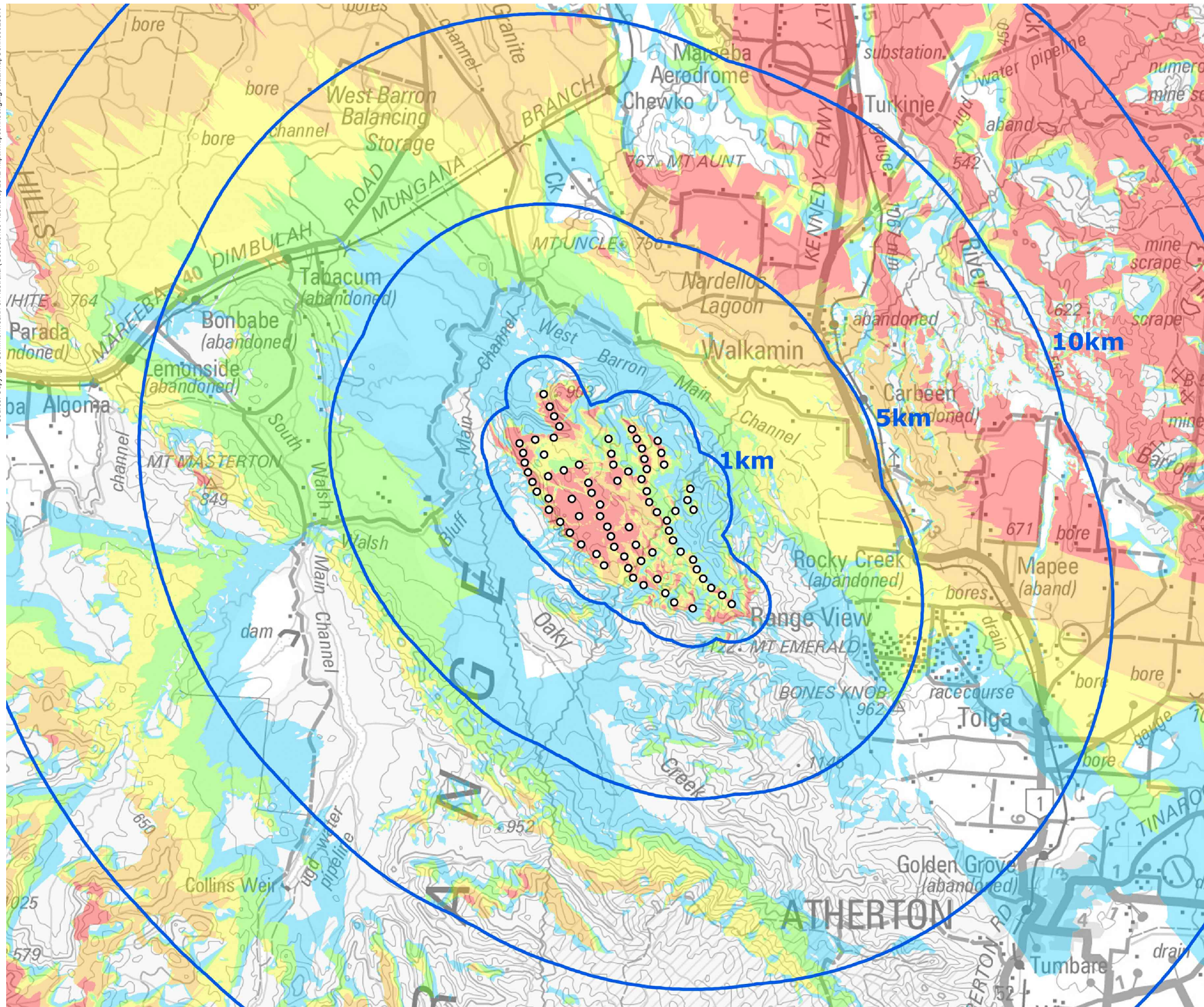


ZVI prepared by Truescape Visual Communication (based on a 75 wind turbine layout)

Figure 11
ZVI Diagram 1 Tip of blade

MOUNT EMERALD WIND FARM





NOTES:

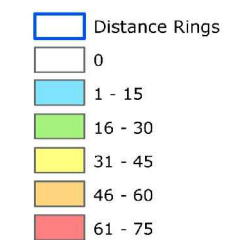
The ZVI methodology is a purely geometric assessment where the visibility of the proposed Mount Emerald wind farm is determined from carrying out calculations based on a digital terrain model of the site and the surrounding terrain.

This assessment methodology is assumed to be conservative as the screening affects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not be visible at many of the locations indicated on the ZVI maps due to the local presence of trees, vegetation or other screening potential. While the ZVI maps are a useful visualisation tool, they are very conservative in nature.

Additionally, the number of turbines visible at any one time is also affected by the weather condition at the time. Inclement or cloudy weather tends to mask the visibility of the proposed wind project.

LEGEND:

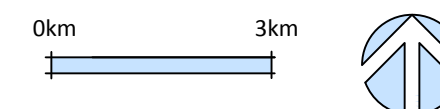
Number of wind turbine tip of blade visible

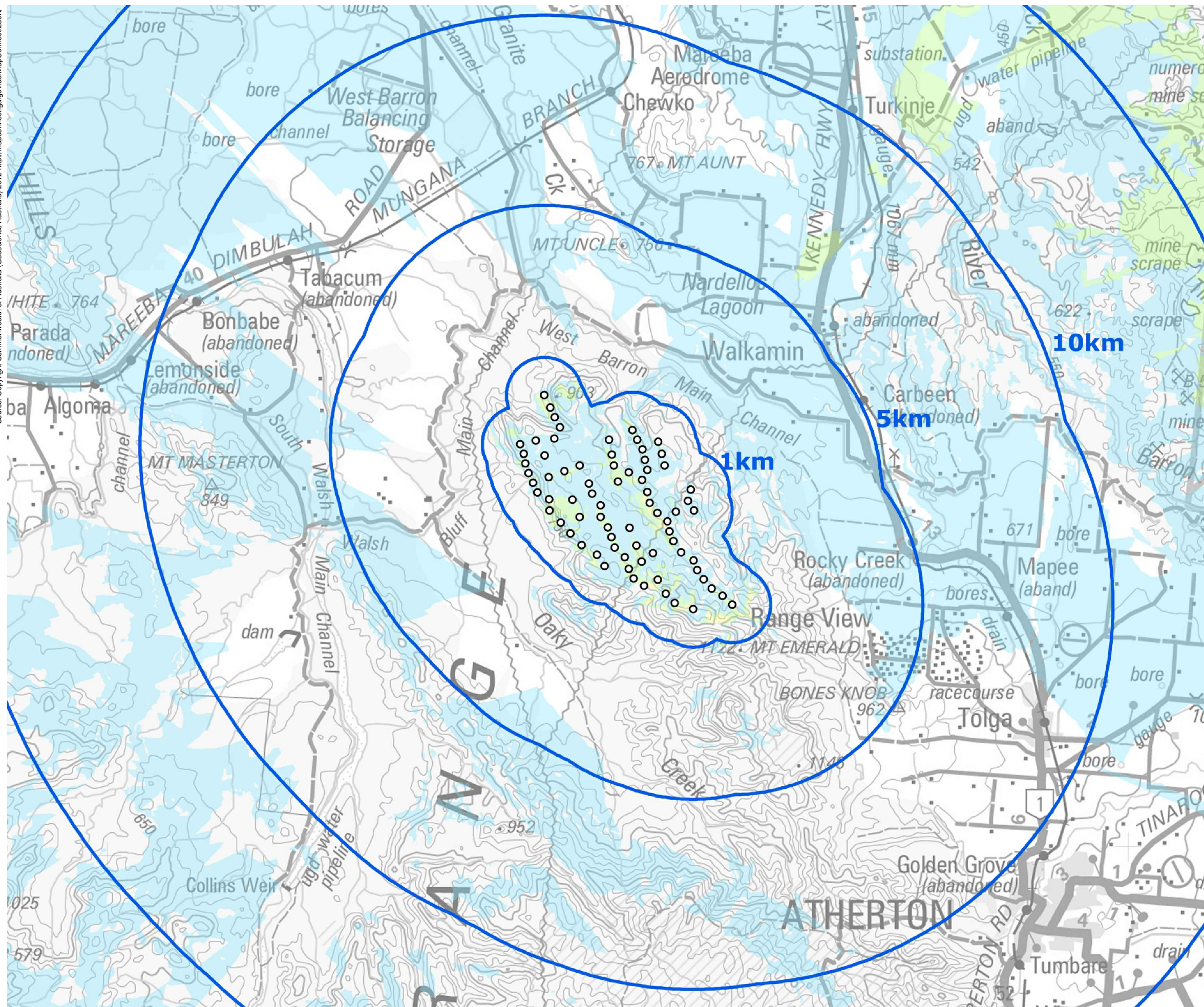


ZVI prepared by Truescape Visual Communication (based on a 75 wind turbine layout)

Figure 12
ZVI Diagram 2 Hub height

MOUNT EMERALD WIND FARM





NOTES:

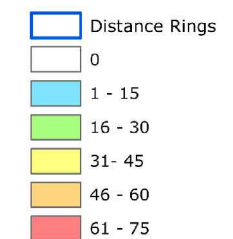
The ZVI methodology is a purely geometric assessment where the visibility of the proposed Mount Emerald wind farm is determined from carrying out calculations based on a digital terrain model of the site and the surrounding terrain.

This assessment methodology is assumed to be conservative as the screening affects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not be visible at many of the locations indicated on the ZVI maps due to the local presence of trees, vegetation or other screening potential. While the ZVI maps are a useful visualisation tool, they are very conservative in nature.

Additionally, the number of turbines visible at any one time is also affected by the weather condition at the time. Inclement or cloudy weather tends to mask the visibility of the proposed wind project.

LEGEND:

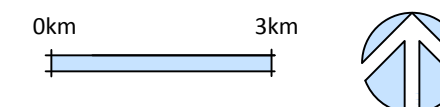
Number of wind turbine tip of blade visible



ZVI prepared by Truescape Visual Communication (based on a 75 wind turbine layout)

Figure 13
ZVI Diagram 3 Whole turbine

MOUNT EMERALD WIND FARM



This assessment methodology is conservative as:

- the screening effects of any structures and vegetation above ground level are not considered in any way. Therefore the wind farm may not be visible at many of the locations indicated on the ZVI diagrams due to the local presence of trees or other screening materials.
- additionally, the number of turbines visible is also affected by the weather conditions at the time. Inclement or cloudy weather tends to mask the visibility of the proposed wind project.

Accordingly, while ZVI diagrams are a useful visualisation tool, they are very conservative in nature.

7.5 ZVI summary

The most extensive and continuous area of visibility toward the project turbines would generally occur where the tips of the wind turbine rotor blades are visible above surrounding ridgelines or vegetation; however, views toward the tips and upper portions of the wind turbine rotors are likely to become less noticeable at reasonably short distances from the wind farm due to the screening influence of topography and dense tree cover. Views toward tip of blade are visually negligible from medium to longer distance view locations.

The ZVI diagrams for 'tip' and 'hub height' cover similar extents of landscape surrounding the wind farm, and extend toward isolated pockets of rural landscape beyond 10 km of the nearest wind turbine. The number and distribution of turbines visible between 'tip' and 'hub' height is influenced by ridgelines and surrounding hills for a number of areas between the 5 km to 10 km distance offsets.

The ZVI diagrams illustrate areas of landscape which are likely to offer views toward the wind turbines and demonstrate that the majority of views generally occur within private property and across tracts of unoccupied rural landscape.

The ZVI diagrams also illustrate a number of discrete pockets within portions of the 5 km to 10 km distance offset from which the wind turbines would not be visible, although this band of the viewshed also represents areas from which a greater number of turbines would also be visible.

The ZVI diagrams illustrate that the influence of surrounding landform begins to disperse visibility from beyond 5 km, although opportunities to view turbines from elevated, but moderately distant and generally unoccupied areas occur from areas beyond 5 km.

It should be noted that the wind turbines, when viewed from distances of around, or greater than 10 km, will generally be less distinct from other distant elements within the same field of view, and that the majority of land within the viewshed comprises rural agricultural land and areas of dense timber growth.

7.6 Visibility

The level of wind turbine visibility within the Mount Emerald wind farm 10 km viewshed can result from a number of factors such as:

- distance effect;
- movement;
- relative position; and
- weather.

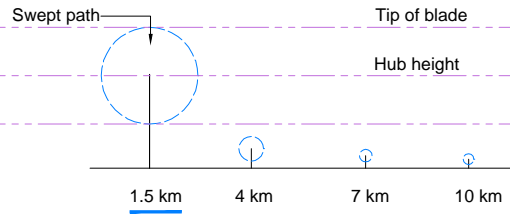
7.6.1 Distance effect

With an increase in distance the proportion of a person's horizontal and vertical view cone occupied by a visible turbine structure, or group of turbine structures, will decline. In order to demonstrate this a series of single frame photographs have been taken from pre-set distances (1.5 km, 4 km, 7 km and 10 km) toward wind turbines at the Capital wind farm in New South Wales. The photographs, illustrated in **Figure 14**, demonstrate the degree to which the apparent visible height of a wind turbine decreases with increasing distance (in a negative exponential relationship), and the increasing amount of horizontal skyline visible with an increasing distance.

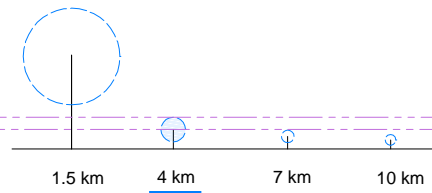
As the view distance increases so do the atmospheric effects resulting from dust particles and moisture in the atmosphere, which makes the turbines appear to be grey thus potentially reducing the contrast between the wind turbines and the background against which they are viewed.



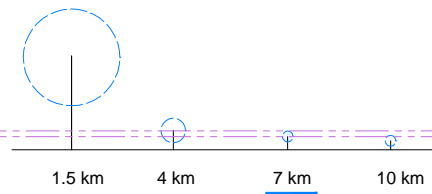
Capital Wind Farm - View distance 1.5 km



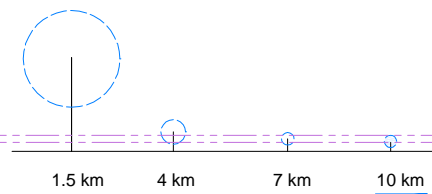
Capital Wind Farm - View distance 4 km



Capital Wind Farm - View distance 7 km



Capital Wind Farm - View distance 10 km



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

Photographs: Pentax K10D, 50mm lens

Figure 14
Distance effect



GREEN BEAN DESIGN
landscape architects

MOUNT EMERALD WIND FARM

Whilst the distance between a view location and the wind turbines is a significant factor to consider when determining potential visibility, there are other issues which may also affect the degree of visibility. **Table 11** outlines the relative effect of distance on visibility and has been based on empirical research conducted by the University of Newcastle (2002) as well as direct observations made during wind farm site inspections.

Table 11 – Distance effect

Distance from turbine	Distance effect
>20 km	<p>Wind turbines become indistinct with increasing distance. Rotor movement may be visible but rotor structures are usually not discernible.</p> <p>Turbines may be discernible but generally indistinct within viewshed resulting in Low level visibility and Nil where influenced or screened by surrounding topography and vegetation.</p>
10 km – 20 km	<p>Wind turbines noticeable but tending to become less distinct with increasing distance. Blade movement may be visible but becomes less discernible with increasing distance.</p> <p>Turbines discernible but generally less distinct within viewshed (potentially resulting in Low level visibility).</p>
5 km – 10 km	<p>Wind turbines visible but tending to become less distinct depending on the overall extent of view available from the potential view location. Movement of blades discernible where visible against the skyline.</p> <p>Turbines potentially noticeable within viewshed (potentially resulting in Low to Moderate level visibility).</p>
3 – 5 km	<p>Wind turbines clearly visible in the landscape but tending to become less dominant with increasing distance. Movement of blades discernible.</p> <p>Turbines noticeable but less dominant within viewshed (potentially resulting in Moderate level visibility).</p>
1 – 3 km	<p>Wind turbines would generally dominate the landscape in which the wind turbine is situated. Potential for high visibility depending on the category of view location, their location, sensitivity and subject to other visibility factors.</p> <p>Turbines potentially dominant within viewshed (potentially resulting in Moderate to High level visibility).</p>
<1 km	<p>Wind turbines would dominate the landscape in which they are situated due to large scale, movement and proximity.</p> <p>Turbines dominant and significant within viewshed (potentially resulting in High level visibility).</p>

7.6.2 Movement

The visibility of the wind turbines would vary between the categories of static and dynamic view locations. In the case of static views the relationship between a wind turbine and the landscape would not tend to vary greatly. The extent of vision would be relatively wide as a person tends to scan back and forth across the landscape.

In contrast views from a moving vehicle are dynamic as the visual relationship between wind turbines is constantly changing, as is the visual relationship between the wind turbines and the landscape in which they are seen. The extent of vision can be partially constrained by the available view from within a vehicle at proximate distances.

7.6.3 Relative position

In situations where the view location is located at a lower elevation than the wind turbine, most of the turbine would be viewed against the sky. The degree of visual contrast between a white coloured turbine and the sky would depend on the presence of background clouds and their colour. For example, dark grey clouds would contrast more strongly with white turbines than a background of white clouds.

The level of visual contrast can also be influenced by the position of the sun relative to individual wind turbines and the view location. Where the sun is located in front of the viewer some visible portions of the wind turbine would be seen in shadow. If the background to the wind turbine is dark toned then visual contrast would tend to be reduced. Conversely where the sun is located behind the view location then the visible portion of the wind turbine would be in full sun.

Significance of visual impact

Section 8

8.1 Introduction

The significance of visual impact resulting from the construction and operation of the Mount Emerald wind farm would result primarily from a combination of:

- the overall sensitivity of visual receptors in the surrounding landscape; and
- the scale or magnitude of visual effects presented by the wind farm development.

The sensitivity of visual receptors has been determined and described in this LVIA by reference to:

- the location and context of the view point;
- the occupation or activity of the receptor; and
- the overall number of people affected.

This LVIA notes that although a large number of viewers in a category that would otherwise be of low or moderate sensitivity may increase the sensitivity of the receptor, it is also the case that a small number of people (such as residents) with a high sensitivity may increase the significance of visual impact.

Table 12 – View Location Sensitivity

View Category	Sensitivity
Residential Properties	<i>Highest Sensitivity</i>
Pedestrians (recreational)	▽
Public Recreational Space	▽
Rural employment/farming	▽
Motorists	▽
Business (commercial)	▽
Industry	<i>Lower Sensitivity</i>

Table 13 – Numbers of viewers

Criteria	Definition
Number of viewers	
High	> 400 people per day
Medium to high	100 - 399 people per day
Medium	50 - 99 people per day
Low	10 - 25 people per day
Very low	< 10 people per day

The scale or magnitude of visual effects associated with the project have been determined and described by reference to:

- the distance between the view location and the wind farm turbines;
- the duration of effect;
- the extent of the area over which the wind farm could be theoretically visible (ZVI hub height)
- the degree of visibility subject to existing landscape elements (such as forested areas or tree cover).

An overall determination of visual impact at each view location has also been assessed and determined against the criteria outlined in **Table 14** below:

Table 14 – Sensitivity and magnitude assessment criteria

Criteria	Definition
Distance	
Very short	<1 km
Short	1 – 3 km
Medium	3 km – 5 km
Long	5 km - 10 km +
Duration of effect	
High	> 2 hours
Medium	30 - 120 minutes
Low	10 – 30 minutes
Very low	< 10 minutes
Extent of visibility	
High	46 – 75 wind turbines visible from hub height

Table 14 – Sensitivity and magnitude assessment criteria

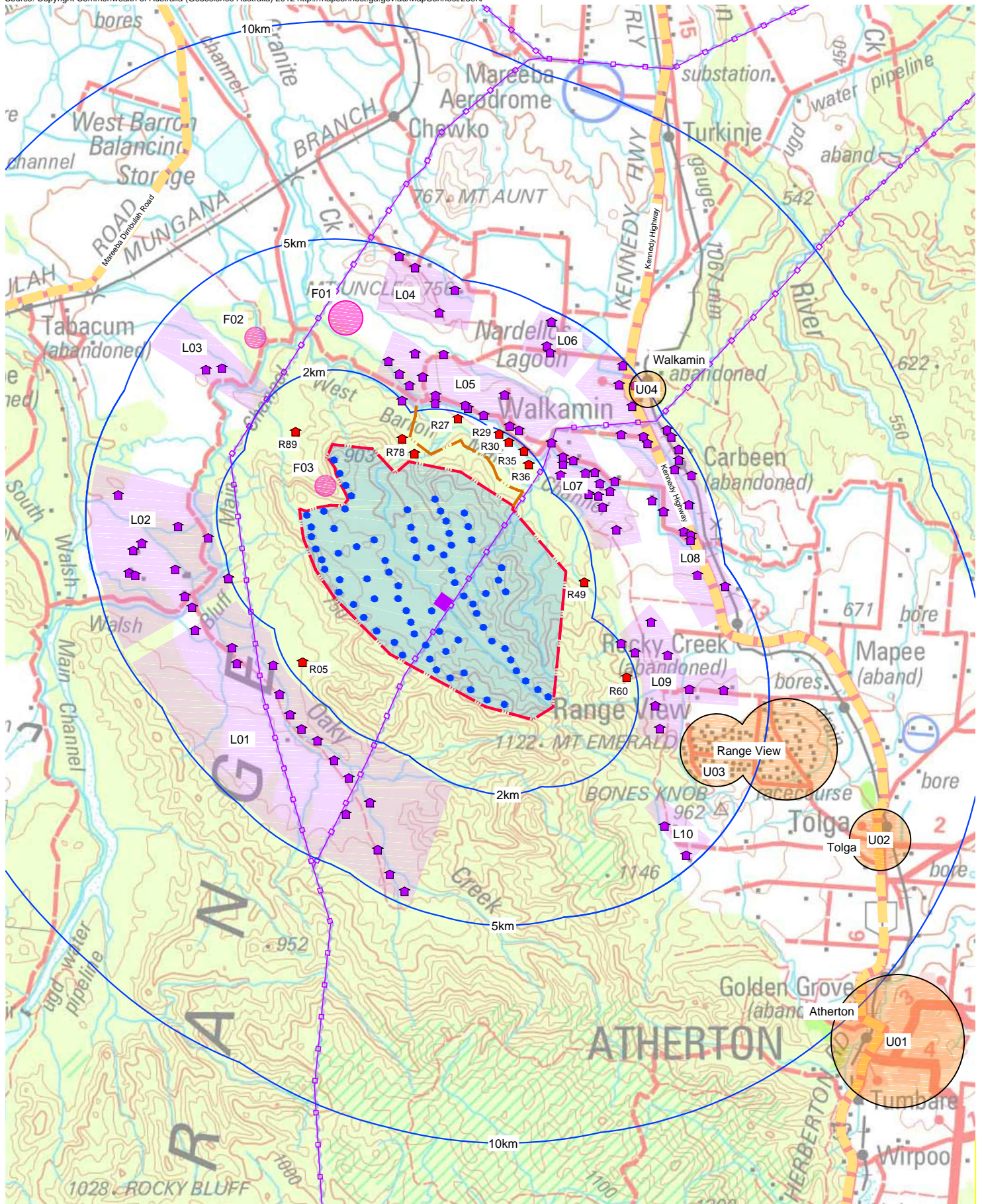
Criteria	Definition
Medium	31 – 45 wind turbines visible from hub height
Low	16 – 30 wind turbines visible from hub height
Very low	1 – 15 wind turbines visible from hub height

The levels of view sensitivity and scale or magnitude of change outlined in **Table 15** is used **as a guide** to determine levels of visual significance.

Table 15 Visual significance matrix

			Scale or magnitude of change in view caused by proposed development			
			High	Medium	Low	Very Low
			Very short distance view over a long duration of time. A high extent of wind turbine visibility would tend to dominate the available skyline view and significantly disrupt existing views or vistas.	Short to medium distance views over a medium duration of time. A moderate extent of wind turbine visibility would have the potential to dominate available views with visibility recessing over increasing distance.	Medium to long distance views over a low to medium duration of time. Wind turbines in views, at long distances or visible for a short duration not expected to be significantly distinct in the existing view.	Visible change perceptible at a very long distance, or visible for a very short duration, and/or is expected to be less distinct within the existing view.
Sensitivity of visual receptor	High	Indicator	High	Medium to High	Medium	Low to Medium
		Large numbers of viewers or those with proprietary interest and prolonged viewing opportunities such as residents and users or visitors to attractive and/or well-used recreational facilities. Views from a regionally important location whose interest is specifically focussed on the landscape				
	Medium	Medium numbers of residents and moderate numbers of visitors with an interest in their environment e.g. visitors to environmental areas, such as bush walkers and horse riders etc.... Larger numbers of travellers with an interest in their surroundings	Medium to High	Medium	Low to medium	Low
	Low	Low numbers of visitors with a passing interest in their surroundings e.g. those travelling along principal roads. Viewers whose interest is not specifically focussed on the landscape e.g. farm workers, commuters.	Medium	Low to Medium	Low	Very low to low
Very Low	Very low numbers of viewers or those with a passing interest in their surroundings e.g. those travelling along minor roads.	Low to Medium	Low	Very low to low	Very low	

This table is used as a guide only. The descriptions of magnitude and sensitivity are illustrative only. Each case is assessed on its own merits using professional judgement and experience, and there is no defined boundary between levels of impacts.



Legend

- Proposed Mount Emerald wind turbine (indicative layout)
- Proposed substation (indicative location)
- ▲ Residential dwelling within 2 km of wind turbine
- (Distance from proposed Mount Emerald wind turbine
- Indicative site boundary
- Residential dwelling between 2 km and 5 km of wind turbine
- Existing transmission line
- Proposed access track
- Residential development or urban center

0km 2km



Figure 15
View locations

RAC
RATCH-Australia Corporation

GREEN BEAN DESIGN
landscape architects

MOUNT EMERALD WIND FARM

8.2 View location matrix

Table 16 – View location matrix (Refer Figure 15 for view locations)

View location (Refer to Figure 28)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
R05	Uninvolved landowner Residential dwelling High sensitivity	Very low	Short 1,800 m	High	Very Low	Short distance and elevated views will extend toward a very low number of wind turbines along the south west boundary of the project site. Views toward wind turbines will be restricted to upper sections of towers and rotors.	Medium
R27	Uninvolved landowner Residential dwelling High sensitivity	Very low	Short 1,930 m	High	Very Low to Low	Short distance and elevated views will extend toward a low number of wind turbines along the north to north east boundary of the project site.	Medium
R29	Uninvolved landowner Residential dwelling High sensitivity	Very low	Short 1,977 m	High	Medium	Short distance and elevated views will extend toward a medium number of wind turbines along the north and north east portion of the project site.	Medium to High
R30	Uninvolved landowner Residential dwelling	Very low	Short 1,890 m	High	Medium	Short distance and elevated views will extend toward a medium number of wind turbines along the north and north east portion of the project site. Some screening toward turbines from internal residential views and views from house veranda will occur through	Medium to High

Table 16 – View location matrix (Refer Figure 15 for view locations)

View location (Refer to Figure 28)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
	High sensitivity					tree planting surrounding and beyond dwelling.	
R35	Uninvolved landowner Residential dwelling High sensitivity	Very low	Short 1,948 m	High	Medium	Short distance and elevated views will extend toward a medium number of wind turbines along the north and north east portion of the project site. Vegetation surrounding the residential dwelling will provide some degree of screening toward the wind turbines.	Medium to High
R36	Uninvolved landowner Residential dwelling High sensitivity	Very low	Short 1,825 m	High	Medium	Short distance and elevated views will extend toward a medium number of wind turbines along the north and north east portion of the project site.	Medium to High
R49	Uninvolved landowner Residential dwelling High sensitivity	Very low	Short 1,815 m	High	Medium	Short distance elevated views will extend toward a medium number of wind turbines along the eastern portion of the project site.	Medium to High
R60	Uninvolved landowner Residential dwelling High	Very low	Short 1,846 m	High	Nil	Views toward wind turbines from main residential dwelling and cabins within the Allawah Retreat will be screened by rising landform and ridgeline topography to the west of the occupied area.	Nil

Table 16 – View location matrix (Refer Figure 15 for view locations)

View location (Refer to Figure 28)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
	sensitivity						
R78	Uninvolved landowner 2 Residential dwellings High sensitivity	Very low	Short 1,145 m	High	Very Low	Short distance and elevated views will extend toward a very low number of wind turbines within the north east portion of the project area.	Low to Medium
R89	Uninvolved landowner Residential dwelling High sensitivity	Very low	Short 1,100 m	High	Low	Short distance and elevated views will extend toward a very low number of wind turbines within the north portion of the project area.	Low
Assessment of residential dwellings between 2 km and 5 km of the proposed Mount Emerald wind turbines (Refer Figure 15 for locations)							
L01	Uninvolved landowners Residential dwellings High sensitivity	Very low	Short to Medium 2,300 m to 4,600 m	High	Nil to Very Low	Short to medium distance and elevated views will extend toward wind turbines along the western boundary of the project area from a small number of residential dwellings along Oak Creek Road. Views toward the wind turbines from a small number of residential dwellings located between the existing 275 kV transmission line corridors will be screened by topography. A small number of residential dwellings will have views toward the wind turbines screened by tree cover and vegetation along the	Low to Medium

Table 16 – View location matrix (Refer Figure 15 for view locations)

View location (Refer to Figure 28)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
						Oaky Creek corridor.	
L02	Uninvolved landowners Residential dwellings High sensitivity	Very low	Short to Medium 2,128 m to 4,365 m	High	Very Low to Low	Short to medium distance and elevated views will extend toward a very low to low number of wind turbines within the north west portion of the project area. Some degree of screening exists through tree cover surrounding and beyond residential dwellings.	Low to Medium
L03	Uninvolved landowners Residential dwellings High sensitivity	Very low	Medium 3,328 m to 3,600 m	High	Very Low	Medium distance and elevated views will extend toward a very low number of wind turbines within the north portion of the project area.	Low
L04	Uninvolved landowners Residential dwellings High sensitivity	Very low	Medium 4,150 m to 4,918 m	High	Nil to Medium	Medium distance views toward wind turbines will be largely screened by topography (sloping ground and ridgeline of Mount Uncle) as well as established tree cover surrounding and beyond residential dwellings.	Nil to Low
L05	Uninvolved landowners Residential dwellings High	Very low	Short to Medium 2,261 m to 3,483 m	High	Very Low to Medium	Short to medium distance and elevated views toward wind turbines from residential dwellings north of Channel Road will be partially screened by established tree cover surrounding and beyond a number of the residential dwellings.	Low to Medium

Table 16 – View location matrix (Refer Figure 15 for view locations)

View location (Refer to Figure 28)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
	sensitivity						
L06	Uninvolved landowners Residential dwellings High sensitivity	Very low	Medium 4,859 m to 4,248 m	High	Medium to High	Medium distance and elevated views will be partially screened by established tree cover surrounding and beyond residential dwellings.	Low
L07	Uninvolved landowners Residential dwellings High sensitivity	Very low	Short to Medium 2,363 m to 3,269 m	High	Medium	Short to medium distance and elevated views will extend toward a medium number of wind turbines within the east and south east portion of the project area.	Low to Medium
L08	Uninvolved landowners Residential dwellings High sensitivity	Very low	Medium 3,790 m to 4,969 m	High	Medium	Medium distance views toward wind turbines within the east portion of the project area from residential dwellings either side of the Kennedy Highway will be partially screened by tree cover.	Low to Medium
L09	Uninvolved landowners Residential dwellings High sensitivity	Very low	Short to Medium 2,069 m to 4,029 m	High	Very Low to Low	Short to medium distance views toward wind turbines within the east portion of the project area will be largely screened by established tree cover surrounding and beyond residential dwellings.	Low

Table 16 – View location matrix (Refer Figure 15 for view locations)

View location (Refer to Figure 28)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
L10	Uninvolved landowners Residential dwellings High sensitivity	Very low	Medium 3,986 m to 4,825 m	High	Very Low	Medium distance and elevated views toward wind turbines within the south portion of the project area are largely screened by topography. Views toward a very low number of wind turbines will be restricted to upper sections and tips of turbine structures.	Very Low
Assessment of developed areas and facilities between 2 km and 5 km of the proposed Mount Emerald wind turbines (Refer Figure 15 for locations)							
U01 Atherton	Uninvolved landowners Residential dwellings High sensitivity	High	Around 10 km	High	Very Low	Distant views toward the Mount Emerald wind farm turbines will be largely screened by a combination of tree cover and built structures within the urban area. Views will extend toward a small portion of the project area from elevated areas within Atherton; however, the wind turbines are unlikely to have any significant impact as a distant view.	Very Low
U02 Tolga	Uninvolved landowners Residential dwellings High sensitivity	High	Around 8 km	High	Very Low	Distant views toward the Mount Emerald wind farm turbines will be largely screened by a combination of tree cover and gently sloping landform which rises to the west of Tolga. The wind turbines are unlikely to have any significant impact as a distant view.	Very Low
U03 Range View	Uninvolved landowners Residential dwellings	High	3,400 m to 6,300 m	High	Very Low to Medium	Medium to distant views toward the Mount Emerald wind farm will be screened by established tree cover for the majority of residential dwellings within Range View. Residential dwellings located within elevated and cleared areas of Range View will have	Very Low to Low

Table 16 – View location matrix (Refer Figure 15 for view locations)

View location (Refer to Figure 28)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
	High sensitivity					medium to distant views toward wind turbines within the south portion of the project area which, due to distance, will not result in a significant level of visibility.	
U04 Walkamin	Uninvolved landowners Residential dwellings High sensitivity	High	Around 5 km	High	Medium to High	Medium to distant views toward the Mount Emerald wind turbines from the majority of residential dwellings within Walkamin will be screened by established tree planting surrounding and beyond residential dwellings, as well as tree planting alongside the Kennedy Highway corridor.	Low
F01 Lotus Glen Correctional Centre	Uninvolved dwellings	High	3,250 m	High	Low	Medium distance and elevated views will extend toward wind turbines within the north portion of the project area. Some screening will occur where views are disrupted or screened by built structures within the centre. Views will more likely occur from open areas including those for recreation in the east portion of the centre.	Low
F02 Tableland Mill	Uninvolved landowners and commercial facility Residential dwellings High	Very Low	3,342 m	High	Very Low	Medium distance and elevated views will extend toward a very low number of wind turbines within the north portion of the project area. Views from within the industrial complex, as well as a small number of dwellings immediately north of the mill, will tend to be screened by mill infrastructure and established tree cover.	Nil to Low

Table 16 – View location matrix (Refer Figure 15 for view locations)

View location (Refer to Figure 28)	Category of view location and sensitivity	Relative number of people	Approximate distance to closest turbine	Duration of effect	Extent of visibility (ZVI hub height)	Degree of visibility	Visual significance
F03 Springmount Waste Management Facility	Commercial facility	Very Low	Adjoining	High	Very Low	Very short distance and elevated views will extend toward a very low number of wind turbines within the north portion of the project area from the working area of the waste management facility.	Low

8.3 Summary of residential visual significance (within 2 km of wind turbines)

This LVIA identified a total of 11 uninvolved residential view locations within the Mount Emerald wind farm 2 km viewshed. Unoccupied residential dwellings have been included and assessed as part of this LVIA where structures and buildings were considered to be habitable at the time of the field work. An assessment of each potential residential view location indicated that for the Mount Emerald wind turbine design layout:

- 1 of the 11 residential view locations has been determined to have a nil visual significance;
- 1 of the 11 residential view locations has been determined to have a low visual significance;
- 2 of the 11 residential view locations have been determined to have a low to medium visual significance;
- 2 of the 11 residential view locations have been determined to have a medium visual significance;
- 5 of the 11 residential view locations have been determined to have a medium to high visual significance; and
- 0 of the 11 residential view locations has been determined to have a high visual significance.

The field assessment for the majority of residential view locations was undertaken from the closest publicly accessible location, with a conservative approach adopted where there was no opportunity to confirm the actual extent of the available view from areas within or immediately surrounding the residence. It is anticipated that some visibility ratings would be less than those determined subject to a process of verification from private property.

8.4 Summary of residential visual significance (beyond 2 km of wind turbines)

The majority of residential dwellings located beyond a 2 km distance from the wind turbines are unlikely to be significantly impacted by the wind farm development and have been determined to have an overall low to medium and medium visual significance between 2 km and 5 km of the wind turbines. The localised influence of topography, as illustrated in the ZVI diagrams, has some direct impact on the extent and nature of views between the 2 km and 5 km viewshed.

8.5 Future residential dwellings

In general existing residential dwellings in the vicinity of the wind farm are located below surrounding ridgelines and where exposed tend to include a degree of shelter from windbreak planting or tree planting around dwellings. The tendency to locate residential dwellings in sheltered situations also acts to limit the extent of available views across the surrounding landscape for the majority of residential view locations, although there are a small number of dwellings that appear to have been located on properties to take advantage of distant and panorama views.

Potential future planning considerations for residential dwellings would be able to take advantage of any approved layout design for the Mount Emerald wind farm when determining the optimal location for residential dwellings on individual portions of land to minimise views toward wind turbines if desired. In some circumstances future residential dwellings could be located to take advantage of local topographic features in order to screen views toward wind turbines or implement in advance mitigation measures such as tree planting for windbreak and/or screening purposes.

Should residential dwellings be constructed on existing portions of land immediately adjacent to the wind farm site, there is likely to be an associated visual impact not only with additional residential structures within the landscape but also a range of domestic infrastructure associated with it.

8.6 Towns and localities

There are a small number of towns and localities within the Mount Emerald wind farm viewshed. These generally occur along, or in proximity to the Kennedy Highway corridor and to the east of the wind farm project area. Views toward the Mount Emerald wind farm project site from towns and localities are partially restricted by a combination of landform, vegetation and built structures within urban areas. Overall the Mount Emerald wind farm will have a very low to low visual impact on the majority of residential dwellings within surrounding towns and localities.

8.7 Local roads and highways

There are a small number of local roads that pass through the landscape surrounding the wind farm project area including the:

- Hansen Road;

- Channel Road;
- Springmount Road;
- Chettle Road; and
- Oaky Valley Road.

Views from vehicles travelling along local road corridors surrounding the project site would include a combination of short to medium distance direct and indirect views toward wind turbines. Whilst wind turbines may be visible whilst driving through the project site, it is likely that the majority of journeys will comprise very short to short duration views and not result in significant visual effects.

The Kennedy Highway extends north south to the east of the project area between and is approximately 4 km at its closest point to the wind turbines. Medium to long distance direct and indirect views toward the Mount Emerald wind farm site will tend to be screened by roadside tree planting, as well as larger areas of established tree cover beyond the road corridor. Views from the Kennedy Highway will tend to be of short duration and unlikely to be significant in magnitude or visual effect.

Cumulative assessment

Section 9

9.1 What is cumulative assessment?

A cumulative impact can result from a proposed wind farm development being constructed in conjunction with other existing or proposed wind farm developments, and could be either associated or separate to it.

Separate wind farm developments can occur within the established viewshed of the proposed wind farm, or be located within a regional context where visibility is dependent on a journey between each site or an individual project viewshed. Cumulative impacts presented by multiple wind farm developments may be presented as 'direct', 'indirect' or 'sequential' impacts.

- 'direct' cumulative visual impacts could occur where two or more wind farms have been constructed within the same locality, and could be viewed from the same view location simultaneously.
- 'indirect' cumulative visual impacts could occur where two or more wind farms have been constructed within the same locality, and could be viewed from the same view location but not within the same field of view.
- 'sequential' cumulative visual impacts could arise as a result of multiple wind farms being observed at different locations during the course of a journey (e.g. from a vehicle travelling along a highway or from a network of local roads), which could form an impression of greater magnitude and impact within the construct of short term memory.

9.2 State and regional wind farm developments

There is one operational wind farm within the regional area. The Windy Hill wind farm, commissioned in 2000, comprises 20 wind turbines and is located approximately 50 km to the south south-east of the Mount Emerald wind farm project site. The number and location of wind farms is likely to change as more wind farm projects are announced and enter the state or local planning system.

The distance between the operational Windy Hill wind farm and the proposed Mount Emerald project site will limit the opportunity for any 'direct' or 'indirect' visual impacts.

‘Sequential’ visual impacts will also tend to be limited by the distance and travel time between the existing and proposed wind farm development.

GBD is not aware of any smaller wind farm developments that are currently lodged, or being assessed by the relevant local government authorities.