

White Rock Wind Farm Stage 2 Modification 6 Application

VISUAL IMPACT ASSESSMENT

Prepared for:



Prepared by:

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November 2017

DOUCMENT CONTROL

Item	Detail
Project Name:	White Rock Wind Farm Stage 2 Modification 6 Application
Report Title:	Visual Impact Assessment
Project Number:	17-230
Version Number:	v3
Status:	Final
Author:	Andrew Homewood, Registered Landscape Architect, AILA <i>Graduate Diploma Landscape Management, Bachelor Science (Dual Honours)</i> <i>Landscape Design and Archaeology, National Diploma Horticulture</i>
Date:	2 November 2017

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Table 1 Glossary

Term	Definition
Cumulative effects	The summation of effects that result from changes caused by a development in conjunction with other past, present or reasonably foreseeable actions.
Magnitude	A combination of the scale, extent and duration of an effect.
Mitigation	Measures, including any processes, activity or design to avoid, reduce, remedy or compensate for adverse landscape and visual effects of a development project.
Residual visual effect	Observable difference between the approved WRWF and the proposed modification.
Sensitivity	Susceptibility of a receiver to a specific type of change.
Swept area	Circular area defined by the rotational path of the rotor blades.
Visibility	A relative determination at which the proposal can be discerned and described.
Visual amenity	The value of a particular area or view in terms of what is seen.
Visual effect	The changes in the character of the available views resulting from the development or the changes in visual amenity of the visual receivers.
Visual Impact Assessment	A process of applied professional and methodical techniques to assess and determine the extent and nature of change to the composition of existing views that may result from a development.
View location	A place or situation from which a proposed development may be visible.
Visual receiver	Individual and/or defined groups of people who have the potential to be impacted.
Visual significance	A measure of visual effect culminating from the degree of magnitude and receiver sensitivity.
Zone of Visual Influence Diagram	A map, usually digitally produced, showing areas of land within which wind turbines are theoretically visible.

Executive summary

Green Bean Design Pty Ltd has been commissioned by Goldwind Australia Pty Ltd, to prepare a Visual Impact Assessment report for the White Rock Wind Farm Stage 2 Modification 6 Application (WRWF Stage 2). The application is for an amendment of the Project Approval in accordance with Section 96(2) of the Environment Planning and Assessment Act 1979.

This Visual Impact Assessment report has been prepared with regard to the visual assessment process outlined in the New South Wales State Government Wind Energy: Visual Assessment Bulletin December 2016 (the Guidelines) as applicable to the WRWF Stage 2.

The White Rock Wind Farm (Modification 4) Consolidated Project Approval (dated May 2017) permits the construction and operation of up to 119 wind turbines to a maximum 150 metre tip height. Subsequent to the Project Approval, the White Rock Wind Farm is being developed in Stages 1 and 2.

Construction of the White Rock Wind Farm Stage 1 is effectively complete and has included the installation of 70 Goldwind GW121-2.5MW wind turbines with an approximate 150 metre tip height. The Stage 1 wind turbine locations are illustrated in **Figure 1**.

This VIA has been prepared to assess the potential visual effect of the WRWF Stage 2 and includes for two potential wind turbine models with an increased wind turbine dimension as follows:

- Maximum blade tip height up to approximately 200 metres (150 metres for existing Project Approval)
- Wind turbine rotor diameter up to approximately 140 or 170 metres (100 metres for previous VIA)
- Wind turbine blade length up to approximately 85 metres and
- Hub height up to approximately 130 metres, but dependent on selected rotor diameter.

The location of 28 WRWF Stage 2 wind turbines would remain in accordance with the Project Approval, July 2012. A total of 20 WRWF Stage 2 wind turbines would be relocated from the Project Approval locations largely in response to ongoing consultation with non-associated landowners.

The VIA included the following tasks:

- Preparation of Zone of Visual Influence (ZVI) Diagrams (**Figures 2 and 3**)
- Preparation of 19 wire frame models and 5 photomontages to illustrate the WRWF Project Approval and Stage 2 wind turbines. The wireframe models and photomontages are illustrated in **Figures 7 to 30**
- Assessment of 19 non-associated residential dwellings surrounding (and within 4 kilometres of) the WRWF Project Approval and
- Review of any changes to ancillary facilities.

The findings of the VIA include the following:

The ZVI for the approved and modified Stage 2 demonstrate that the area of land within which the approved WRWF Project and modified WRWF Stage 2 would be theoretically visible would be similar, as would the overall number of wind turbines visible at tip height.

Previously approved and largely constructed ancillary wind farm infrastructure would not result in a significant change in levels of visual impact from surrounding key receiver locations due to the changes involved, the low height of ancillary facilities and locations of these facilities that are often concealed by topography and vegetation screening.

The modified WRWF Stage 2 is not considered to be of a magnitude that would significantly increase visual effects relative to the WRWF Project Approval. Key differences in the approved WRWF Project and modified Stage 2 are illustrated in **Figures 4, 5 and 6**.

The modified WRWF Stage 2 would not introduce elements that are any more prominent or out of character with the approved WRWF Project, and the potential for the modified Stage 2 wind turbines to result in any additional significant cumulative visual effects is considered to be low. The proposed WRWF Stage 2 would result in an overall low-level change in visibility and a largely unchanged visual impact rating in accordance with the White Rock Wind Farm Project Approval.

1 Introduction

Green Bean Design Pty Ltd (GBD) has been commissioned by Goldwind Australia Pty Ltd (the Proponent) to prepare a Visual Impact Assessment (VIA) report for the modified WRWF Stage 2.

This VIA has been prepared to compare and assess the potential visual effect of the proposed WRWF Stage 2 with the visual ratings determined for the WRWF Project Approval. The WRWF visual ratings have been extracted from the White Rock Wind Farm Landscape and Visual Impact Assessment (Green Bean Design Pty Ltd, March 2011).

This VIA has included consideration of the:

- WRWF Project Approval wind turbines which have been deleted and or relocated within the project site.
- WRWF Project Approval Stage 1 wind turbines. All the WRWF Stage 1 wind turbines have been constructed and are mostly operational. As such, Stage 1 turbines are not subject to the modification application.
- Approved WRWF Stage 2 wind turbines. The approved WRWF Stage 2 wind turbines are located in accordance with the WRWF Project Approval and subject to the proposed modification application.
- Modified WRWF Stage 2 wind turbines. The modified WRWF Stage 2 wind turbines have been relocated from the Project Approval locations following discussions with the associated landowners and are subject to the modification application.

The comparison of the WRWF Project Approval and proposed WRWF Stage 2 has been used to determine if any of the approved WRWF visual ratings applied to view locations within 4 kilometres of the WRWF Project Approval are subject to an increased level of visual effect as a result of the Stage 2 wind turbines.

GBD confirm the following information has been provided by the Proponent, or procured by GBD, for consideration and/or incorporation into this VIA:

- location and description of proposed wind turbine modifications
- Zone of Visual Influence (ZVI) diagrams
- wireframe models illustrating the installed Stage 1 turbines, approved WRWF Stage 2 wind turbines and the modified WRWF Stage 2 wind turbines
- photomontages illustrating the installed WRWF Stage 1 wind turbines (where relevant) and the modified WRWF Stage 2 wind turbines
- White Rock Wind Farm Landscape and Visual Impact Assessment, Green Bean Design March 2011 and
- New South Wales Government Wind Energy: Visual Assessment Bulletin December 2016.

2 Report structure

2.1 Report structure

This VIA report been structured into eleven parts as follows:

Table 2 – Report structure

Report section	Description
Section 1 Introduction	Overview of scope of VIA and summary of project information provided to or sourced by GBD in order to undertake the VIA.
Section 2 Report structure	This section provides a description of the report structure.
Section 3 Methodology	This section sets out the methodology employed in the VIA preparation.
Section 4 Approved White Rock Wind Farm and modified WRWF Stage 2	This section describes the key differences in wind turbine layout and design criteria between the WRWF Project Approval and WRWF modified Stage 2.
Section 5 Zone of Visual Influence (ZVI) diagrams	This section identifies the area of land surrounding the wind farm from which wind turbines, or portions of wind turbine structures, may be theoretically visible
Section 6 Ancillary structures	This section describes infrastructure associated with the wind farm other than the wind turbines
Section 7 Assessment of visual effects	This section describes the assessment and determination of residual visual effects between WRWF Project Approval and modified WRWF Stage 2.
Section 8 Visual Assessment	This section describes the application of the NSW State Government Wind Energy: Visual Assessment Bulletin December 2016 to the modified WRWF Stage 2
Section 9 Wire frame models and photomontages	This section describes and presents the wire frame models and photomontage prepared for the modified WRWF Stage 2.

Table 2 – Report structure

Report section	Description
Section 10 Review of Conditions of Approval	This section identifies the WRWF Conditions of Approval relevant to visual amenity and confirms their applicability to the modified WRWF Stage 2.
Section 11 Conclusion	Conclusions are drawn on the overall visual impact of the modified WRWF Stage 2.

3 Methodology

3.1 Introduction

The visual assessment methodology for the WRWF modified Stage 2 included the following activities:

- review of the original project application and VIA undertaken and the WRWF project layouts for the approved and modified WRWF Stage 2
- preparation of ZVI diagrams (approved and modified) projects
- preparation of wire frame models, photomontages and illustrative figures and
- assessment of significance of residual visual effects and changes in visual impacts.

3.2 Project review

A review of the WRWF Project Approval was carried out to confirm the location of sensitive view locations and the visual impact ratings determined through previous landscape and visual impact assessments. This review also included familiarisation with the NSW Department of Planning and Environment (DPE) Assessment Report and the Consolidated Project Approval Conditions.

3.3 ZVI diagrams

ZVI Diagrams were prepared to illustrate the theoretical visibility of the WRWF Project Approval wind turbines (tip height at 150 metres) and WRWF Stage 2 wind turbines (tip height at approximately 200 metres). The ZVI Diagrams are illustrated in **Figures 2 and 3**.

3.4 Residual visual effects

The WRWF Stage 2 residual visual effects on surrounding receiver locations would result from a combination of wind turbine visibility (beyond that of the Project Approval) and the characteristics of the landscape between, and surrounding, the receiver locations and the wind farm. The potential degree of visibility and resultant visual effect in addition to the WRWF Project Approval visual effect, would be partly determined by a combination of factors such as:

- category and type of situation from which people could view the wind farm (examples of view location categories include residents or motorists)
- visual sensitivity of view locations surrounding the wind farm
- distance of visual effect (between view locations and the wind farm) and
- duration of time people could view the wind farm from any particular static or dynamic view location.

3.5 Visual Assessment

The WRWF modified Stage 2 VIA has undertaken a further visual assessment which extends to residential dwellings located within 4 kilometres of the WRWF Project Approval wind turbines. The 4 kilometre threshold distance (blue line, refer **Figure 1**) has been established by reference to the Guidelines (Figure 5 Visual magnitude thresholds for visual assessment).

This VIA has not addressed the Stage 1 Preliminary Environmental Assessment (pre-lodgement) guidelines as these do not appear to be pertinent to the preparation of a wind farm modification.

Similarly, Stage 2 of the Guidelines (Figure 1, Steps in the Visual Assessment), addresses the preparation of a Visual Baseline Study as part of the Environmental Impact Statement, which is also not pertinent to the proposed modification.

This VIA has considered the Visual Assessment Process set out in Appendix 1 of the Guidelines against the modified WRWF Stage 2 project as relevant to the Modification Application.

3.6 Wire frame models and photomontages

Wire frame models and photomontages have been prepared from residential dwelling and public view locations surrounding the WRWF Project Approval and Stage 2 wind farm site. The wire frame models and photomontages illustrate and contrast the WRWF Project Approval wind turbines and the proposed WRWF Stage 2 wind turbines. The wireframe models and photomontages are illustrated in **Figures 7 to 30**.

4 WRWF Stage 2 approved and modified wind turbines

4.1 WRWF wind turbine assessed for the current approval

The WRWF Project Approval permits construction and operation of up to 70 Stage 1 and 49 Stage 2 wind turbines and the installation of wind turbines to a maximum tip height of 150 metres. As the WRWF Stage 1 wind turbine construction is effectively complete, this section of the VIA considers differences between the WRWF approved and modified Stage 2 designs only.

The VIA for the approved wind farm was based on an 85.5 metre hub height and 112 metre rotor blade diameter with a maximum wind turbine height of 150 metres (measured from above ground level to the blade tip) and a modification application approval is required to enable development of the proposed WRWF Stage 2 project.

4.2 WRWF Stage 2 modified wind turbines

The WRWF Stage 2 would include a wind turbine with an approximate tip height up to 200 metres. This may consist of a wind turbine model comprising a 70 metre blade length and a 130 metre high hub or an 85 metre blade length and a 115 metre high hub. In summary the proposed WRWF Stage 2 would include:

- up to 48 wind turbines (28 in original locations and 20 in alternative locations)
- an increase of the blade tip height up to approximately 200 metres
- a hub height up to approximately 115 or 130 metres
- an increase in blade length to approximately 70 or 85 metres and
- an increase in rotor diameter up to approximately 140 or 170 metres.

Table 3 outlines the differences between the Project Approval (Stage 1 constructed) and the proposed WRWF Stage 2 wind turbine design criteria.

Table 3: WRWF Project Approval and proposed WRWF Stage 2 design criteria

Planning phase	Hub height	Rotor diameter	Rotor swept area	Max. tip height	Total number
WRWF VIA Mar 2011	85.5 m	112 m	9,856 m ²	140 m	119
WRWF Stage 1 installed (approved Mod 3)	89.5 m	121 m	11,499 m ²	150 m	70
WRWF modified Stage 2 wind turbine (Mod 6)	Up to 130 m	up to 170 m (140 m)	22,698 m ² (15,393 m ²)	200 m	48 (Total 118)
Difference compared to Stage 1 installed	+40.5 m	+49 m (+19 m)	+11,199 m ² (3,894 m ²)	+50 m	-1
Percentage difference	45%	+40% (+15.7%)	(+97%) (+33.8%)	+33%	-0.8%

The layout for the WRWF Project Approval and WRWF Stage 2 is illustrated in **Figure 1**.

4.3 WRWF Project Approval and proposed WRWF Stage 2 wind turbine visibility

The modified WRWF Stage 2 wind turbine layout would result in both increases and decreases in the extent of wind turbine tip and hub visibility from residential dwellings surrounding the wind farm site. **Table 4** identifies residential dwellings within 4 kilometres of a wind turbine and the associated changes in wind turbine visibility.

Table 4 Change in wind turbine visibility

Non-associated residential dwelling (Figure 1)	Distance to closest WRWF Stage 2 wind turbine (m)	Wind turbine hubs and tips theoretically visible* (Tips in brackets)			GBD Visibility Rating** (2011)
		WRWF Project Approval (119 wind turbines)	WRWF Stage 1 and modified Stage 2 (118 wind turbines)	Difference	
D121	4,002	46 (68)	55 (76)	9 (8)	Moderate
E140	2,236	43 (61)	53 (68)	10 (7)	Moderate
S160	1,968	0 (4)	0 (1)	0 (-3)	Nil
S170	2,007	0 (1)	3 (6)	3 (5)	Nil
T170	3,083	4 (5)	0 (0)	-4 (-5)	Nil
Q170	1,556	8 (8)	7 (8)	-1 (0)	Moderate
S180	3,269	5 (9)	5 (6)	0 (-3)	Low
N180	1,631	39 (53)	40 (54)	1 (1)	High
N190	1,764	23 (35)	18 (34)	0 (5)	High
P190	3,031	6 (9)	0 (7)	-6 (-2)	Moderate
R190	1,457	5 (9)	2 (7)	-5 (-2)	Moderate
L200	1,342	14 (17)	8 (24)	-6 (7)	Moderate
L220	1,507	3 (4)	2 (9)	-1 (5)	Derelict building (not assessed)
I221	2,303	11 (11)	11(16)	0 (5)	Low
I222	1,918	11 (12)	12 (18)	1 (6)	Low
M221	3,858	25 (45)	31 (57)	6 (12)	Moderate
M220	2,486	12 (26)	17 (36)	5 (10)	Moderate
N230	4,002	25 (45)	29 (48)	4 (3)	Moderate
L230	2,236	3 (6)	4 (6)	1 (0)	Low

Notes:

* Wind turbine hub visibility has been determined using the proposed 130 metre hub height. The theoretical visibility does not account for existing vegetation or other structures that may limit views to wind farm.

**Green Bean Design Pty Ltd, White Rock Wind Farm Landscape and Visual Impact Assessment – March 2011.

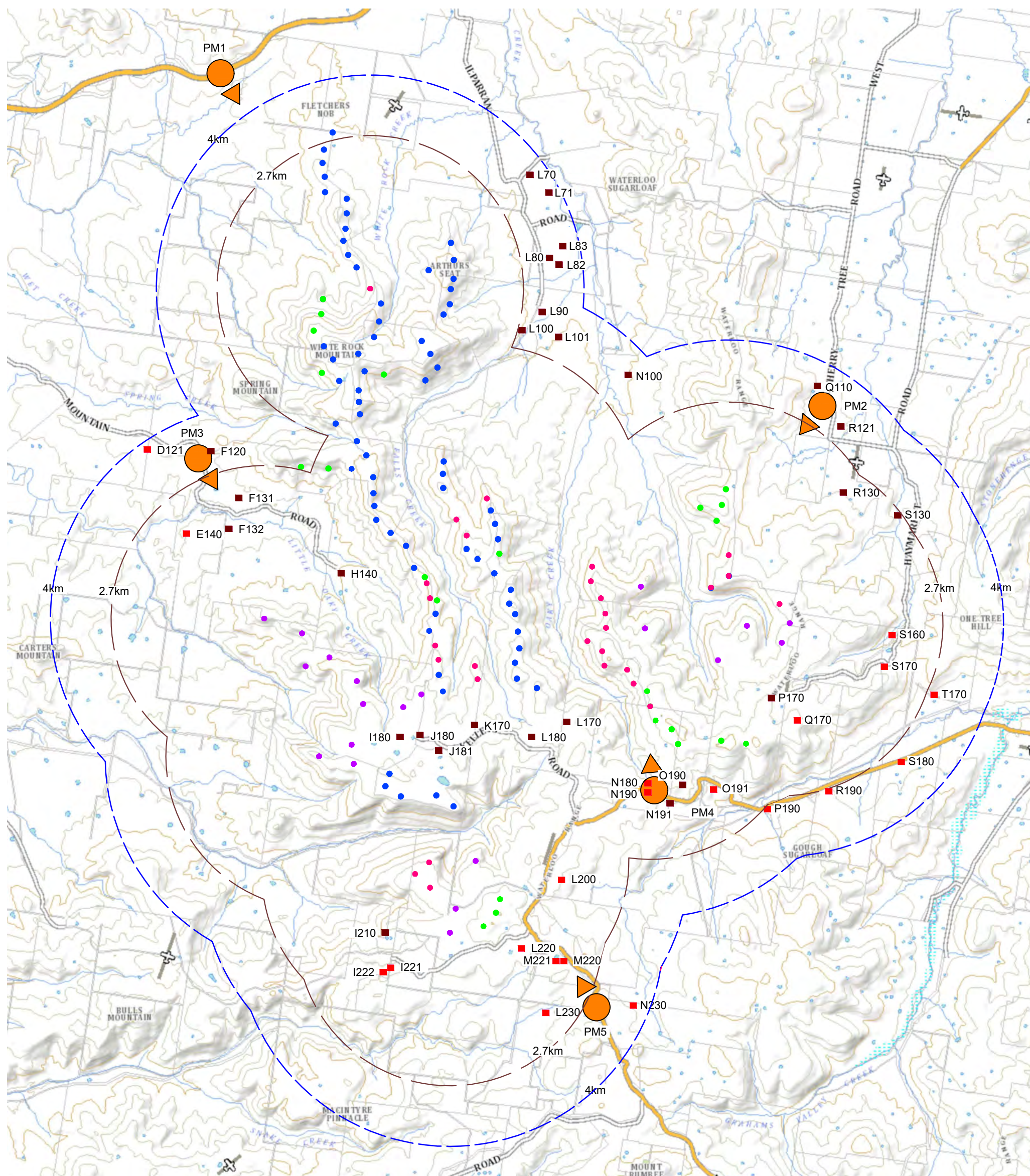
4.4 Magnitude of visual effects

The determination of residual visual effects resulting from the modified WRWF Stage 2 wind turbines would result primarily from observable differences between the WRWF Project Approval and modified WRWF Stage 2 wind turbines, including an increase of 50 metres in maximum tip height and increase in the wind turbine rotor swept area (refer **Figure 4**). Observable differences for some dwellings would include views toward additional wind turbines (blade tips) where previously screened by landform and/or vegetation.

This VIA notes that there would be a reduction in the number of wind turbines visible for eight of the nineteen non-associated residential dwellings within 4 kilometres of the WRWF Stage 2 wind turbines.

Table 4 indicates that the modified WRWF Stage 2 wind turbines would result in additional wind turbine blades being visible at eleven residential dwellings within 4 kilometres of the Project Approval wind turbine locations. Eight of the eleven dwellings will have views to less than 10 additional hubs and/or blades.

Views toward additional wind turbine rotors and blade tips are not considered to result in a magnitude of visual effect which is greater than the magnitude of visual effect associated with the WRWF Project Approval.



Legend

- | | | | | |
|---|---|---|------|---|
|  | Not Stage 1 or 2
(wind turbine removed) |  | H140 | Associated dwelling
or neighbour agreement |
|  | Project Approval
(Stage 1 Constructed) |  | L200 | Non associated dwelling |
|  | Project Approval
(Stage 2 Approved subject to Mod) |  | | 2.7 km wind turbine distance offset in accordance with DPE
Visual Bulletin Dec 2016, Figure 5 - 200 metre tip height |
|  | Stage 2 wind turbine (subject to Mod) |  | | 4 km wind turbine distance offset in accordance with DPE
Visual Bulletin Dec 2016, Figure 5 - 200 metre tip height |

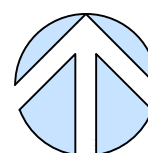
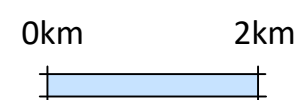


Figure 1 -
WRWF Project Approval and
Stage 2 wind turbine layout with
residential dwellings to 4km

5 Zone of Visual Influence Diagrams

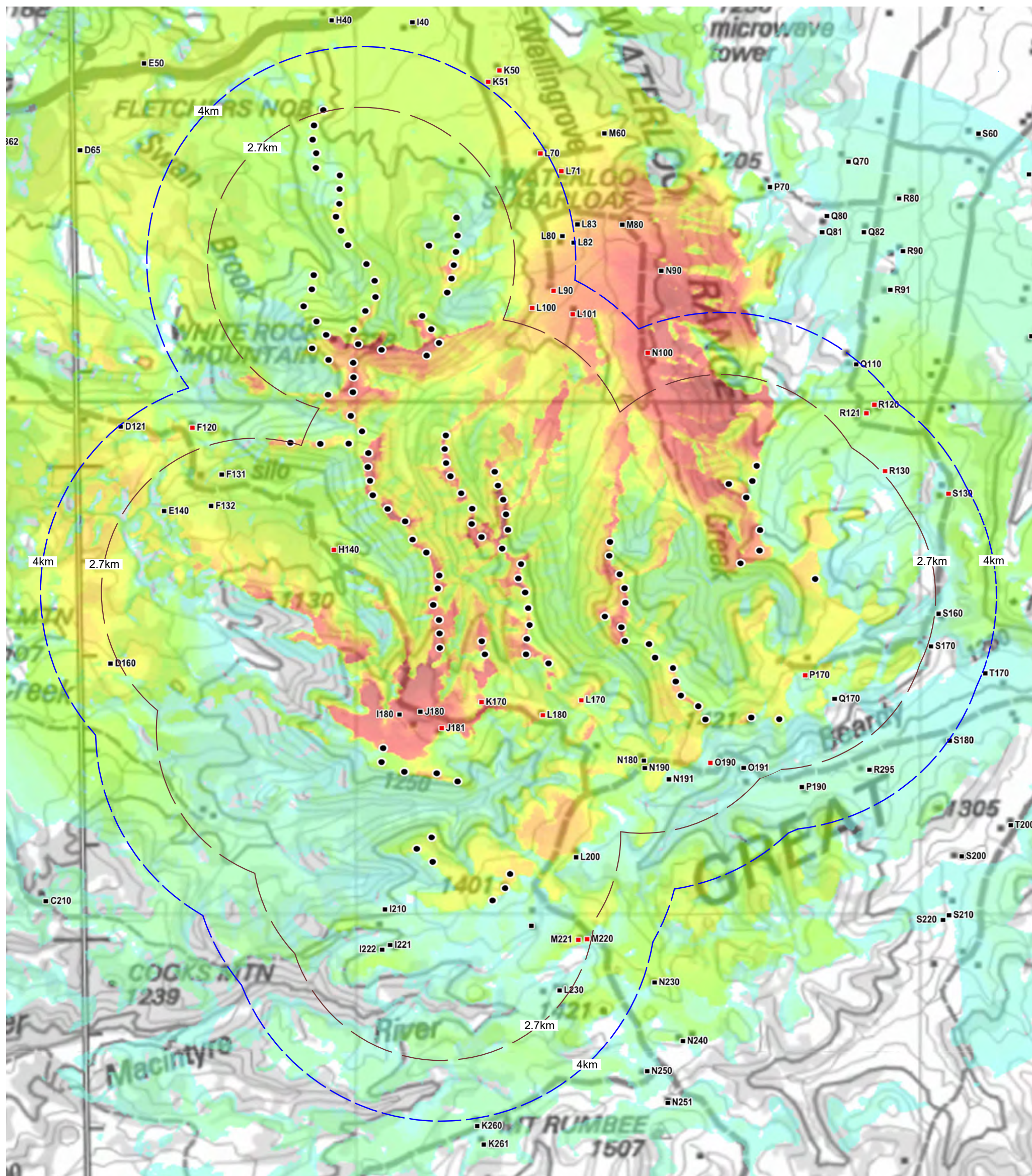
5.1 Introduction

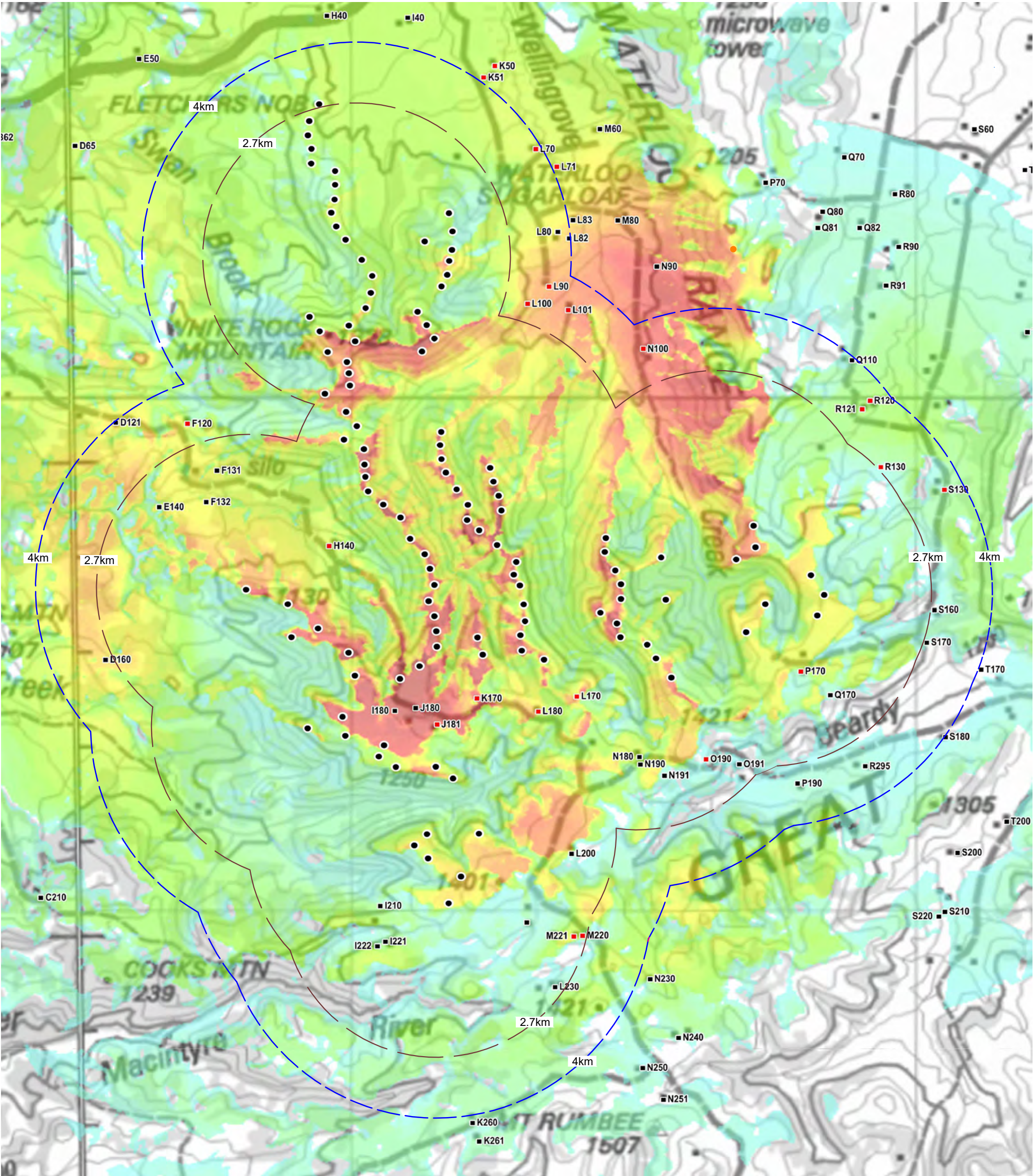
Within the recognised limitations of Zone of Visual Influence (ZVI) diagrams, the overall extent of visibility for the WRWF approved and modified WRWF Stage 2 wind turbines, covers a very similar extent within 4 kilometres of the landscape surrounding the approved WRWF wind farm.

Figure 2 illustrates the theoretical visibility of the WRWF Project Approval at a 150-metre tip height. **Figure 3** illustrates the modified WRWF Stage 2 wind turbines at approximately 200 m tip height.

The similarity in theoretical wind turbine visibility shown in **Figures 2** and **3** demonstrates the influence of local topographical features on views toward the WRWF Project Approval and Stage 2 wind turbines. The ZVI diagrams also illustrate that the modified WRWF Stage 2 wind turbines would have a very limited increase in visual effects across the WRWF viewshed.

Whilst the overall extent of wind turbine visibility would be contained by topography for both the WRWF approved and modified WRWF Stage 2 wind turbines, the number of wind turbine hubs and tips visible from receiver locations within the wind farm viewshed is likely to be subject to a marginal increase. The theoretical maximum change in blade tip visibility for any residence is 12 additional blade tips. The maximum change is in respect of residences M221 (12 additional tips) and E140, (10 additional hubs). The maximum change in visibility is derived from the preparation of the wire frame diagrams. The wire frame diagrams do not account for screening provided by trees and vegetation and are therefore very conservative in the number of wind turbine blade tip visibility.





Legend

Zone of Visual Influence
(Tip height)

- 0
- 1-28
- 29-57
- 58-85
- 86-114

■ H140 Associated dwelling
or neighbour agreement

■ L200 Non associated dwelling

--- 2.7 km wind turbine distance offset in accordance with DPE
Visual Bulletin Dec 2016, Figure 5 - 200 metre tip height

--- 4 km wind turbine distance offset in accordance with DPE
Visual Bulletin Dec 2016, Figure 5 - 200 metre tip of blade

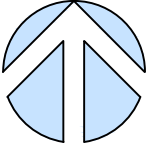


Figure 3 -
WRWF Project Approval and
Stage 2 ZVI Diagram (150 and 200
metre tip of blade)

White Rock Wind Farm Stage 2

6 Ancillary infrastructure

6.1 Introduction

The Consolidated Project Approval defines ancillary infrastructure as follows:

‘Temporary facility for construction, including for example an office and amenities compound, construction compound, batch plant (concrete or bitumen), materials storage compound, maintenance workshop, testing laboratory or material stockpile area’.

Ancillary infrastructure may also include:

- additional overhead 33kV powerlines and
- new temporary construction facilities and compounds.

The modified WRWF Stage 2 would include some minor changes to the above ancillary infrastructure and infrastructure previously approved and constructed as part of the WRWF Stage 1 project. The WRWF Stage 2 changes to proposed ancillary infrastructure would not be expected to result in any significant additional level of visual effects and would be largely involve temporary change.

7 Assessment of visual effects

7.1 Introduction

This section considers the visual effect of the modified WRWF Stage 2 wind turbines compared to the approved WRWF Stage 2 wind turbines. It is noted that the modified WRWF Stage 2 wind turbines would be consistent with the approved WRWF wind turbines with regard to their visual form, design, pattern and colour. This VIA therefore focusses on the change in wind turbine dimensions for the modified WRWF Stage 2 wind turbines relative to those allowed under the Project Approval. **Figures 4, 5 and 6** provide illustrations of the change in turbine dimensions and consider the appearance at different distances. **Tables 6 and 7** describe the characterisation of visual effect (magnitude) and for respective receiver locations.

7.2 Perception of changes in Visual magnitude

A comparison of the WRWF approved and modified Stage 2 wind turbine is illustrated in **Figure 4**. **Figures 5 and 6** consider:

- the representation of the WRWF approved and modified Stage 2 wind turbine in terms of comparative height when viewed from 2 and 5km
- the change in vertical view angle for the two turbines at 2 and 5 km. **Figure 5** illustrates that the modified Stage 2 wind turbine would include an additional and approximate one and a half degrees view angle above the approved 150 metre tip of blade wind turbine from a 2 kilometre view distance. The additional view angle from a view distance of 5 kilometres would be around half of a degree (34 minutes) increase in view angle.
- the perceived visual scale at 2.7 kilometres and 4 kilometres. **Figure 6** illustrates the perceived and relative height difference between the 150 metre tip height wind turbine for the WRWF Project Approval and the modified WRWF Stage 2 wind turbine with 200 metre tip height. At a view distance of 4 kilometres the WRWF approved and modified Stage 2 wind turbines would be perceived at less than half the height of the wind turbines when viewed at a distance of 2.7 kilometres. The relatively small increase in view angle toward the modified WRWF Stage 2 wind turbine tip height, at a view distance of 4km (and beyond) is considered unlikely to result in a level of visual magnitude greater than the WRWF Project Approval wind turbines.

Whilst the modified WRWF Stage 2 wind turbines would extend above the WRWF Project Approval tip height of 150 metres; this VIA has determined, using the methods described in this section, that the overall scale of the modified WRWF Stage 2 wind turbines at a 4km (and beyond) view distance would not result in an order of visual magnitude that is significantly greater than the visual magnitude of the WRWF Project Approval wind turbines. Within the parameters of normal human vision, the modified WRWF wind turbines are not considered to give rise to an increased level of visual magnitude over and above that determined for the approved WRWF project.

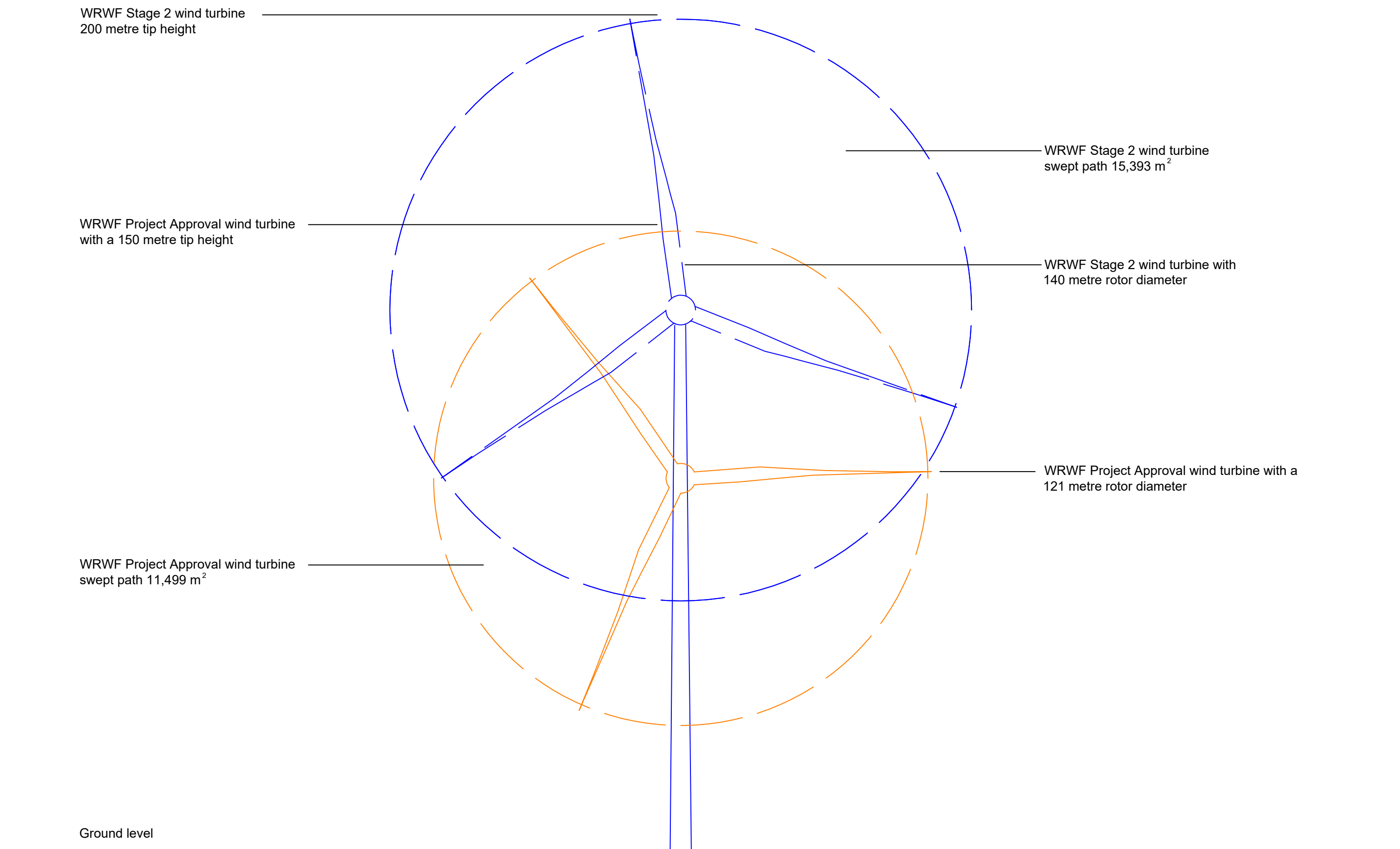


Figure 4 -
WRWF Project Approval and
Stage 2 (130 m hub and 70 m blade)
wind turbine comparison

White Rock Wind Farm Stage 2

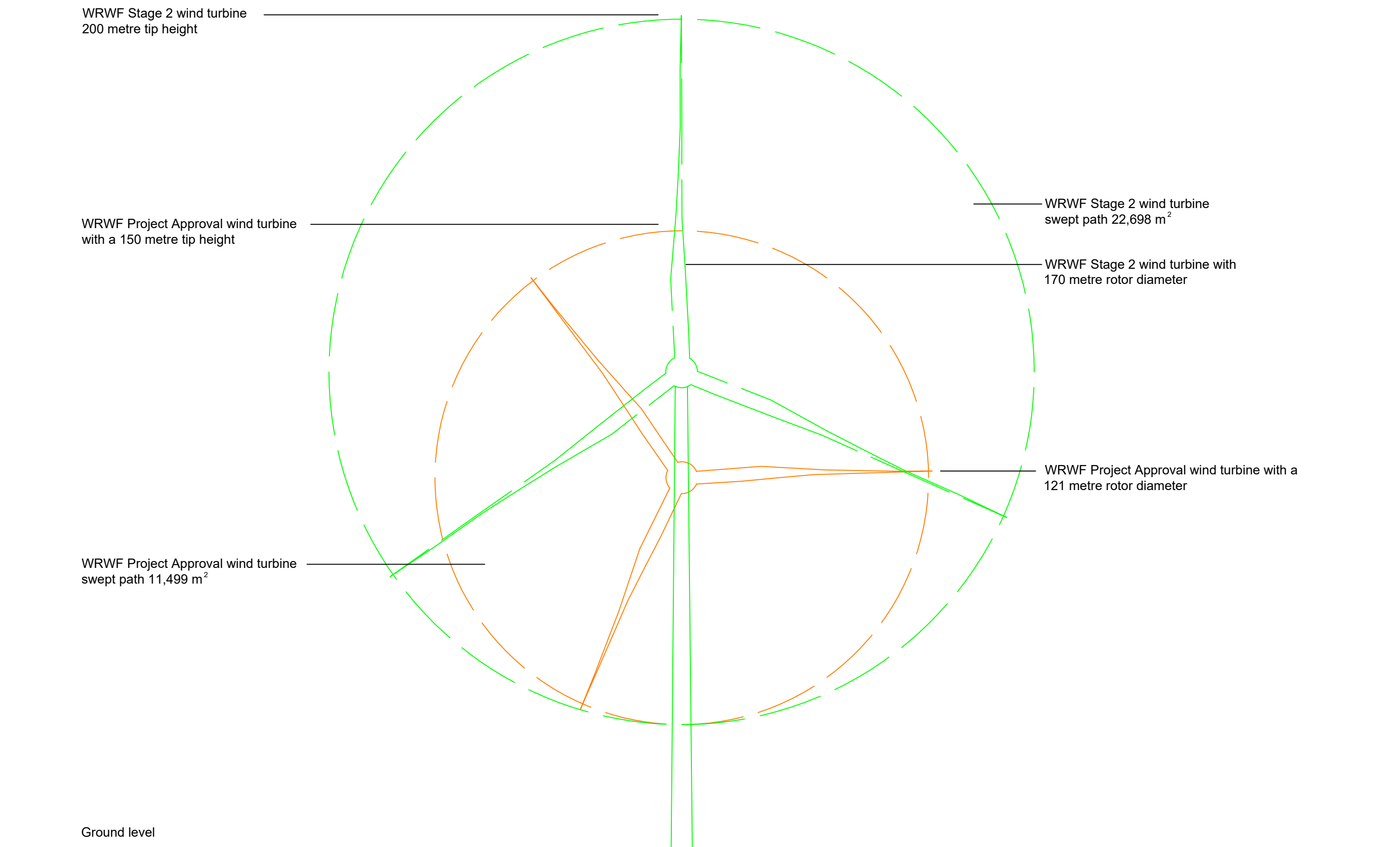


Figure 4a -
WRWF Project Approval and
Stage 2 (115 m hub and 85 m blade)
wind turbine comparison

White Rock Wind Farm Stage 2

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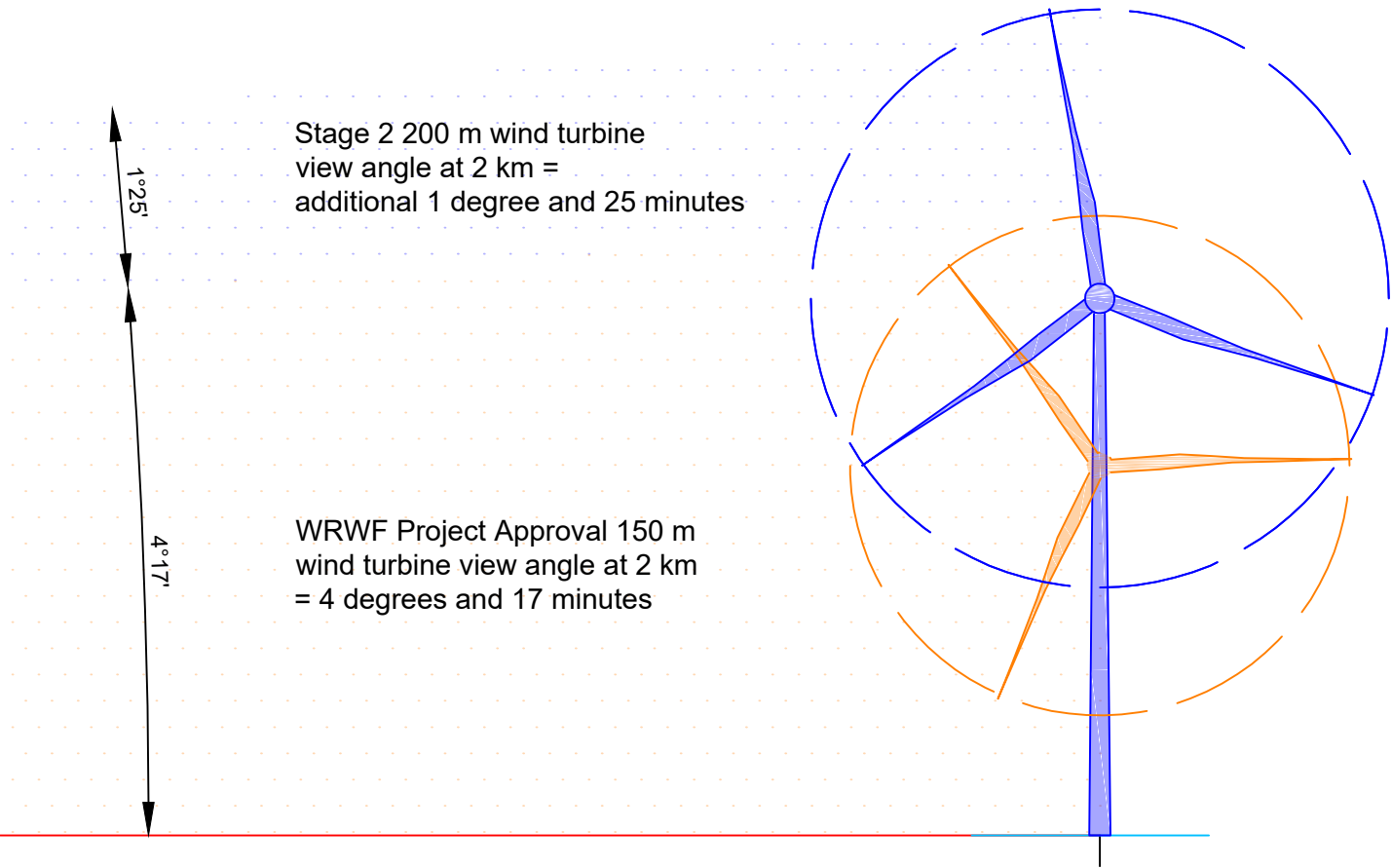
Orange line = view line toward tip height of constructed wind turbine (150 metres)
Blue line = view line toward tip height of Stage 2 wind turbine (200 metres)



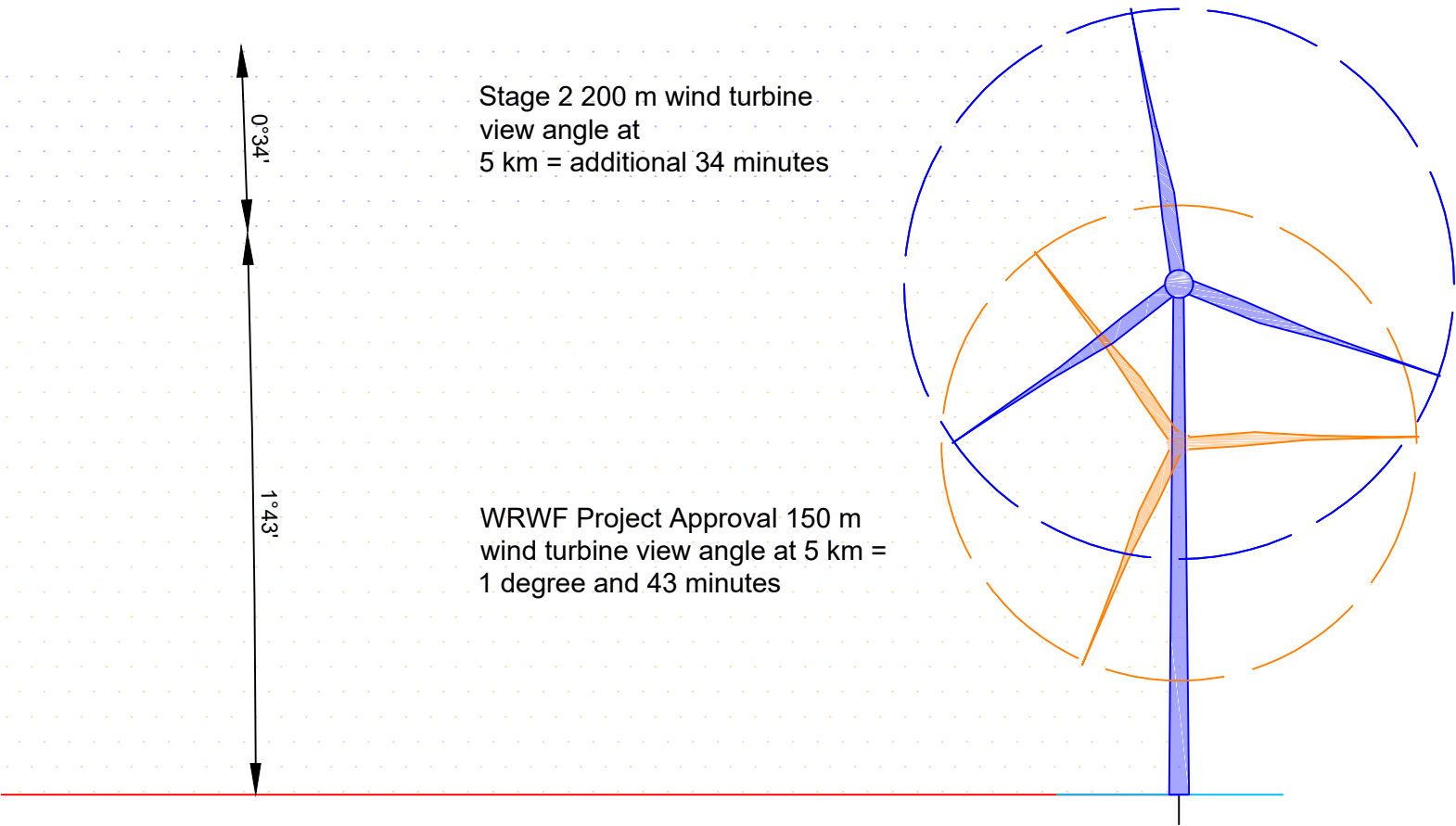
Comparative height of WRWF Project Approval and Stage 2 wind turbine from a 2 km view distance



Comparative height of WRWF Project Approval and Stage 2 wind turbine from a 5 km view distance



View angle toward WRWF Project Approval and Stage 2 wind turbine tip of blade from a 2 km view distance



View angle toward WRWF Project Approval and Stage 2 wind turbine tip of blade from a 5 km view distance

Figure 5 - WRWF Project Approval and Stage 2 wind turbine view angle comparison

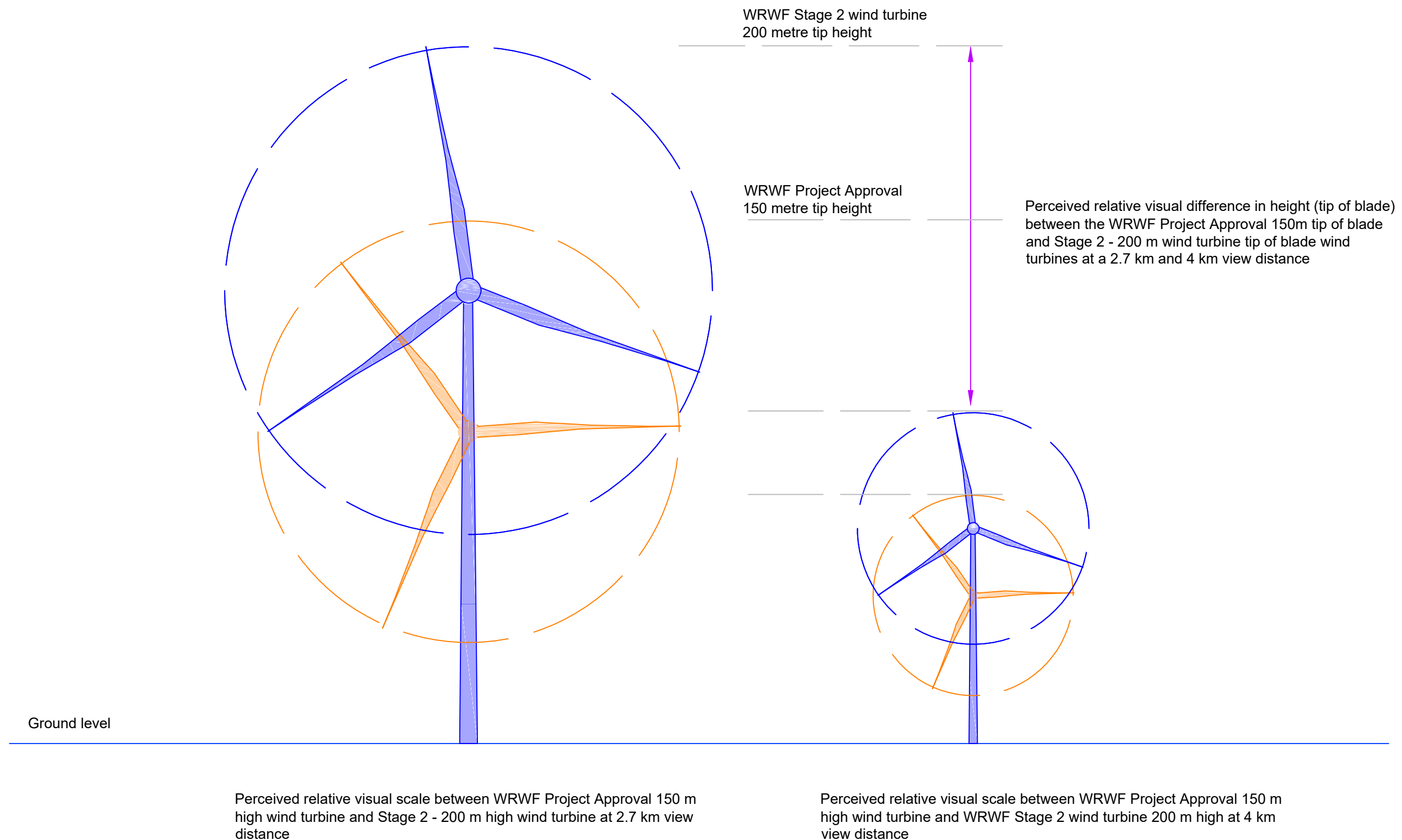


Figure 6 - WRWF Project Approval
and Stage 2 wind turbine comparison
at 2.7km and 4km view distance

For the purpose of this VIA the magnitude of visual effect takes account of the scale of the change in the view with respect to the loss or addition of features in the view and changes in its composition or contrast with the landscape, including the proportion of the view occupied by the modified WRWF Stage 2 wind turbine relative to the WRWF Project Approval wind turbines.

For the purpose of this VIA **Table 6** sets out ratings and definitions associated with the magnitude of visual effects.

Table 6 – Magnitude of visual effect

Visual effect	Magnitude
Amendments to the approved WRWF project would result in a major and prominent visual effect and introduce elements that contrast, or are not in character with the approved WRWF project.	High
Amendments to the approved WRWF project would result in a partial visual effect and introduce elements which may be prominent, but not completely out of character with the approved WRWF project.	Medium
Amendments to the approved WRWF project would result in minor visual effects and introduce elements which are not prominent or out of character with the approved WRWF project.	Low
Amendments to the approved WRWF project would result in a very minor visual effect and introduce elements which are not prominent or uncharacteristic of the approved WRWF project. There would likely be 'no change' to the approved WRWF visual effect.	Negligible

7.2 Visual Effect Matrix

Table 6 sets out the assessment of visual effects from residential dwellings up to 4 kilometres from the approved WRWF project and specifically addresses the residential dwellings locations assessed in the Environmental Assessment. The residential dwelling locations are illustrated in **Figure 1**.

Whilst the assessment includes a determination of visual effects from dwellings, it also takes into account any curtilage surrounding each dwelling which may be considered an extension to the dwelling for domestic or social activities. The criteria set out in **Table 5** are noted against each dwelling, with a visual effect rating determined against the matrix in **Table 6**.

Table 7 – Visual Effect Matrix (Refer Figure 1 for non-associated residential dwelling locations)

Receiver location/s	Category of receiver location	Approximate distance to WRWF Stage 2 wind turbine (m)	WRWF Project Approval Visual Rating* GBD 2011	Description and Magnitude of WRWF modified Stage 2 wind turbine visual effect	Magnitude of visual effect
Residential dwellings within 4 km of WRWF modified Stage 2 wind turbine					
D121	Non-associated residential dwelling	4,002 Far middle-ground	Moderate	Amendments to the approved WRWF project would result in a partial visual effect and introduce elements which may be prominent, but not completely out of character with the approved WRWF project. The observable scale of change would also be partially limited by distance and existing tree planting between the dwelling and closest proposed WRWF Stage 2 wind turbine. Magnitude rating: Low	Low
E140	Non-associated residential dwelling	2,236 Near middle-ground	Moderate	The observable scale of change would be increased by a reduction in distance between the dwelling and closest proposed WRWF Stage 2 wind turbines. There would be limited change in the composition or contrast between the approved and proposed wind turbines and the surrounding landscape. Magnitude rating: Medium	Medium

Table 7 – Visual Effect Matrix (Refer Figure 1 for non-associated residential dwelling locations)

Receiver location/s	Category of receiver location	Approximate distance to WRWF Stage 2 wind turbine (m)	WRWF Project Approval Visual Rating* GBD 2011	Description and Magnitude of WRWF modified Stage 2 wind turbine visual effect	Magnitude of visual effect
S160	Non-associated residential dwelling	1,968 Far fore-ground	Nil	The observable scale of change would be limited by intervening vegetation and landform between the dwelling and wind turbines. There would be very limited change in the composition or contrast between the approved and proposed development and the surrounding landscape. Tree cover beyond the dwelling would screen the majority of views toward the WRWF Stage 2 wind turbines. Magnitude rating Negligible	Negligible
S170	Non-associated residential dwelling	2,007 Near middle-ground	Nil	The observable scale of change would be limited by intervening vegetation and landform between the dwelling and wind turbines. There would be very limited change in the composition or contrast between the approved and proposed development and the surrounding landscape. Tree cover beyond the dwelling would screen the majority of views toward the WRWF Stage 2 wind turbines. Magnitude rating Negligible – resulting in no change to the approved WRWF visual impact rating.	Negligible

Table 7 – Visual Effect Matrix (Refer Figure 1 for non-associated residential dwelling locations)

Receiver location/s	Category of receiver location	Approximate distance to WRWF Stage 2 wind turbine (m)	WRWF Project Approval Visual Rating* GBD 2011	Description and Magnitude of WRWF modified Stage 2 wind turbine visual effect	Magnitude of visual effect
T170	Non-associated residential dwelling	3,083 Near middle-ground	Nil	Views toward the WRWF Stage 2 wind turbines would be screened through a combination of landform and tree planting. Magnitude rating Negligible	Negligible
Q170	Non-associated residential dwelling	1,556 Far fore-ground	Moderate	Amendments to the WRWF Project Approval would result in a partial visual effect and introduce elements which may be prominent, but not completely out of character with the approved WRWF project. Magnitude rating Medium	Medium
S180	Non-associated residential dwellings	3,269 Near middle-ground	Low	Amendments to the approved WRWF project would result in a partial visual effect and introduce elements which may be prominent, but not completely out of character with the approved WRWF project. Magnitude rating Low – resulting in no change to the approved WRWF visual impact rating.	Low

Table 7 – Visual Effect Matrix (Refer Figure 1 for non-associated residential dwelling locations)

Receiver location/s	Category of receiver location	Approximate distance to WRWF Stage 2 wind turbine (m)	WRWF Project Approval Visual Rating* GBD 2011	Description and Magnitude of WRWF modified Stage 2 wind turbine visual effect	Magnitude of visual effect
N180	Non-associated residential dwellings	1,631 Far fore-ground	High	The observable scale of change would be partially limited by distance between the dwelling and closest approved WRWF wind turbine; however, there would be a noticeable increase in height of the wind turbines. There would be very limited change in the composition or contrast between the approved and WRWF Stage 2 wind turbines. Magnitude rating Low	Low
N190	Non-associated residential dwelling	1,764 Far fore-ground	High	The observable scale of change would be partially limited by distance between the dwelling and closest approved WRWF wind turbine; however, there would be a noticeable increase in height of the wind turbines. There would be very limited change in the composition or contrast between the approved and WRWF Stage 2 wind turbines. Magnitude rating Low	Low

Table 7 – Visual Effect Matrix (Refer Figure 1 for non-associated residential dwelling locations)

Receiver location/s	Category of receiver location	Approximate distance to WRWF Stage 2 wind turbine (m)	WRWF Project Approval Visual Rating* GBD 2011	Description and Magnitude of WRWF modified Stage 2 wind turbine visual effect	Magnitude of visual effect
P190	Non-associated residential dwelling	3,031 Near middle-ground	Moderate	Views toward the WRWF Stage 2 wind turbines would be largely screened through a combination of landform and tree planting. The removal of approved Stage 2 wind turbines would reduce the magnitude of visual effect. Magnitude rating Negligible	Negligible
R190	Non-associated residential dwelling	3,048 Near middle-ground	Moderate	Views toward the WRWF Stage 2 wind turbines would be largely screened through a combination of landform and tree planting. The removal of approved Stage 2 wind turbines would reduce the magnitude of visual effect. Magnitude rating Negligible	Negligible
L200	Non-associated residential dwelling	1,679 Far fore-ground	Moderate	Views toward the WRWF Stage 2 wind turbines would be largely screened through a combination of landform and tree planting. The removal of approved Stage 2 wind turbines would reduce the magnitude of visual effect. Magnitude rating Negligible	Negligible

Table 7 – Visual Effect Matrix (Refer Figure 1 for non-associated residential dwelling locations)

Receiver location/s	Category of receiver location	Approximate distance to WRWF Stage 2 wind turbine (m)	WRWF Project Approval Visual Rating* GBD 2011	Description and Magnitude of WRWF modified Stage 2 wind turbine visual effect	Magnitude of visual effect
L220	Non-associated residential dwelling	1,457 Far fore-ground	Not assessed	The dwelling is dilapidated and unoccupied and has not been assessed in this VIA.	Not assessed
I221	Non-associated residential dwelling	1,342 Far fore-ground	Low	The observable scale of change would be increased by a reduction distance between the dwelling and closest proposed WRWF Stage 2 wind turbines. There would be limited change in the composition or contrast between the approved and proposed Stage 2 wind turbines and the surrounding landscape. Magnitude rating: Medium	Medium
I222	Non-associated residential dwelling	1,507 Far fore-ground	Low	The observable scale of change would be increased by a reduction distance between the dwelling and closest proposed WRWF Stage 2 wind turbines. There would be limited change in the composition or contrast between the approved and proposed Stage 2 wind turbines and the surrounding landscape. Magnitude rating: Medium	Medium

Table 7 – Visual Effect Matrix (Refer Figure 1 for non-associated residential dwelling locations)

Receiver location/s	Category of receiver location	Approximate distance to WRWF Stage 2 wind turbine (m)	WRWF Project Approval Visual Rating* GBD 2011	Description and Magnitude of WRWF modified Stage 2 wind turbine visual effect	Magnitude of visual effect
M221	Non-associated residential dwelling	2,303 Near middle-ground	Moderate	Amendments to the approved WRWF project would result in a partial visual effect and introduce elements which may be prominent, but not completely out of character with the approved WRWF project. Magnitude rating Medium	Medium
M220	Non-associated residential dwelling	2,438 Near middle-ground	Moderate	Amendments to the approved WRWF project would result in a partial visual effect and introduce elements which may be prominent, but not completely out of character with the approved WRWF project. Magnitude rating Medium – resulting in no change to the approved WRWF visual impact rating.	Medium
N230	Non-associated residential dwelling	1,918 Far fore-ground	Moderate	Amendments to the approved WRWF project would result in a partial visual effect and introduce elements which may be prominent, but not completely out of character with the approved WRWF project.	Medium

Table 7 – Visual Effect Matrix (Refer Figure 1 for non-associated residential dwelling locations)

Receiver location/s	Category of receiver location	Approximate distance to WRWF Stage 2 wind turbine (m)	WRWF Project Approval Visual Rating* GBD 2011	Description and Magnitude of WRWF modified Stage 2 wind turbine visual effect	Magnitude of visual effect
				Magnitude rating Medium	
L230	Non-associated residential dwelling	3,858 Near middle-ground	Low	The observable scale of change would be partially limited by distance between the dwelling and closest approved WRWF wind turbine; however, there would be a noticeable increase in height of the wind turbines. There would be very limited change in the composition or contrast between the approved and proposed Stage 2 wind turbines. Magnitude rating Low – resulting in no change to the approved WRWF visual impact rating.	Low

* Approved WRWF Visual Rating as determined by GBD, March 2011

7.3 Summary of visual effect

The Visual Effect Matrix (Table 6) includes nineteen residential dwellings within 4 kilometres of a modified WRWF Stage 2 wind turbine which were originally assessed in the White Rock Wind Farm Environmental Assessment. The overall assessment of magnitude of visual effect associated with the modified WRWF Stage 2 wind turbines is summarised as Low to Medium.

The overall scale of change in the wind turbine structures, whilst noticeable from proximate residential view locations would not result in a degree of change significantly above the visibility of the WRWF Project Approval wind turbines.

A small number of non-associated dwellings would experience some increase in magnitude where relocated WRWF Stage 2 wind turbines would result in closer view distances; however, the relocation of wind turbines would also reduce the magnitude of visual effect on a greater number of non-associated dwellings.

7.4 Night time obstacle lighting

The Proponent commissioned an aviation assessment which was undertaken by Aviation Projects. The aviation assessment included a detailed consideration with regard to obstacle lighting needs and requirements for the installation and operation of obstacle lighting.

The aviation assessment concluded that *'that there will be an acceptable level of aviation safety risk associated with the potential for an aircraft collision with a wind turbine, without obstacle lighting on the turbines of the Project'* and noted that the Project will not require obstacle lighting to maintain an acceptable level of safety to aircraft.

Whilst Civil Aviation Safety Authority (CASA) has recommended that the WRWF Stage 2 wind turbines, at an approximate 200 metre tip height be lit, the Proponent has advised they are unlikely to operate night time obstacle lighting unless required by CASA to do so.

Accordingly, the WRWF Stage 2 VIA has not undertaken an assessment of potential visual effects associated with obstacle lighting.

8 Visual assessment

8.1 Introduction

Following the assessment of the magnitude of visual effect this VIA has undertaken a further visual assessment of the modified WRWF Stage 2 wind turbines on people at residential dwellings surrounding the WRWF site. The visual assessment has been prepared with regard to the Guidelines, and specifically the inputs required for the baseline study outlined in the Guidelines Appendix 1: Visual Assessment Process.

8.2 Sensitive Land Use Designations

The WRWF wind farm is wholly located within land use zone RU1 (Primary Production). Land use zone RU1 is not considered to be a sensitive land use designation as per the Guidelines, Appendix 1 Table 3.

8.3 Landscape character type

The broader landscape character type surrounding the approved WRWF has been previously described as both pastoral with agricultural improvements (GBD 2011). The WRWF Landscape and Visual Assessment noted:

‘In terms of overall landscape sensitivity, this LVIA has determined that the landscape within the viewshed of the proposed White Rock wind farm has a medium sensitivity to accommodate change, and represents a landscape that is reasonably typical of landscape types found in surrounding areas of the New England Tablelands’.

“As a landscape with an overall medium sensitivity to accommodate change, some characteristics are likely to be altered by the wind farm development; however, the landscape would have some capability to accommodate change. This capability is largely derived from the presence of predominantly large scale and open landscape across portions of the wind farm development, together with the relatively low density of settlement and potential views located within the immediate and surrounding areas of the viewshed”.

“This LVIA has determined that the wind farm would not be an unacceptable development within the White Rock wind farm viewshed, which in a broader context also contains built elements such as roads, agricultural industry, aircraft landing strips, communication towers, power lines as well as an approved wind farm development within the vicinity of the White Rock wind farm site”.

“This LVIA notes that the Glen Innes wind farm has been approved for construction within the White Rock 10km viewshed; however, as this had not been constructed and was not a visible element at the time of this LVIA preparation, it has not been included in the assessment of landscape sensitivity. The presence of an existing wind farm would tend to decrease the level of sensitivity of any landscape character areas in which it was located subject to an assessment and determination of cumulative impact”.

“Despite being ‘naturalistic’ in appearance large portions of the New England Tablelands landscape have been heavily modified by agricultural improvement for pasture and arable production post European settlement. 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”.

Further to the preparation of the WRWF LVIA (2011) this VIA notes that approvals have been granted for the Sapphire and Glen Innes Wind Farms which are located to the north west and east of the approved WRWF site. These projects, together with the approved White Rock Solar Farm have established a 'renewable energy hub' and have the potential to create a 'wind farm' and 'renewable energy' landscape character type within the broader rural and agricultural landscape setting.

8.4 Viewer sensitivity levels and visibility distance zones

Viewer sensitivity and visibility distance zones are included in Table 7. These predominantly include Level 2 Sensitivity Levels from rural dwellings. Visibility distance zones have been classified from near-middle ground to far middle-ground views.

Table 8 – Visual assessment matrix (Refer **Figure 1** for dwelling locations)

Receiver location	Category of receiver location and viewer sensitivity level	Approximate distance to WRWF Stage 2 wind turbine (m) and Distance Zone	Visual Influence Zone	Approved WRWF GBD visual rating*	WRWF Stage 2 wind turbine visual assessment
D121	Non-associated residential dwelling Level 2	4,002 Far middle-ground	VIZ2	Moderate	The dwelling is located to the south of Spring Mountain Road amongst scattered mature tree cover. The WRWF Stage 2 wind turbines would be unlikely to result in any significant amendment to the GBD assessment and visual mitigation measures would not result in any significant screening benefit toward the WRWF Project Approval and Stage 2 wind turbines.
E140	Non-associated residential dwelling Level 2	2,236 Near middle-ground	VIZ2	Moderate	The WRWF Stage 2 wind turbines would be visible to the south east of the dwelling and from the surrounding curtilage. The overall magnitude of visual effect would increase with relocated wind turbines visible at a closer distance than previously approved. Visual mitigation measures including tree planting may assist in screening and filtering of views toward the WRWF Stage 2 wind turbines.
S160	Non-associated residential dwelling	1,968 Far fore-ground	VIZ2	Nil	The WRWF Stage 2 wind turbines would be unlikely to result in any significant visual amendment to the approved WRWF project with the majority of WRWF Stage 2 wind turbines screened by landform and tree cover.

Table 8 – Visual assessment matrix (Refer **Figure 1** for dwelling locations)

Receiver location	Category of receiver location and viewer sensitivity level	Approximate distance to WRWF Stage 2 wind turbine (m) and Distance Zone	Visual Influence Zone	Approved WRWF GBD visual rating*	WRWF Stage 2 wind turbine visual assessment
	Level 2				
S170	Non-associated residential dwelling Level 2	2,007 Near middle-ground	VIZ2	Nil	The WRWF Stage 2 wind turbines would be unlikely to result in any significant visual amendment to the approved WRWF project with the majority of WRWF Stage 2 wind turbines screened by landform and tree cover.
T170	Non-associated residential dwelling Level 2	3,083 Near middle-ground	VIZ2	Nil	The WRWF Stage 2 wind turbines would be unlikely to result in any significant visual amendment to the approved WRWF project with the majority of WRWF Stage 2 wind turbines screened by landform and tree cover.

Table 8 – Visual assessment matrix (Refer **Figure 1** for dwelling locations)

Receiver location	Category of receiver location and viewer sensitivity level	Approximate distance to WRWF Stage 2 wind turbine (m) and Distance Zone	Visual Influence Zone	Approved WRWF GBD visual rating*	WRWF Stage 2 wind turbine visual assessment
Q170	Non-associated residential dwelling Level 2	1,556 Far fore-ground	VIZ2	Moderate	The residential dwelling is located on a hill side with views north toward a small number of WRWF Stage 2 wind turbines in both approved and relocated positions. Approved Stage 2 wind turbine locations have been removed to the west of the dwelling removing potential for views toward upper sections of wind turbine structures beyond the hill top west of the dwelling. Visual mitigation measures including tree planting to the north of the residential curtilage would provide some screening benefit toward the WRWF Project Approval and Stage 2 wind turbines.
S180	Non-associated residential dwelling Level 2	3,269 Near middle-ground	VIZ2	Low	The WRWF Stage 2 wind turbines would be unlikely to result in any significant amendment to the GBD assessment and visual mitigation measures would not result in any significant screening benefit toward the WRWF Project Approval and Stage 2 wind turbines.

Table 8 – Visual assessment matrix (Refer **Figure 1** for dwelling locations)

Receiver location	Category of receiver location and viewer sensitivity level	Approximate distance to WRWF Stage 2 wind turbine (m) and Distance Zone	Visual Influence Zone	Approved WRWF GBD visual rating*	WRWF Stage 2 wind turbine visual assessment
N180	Non-associated residential dwelling Level 2	1,631 Far fore-ground	VIZ2	High	The dwelling, located to the north of Maybole Road, would have views toward WRWF Stage 2 wind turbines to the north of the dwelling; however, around six approved WRWF Stage 2 wind turbines have been relocated and the resultant magnitude of visual effect would be less than originally assessed. The WRWF Stage 2 wind turbines would be directly visible from the dwelling curtilage and mitigation measures including additional tree planting to the north of the dwelling would be unlikely to provide any significant screening benefit toward the proposed WRWF Stage 2 wind turbines.
N190	Non-associated residential dwelling Level 2	1,764 Far fore-ground	VIZ2	High	The dwelling, located to the north of Maybole Road, would have views toward WRWF Stage 2 wind turbines to the north of the dwelling; however, around six approved WRWF Stage 2 wind turbines have been relocated and the resultant magnitude of visual effect would be less than originally assessed. The WRWF Stage 2 wind turbines would be directly visible from the dwelling curtilage and mitigation measures including additional tree planting to the

Table 8 – Visual assessment matrix (Refer **Figure 1** for dwelling locations)

Receiver location	Category of receiver location and viewer sensitivity level	Approximate distance to WRWF Stage 2 wind turbine (m) and Distance Zone	Visual Influence Zone	Approved WRWF GBD visual rating*	WRWF Stage 2 wind turbine visual assessment
					north of the dwelling would be unlikely to provide any significant screening benefit toward the proposed WRWF Stage 2 wind turbines.
P190	Non-associated residential dwelling Level 2	3,031 Near middle-ground	VIZ2	Moderate	The WRWF Stage 2 wind turbines would be unlikely to result in any significant visual amendment to the approved WRWF project. The removal of approved WRWF Stage 2 wind turbines from the south portion of the project site would reduce the visual effect to Low.
R190	Non-associated residential dwelling Level 2	3,048 Near middle-ground	VIZ2	Moderate	The WRWF Stage 2 wind turbines would be unlikely to result in any significant visual amendment to the approved WRWF project. The removal of approved WRWF Stage 2 wind turbines from the south portion of the project site would reduce the visual effect to Low.

Table 8 – Visual assessment matrix (Refer **Figure 1** for dwelling locations)

Receiver location	Category of receiver location and viewer sensitivity level	Approximate distance to WRWF Stage 2 wind turbine (m) and Distance Zone	Visual Influence Zone	Approved WRWF GBD visual rating*	WRWF Stage 2 wind turbine visual assessment
L200	Non-associated residential dwelling Level 2	1,679 Far fore-ground	VIZ2	Moderate	The relocation of approved WRWF Stage 2 wind turbines within the southern portion of the project site would assist in the reduction of the magnitude of visual effect; however, a small number of proposed WRWF Stage 2 wind turbines would be visible from the dwelling curtilage. Visual mitigation measures including tree planting may assist in screening and filtering of views toward the WRWF Stage 2 wind turbines.
L220	Non-associated residential dwelling Level 2	1,457 Far fore-ground	VIZ2	Not assessed	Not assessed
I221	Non-associated residential dwelling	1,342 Far fore-ground	VIZ2	Low	Views toward the WRWF approved Stage 2 and proposed WRWF Stage 2 wind turbines would be partially screened by tree cover beyond the dwelling; however, views would extend from the

Table 8 – Visual assessment matrix (Refer **Figure 1** for dwelling locations)

Receiver location	Category of receiver location and viewer sensitivity level	Approximate distance to WRWF Stage 2 wind turbine (m) and Distance Zone	Visual Influence Zone	Approved WRWF GBD visual rating*	WRWF Stage 2 wind turbine visual assessment
	Level 2				curtilage of the property toward the wind turbines which would be directly visible. The more proximate and taller WRWF Stage 2 wind turbines would result in a Moderate visual effect.
I222	Non-associated residential dwelling Level 2	1,918	VIZ2	Low	Views toward the WRWF approved Stage 2 and proposed WRWF Stage 2 wind turbines would be partially screened by tree cover beyond the dwelling; however, views would extend from the curtilage of the property toward the wind turbines which would be directly visible. The more proximate and taller WRWF Stage 2 wind turbines would result in a Moderate visual effect.
M221	Non-associated residential dwelling Level 2	3,858 Near middle-ground	VIZ2	Moderate	The dwelling is located to the west to Maybole Road and consists of a single storey rural dwelling in a north south alignment. Views would extend toward the WRWF Stage 2 wind turbines within the southern portion of the project area where a small number of approved WRWF Stage 2 wind turbines have been relocated. Existing tree cover beyond the dwelling would provide some screening and/or filtering of views toward the WRWF Stage 2 wind

Table 8 – Visual assessment matrix (Refer **Figure 1** for dwelling locations)

Receiver location	Category of receiver location and viewer sensitivity level	Approximate distance to WRWF Stage 2 wind turbine (m) and Distance Zone	Visual Influence Zone	Approved WRWF GBD visual rating*	WRWF Stage 2 wind turbine visual assessment
					turbines. Supplementary tree planting may provide some additional level of screening.
M220	Non-associated residential dwelling Level 2	2,438 Near middle-ground	VIZ2	Moderate	The dwelling is located to the west to Maybole Road and consists of a single storey rural dwelling in a north south alignment. Views would extend toward the WRWF Stage 2 wind turbines within the southern portion of the project area where a small number of approved WRWF Stage 2 wind turbines have been relocated. Existing tree cover beyond the dwelling would provide some screening and/or filtering of views toward the WRWF Stage 2 wind turbines. Supplementary tree planting may provide some additional level of screening.
N230	Non-associated residential dwelling Level 2	4,002 Far fore-ground	VIZ2	Moderate	The dwelling is located to the east of Maybole Road corridor and consists of a single storey rural dwelling in a north to south alignment. The dwelling has a small amount scattered tree and shrub cover. Wind turbines would be visible from the dwelling

Table 8 – Visual assessment matrix (Refer **Figure 1** for dwelling locations)

Receiver location	Category of receiver location and viewer sensitivity level	Approximate distance to WRWF Stage 2 wind turbine (m) and Distance Zone	Visual Influence Zone	Approved WRWF GBD visual rating*	WRWF Stage 2 wind turbine visual assessment
					and/or curtilage which would not tend to form an overly dominant element where visible due to distance. The WRWF Stage 2 wind turbines would be unlikely to result in any significant visual impact in addition to the WRWF Project Approval. Visual mitigation measures including tree planting to the north of the dwelling would provide some screening benefit toward the approved WRWF and wind turbine modification.
L230	Non-associated residential dwelling Level 2	3,858 Near middle-ground	VIZ2	Low	The dwelling is located to the west of the Maybole Road corridor and consists of a single storey rural dwelling in a north to south alignment. The dwelling has some surrounding scattered tree and shrub cover. The WRWF Stage 2 turbines would be visible from the dwelling and/or curtilage and would not tend to form a dominant element where visible due to distance. The WRWF Stage 2 wind turbines would be unlikely to result in any significant visual impact in addition to the WRWF Project Approval. Visual mitigation measures including tree planting along the

Table 8 – Visual assessment matrix (Refer **Figure 1** for dwelling locations)

Receiver location	Category of receiver location and viewer sensitivity level	Approximate distance to WRWF Stage 2 wind turbine (m) and Distance Zone	Visual Influence Zone	Approved WRWF GBD visual rating*	WRWF Stage 2 wind turbine visual assessment
					northern curtilage boundary would provide screening benefit toward the WRWF Project Approval and Stage 2 wind turbines.

*Green Bean Design Pty Ltd, White Rock Wind Farm Landscape and Visual Impact Assessment – March 2011

9 Wire frame models and photomontages

9.1 Introduction

The wireframe model and photomontage locations have been selected to illustrate viewpoints from public view points and residential dwellings with views toward the WRWF approved and modified Stage 2 wind turbines.

The photomontage and wireframe locations coincide, and are numbered in accordance with, dwelling locations illustrated in **Figure 1**. The photomontages and wireframe models illustrate views toward the WRWF Stage 1 and modified Stage 2 wind turbines.

The wireframe models do not include, or illustrate, the location of existing trees or other structures that may limit views to the approved and modified wind farm. The wire frame models are therefore considered to be very conservative in both the extent of view and visibility of wind turbines indicated in each wire frame model.

9.2 Wireframe model and photomontage preparation

The wireframe models and photomontages have been prepared with regard to the general guidelines set out in the Scottish Natural Heritage (2006) Visual representation of windfarms: good practice guidance and British Landscape Institute Advice Note 01/11 (March 2011) Photography and photomontage in landscape and visual impact assessment.

Photography for the photomontages was undertaken by GBD using tripod mounted Nikon D700 a digital single-lens reflex (SLR) full frame sensor camera. A 50mm focal length prime lens was attached to the Nikon D700 SLR camera.

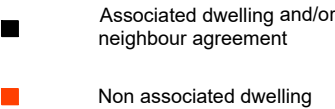
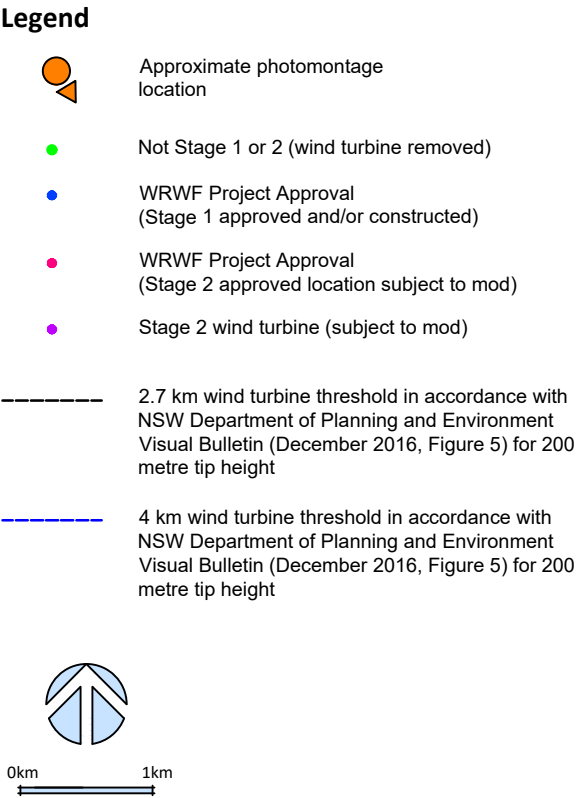
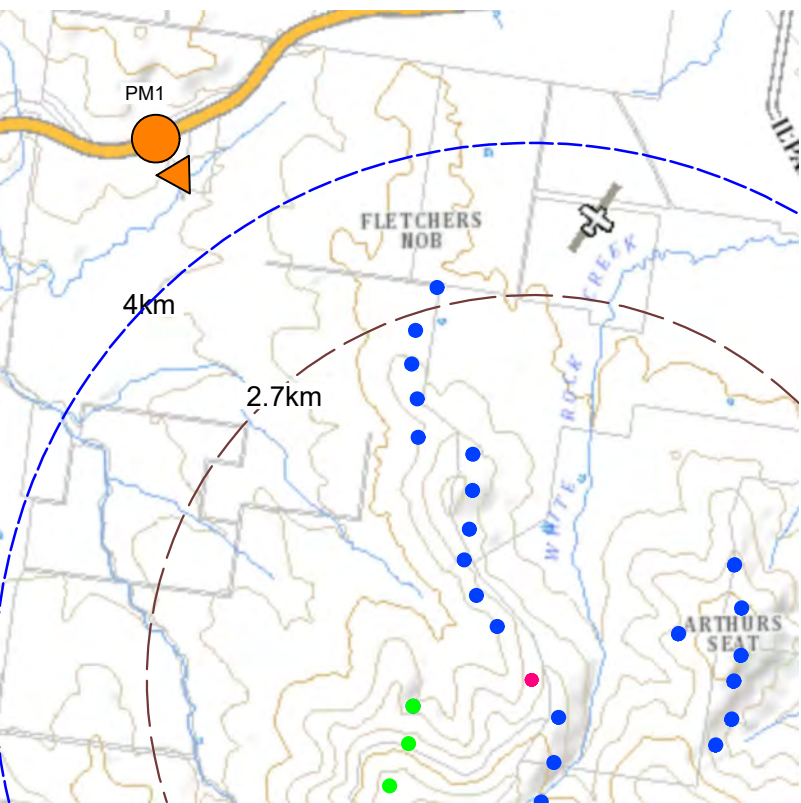
The Nikon D700 has a full frame image sensor (36 x 23.9 mm Nikon FX format), and when mounted with a 50mm lens results in a single photographic image with a view angle equivalent to a 35 mm SLR camera with a 50mm lens. The 50mm lens is commonly utilised, and cited in landscape and visual assessment manuals and guidelines, for the preparation of landscape and visual assessment photomontages. Following site photography, the wireframe models and photomontages were generated through the following steps:

- a digital terrain model (DTM) of the project site was created from a terrain model of the surrounding area using digital contours
- the site DTM was loaded in the DNV-GL 'Wind Farmer' software package
- the layout of the wind farm and 3D representation of the wind turbine was configured in Wind Farmer
- the location of each viewpoint (photo location) was configured in Wind Farmer – the sun position for each viewpoint was configured by using the time and date of the photographs from that viewpoint
- the view from each photomontage location was then assessed in Wind Farmer. This process requires accurate mapping of the terrain as modelled, with that as seen in the photographs. The photographs, taken from each photomontage location were loaded into Wind Farmer and the visible turbines superimposed on the photographs

- the photomontage were adjusted using Photoshop CS3 to compensate for fogging due to haze or distance, as well as screening by vegetation or obstacles and
- the final image was converted to JPG format and imported and annotated as the final figure.



Viewpoint PM1 - view south east from Gwydir Highway toward the constructed Stage 1 and Stage 2 wind turbine (200 metre tip height) for White Rock Wind Farm
Approximate distance to closest Stage 2 wind turbine 2,398 metres



Photomontage limitations

A photomontage can never show exactly what the wind farm will look like in reality due to factors such as different lighting, weather and seasonal conditions which vary through time and the resolution of the image. Also a static image cannot convey turbine movement.

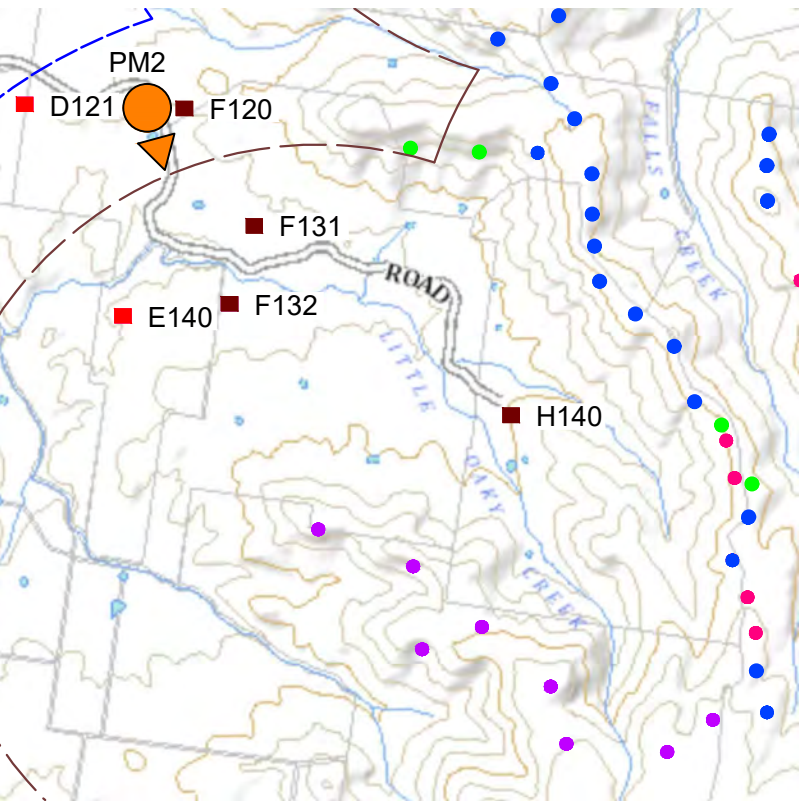
The images provided give a reasonable impression of the scale of the turbines and the distance to the turbines, but can never be 100% accurate.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

White Rock Wind Farm Stage 2



Viewpoint PM2 - view south to south east from Spring Mountain Road toward WRWF constructed and Stage 2 wind turbines (200 metre tip height) for White Rock Wind Farm - Approximate distance to closest Stage 2 wind turbine 3,400 metres



Legend

- Approximate photomontage location
 - Not Stage 1 or 2 (wind turbine removed)
 - WRWF Project Approval (Stage 1 approved and/or constructed)
 - WRWF Project Approval (Stage 2 approved location subject to mod)
 - Stage 2 wind turbine (subject to mod)
 - 2.7 km wind turbine threshold in accordance with NSW Department of Planning and Environment Visual Bulletin (December 2016, Figure 5) for 200 metre tip height
 - 4 km wind turbine threshold in accordance with NSW Department of Planning and Environment Visual Bulletin (December 2016, Figure 5) for 200 metre tip height
 - Associated dwelling and/or neighbour agreement
 - Non associated dwelling
- 0km 1km

Photomontage limitations

A photomontage can never show exactly what the wind farm will look like in reality due to factors such as different lighting, weather and seasonal conditions which vary through time and the resolution of the image. Also a static image cannot convey turbine movement.

The images provided give a reasonable impression of the scale of the turbines and the distance to the turbines, but can never be 100% accurate.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

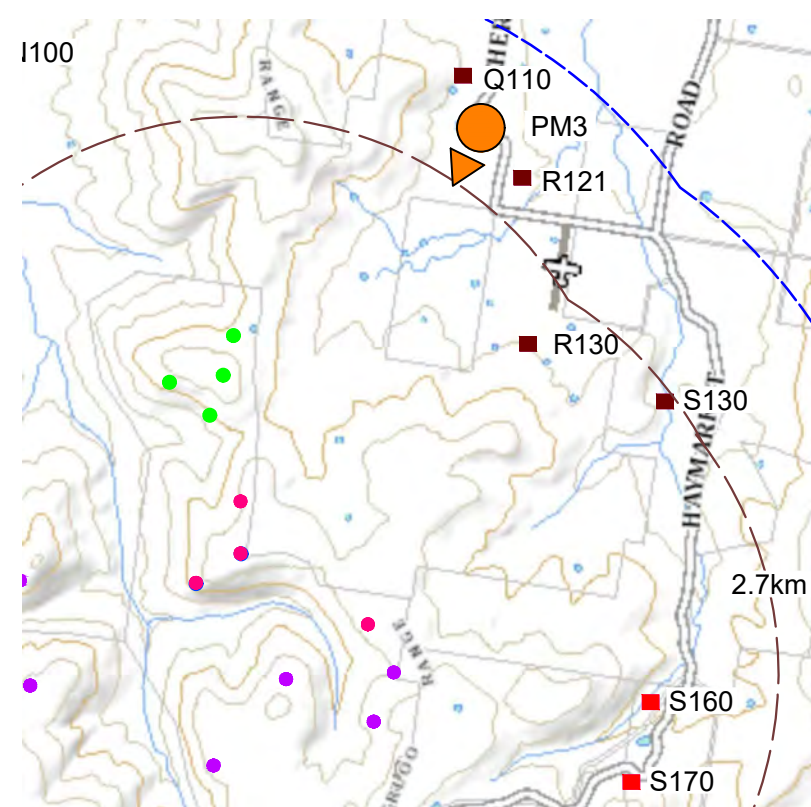
Figure 8 Photomontage PM2 from Spring Mountain Road

White Rock Wind Farm Stage 2

WRWF Stage 2 wind turbines



Viewpoint PM3 - view south to south west from Cherry Tree Road toward the constructed WRWF and Stage 2 wind turbines (200 metre tip height) for White Rock Wind Farm - Approximate distance to closest Stage 2 wind turbine 3,300 metres



Photomontage location plan

Legend

-  Approximate photomontage location
-  Not Stage 1 or 2 (wind turbine removed)
-  WRWF Project Approval (Stage 1 approved and/or constructed)
-  WRWF Project Approval (Stage 2 approved location subject to mod)
-  Stage 2 wind turbine (subject to mod)
-  2.7 km wind turbine threshold in accordance with NSW Department of Planning and Environment Visual Bulletin (December 2016, Figure 5) for 200 metre tip height
-  4 km wind turbine threshold in accordance with NSW Department of Planning and Environment Visual Bulletin (December 2016, Figure 5) for 200 metre tip height
- 
-  0km 1km
-  Associated dwelling and/or neighbour agreement
-  Non associated dwelling

Photomontage limitations

A photomontage can never show exactly what the wind farm will look like in reality due to factors such as different lighting, weather and seasonal conditions which vary through time and the resolution of the image. Also a static image cannot convey turbine movement.

The images provided give a reasonable impression of the scale of the turbines and the distance to the turbines, but can never be 100% accurate.

The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 9 Photomontage PM3 from Cherry Tree Road

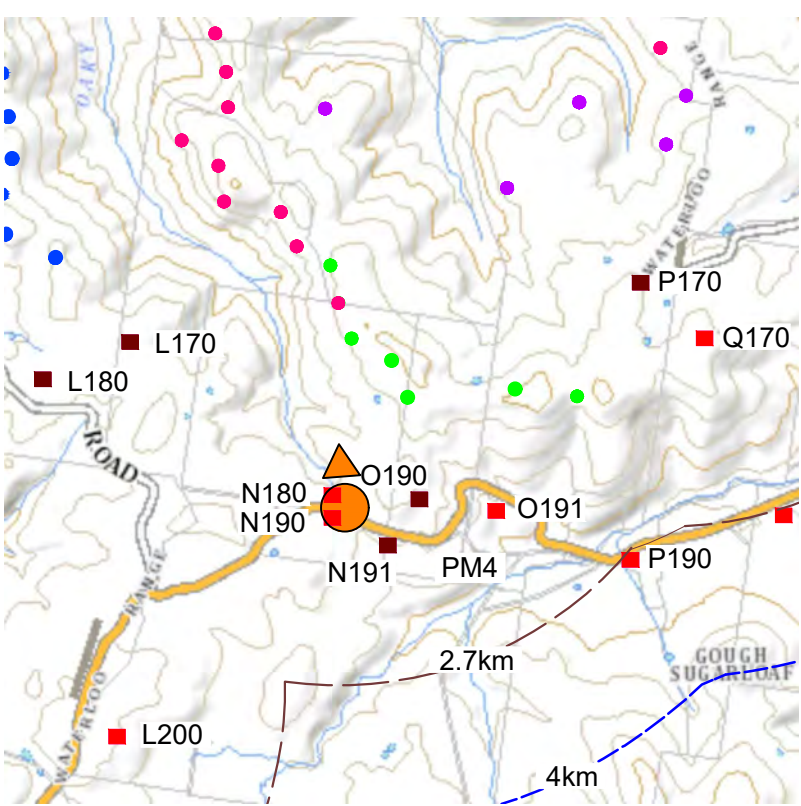
GREEN BEAN DESIGN

landscape architects

White Rock Wind Farm Stage 2



Viewpoint PM4 - view north to north east from Maybole Road toward the WRWF constructed and Stage 2 wind turbines (200 metre tip height) for White Rock Wind Farm - Approximate distance to closest Stage 2 wind turbine 1,840 metres



Photomontage location plan

Legend

-  Approximate photomontage location
-  Not Stage 1 or 2 (wind turbine removed)
-  WRWF Project Approval (Stage 1 approved and/or constructed)
-  WRWF Project Approval (Stage 2 approved location subject to mod)
-  Stage 2 wind turbine (subject to mod)
-  Associated dwelling and/or neighbour agreement
-  Non associated dwelling
-  2.7 km wind turbine threshold in accordance with NSW Department of Planning and Environment Visual Bulletin (December 2016, Figure 5) for 200 metre tip height
-  4 km wind turbine threshold in accordance with NSW Department of Planning and Environment Visual Bulletin (December 2016, Figure 5) for 200 metre tip height
-  0km 1km

Photomontage limitations

A photomontage can never show exactly what the wind farm will look like in reality due to factors such as different lighting, weather and seasonal conditions which vary through time and the resolution of the image. Also a static image cannot convey turbine movement.

The images provided give a reasonable impression of the scale of the turbines and the distance to the turbines, but can never be 100% accurate.

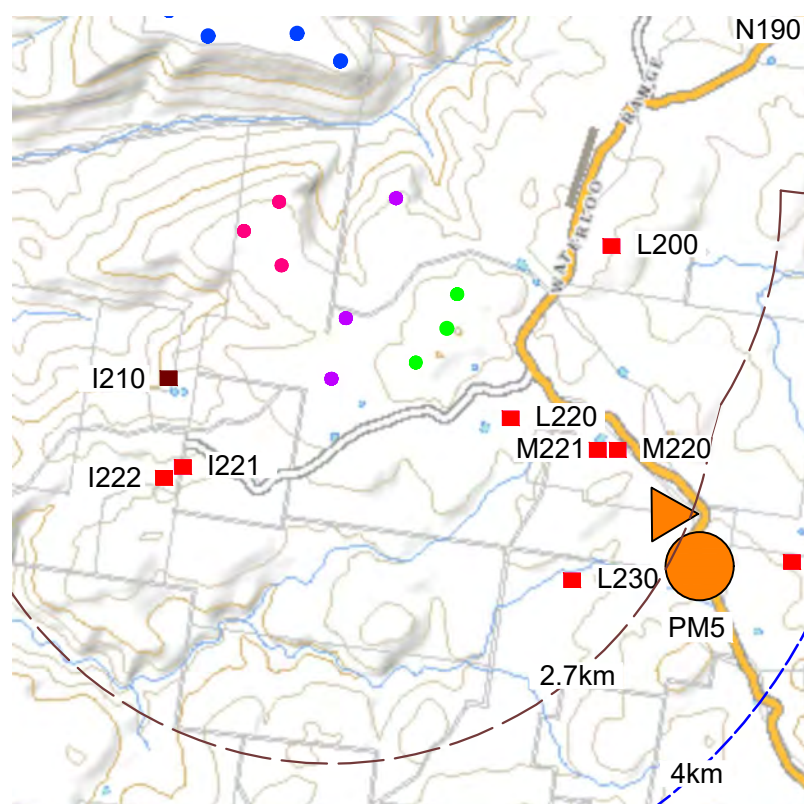
The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 10 Photomontage PM4 from Maybole Road

White Rock Wind Farm Stage 2



Viewpoint PM5 - view north to north west from Maybole Road toward the WRWF constructed and Stage 2 wind turbines (200 metre tip height) for White Rock Wind Farm - Approximate distance to closest Stage 2 wind turbine 3,113 metres



Legend

- Approximate photomontage location
 - Not Stage 1 or 2 (wind turbine removed)
 - WRWF Project Approval (Stage 1 approved and/or constructed)
 - WRWF Project Approval (Stage 2 approved location subject to mod)
 - Stage 2 wind turbine (subject to mod)
 - Associated dwelling and/or neighbour agreement
 - Non associated dwelling
 - 2.7 km wind turbine threshold in accordance with NSW Department of Planning and Environment Visual Bulletin (December 2016, Figure 5) for 200 metre tip height
 - 4 km wind turbine threshold in accordance with NSW Department of Planning and Environment Visual Bulletin (December 2016, Figure 5) for 200 metre tip height
- 0km 1km

Photomontage limitations

A photomontage can never show exactly what the wind farm will look like in reality due to factors such as different lighting, weather and seasonal conditions which vary through time and the resolution of the image. Also a static image cannot convey turbine movement.

The images provided give a reasonable impression of the scale of the turbines and the distance to the turbines, but can never be 100% accurate.

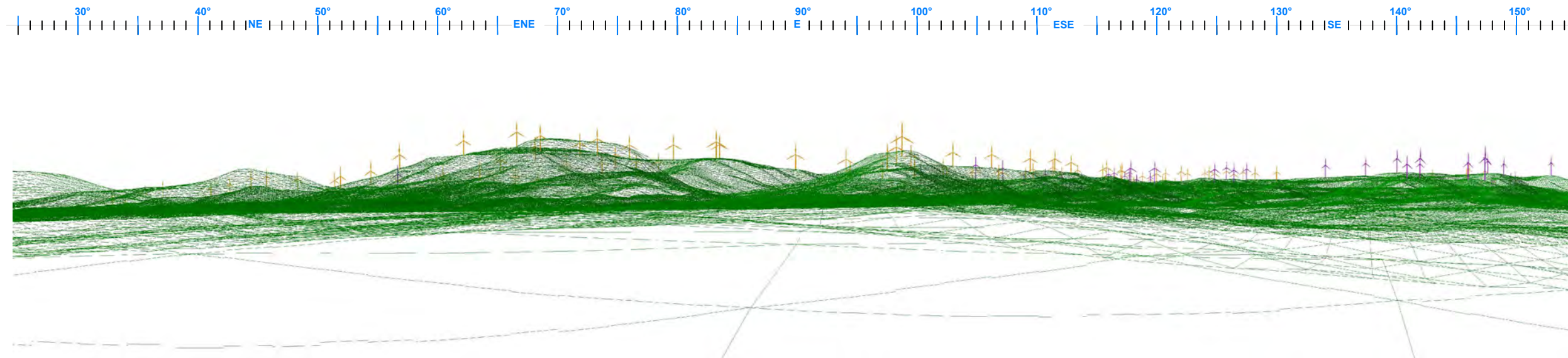
The viewpoints illustrated are representative of views in this location, but cannot represent visibility at all locations.

Figure 11 Photomontage PM5 from Maybole Road

GREEN BEAN DESIGN

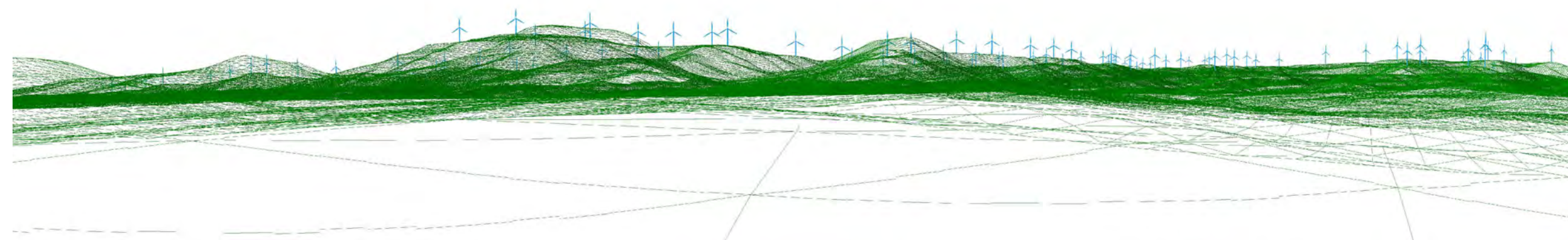
landscape architects

White Rock Wind Farm Stage 2



Wireframe 1 Dwelling D121: WRWF Project Approval and Stage 2 wind turbine overlay

Distance to closest Project Approval WRWF wind turbine 3.29 kilometres. Project Approval tips visible 68, hubs visible 46
 Distance to closest WRWF Stage 2 wind turbine 4.02 kilometres. Project Approval and Stage 2 tips visible 76, hubs visible 55



Wireframe 1 Dwelling D121: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

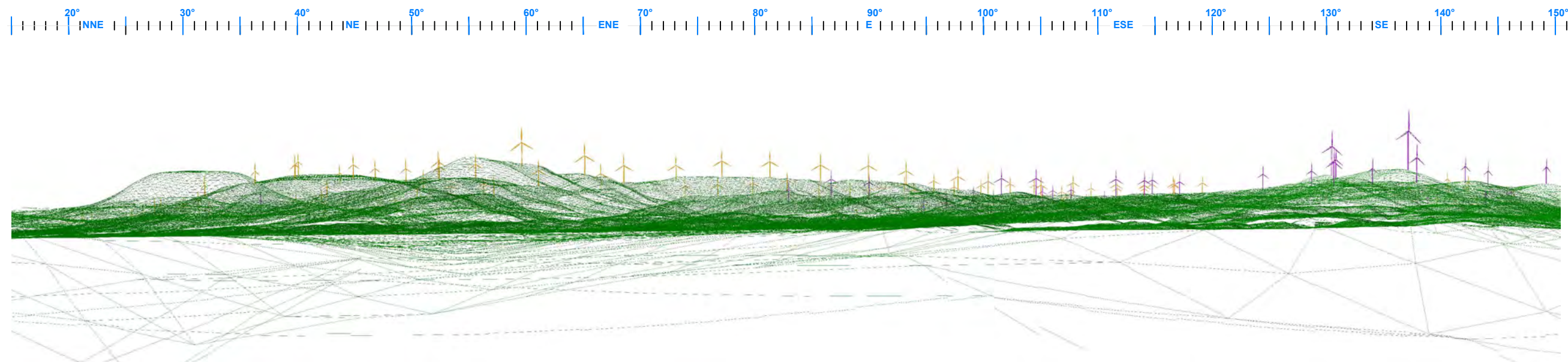
Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 12 -
Wireframe 1 Dwelling D121

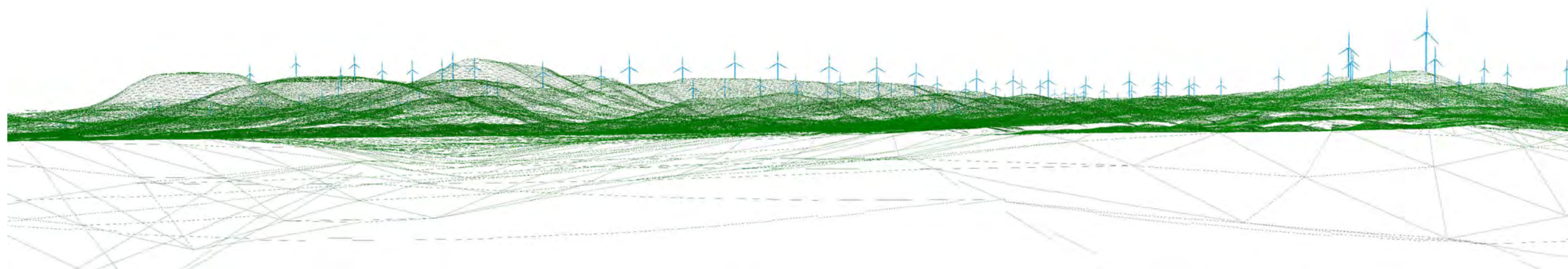
White Rock Wind Farm Stage 2



Wireframe 2 Dwelling E140: WRWF Project Approval and Stage 2 wind turbine overlay

Distance to closest Project Approval WRWF wind turbine 2.59 kilometres. Project Approval tips visible 61, hubs visible 43

Distance to closest WRWF Stage 2 wind turbine 2.23 kilometres. Project Approval and Stage 2 tips visible 68, hubs visible 53



Wireframe 2 Dwelling E140: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

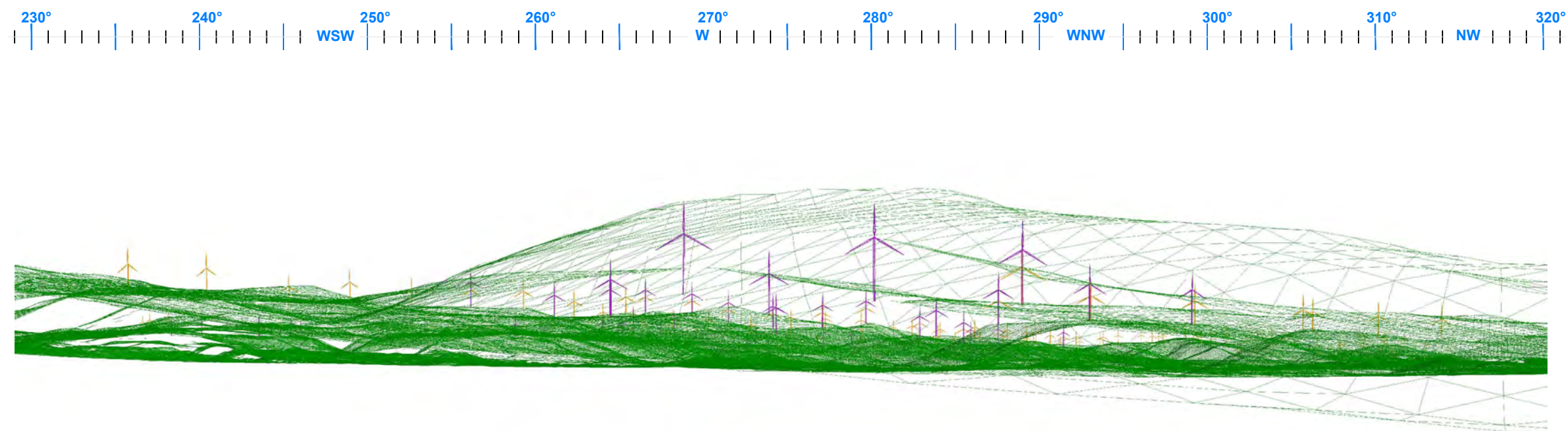
The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 13 -
Wireframe 2 Dwelling E140

White Rock Wind Farm Stage 2

GREEN BEAN DESIGN

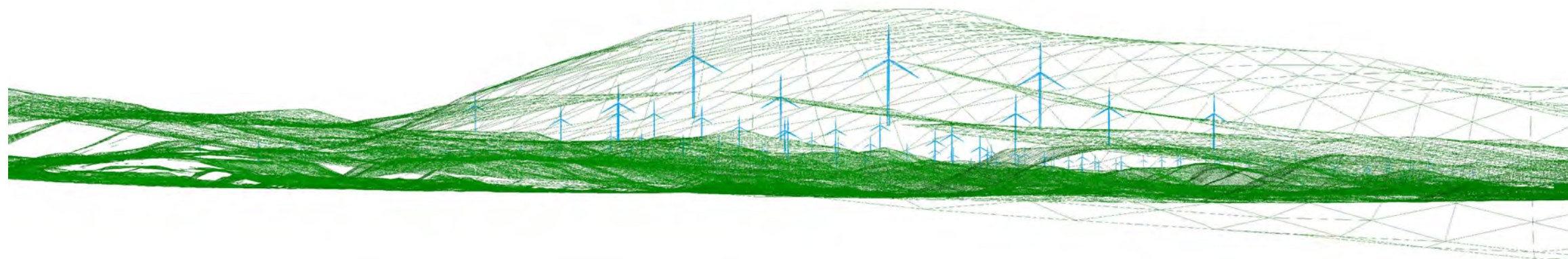
landscape architects



Wireframe 3 Dwelling S160: WRWF Project Approval and Stage 2 wind turbine overlay

Distance to closest Project Approval WRWF wind turbine 2.28 kilometres. Project Approval tips visible 4, hubs visible 0

Distance to closest WRWF Stage 2 wind turbine 1.96 kilometres. Project Approval and Stage 2 tips visible 1, hubs visible 0



Wireframe 3 Dwelling S160: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed
and Stage 2 wind turbines

Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

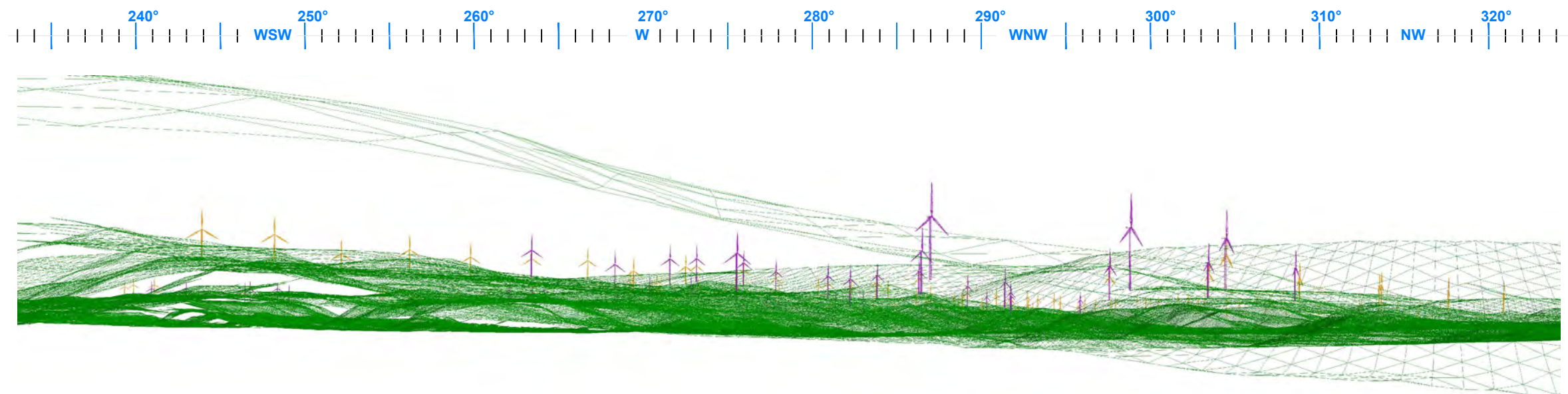
The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 14 -
Wireframe 3 Dwelling S160

White Rock Wind Farm Stage 2

GREEN BEAN DESIGN

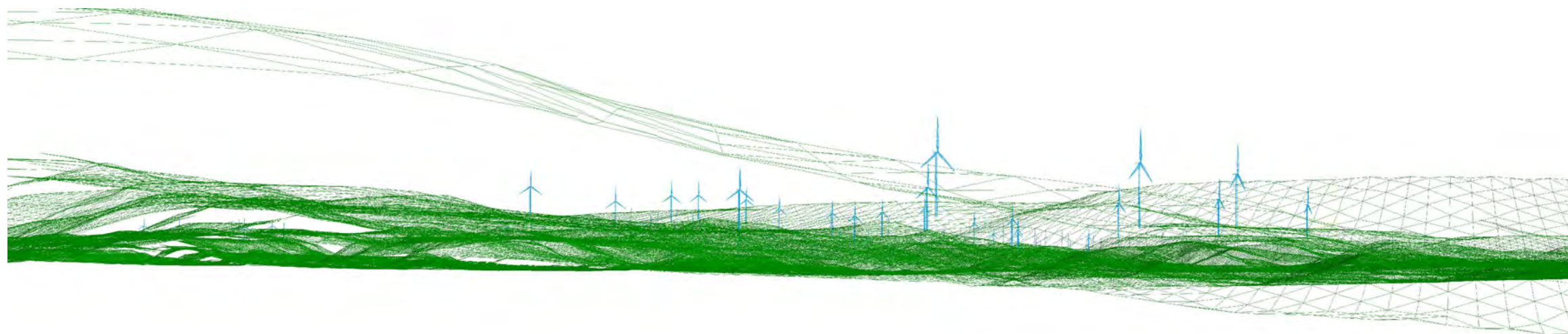
landscape architects



Wireframe 4 Dwelling S170: WRWF Project Approval and Stage 2 wind turbine overlay

Distance to closest Project Approval WRWF wind turbine 2.42 kilometres. Project Approval tips visible 1, hubs visible 0

Distance to closest WRWF Stage 2 wind turbine 2.00 kilometres. Project Approval and Stage 2 tips visible 6, hubs visible 3



Wireframe 4 Dwelling S170: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

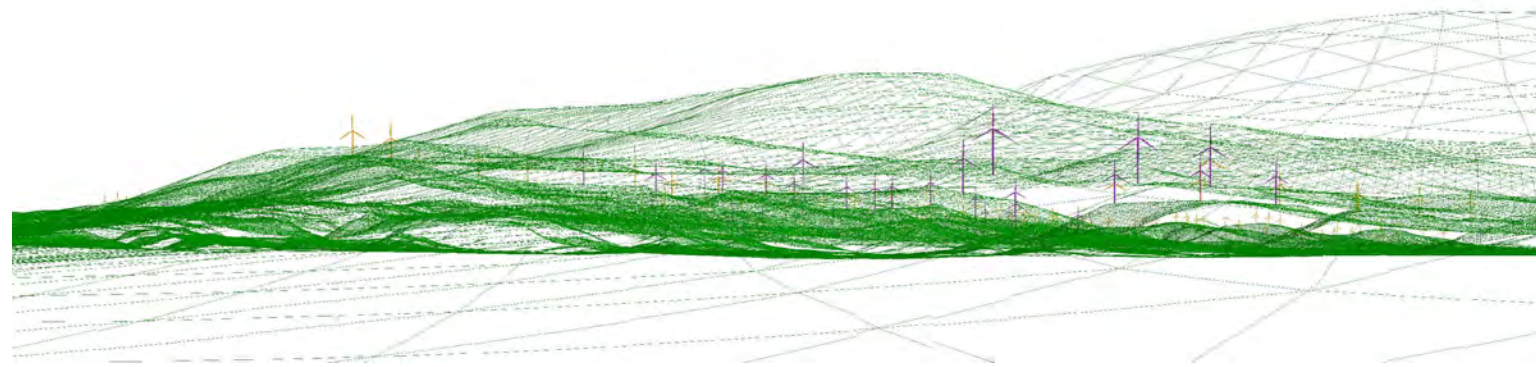
The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 15 -
Wireframe 4 Dwelling S170

White Rock Wind Farm Stage 2

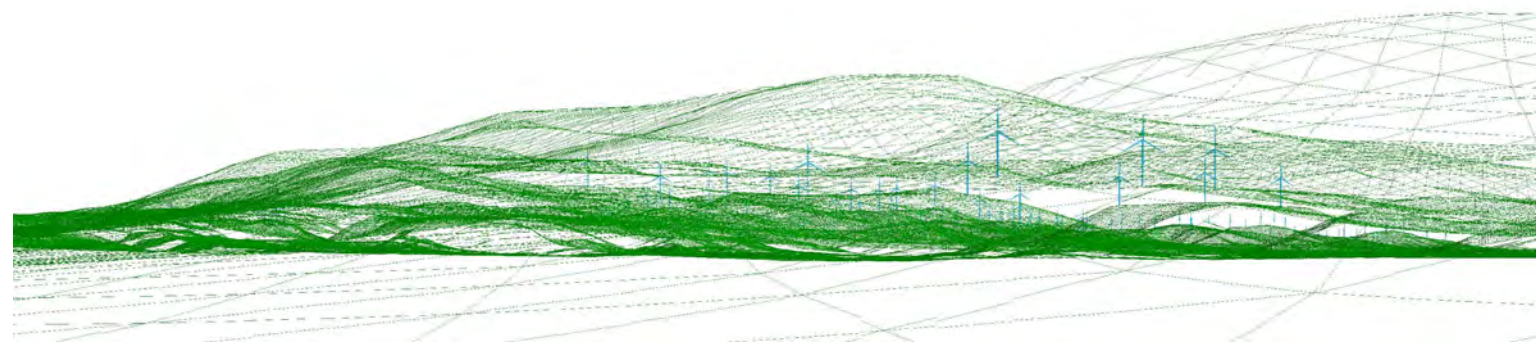
GREEN BEAN DESIGN

landscape architects



Wireframe 5 Dwelling T170: Project Approval and Stage 2 wind turbine overlay

Distance to closest Project Approval WRWF wind turbine 3.52 kilometres. Project Approval tips visible 5, hubs visible 4
 Distance to closest WRWF Stage 2 wind turbine 3.08 kilometres. Project Approval and Stage 2 tips visible 0, hubs visible 0



Wireframe 5 Dwelling T170: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

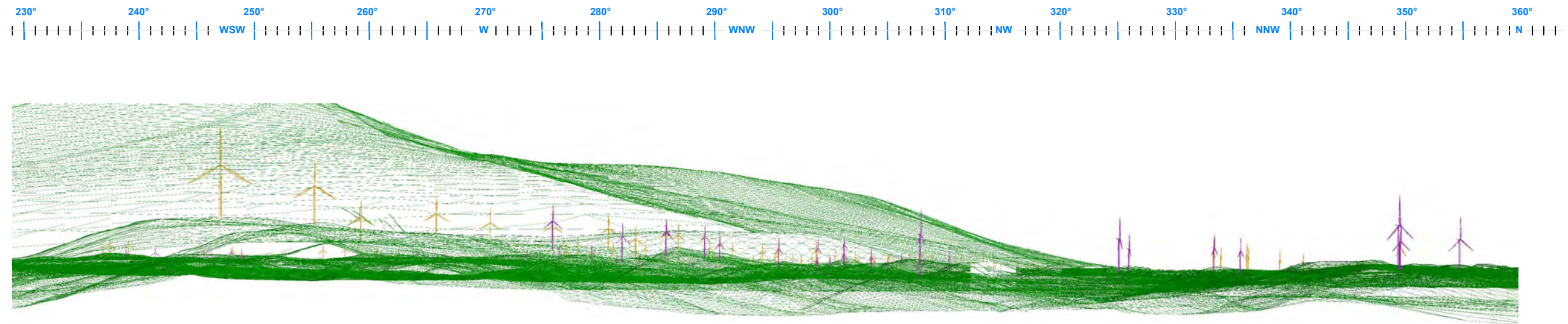
Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 16 -
Wireframe 5 Dwelling T170

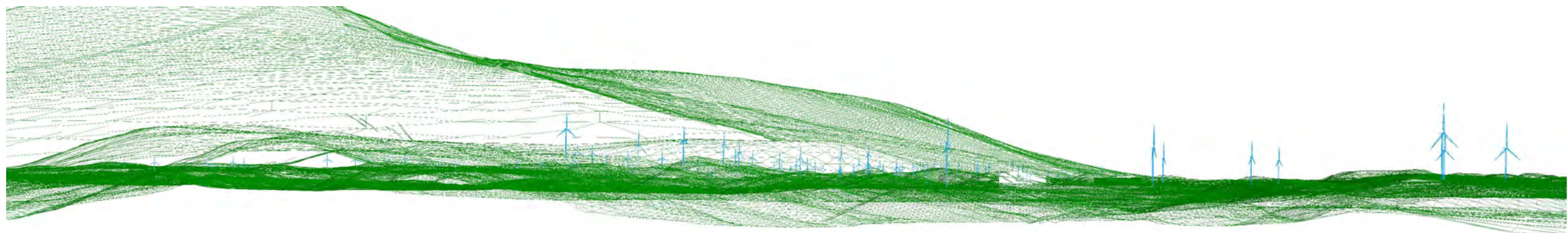
White Rock Wind Farm Stage 2



Wireframe 6 Dwelling Q170: WRWF Project Approval and Stage 2 wind turbine overlay

Distance to closest approved Project Approval WRWF wind turbine 1.06 kilometres. Project Approval tips visible 8, hubs visible 8

Distance to closest WRWF Stage 2 wind turbine 1.55 kilometres. Project Approval and Stage 2 tips visible 8, hubs visible 7



Wireframe 6 Dwelling Q170: Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

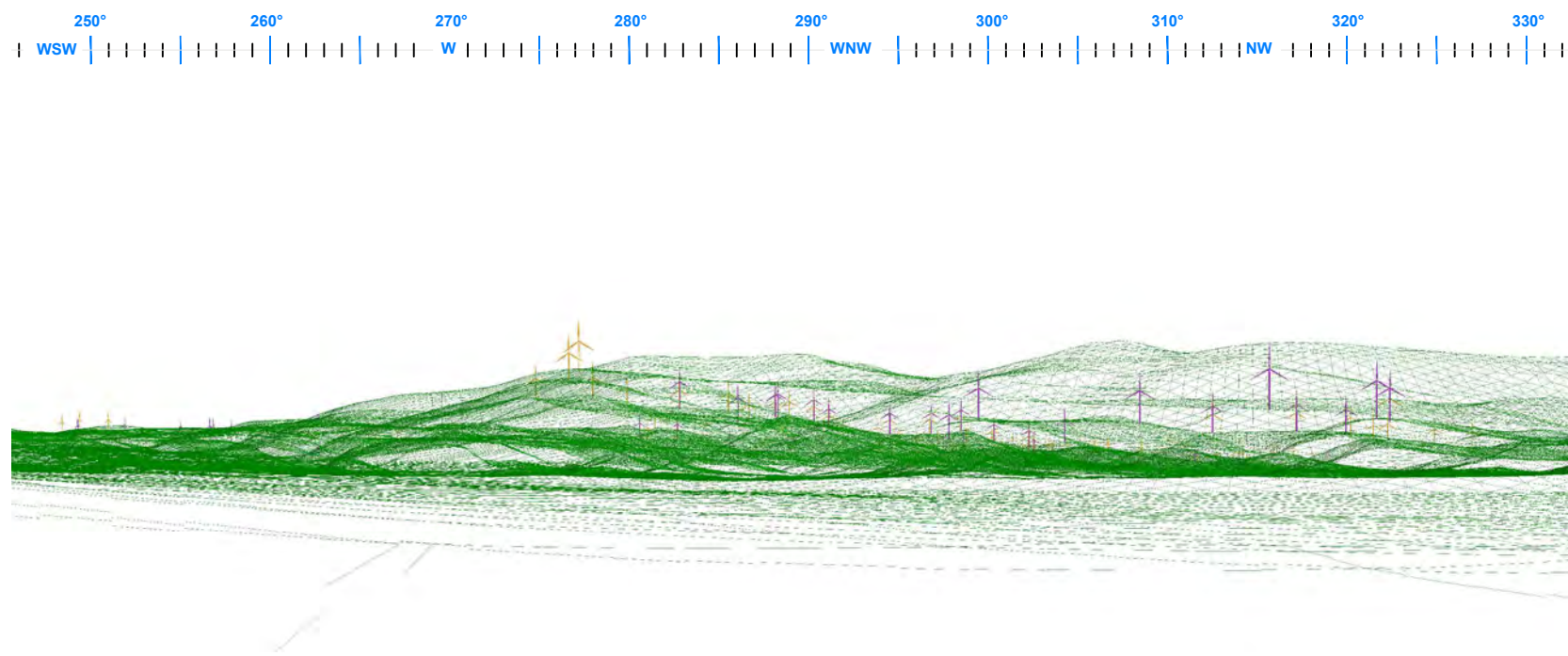
The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 17 -
Wireframe 6 Dwelling Q170

White Rock Wind Farm Stage 2

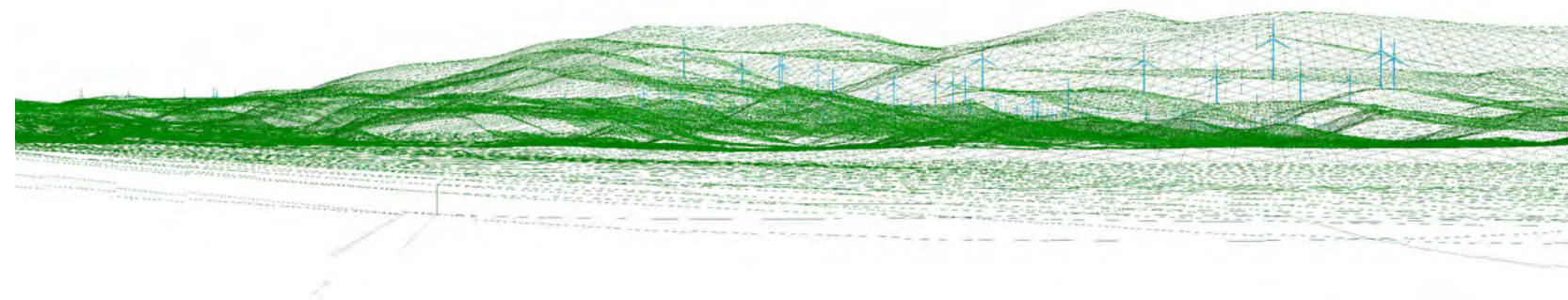
GREEN BEAN DESIGN

landscape architects



Wireframe 7 Dwelling S180: WRWF Project Approval and Stage 2 wind turbine overlay

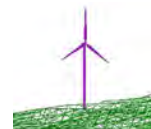
Distance to closest approved Project Approval WRWF wind turbine 3.04 kilometres. Project Approval tips visible 9, hubs visible 5
 Distance to closest WRWF Stage 2 wind turbine 3.26 kilometres. Project Approval and Stage 2 tips visible 6, hubs visible 5



Wireframe 7 Dwelling S180: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

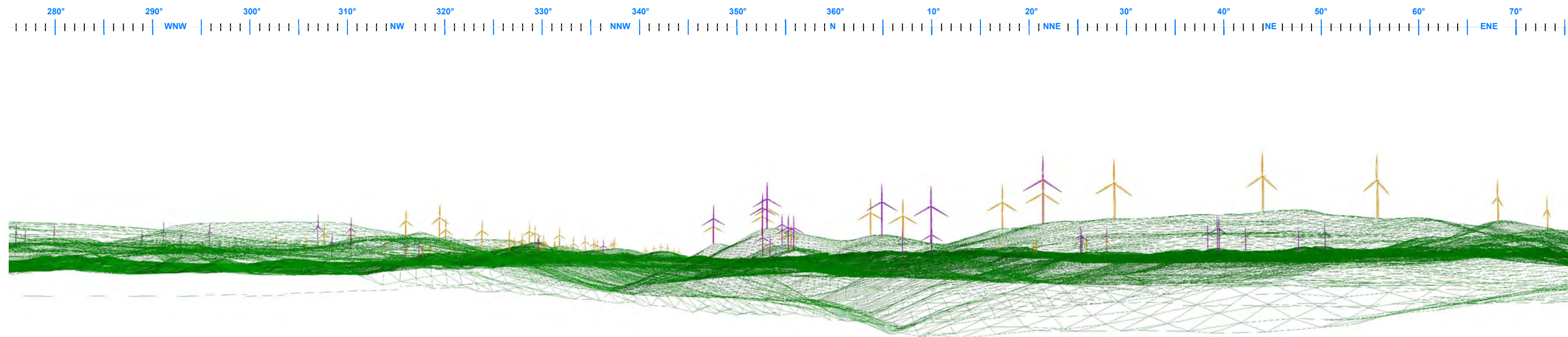
Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

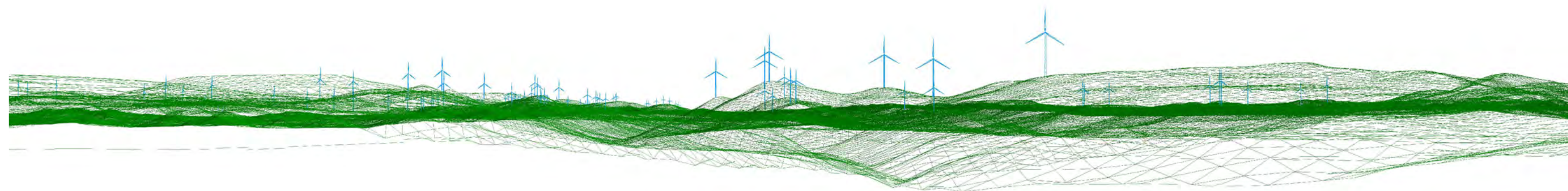
Figure 18
Wireframe 7 Dwelling S180

White Rock Wind Farm Stage 2



Wireframe 8 Dwelling N180: WRWF Project Approval and Stage 2 wind turbine overlay

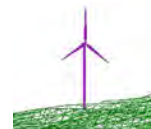
Distance to closest approved Project Approval WRWF wind turbine 1.34 kilometres. Project Approval tips visible 53, hubs visible 39
 Distance to closest WRWF Stage 2 wind turbine 1.63 kilometres. Project Approval and Stage 2 tips visible 54, hubs visible 40



Wireframe 8 Dwelling N180: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

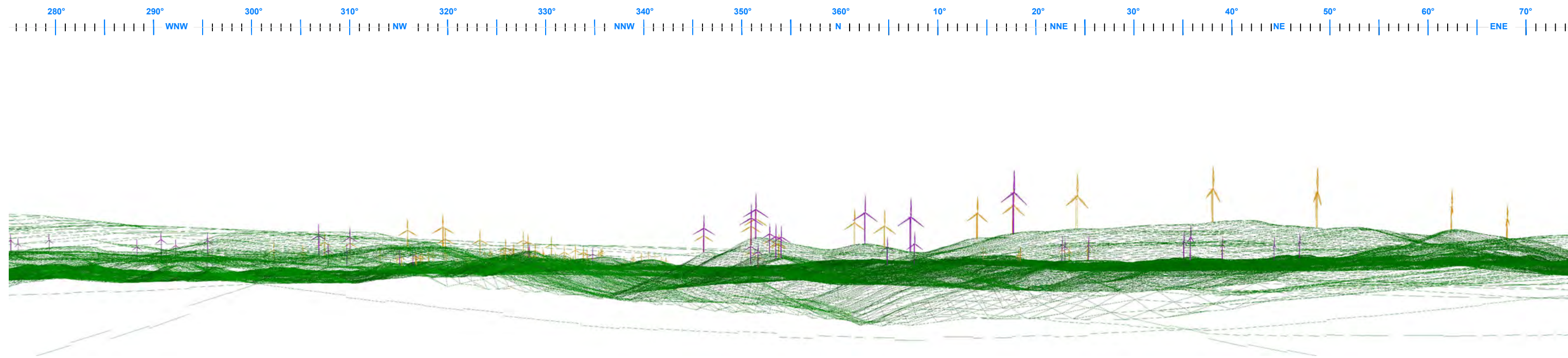
Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

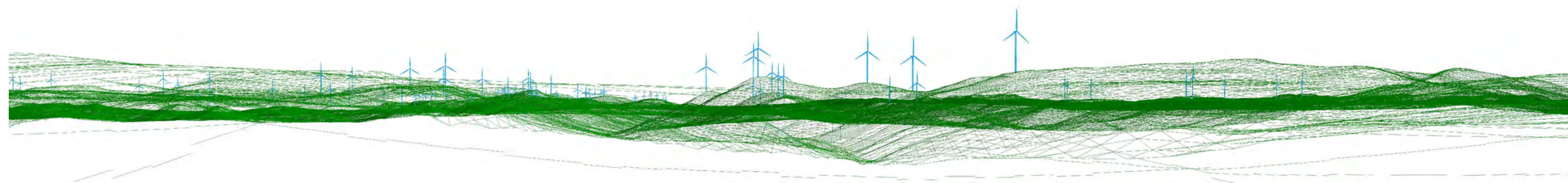
Figure 19
Wireframe 8 Dwelling N180

White Rock Wind Farm Stage 2



Wireframe 9 Dwelling N190: WRWF Project Approval and Stage 2 wind turbine overlay

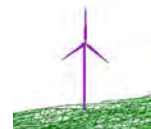
Distance to closest approved Project Approval WRWF wind turbine 1.42 kilometres. Project Approval tips visible 35, hubs visible 23
 Distance to closest WRWF Stage 2 wind turbine 1.76 kilometres. Project Approval and Stage 2 tips visible 34, hubs visible 18



Wireframe 9 Dwelling N190: Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

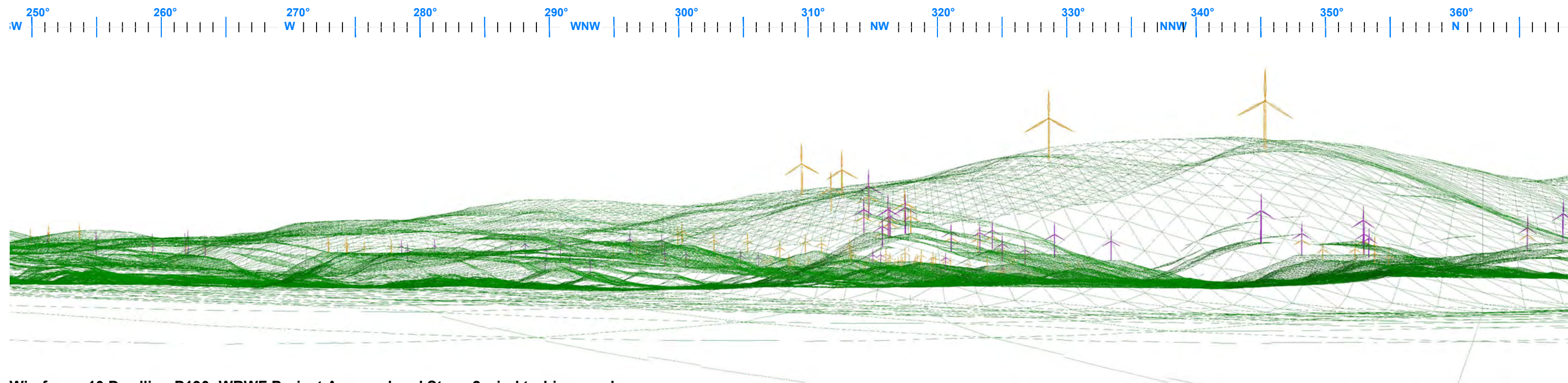
Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

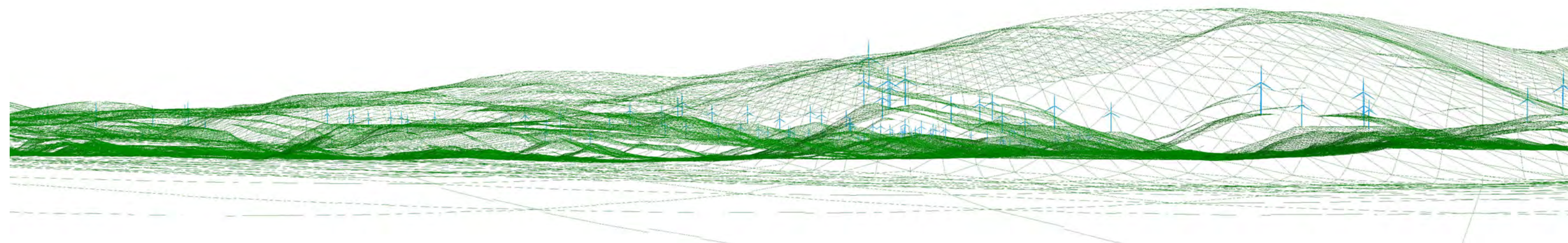
The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 20
Wireframe 9 Dwelling N190

White Rock Wind Farm Stage 2



Wireframe 10 Dwelling P190: WRWF Project Approval and Stage 2 wind turbine overlay
 Distance to closest Project Approval WRWF wind turbine 1.37 kilometres. Project Approval tips visible 9, hubs visible 6
 Distance to closest WRWF Stage 2 wind turbine 3.03 kilometres. Project Approval and Stage 2 tips visible 7, hubs visible 0



Wireframe 10 Dwelling P190: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

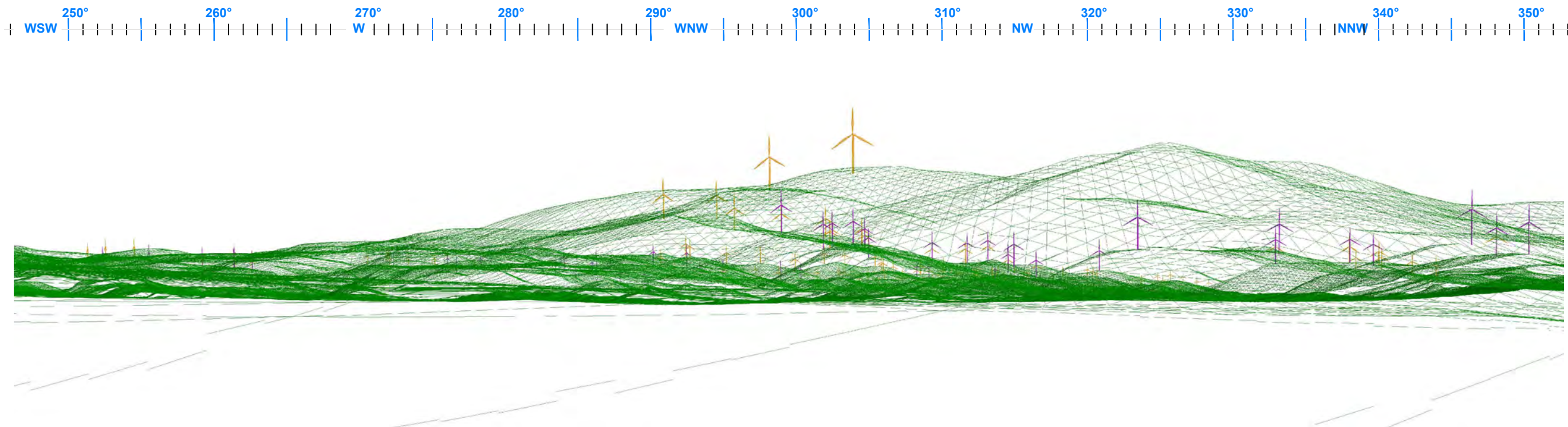
Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 21
Wireframe 10 Dwelling P190

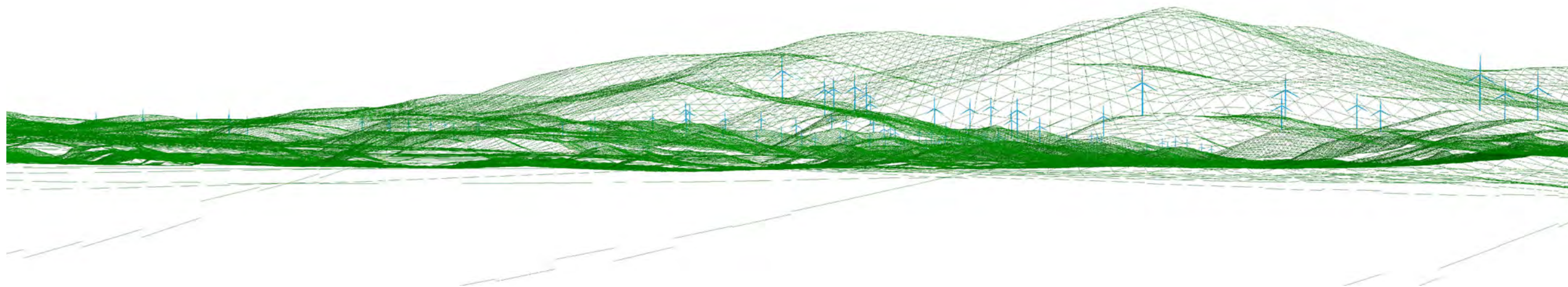
White Rock Wind Farm Stage 2



Wireframe 11 Dwelling R190: WRWF Project Approval and Stage 2 wind turbine overlay

Distance to closest Project Approval WRWF wind turbine 1.87 kilometres. Project Approval tips visible 9, hubs visible 5

Distance to closest WRWF Stage 2 wind turbine 3.04 kilometres. Project Approval and Stage 2 tips visible 7, hubs visible 2



Wireframe 11 Dwelling R190: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

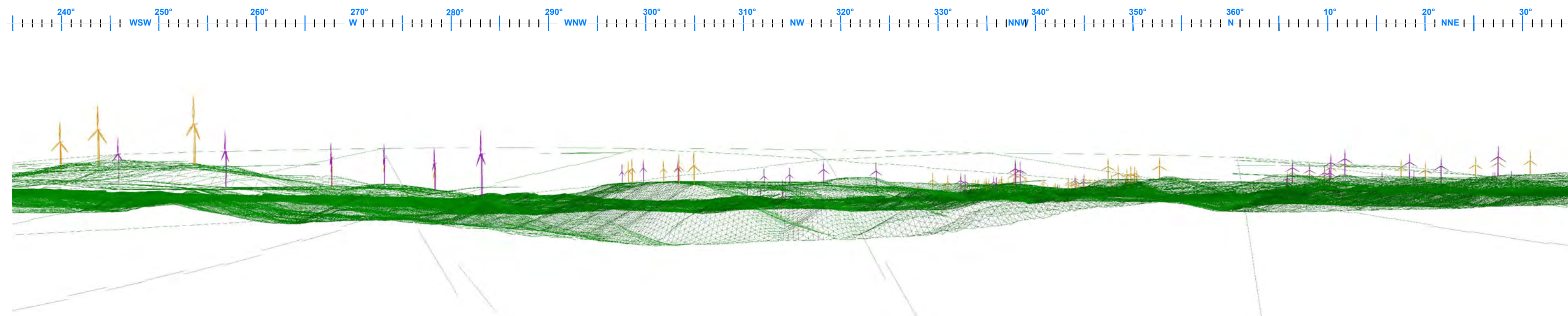
Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

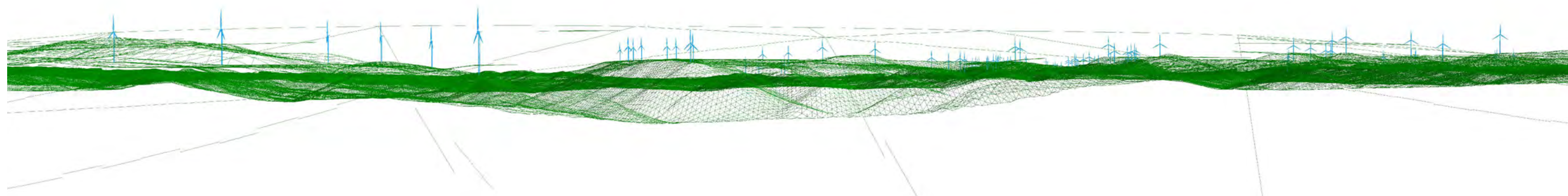
Figure 22
Wireframe 11 Dwelling R190

White Rock Wind Farm Stage 2



Wireframe 12 Dwelling L200: WRWF Project Approval and Stage 2 wind turbine overlay

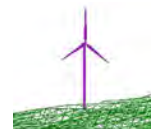
Distance to closest Project Approval WRWF wind turbine 1.21 kilometres. Project Approval tips visible 17, hubs visible 14
 Distance to closest WRWF Stage 2 wind turbine 1.67 kilometres. Project Approval and Stage 2 tips visible 24, hubs visible 8



Wireframe 12 Dwelling L200: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

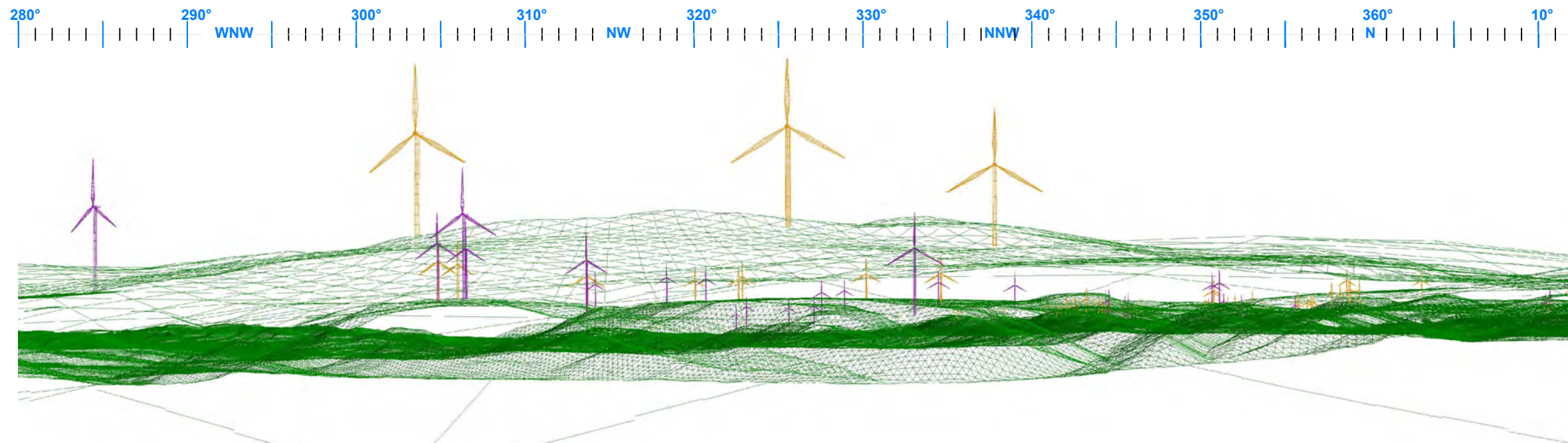
Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 23
Wireframe 12 Dwelling L200

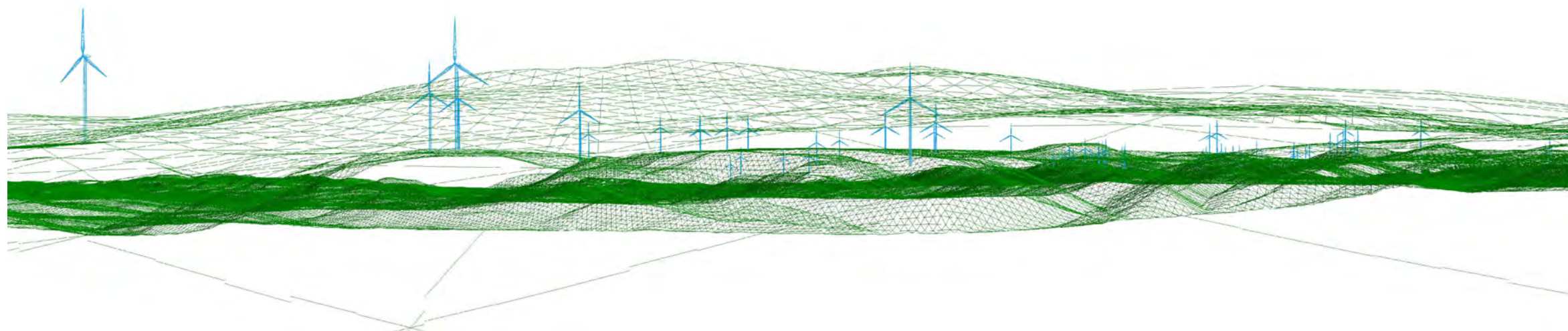
White Rock Wind Farm Stage 2



Wireframe 13 Dwelling L220: WRWF Project Approval and Stage 2 wind turbine overlay

Distance to closest Project Approval WRWF wind turbine 0.85 kilometres. Project Approval tips visible 4, hubs visible 3

Distance to closest WRWF Stage 2 wind turbine 1.45 kilometres. Project Approval and Stage 2 tips visible 9, hubs visible 2



Wireframe 13 Dwelling L220: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

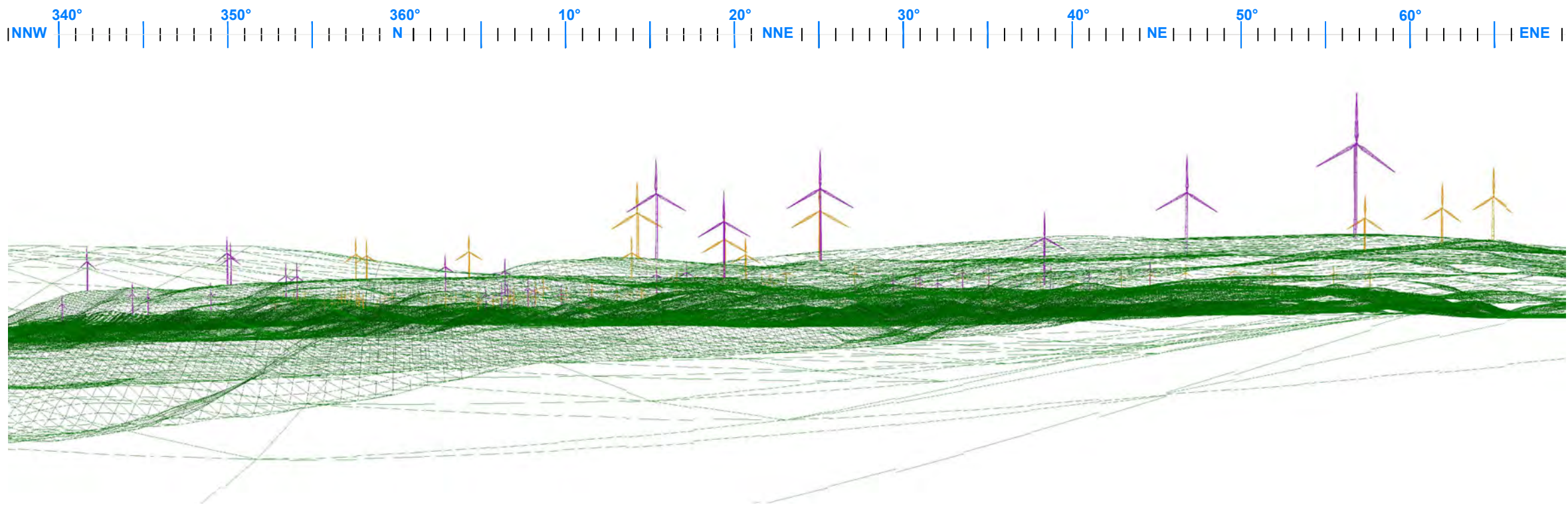
Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

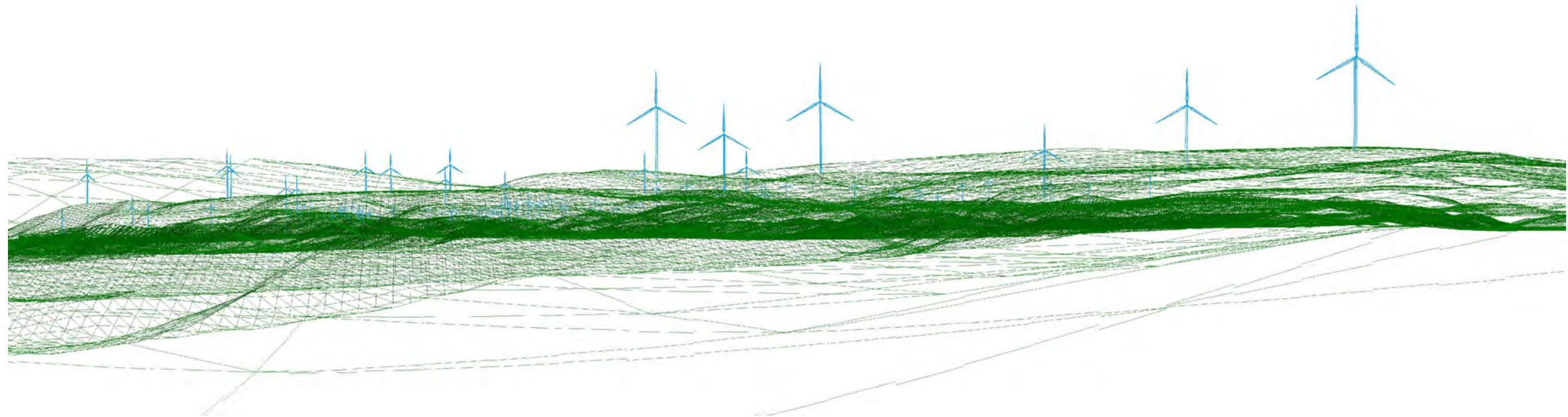
The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 24 -
Wireframe 13 Dwelling L220

White Rock Wind Farm Stage 2



Wireframe 14 Dwelling I221: WRWF Project Approval and Stage 2 wind turbine overlay
 Distance to closest Project Approval WRWF wind turbine 1.78 kilometres. Project Approval tips visible 11, hubs visible 11
 Distance to closest WRWF Stage 2 wind turbine 1.34 kilometres. Project Approval and Stage 2 tips visible 16, hubs visible 11



Wireframe 14 Dwelling I221: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



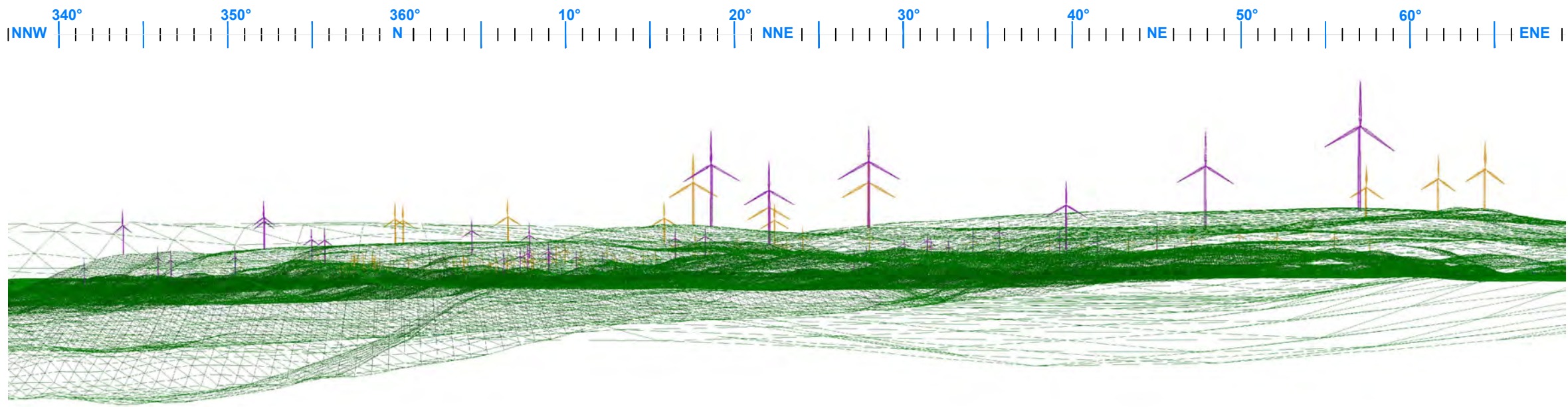
WRWF Stage 1 constructed,
and Stage 2 wind turbines

Notes:
 Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

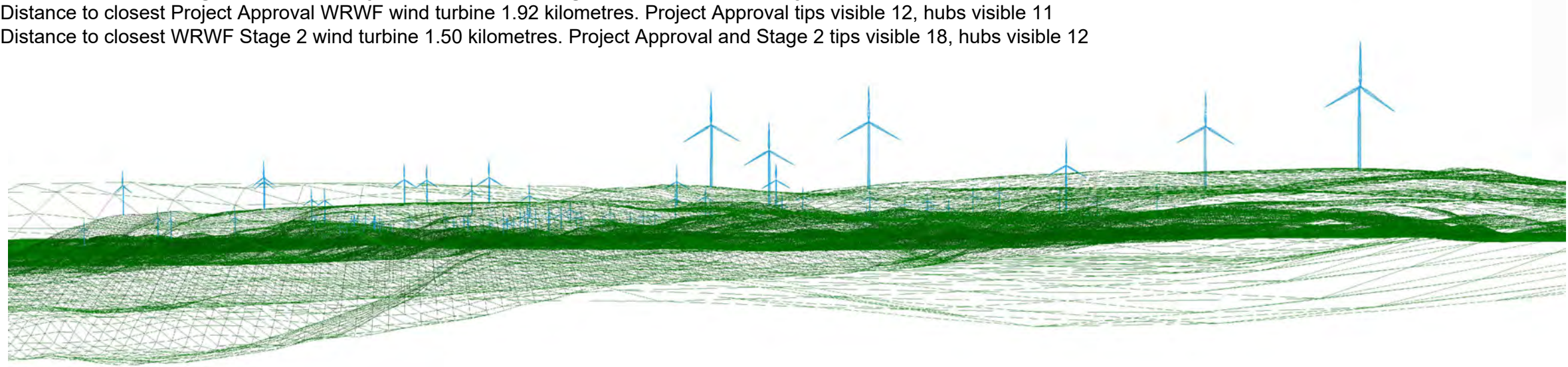
Figure 25 -
Wireframe 14 Dwelling I221

White Rock Wind Farm Stage 2



Wireframe 15 Dwelling I222: WRWF Project Approval and Stage 2 wind turbine overlay

Distance to closest Project Approval WRWF wind turbine 1.92 kilometres. Project Approval tips visible 12, hubs visible 11
 Distance to closest WRWF Stage 2 wind turbine 1.50 kilometres. Project Approval and Stage 2 tips visible 18, hubs visible 12



Wireframe 15 Dwelling I222: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



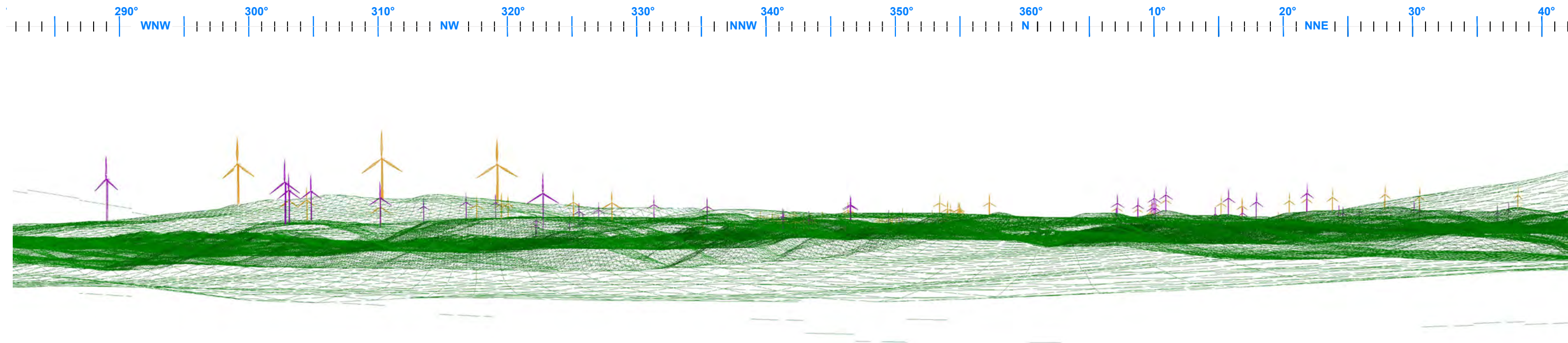
WRWF Stage 1 constructed,
and Stage 2 wind turbines

Notes:
 Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

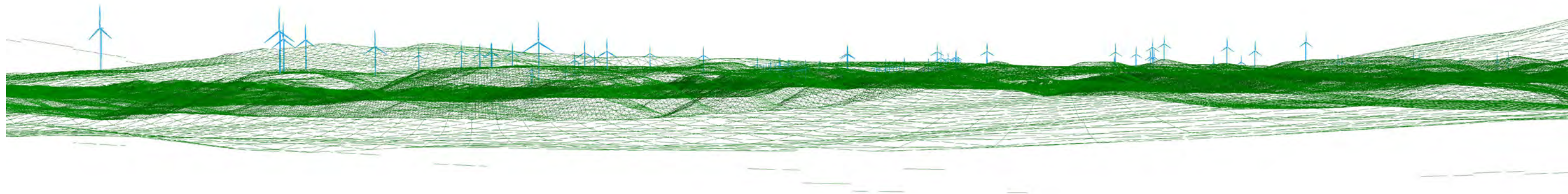
Figure 26 -
Wireframe 15 Dwelling I222

White Rock Wind Farm Stage 2



Wireframe 16 Dwelling M221: Project Approval and Stage 2 wind turbine overlay

Distance to closest Project Approval WRWF wind turbine 1.63 kilometres. Project Approval tips visible 45, hubs visible 25
 Distance to closest WRWF Stage 2 wind turbine 2.30 kilometres. Project Approval and Stage 2 tips visible 57, hubs visible 31



Wireframe 16 Dwelling M221: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

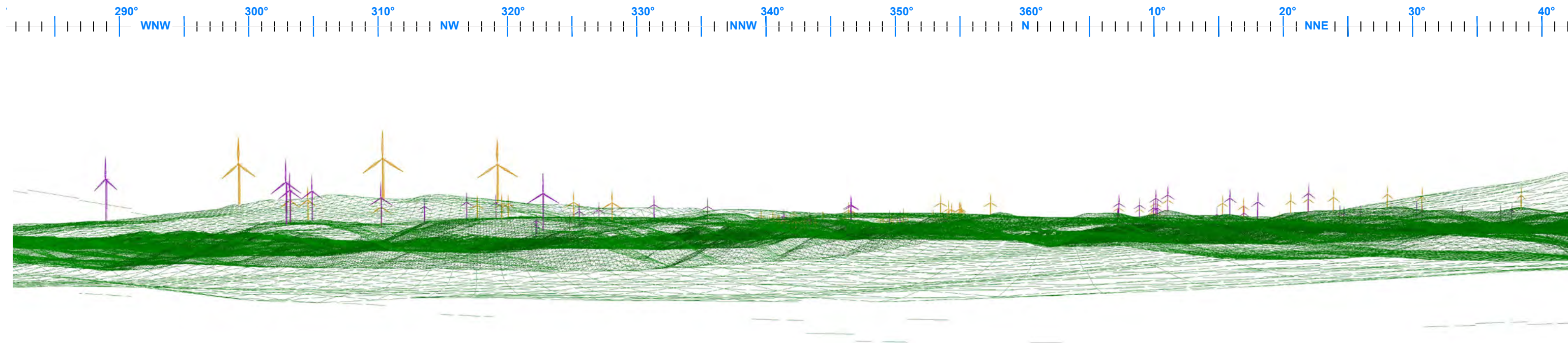
Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

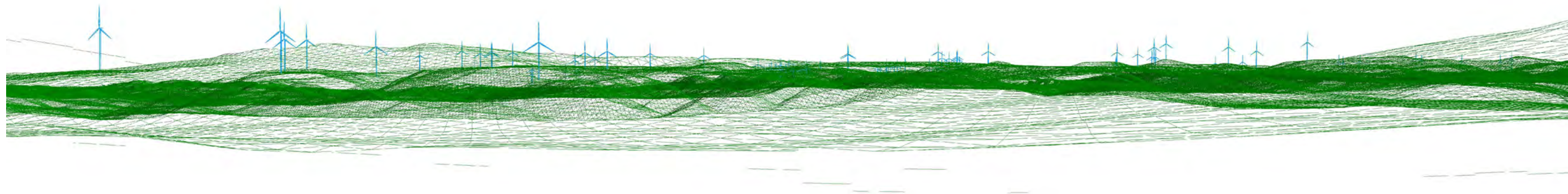
Figure 27 -
Wireframe 16 Dwelling M221

White Rock Wind Farm Stage 2



Wireframe 17 Dwelling M220: WRWF Project Approval and Stage 2 wind turbine overlay

Distance to closest Project Approval WRWF wind turbine 1.75 kilometres. Project Approval tips visible 26, hubs visible 12
 Distance to closest WRWF Stage 2 wind turbine 2.43 kilometres. Project Approval and Stage 2 tips visible 36, hubs visible 17



Wireframe 17 Dwelling M220: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

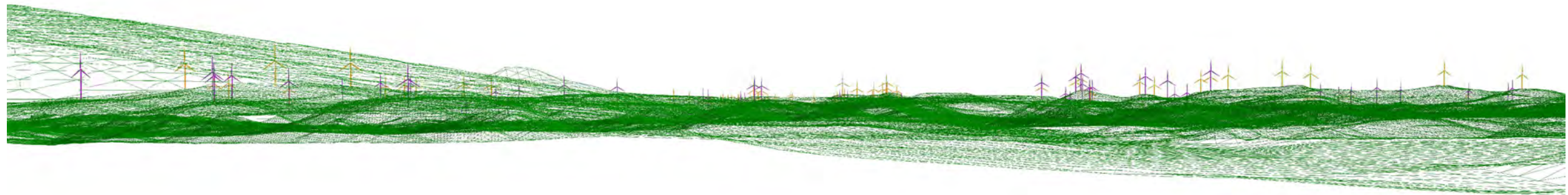
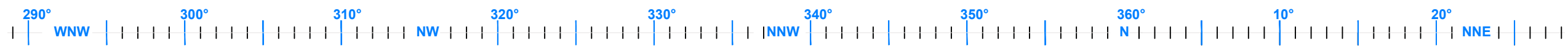
Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 28 -
Wireframe 17 Dwelling M220

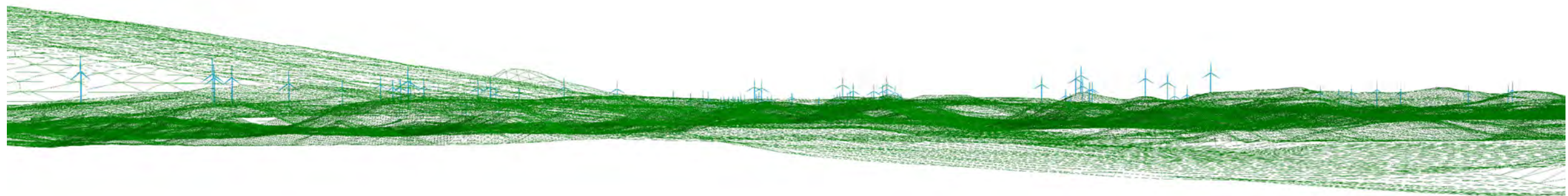
White Rock Wind Farm Stage 2



Wireframe 18 Dwelling N230: WRWF Project Approval and Stage 2 wind turbine overlay

Distance to closest Project Approval WRWF wind turbine 3.21 kilometres. Project Approval tips visible 45, hubs visible 25

Distance to closest WRWF Stage 2 wind turbine 3.85 kilometres. Project Approval and Stage 2 tips visible 48, hubs visible 29



Wireframe 18 Dwelling N230: WRWF Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

Notes:

Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

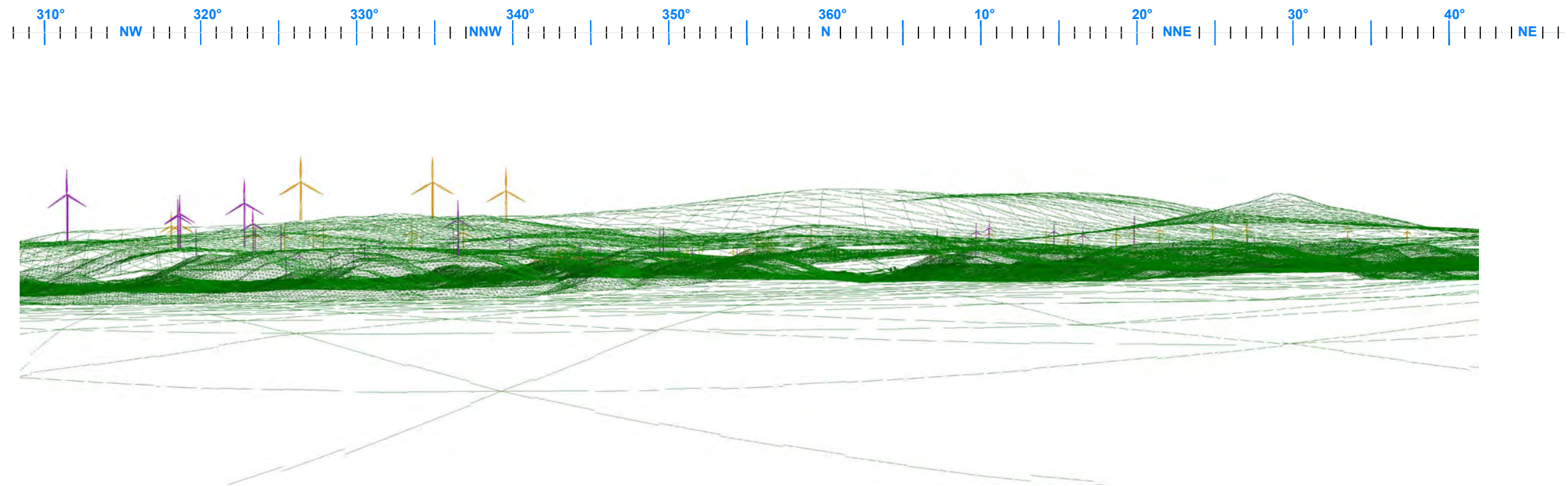
The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 29 -
Wireframe 18 Dwelling N230

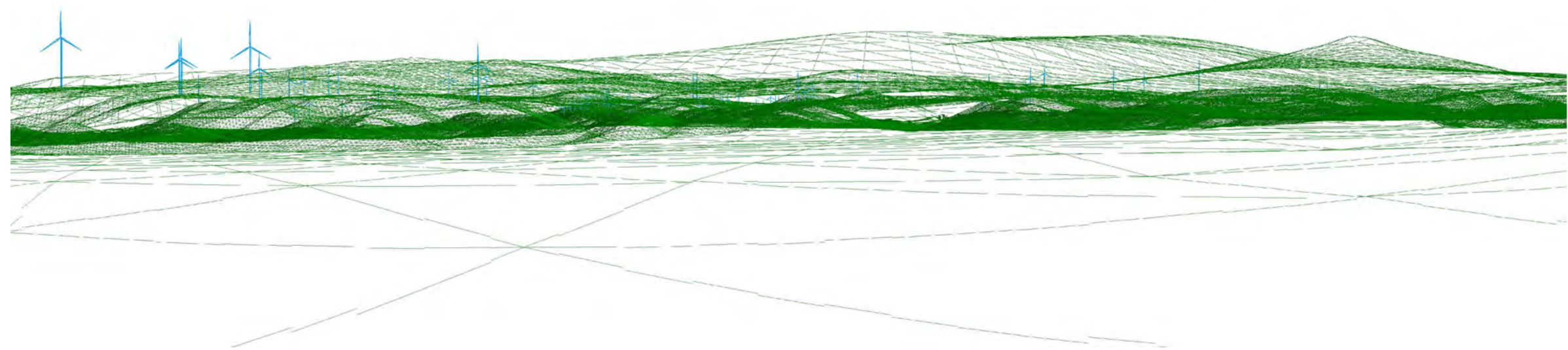
White Rock Wind Farm Stage 2

GREEN BEAN DESIGN

landscape architects



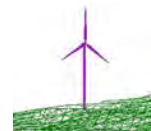
Wireframe 19 Dwelling L230: WRWF Project Approval and Stage 2 wind turbine overlay
 Distance to closest Project Approval WRWF wind turbine 2.10 kilometres. Project Approval tips visible 6, hubs visible 3
 Distance to closest WRWF Stage 2 wind turbine 2.48 kilometres. Project Approval and Stage 2 tips visible 6, hubs visible 4



Wireframe 19 Dwelling L230: Project Approval (Stage 1 constructed) and Stage 2 wind turbines



WRWF Project Approval
wind turbines



WRWF Stage 2
wind turbine



WRWF Stage 1 constructed,
and Stage 2 wind turbines

Notes:
 Views toward wind turbines or portions of wind turbines located below the green wire-frame will be screened by landform.

The wire-frame does not account for, or illustrate, any vegetation including trees adjacent to or beyond residential dwellings which may screen or filter views toward the wind turbines. The extent of wind turbine visibility is very conservative and may illustrate a number of wind turbines that will not be visible from the dwelling.

Figure 30 -
Wireframe 19 Dwelling L230

White Rock Wind Farm Stage 2

10 Review of Consolidated Project Approval and Administrative Conditions

10.1 Introduction

The WRWF Consolidated Project Approval has been reviewed as part of this VIA to determine the type and extent of additional mitigation measures that would be required, or should be modified as a result of the proposed WRWF Stage 2.

10.2 Review of Consolidated Project Approval and Administrative Conditions

The following Table outlines the existing Conditions relevant to mitigate the potential visual effects of the modified WRWF Stage 2.

Table 8 Conditions of Consent

Condition	Description	Comment
Condition C23	All residents, business owners or public authorities, whose dwelling, business or public area respectively, may be subject to moderate to high visual impact, as defined in the EA, shall be consulted regarding impact minimisation measures. The outcomes of this consultation process shall be used to inform the Design and Landscape Plan, required under condition C30.	This condition remains valid.
Condition C24	At the request of any owners of residential dwellings or businesses with views of a turbine(s) located within five kilometres of their dwellings, the Proponent shall provide and bear the full cost of reasonable landscaping treatments to visually screen these dwellings. Such a request may be made in writing by the owner of the dwelling or business within 6 months from the commencement of operation of the project, and landscaping treatments agreed between the parties shall be implemented and completed within 12 months of such an agreement. Should the parties not be able to reach agreement on the scope of landscaping treatments, then either party may refer the matter to the Secretary for resolution. The Secretary's decision on such a referral shall be final and binding on the parties	This condition remains valid.
Condition C25	Deleted	
Condition C26	Deleted	
Condition C28	The Proponent must: (a) minimise the off-site visual impacts of the project; (b) ensure the wind turbines are:	This condition remains valid. The WRWF Stage 2 works will

Condition	Description	Comment
	• painted off white/grey, unless otherwise agreed by the Secretary; and • finished with a surface treatment that minimises the potential for glare and reflection; (c) ensure the visual appearance of all ancillary infrastructure (including paint colours), blends in as far as possible with the surrounding landscape; and (d) not mount any advertising signs or logos on wind turbines or ancillary infrastructure.	be consistent with existing infrastructure.
Condition C29	With the exception of aviation hazard lighting implemented in accordance with the requirements of this condition, no external lighting other than low intensity security night lighting is permitted on site unless otherwise agreed or directed by the Secretary, or required by Civil Aviation Safety Authority. Prior to the commencement of construction, the Applicant shall consult with the Civil Aviation Safety Authority on the need for aviation hazard lighting in relation to the wind turbines. Any aviation hazard lighting shall be implemented in a manner that minimises visual intrusion to surrounding non-associated residences as far as reasonable and feasible.	This condition remains valid. The WRWF Stage 2 works will be consistent with existing infrastructure.
Condition C30	A Design and Landscaping Plan shall be prepared to outline measures to ensure appropriate development and maintenance of landscaping on the site to achieve adequate landscape buffers and address the visual impacts arising from the project, including turbines, site access roads and associated above ground infrastructure, as far as is reasonable and feasible. The Plan shall be prepared by a qualified landscape architect and where relevant meet any requirements of the Councils. The Plan shall include design treatments for the turbines and ancillary infrastructure, including, but not necessarily limited to: (a) the landscape screening measures at residences in close proximity to the project site and along nearby roadsides to screen potential moderate to significant views of the project, including an outline of additional measures available for	A Design and Landscaping Plan has been prepared and submitted to the Secretary for approval. The Design and Landscaping Plan will be amended to incorporate the WRWF Stage 2 works and re submitted to the Secretary for approval.

Condition	Description	Comment
	requested landscaping treatments, as permitted under condition C24; (b) landscape elements and built elements, including proposed treatments, finishes and materials of exposed surfaces (including colour specifications); (c) lighting; (d) a schedule of species to be used in landscaping; (e) details of the timing and progressive implementation of landscape works; and (f) procedures and methods to monitor and maintain landscaped areas. The Plan shall be submitted for the approval of the Secretary prior to the commencement of permanent built works and/ or landscaping, unless otherwise agreed by the Secretary. The Plan may be submitted in stages to suit the staged construction program of the project.	

11 Conclusion

This VIA has assessed the potential visual effects associated with the modified WRWF Stage 2 based upon professional judgement and consideration of:

- the modified WRWF Stage 2 wind turbine design criteria
- the blade length (and tip height difference) between WRWF approved and modified Stage 2 wind turbines
- the overall visibility and visual scale of the modified WRWF Stage 2 wind turbines and
- the modified WRWF Stage 2 magnitude of visual effect compared to the WRWF Project Approval wind turbines.

The modified WRWF Stage 2 wind turbines are considered similar in form, pattern and colour to the WRWF Project Approval (Stage 1 constructed) wind turbines within the WRWF, as well as wind turbines within other surrounding approved wind farm projects.

This VIA has illustrated and compared the WRWF Project Approval wind turbines against the modified WRWF Stage 2 wind turbines, and concludes that the increase in wind turbine rotor diameter (and maximum tip height) would be discernible from some surrounding and proximate public and residential view locations. The overall extent of visibility, as illustrated in the ZVI Diagrams, would be very similar for the WRWF Project Approval and modified Stage 2 project.

This VIA has illustrated that the overall increase in view angle toward the WRWF modified Stage 2 wind turbine tip of blade would be around one and a half degrees from an approximate 2 km viewing distance, and less than a half degree from an approximate 5 km viewing distance. These increases represent a small area in the overall extent of view within the range of normal human vision.

This VIA notes that a number of approved WRWF Stage 2 wind turbines have been relocated away from non-associated dwellings which results in a significant reduction in both the magnitude and level of visual effect for dwellings to the east of the WRWF project site. The modified WRWF Stage 2 wind turbines are not considered to be of a magnitude that would significantly increase visual effects associated with the WRWF Project Approval. This VIA has addressed the Guidelines and established Visual Influence Zones for residential dwellings located within 4 kilometres in accordance with the Guideline requirements.

Whilst the WRWF approved and modified Stage 2 wind turbines would be visible (in whole or in part) from some residential dwellings within 4 kilometres of wind turbine locations, overall visibility would be partially restricted from many areas (including from dwellings and associated curtilage) due to tree cover and/or the influence of surrounding landforms.

The implementation of landscape works would provide visual mitigation for a number of dwellings surrounding the approved wind farm site in accordance with the Project Approval and Administrative Conditions.