

Woolsthorpe Wind Farm

Amendment to Planning Permit 2006/0220

VISUAL IMPACT ASSESSMENT

Prepared for:



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ENERFIN ENERGY SERVICES PTY LTD

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Green Bean Design (GBD) was established in 1999 and has specialised in landscape and visual impact assessment for the past 15 years. As an independent consultancy, GBD provide professional advice to a wide range of commercial and government clients involved in large scale infrastructure development.

GBD owner, and principal landscape architect Andrew Homewood, is a registered landscape architect and member of the Australian Institute of Landscape Architects and Environmental Institute of Australia and New Zealand. Andrew has over 30 years continuous employment in landscape consultancy and has completed numerous landscape and visual impact assessments for large scale and state significant infrastructure, including transport, mines, transmission lines/substations, wind farms and solar power developments.

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Contents		Page
	Executive summary	6
1	Introduction	7
2	Report structure	8
3	Methodology	9
4	WWF approved and amended wind turbines	10
5	Zone of Visual Influence Diagrams	12
6	Assessment of visual effects	15
7	Wireframes and photomontages	25
8	Review of Permit Conditions	39
9	Conclusion	41

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Figures

Figure 1	WWF approved and amended wind turbine layouts
Figure 2	WWF ZVI Diagram approved 168m tip height
Figure 3	WWF ZVI Diagram amended 230m tip height
Figure 4	WWF approved and amended wind turbine comparison
Figure 5	WWF approved and amended wind turbine overlay
Figure 6	WWF approved and amended wind turbine view angle comparison
Figure 7	Amended wireframe and photomontage locations
Figure 8	Dwelling A wireframe
Figure 9	Dwelling B wireframe
Figure 10	Dwelling C wireframe
Figure 11	Dwelling D wireframe
Figure 12	Dwelling I wireframe
Figure 13	Dwelling J wireframe
Figure 14	Dwelling K wireframe
Figure 15	Dwelling P wireframe
Figure 16	Photomontage PM 1
Figure 17	Photomontage PM 2
Figure 18	Photomontage PM 3

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Tables

Table 1 Report structure

Table 2 WWF approved and amended design criteria

Table 3 WWF approved and amended wind turbine swept area

Table 4 Magnitude of visual effect

Table 5 Assessment of visual effects

Table 6 Permit Conditions

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Executive summary

Green Bean Design Pty Ltd has been commissioned by Enerfin Energy Services Pty Ltd (the Proponent) to prepare a Visual Impact Assessment (VIA) report for the amendment to Planning Permit 2006/0220.

The Woolsthorpe Wind Farm (WWF) Project Approval permits the construction and operation of up to 20 wind turbines to a maximum 168 metre (m) tip height. This VIA has been prepared to assess the potential visual effect of the WWF amendment which includes:

- 13 wind turbines
- tip height up to 230m
- hub height up to 148m
- rotor diameter up to 164m
- blade length up to 82m, and
- rotor swept area up to 21,113m².

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The total number of wind turbines would be 13, a decrease of 7 wind turbines approved in the Planning Permit. The 13 wind turbines would remain located within the bounds of the project site identified in the Planning Permit.

The Zone of Visual Influence Diagrams (**Figures 2 and 3**) demonstrate areas of land from which the approved WWF and amended wind turbines would be theoretically visible (as well as overall number of wind turbines being visible at tip height), would be similar in extent.

This VIA included a review of 8 dwellings generally within 2km of the approved WWF wind turbine locations. The assessment of visual effects associated with the amended wind turbines is summarised as low to medium. The difference between the WWF approved and amended wind turbine is not considered to be of a magnitude that would significantly increase visual effects associated with the approved development. Key differences between the WWF approved and amended wind turbines are illustrated in **Figures 4, 5, and 6**.

Eight wireframe diagrams and three photomontages have been prepared to illustrate wind turbines within the approved WWF, the amended wind turbine layout and the neighbouring Hawkesdale Wind Farm project. The wireframes have been prepared from photomontage locations included in the previous WWF Amendment Visual Assessment (Wind Farm Developments 2016).

The proposed wind turbine amendments would not introduce elements that are significantly more prominent or out of character with the approved WWF project, and the potential for the amended wind turbines to result in any additional significant cumulative visual effects regarding other wind farm developments is low.

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1 Introduction

1.1 Introduction

This VIA has been prepared to compare the potential visual effect of the wind turbine amendments with overall visibility determined for the approved WWF project. The approved WWF visibility has been established from the WWF Amendment Visual Assessment (2016), together with additional visual analysis presented in the Amendment Visual Assessment.

The comparison between the approved WWF and amended wind turbines has been used to determine if any of the key dwelling view locations within 2 kilometres (km) of the approved WWF are subject to an increased level of visual effect resulting from the wind turbine amendments. This VIA has not undertaken an assessment to verify overall visibility determined in prior approved WWF applications.

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

- confirmation of the amended wind turbine layout
- amended wind turbines description and design criteria
- Zone of Visual Influence (ZVI) diagrams
- wireframes and photomontages illustrating the approved WWF and amended wind turbines
- Woolsthorpe Wind Farm Planning Permit and Permit Conditions and
- Amendment Visual Assessment Report (2016).

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2 Report structure

2.1 Report structure

This VIA report been structured into ten parts as outlined in Table 1:

Table 1 – Report structure

Report section	Description
Section 1 Introduction	This section provides an introduction to the VIA.
Section 2 VIA report structure	This section outlines the VIA report structure and the report sections included in the VIA.
Section 3 Methodology	This section sets out the methodology employed in this VIA preparation.
Section 4 WWF approved and proposed amendments	This section describes the key differences between the approved and amended WWF wind turbines.
Section 5 Zone of Visual Influence (ZVI) diagrams	This section identifies the area of land surrounding the wind farm from which the approved WWF and amended wind turbines, or portions of wind turbine structures, may be theoretically visible.
Section 7 Assessment of visual effects	This section considers potential visual impacts associated with the amended wind turbines including any potential cumulative visual impacts.
Section 8 Wireframes and photomontages	This section describes and presents wireframes and photomontages prepared for this VIA.
Section 9 Review of Permit Conditions	This section identifies visual amenity conditions applicable to the approved WWF and relevance to the amended wind turbines.
Section 10 Conclusion	Conclusions are drawn on the overall visual effect of the amended wind turbines within the surrounding viewshed.

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3 Methodology

3.1 Introduction

This VIA methodology included the following activities:

- desktop review of the approved WWF wind turbine layout
- preparation of ZVI diagrams
- assessment of significance of residual visual effects and
- preparation of wireframes, photomontages and illustrative figures.

3.2 Desktop study

A desktop study was carried out to review the WWF approved project together with associated reports and approval documentation. The desktop study also included a review of the approved wind turbine layout, as well as the surrounding landscape and dwelling locations. This was carried out by reference to topographic maps as well as aerial photographs of the surrounding landscape.

3.3 Site visit and photography

A site visit was undertaken to capture contemporary photography for the preparation of photomontages.

3.4 ZVI Diagrams

ZVI Diagrams were prepared to illustrate the theoretical visibility of the approved WWF wind turbines (tip height at 168m) and amended wind turbines (tip height at 230m). The ZVI Diagrams are illustrated in **Figures 2 and 3**.

3.5 Wind turbine magnitude of visual effects

The determination of residual visual effects resulting from the wind turbine amendments would result primarily from observable differences between the approved WWF and the amended wind turbines. Observable differences may include views toward wind turbines (hubs, rotor face and blade tips) where previously screened by landform and or vegetation.

3.6 Wind turbine visual effects

This VIA has considered the potential visual effects for dwellings located within 2km of the approved WWF project. The visual magnitude of relocated and amended wind turbines from view locations beyond 2km would be generally no greater than the visual scale of the approved wind turbines within 2km of dwellings. Views toward a reduced number of amended wind turbines from key view locations beyond 2km are therefore considered acceptable in accordance with the Planning Permit approval.

3.7 Wind turbine wireframes and photomontages

Wireframes and photomontages have been prepared from eleven locations included in the Amendment Visual Assessment Report. The wireframes and photomontages illustrate and contrast the approved WWF wind turbines and the proposed amended wind turbines. The wireframe and photomontage locations are illustrated in **Figure 7** and the wireframes in **Figures 8 to 18**.

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4 WWF approved and amended wind turbines

4.1 WWF approved WWF wind turbine

The WWF Planning Permit approved the construction and operation of up to 20 wind turbines to a maximum 168m tip height in addition to a range of ancillary wind farm infrastructure.

4.2 WWF amended wind turbine

The amended wind turbine would include:

- a 148m hub height
- blade length up to 82m
- rotor diameter up to 164m and
- wind turbine tip height up to 230m.

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Tables 2 and 3 outline the WWF approved and amended wind turbine design criteria.

Table 2: WWF approved and amended design criteria

	Hub height	Rotor diameter	Tip height	Total number
Approved WWF wind turbine	100m	140m	168m	Up to 20
Amended wind turbine	148m	164m	230m	Up to 13
Difference	+48m	+24m	+62m	-7
Percentage difference	+48%	+17%	+37%	-35%

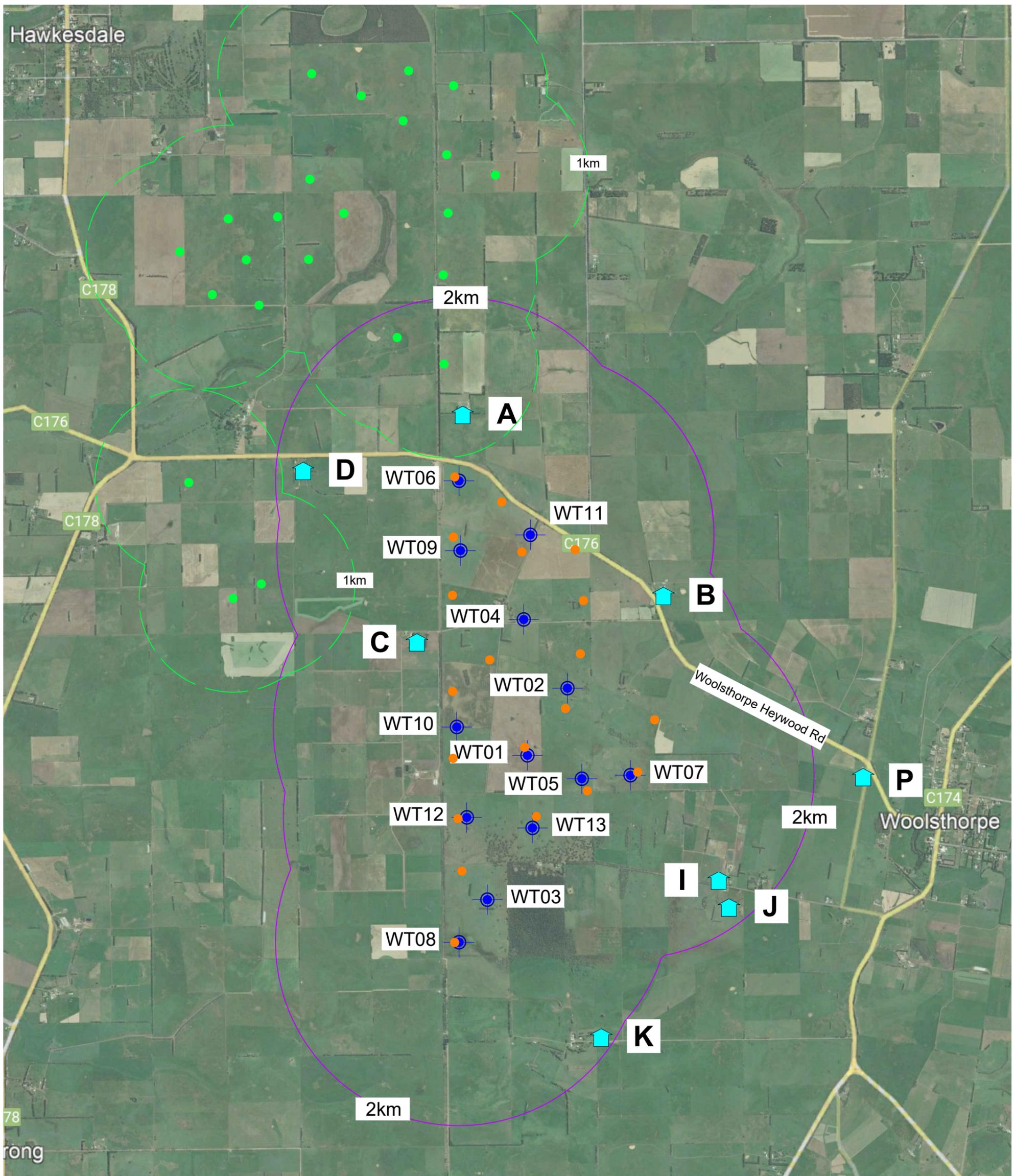
Table 3: WWF approved and amended wind turbine swept area

	Rotor diameter	Swept area
Approved WWF wind turbine	140m	15,386m ²
Amended wind turbine	164m	21,113m ²
Difference	+24m	+5,727m ²
Percentage difference	+17%	+37%

The amended wind turbines are largely located within proximity to the approved WWF wind turbine locations with some additional setbacks included where approved WWF turbines have been removed. The approved WWF and amended wind turbine locations are shown on **Figure 1**.

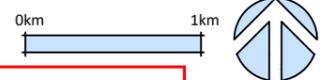
4.3 Amended wind turbine distance and hub visibility

Changes to the approved WWF wind turbine layout would result in amendments to distances between dwellings and the amended wind turbines. The number of amended wind turbine hubs visible from dwellings surrounding the wind farm site would be subject to some variations due to an increase in the amended wind turbine hub height.



Legend

- WWF approved wind turbine location (indicative location)
- ⊕ WWF amended wind turbine location (indicative location)
- 🏠 Dwelling generally within 2 km of amended wind turbine and wireframe location
- Hawkesdale wind turbine location (indicative location)



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Figure 1
WWF approved and amended wind turbine layout

Woolsthorpe Wind Farm Amendment

5 Zone of Visual Influence Diagrams

5.1 Introduction

Figures 2 and 3 illustrate the theoretical visibility of the approved WWF wind turbines at 168m tip height, and the amended wind turbines at 230m tip height. The ZVI diagrams do not account for the screening influence of vegetation or built structures and are therefore conservative in wind turbine visibility.

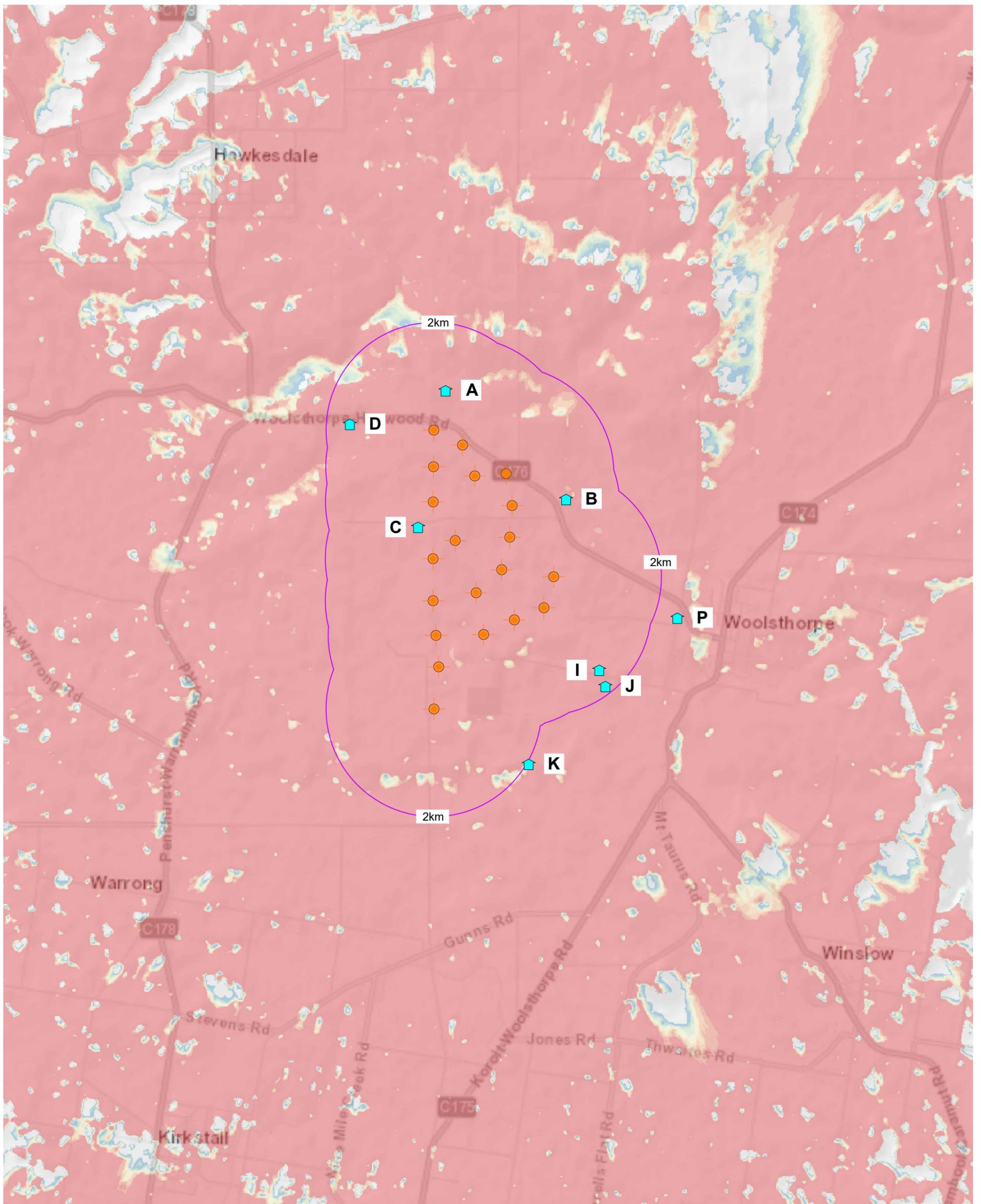
Within the recognised limitations of ZVI diagrams, the overall extent of approved WWF and amended wind turbine visibility, covers a similar extent across the landscape surrounding the approved WWF wind farm.

The similarity in theoretical wind turbine visibility demonstrates the influence of local topographical features on views toward the approved WWF and amended wind turbines. The ZVI diagrams also illustrate that the amended wind turbines would have a limited increase in visual effects across the WWF viewshed.

Whilst the overall extent of wind turbine visibility would be varied by topography for both the approved WWF and the amended wind turbines, the number of wind turbines visible (to tip height) from receiver locations within the wind farm viewshed is likely to be subject to a small increase. However, when compared to the approved WWF wind turbines, the increase in wind turbine visibility would be largely restricted to the upper sections (rotor blades) of wind turbine structures, rather than whole wind turbines.

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Legend

-  Approved WWF up to 20 wind turbines (indicative location)
-  Dwelling within 2km of approved wind turbines (indicative location)



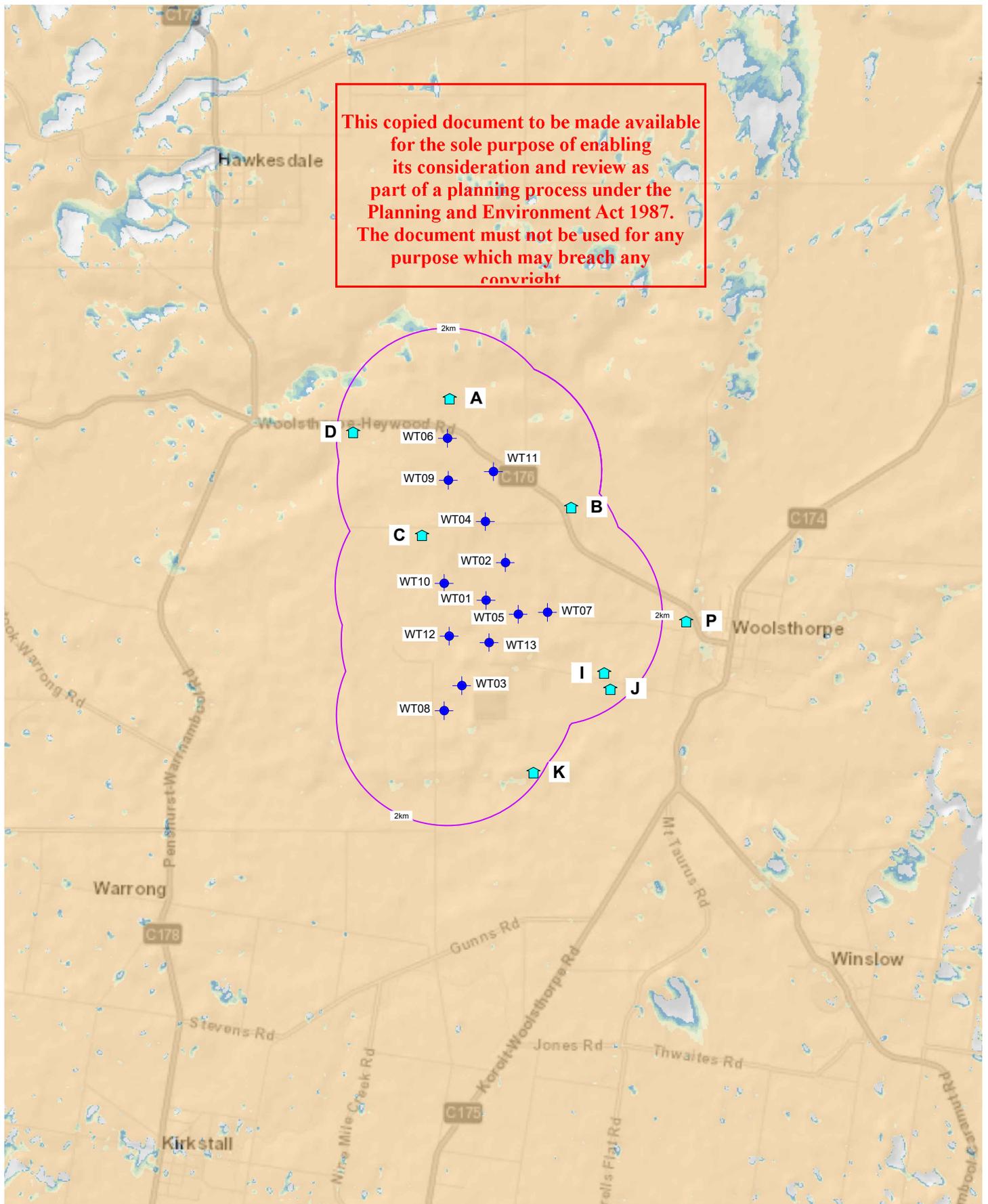
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Figure 2
WWF ZVI Diagram approved 168 metre tip height

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Woolsthorpe Wind Farm Amendment

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Legend

◆ WWF amendment to 13 wind turbines (indicative location)

🏠 Dwelling generally within 2km of wind turbine

WTG tips visible at 1.6 m AGL



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Figure 3
WWF ZVI Diagram amendment to 230 metre tip height

6 Assessment of visual effects

6.1 Introduction

Whilst the amended wind turbine tip height would extend up to 62m above the approved WWF wind turbine tip height, this VIA has determined that the overall scale of the amended wind turbine would not result in an order of visual magnitude that is significantly greater than the visual magnitude of the approved WWF wind turbines. A comparison of the approved WWF and amended wind turbines is illustrated in **Figures 4 and 5**.

The amended wind turbines would be consistent with the approved WWF wind turbines with regard to their visual form, design, pattern and colour. The location of dwellings within 2km of the amended wind turbine layout is illustrated in **Figure 1**.

Figure 6 illustrates the elevated angle of view (toward tip height) for the approved WWF and amended wind turbines from a view distance at 2km and 5km respectively. **Figure 6** illustrates that the amended wind turbine would result in under 2 degrees of additional view angle from a 2km view distance. The additional view angle at 5km would be approximately 42 minutes (under one degree) increase in view angle. The relatively small increase in view angle toward the amended wind turbine tip height, at a view distance of 5km (and beyond) is considered unlikely to result in a level of visual magnitude greater than the approved WWF wind turbines. Within the parameters of normal human vision, the amended wind turbines are not considered to give rise to a significant increase in visual magnitude over and above the approved WWF project.

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WWF amended
230 metre tip height

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WWF amended
swept path 21,113 m²

WWF approved wind turbine
with a 168 metre tip height

WWF approved wind turbine
with 140 metre rotor diameter

WWF approved wind
turbine swept path 15,386 m²

WWF amended wind turbine
with 164 metre rotor diameter

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Ground level

WWF amended wind turbine
with a 230 metre tip height

WWF approved wind turbine
with a 168 metre tip height

Figure 4 -
WWF approved and amended
wind turbine comparison

WWF amended
230 metre tip height

WWF approved wind turbine
with a 168 metre tip height

WWF approved wind turbine
swept path 15,386 m²

WWF amended
swept path 21,113 m²

WWF approved wind turbine with a 140
metre rotor diameter

WWF amended wind turbine with
a 164 metre rotor diameter

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Ground level

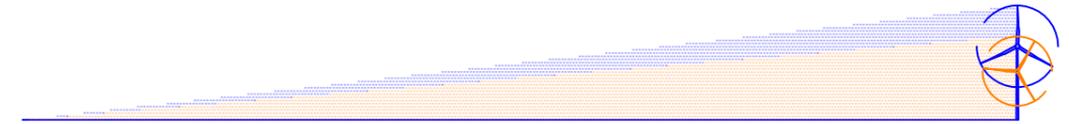
Figure 5-
WWF approved and amended
wind turbine overlay

Orange line = view line toward tip height of WWF approved wind turbine (168m tip height)

Blue line = view line toward tip height of amended wind turbine (230m tip height)

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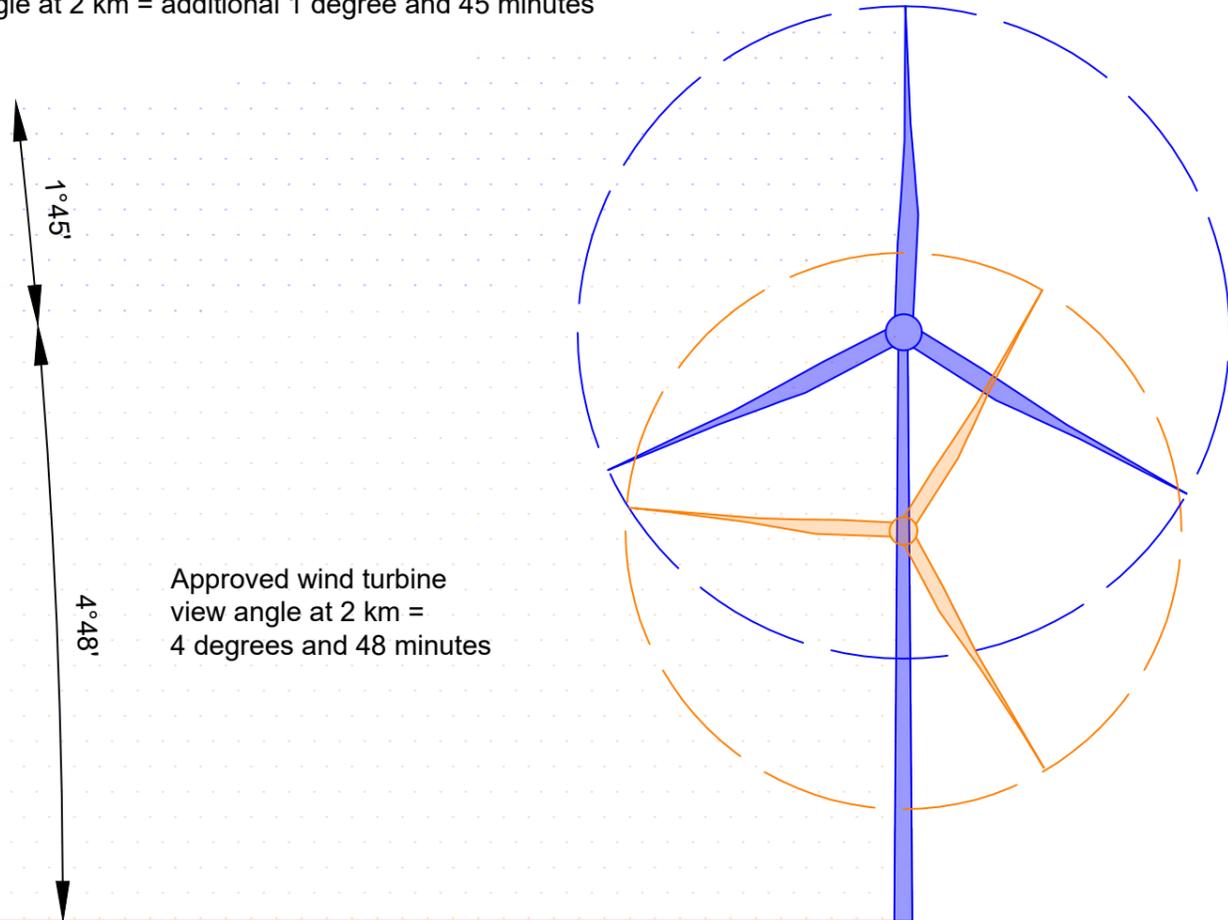


Comparative height of approved WWF and amended wind turbine from a 2 km view distance



Comparative height of approved WWF and amended wind turbine from a 5 km view distance

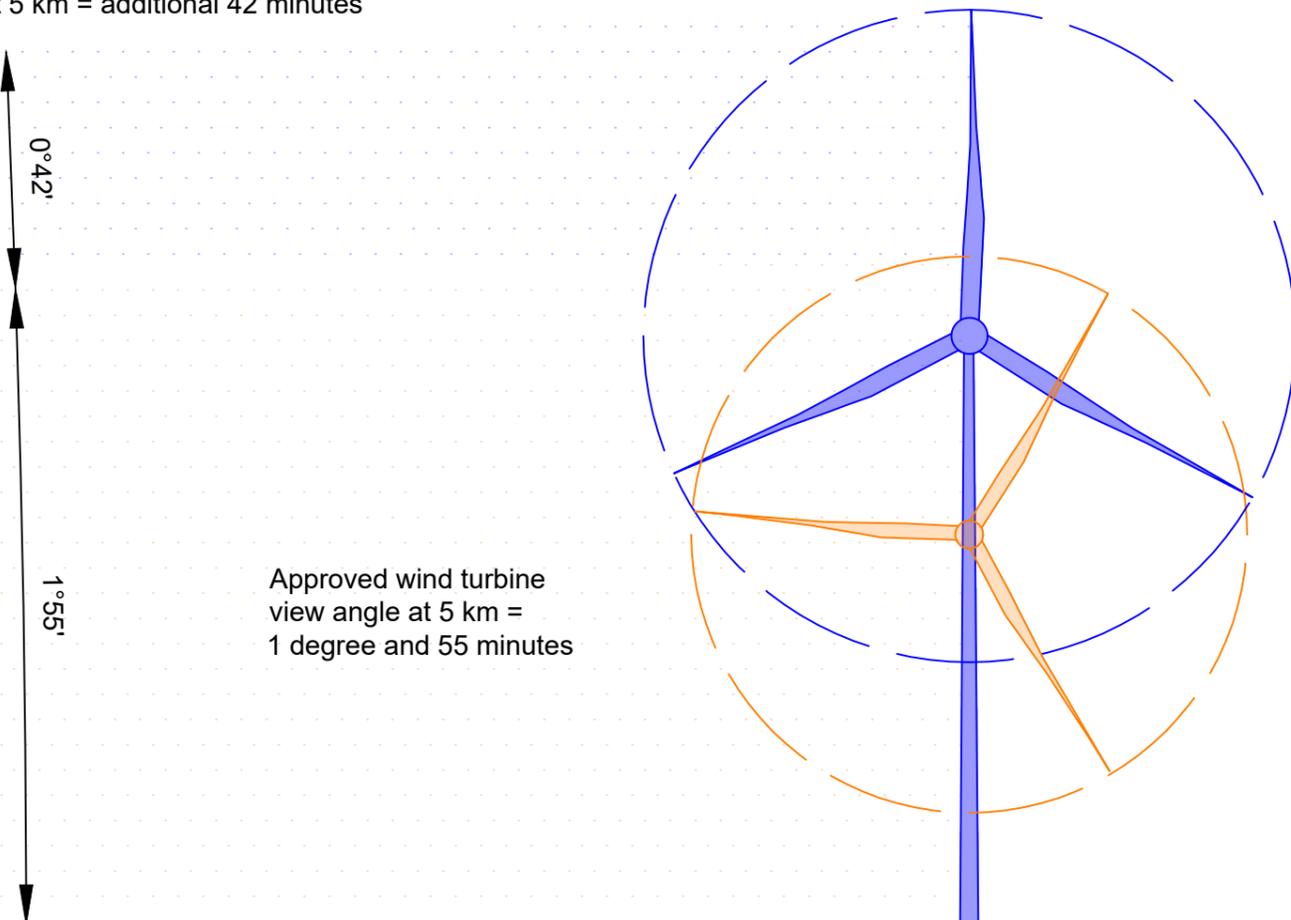
WWF amended wind turbine view angle at 2 km = additional 1 degree and 45 minutes



Approved wind turbine view angle at 2 km = 4 degrees and 48 minutes

View angle toward approved WWF and amended wind turbine tip of blade from a 2 km view distance

WWF amended wind turbine view angle at 5 km = additional 42 minutes



Approved wind turbine view angle at 5 km = 1 degree and 55 minutes

View angle toward approved WWF and amended wind turbine tip of blade from a 5 km view distance

Figure 6 - WWF approved and amended wind turbine view angle comparison at 2 km and 5 km view distance

For 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 amended wind turbine relative to the approved WWF wind turbine. **Table 4** outlines ratings and definitions associated with the magnitude of visual effects.

Table 4 – Magnitude of visual effect

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

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6.2 Magnitude of visual effect matrix

Table 5 sets out the assessment of visual effects from residential dwellings up to 2km from the approved WWF wind turbines. The location of dwellings included in this VIA 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 4** are noted against each dwelling, with a visual effect rating determined against the matrix in **Table 5**.

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Table 5 Assessment of visual effects

Dwelling ID	Category of receiver location	Approximate distance to amended wind turbine (m) and change to approved distance (m)	Description and magnitude of amended visual effect	Amended magnitude
A	Dwelling	752 (WT06) Approved WWF wind turbine distance 727 Change +25	The observable scale of change would be noticeable between the dwelling and closest amended wind turbine (WT06). There would be a limited change in the composition or contrast between the approved WWF and proposed amended wind turbines. Magnitude rating medium – resulting in a partial change to the approved WWF visual effect.	The amended wind turbine WT06 is marginally further from the dwelling than the approved WWF wind turbine WT12; however, it would result in an increased level of visual magnitude from this dwelling location. The increase in rotor face swept area and wind turbine tip height would result in a moderate increase to visual effect when compared to the approved WWF wind turbines.
B	Dwelling	1,519 (WT11) Approved WWF wind turbine distance 953 Change +566	The observable scale of change would be minor between the dwelling and closest amended wind turbine (WT11). There would be a limited change in the composition or contrast between the approved WWF and proposed amended wind turbines. Magnitude rating low – resulting in minor changes to the approved WWF visual effect.	The removal of approved WWF wind turbines to the west of the dwelling would increase the view distance between the dwelling and wind turbines and reduce the visual magnitude of the amended wind turbines. An increase to the swept area of the rotor face and increase to the wind turbine tip height would not result in an increase in visual dominance when compared to the approved WWF wind turbine.
C	Dwelling	1,030 (WT10)	The observable scale of change would be minor between the dwelling and closest amended	The removal of approved WWF wind turbines and relocation of amended wind

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Table 5 Assessment of visual effects

Dwelling ID	Category of receiver location	Approximate distance to amended wind turbine (m) and change to approved distance (m)	Description and magnitude of amended visual effect	Amended magnitude
		Approved WWF wind turbine distance 759 Change +271	wind turbine (WT10). The removal and repositioning of wind turbines would reduce the overall visual magnitude. There would be a limited change in the composition or contrast between the approved WWF and the amended wind turbines. Magnitude rating low – resulting in minor changes to the approved WWF visual effect.	turbines to the east of the dwelling would increase the view distance between the dwelling and wind turbines and reduce the visual magnitude of the amended wind turbines. An increase to the swept area of the rotor face and increase to the wind turbine tip height would not result in an increase in visual dominance when compared to the approved WWF wind turbine.
D	Dwelling	1,723 (WT06) Approved WWF wind turbine distance 1,694 Change +29	The observable scale of change would be minor between the dwelling and closest amended wind turbine (WT06). There would be a limited change in the composition or contrast between the approved WWF and the amended wind turbines. Magnitude rating low – resulting in minor changes to the approved WWF visual effect	The removal of approved WWF wind turbines to the west of the dwelling would increase the view distance between the dwelling and wind turbines and reduce the overall visual magnitude of the amended wind turbines. An increase to the swept area of the rotor face and increase to the wind turbine tip height would not result in an increase in visual dominance when compared to the approved WWF wind turbine.
I	Dwelling	1,509 (WT07)	The observable scale of change would be low to medium between the dwelling and closest	The removal of approved WWF wind turbines within the project site would

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Table 5 Assessment of visual effects

Dwelling ID	Category of receiver location	Approximate distance to amended wind turbine (m) and change to approved distance (m)	Description and magnitude of amended visual effect	Amended magnitude
		Approved WWF wind turbine distance 1,607 Change -98	amended wind turbine (WT07). There would be a partial limited change in the composition or contrast between the approved WWF and proposed amended wind turbines. Magnitude rating low to medium – resulting in minor to partial changes to the approved WWF visual effect.	reduce the overall visual magnitude of the amended wind turbines. An increase to the swept area of the rotor face and increase to the wind turbine tip height would not result in a significant increase in visual dominance when compared to the approved WWF wind turbine.
J	Dwelling	1,803 (WT07) Approved WWF wind turbine distance 1,694 Change +109	The observable scale of change would be low to medium between the dwelling and closest amended wind turbine (WT07). There would be a partial limited change in the composition or contrast between the approved WWF and amended wind turbines. Magnitude rating low to medium – resulting in minor to partial changes to the approved WWF visual effect.	The removal of approved WWF wind turbines within the project site would reduce the overall visual magnitude of the amended wind turbines. An increase to the swept area of the rotor face and increase to the wind turbine tip height would not result in a significant increase in visual dominance when compared to the approved WWF wind turbine.
K	Dwelling	1,872 (WT08) Approved WWF wind turbine distance 1,948 Change +76	The observable scale of change would be partially limited by distance between the dwelling and closest amended wind turbine. There would be limited change in the composition or contrast between the approved WWF and amended development.	The removal of approved WWF wind turbines within the project site would reduce the overall visual magnitude of the amended wind turbines. An increase to the swept area of the rotor face and increase to the wind turbine tip height would not result in a significant increase

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Table 5 Assessment of visual effects

Dwelling ID	Category of receiver location	Approximate distance to amended wind turbine (m) and change to approved distance (m)	Description and magnitude of amended visual effect	Amended magnitude
			Magnitude rating low – resulting in minor change to the approved WWF visual effect.	in visual dominance when compared to the approved WWF wind turbine.
P	Dwelling	2,555 (WT07) Approved WWF wind turbine distance 2,441 Change +114	The observable scale of change would be partially limited by distance between the dwelling and closest amended wind turbine. There would be very limited change in the composition or contrast between the approved WWF and amended development. Magnitude rating low – resulting in minor change to the approved WWF visual impact rating.	The removal of approved WWF wind turbines within the project site would reduce the overall visual magnitude of the amended wind turbines. An increase to the swept area of the rotor face and increase to the wind turbine tip height would not result in a significant increase in visual dominance when compared to the approved WWF wind turbine.

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6.3 Visual effect summary

The assessment of visual effects matrix includes seven dwellings within 2km of an approved WWF wind turbine and dwelling P at 2.55km from an amended wind turbine.

The overall assessment of the magnitude of visual effect associated with dwellings within 2km of the amended wind turbines is summarised as low to medium.

The change in visual magnitude between the WWF approved and amended wind turbines, whilst noticeable from proximate dwelling view locations would not result in any significant increase in visibility above that of the WWF approved wind turbines. Additional views toward amended wind turbine structures would be largely limited to upper portions of wind turbines including blades and hubs where screening restricts views toward approved WWF wind turbines.

Views from dwellings and key view locations beyond 2km of the approved WWF would include views toward the amended wind turbines; however, with increasing distance the overall visual magnitude of the amended wind turbines would be no greater than the WWF approved wind turbines.

The wireframes illustrate that the Hawkesdale wind turbines would be largely recessive in views from dwellings south to southeast of the project site and would tend to be screened by tree planting surrounding a number of dwellings beyond the project site.

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7 Wireframes and photomontages

7.1 Introduction

The wireframe and photomontage locations have been selected to illustrate viewpoints from public and dwelling locations with views toward the approved WWF.

The wireframe and photomontage locations are illustrated in **Figure 7**, and the wireframes and photomontages presented in **Figures 8 to 18**. The wireframes and photomontages illustrate views toward the approved WWF and the amended amendment. The wireframes illustrate the wind turbines with and without their individual identification numbers for clarity.

The wireframes do not include, or illustrate, the location of tree planting between the wire frame viewpoint and the approved WWF and amended wind turbines. The wireframes are therefore considered to be very conservative in both the extent of view and visibility of wind turbines indicated in each wireframe.

7.2 Wireframe and photomontage preparation

The wireframes and photomontages have been prepared regarding the general guidelines set out in the Scottish Natural Heritage (2017) Visual representation of windfarms: good practice guidance. The wireframes and photomontages were generated through the following steps:

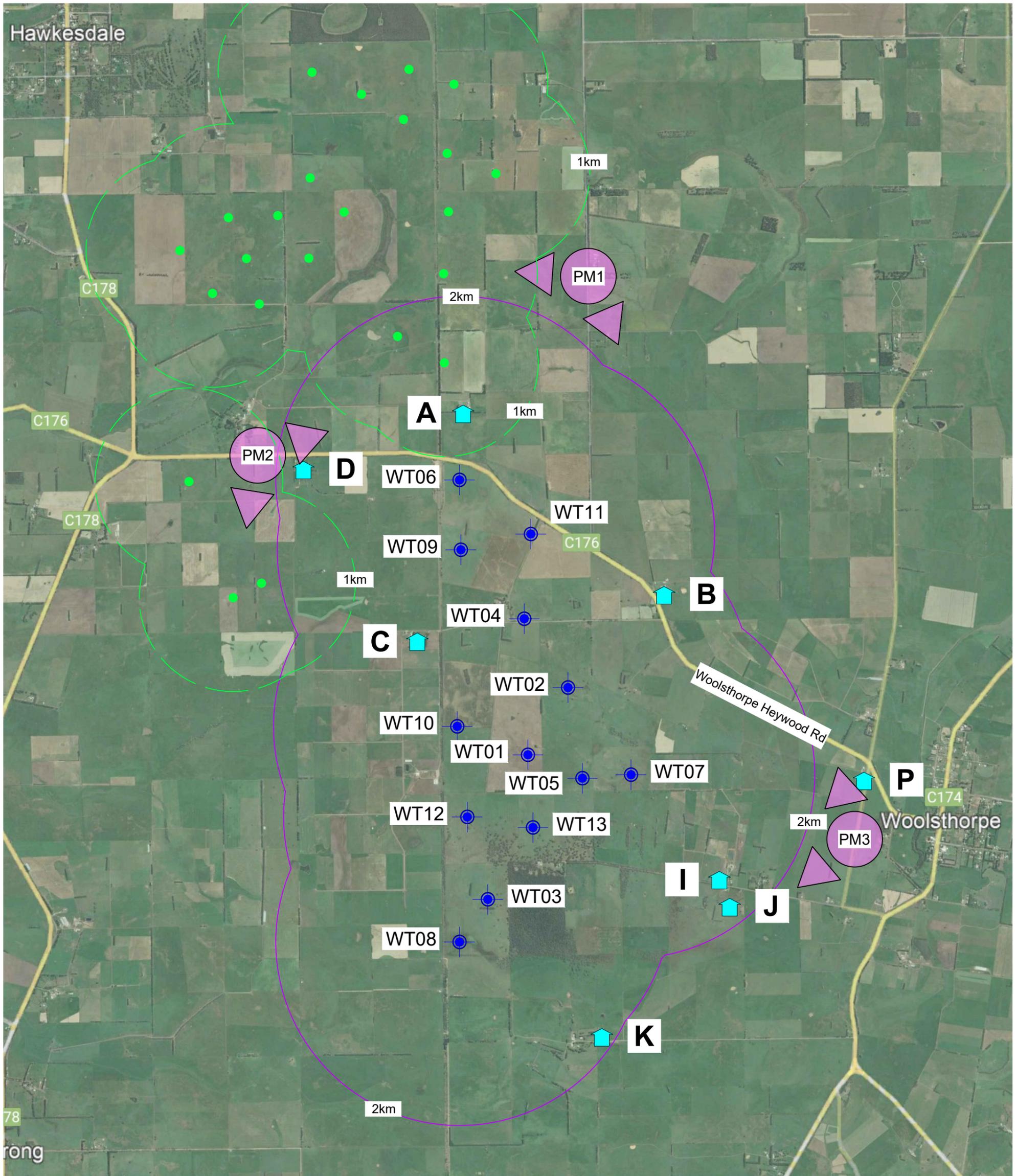
- A digital terrain model (DTM) of the project site was created from a terrain model of the surrounding area using digital contours
- The site DTM was loaded into the Wind Pro software package
- The layout of the wind farm and 3-dimensional representation of the wind turbine was configured
- The location of each viewpoint (photo location) was configured in Wind Pro – 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 Pro. 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 photomontages 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.

The horizontal and vertical field of view within most of the wireframes and photomontages exceeds the parameters of normal human vision. However, the eyes, head and body can all move and under normal conditions a person would sample a broad area of landscape within a panorama view. Rather than restricting the extent of each wireframe and photomontage to a single photographic image, a broader field of view is presented to illustrate the extent of the wind turbines more fully.

Whilst a photomontage can provide an image that illustrates an accurate representation of a wind turbine in relation to its proposed location and scale relative to the surrounding landscape, this VIA acknowledges that large scale objects in the landscape can appear smaller in photomontage than in real life and is partly due to the fact that a flat image does not allow the viewer to perceive any information relating to depth or distance.

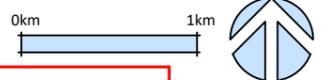
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Legend

-  WWF amended wind turbine location (indicative location)
-  Dwelling generally within 2 km of Mod wind turbine and wireframe location
-  Indicative photomontage location and general view direction
-  Hawkesdale wind turbine location (indicative location)



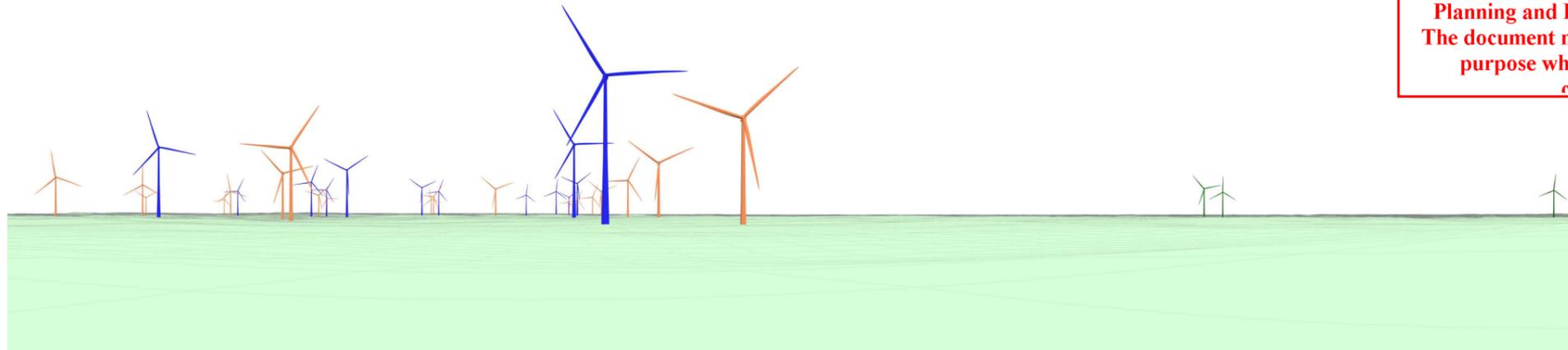
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Figure 7
WWF wireframe and photomontage locations

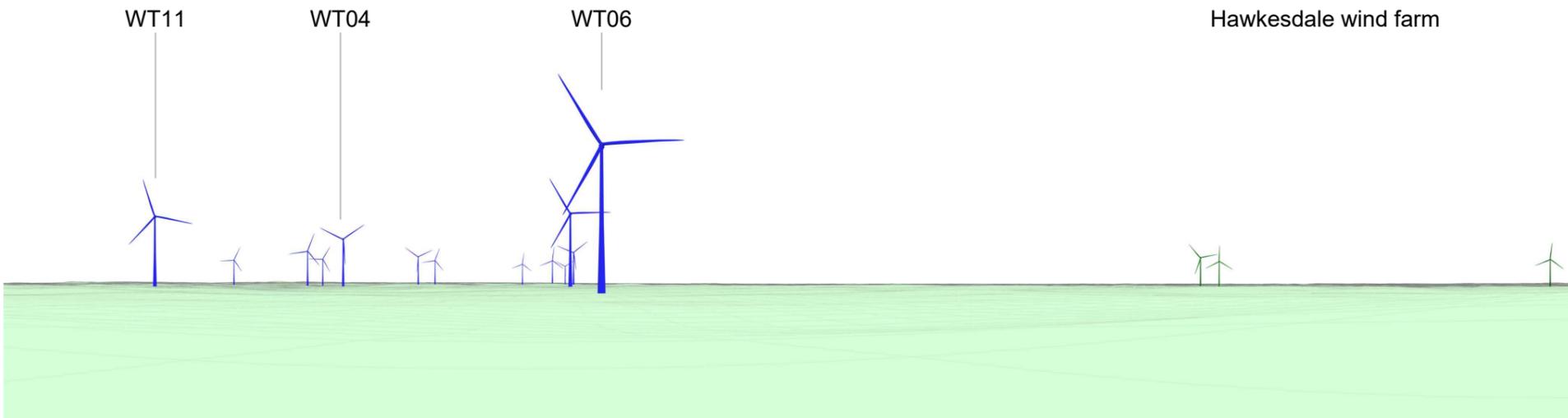
Woolsthorpe Wind Farm Amendment

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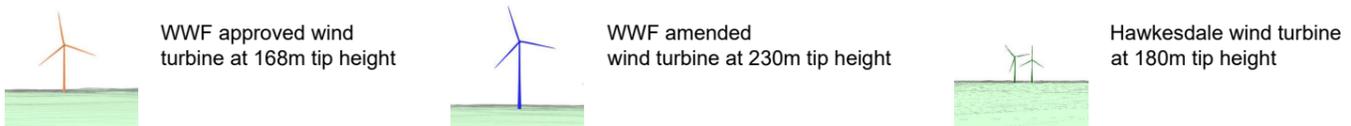


Woolsthorpe Wind Farm, Dwelling A viewpoint: Approved 168m tip of blade wind turbines (orange), amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green). Closest amended wind turbine WT06 at 752m.

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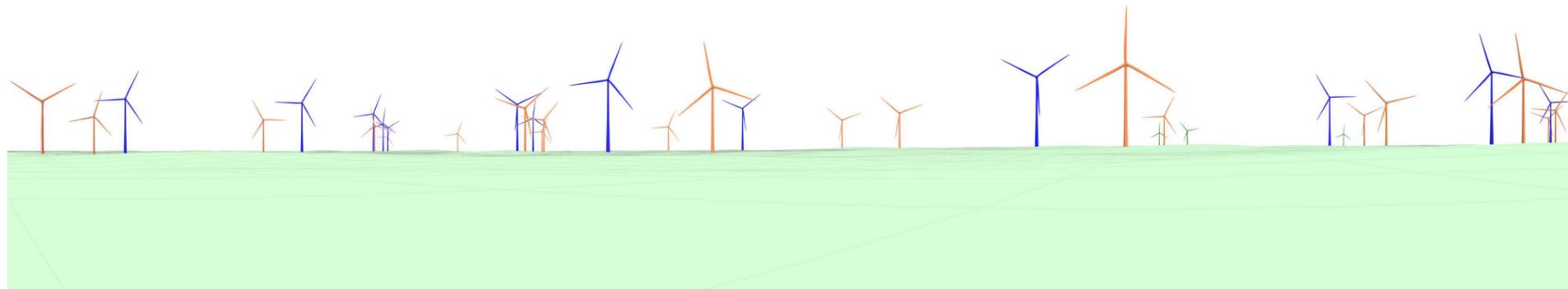
Woolsthorpe Wind Farm, Dwelling A viewpoint. Amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green)



Notes:
The wireframe model does not account for existing tree cover and/or planting which may screen views toward the wind turbines.

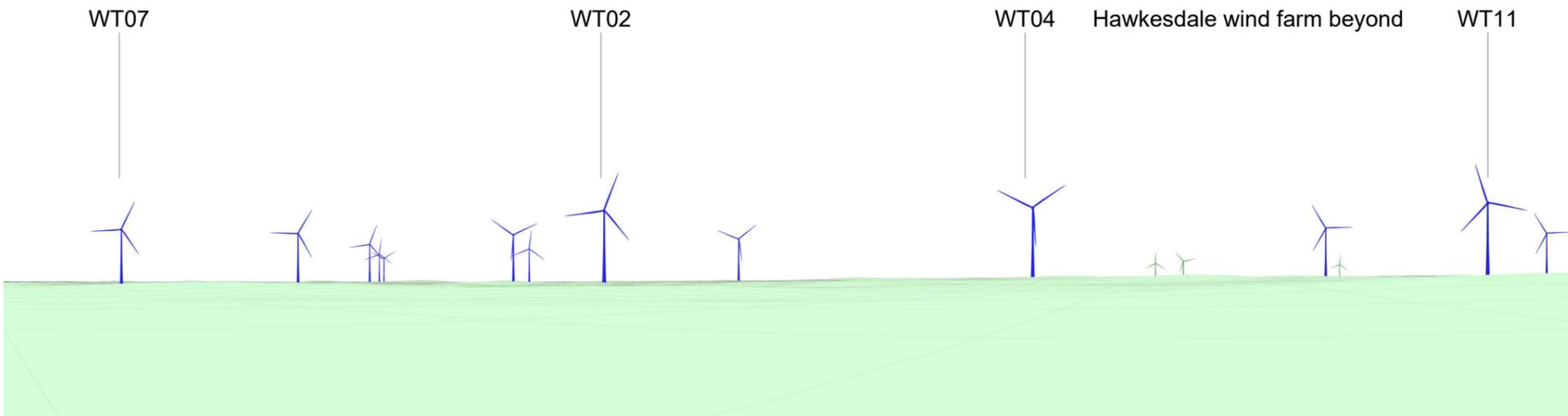
Figure 8 - Dwelling A wireframe

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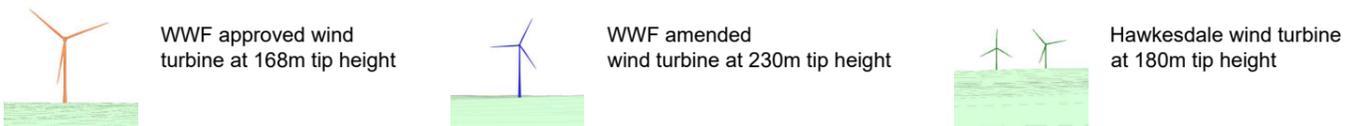


Woolsthorpe Wind Farm, Dwelling B viewpoint: Approved 168m tip of blade wind turbines (orange), amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green). Closest amended wind turbine WT11 at 1,519m.

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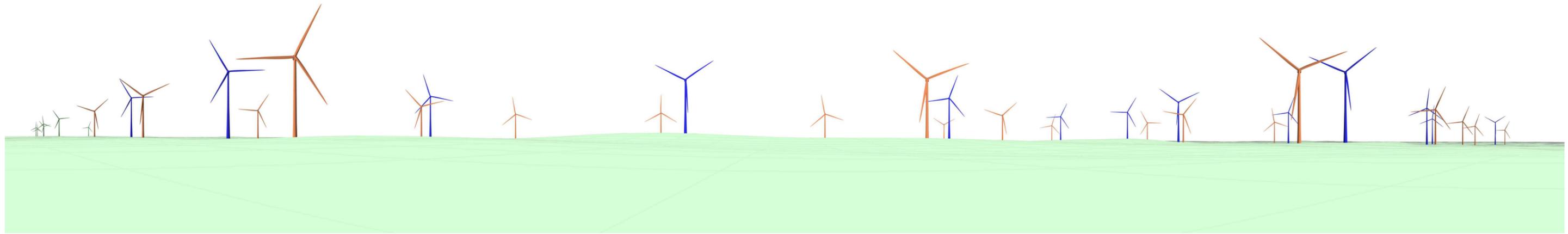
Woolsthorpe Wind Farm, Dwelling B viewpoint. Amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green)



Notes:
The wireframe model does not account for existing tree cover and/or planting which may screen views toward the wind turbines.

Figure 9 - Dwelling B wireframe

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Woolsthorpe Wind Farm, Dwelling C viewpoint: Approved 168m tip of blade wind turbines (orange), amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green). Closest amended wind turbine WT10 at 1,030m.

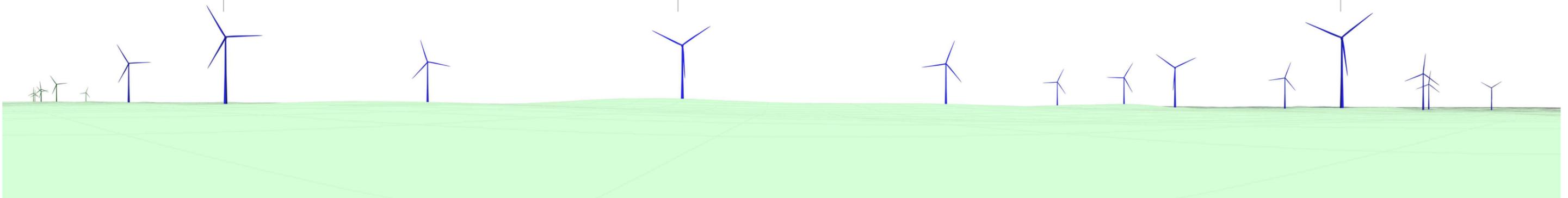
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Hawkesdale wind farm beyond

WT09

WT04

WT10



Woolsthorpe Wind Farm, Dwelling C viewpoint. Amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green)



WWF approved wind turbine at 168m tip height



WWF amended wind turbine at 230m tip height



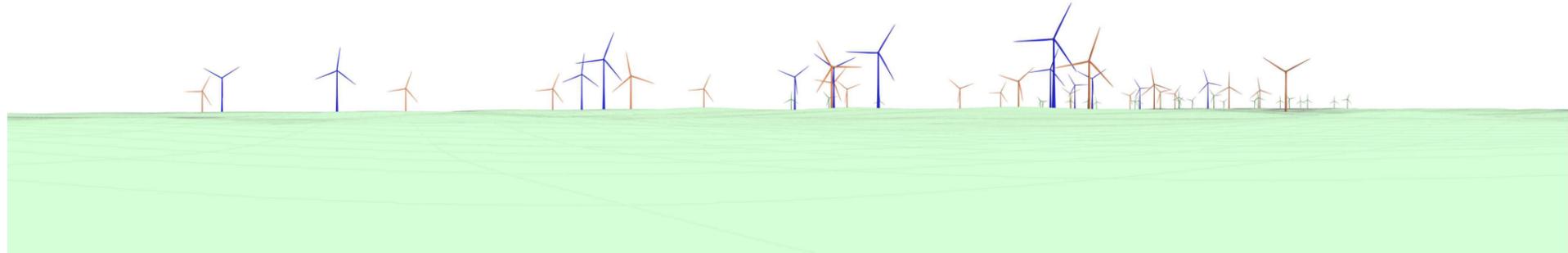
Hawkesdale wind turbine at 180m tip height

Notes:

The wireframe model does not account for existing tree cover and/or planting which may screen views toward the wind turbines.

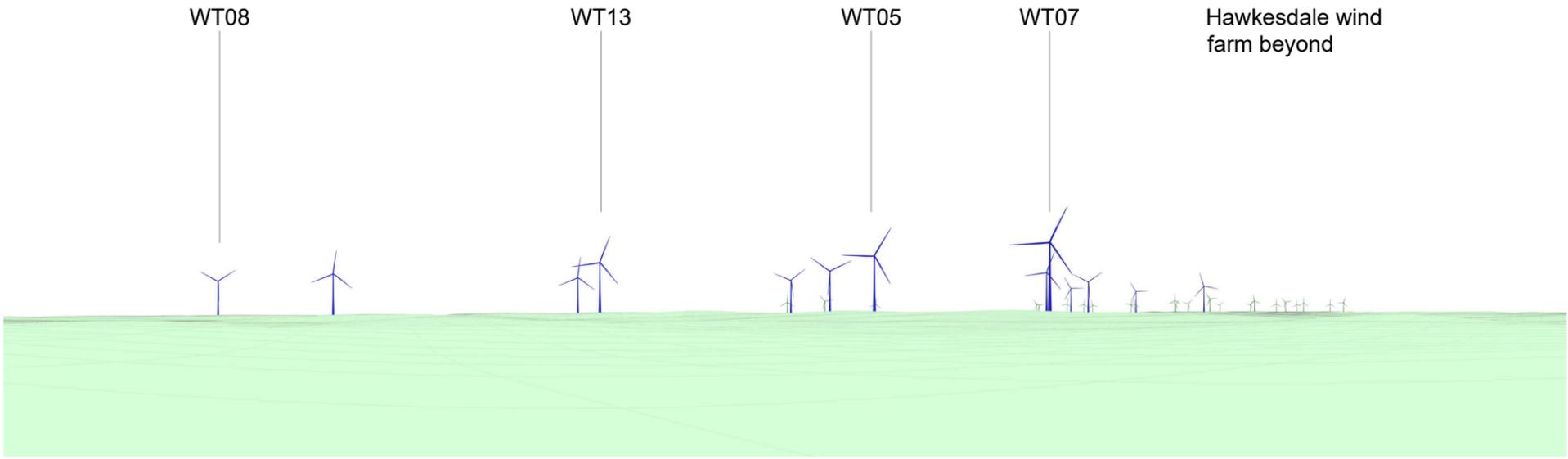
Figure 10 - Dwelling C wireframe

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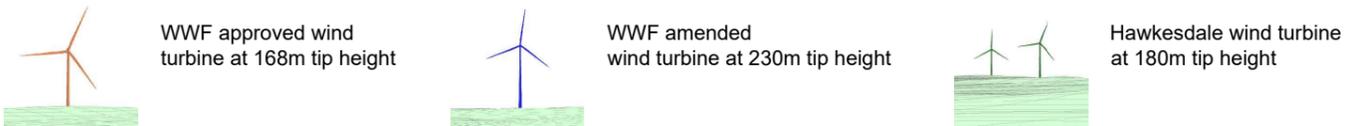


Woolsthorpe Wind Farm, Dwelling I viewpoint: Approved 168m tip of blade wind turbines (orange), amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green). Closest amended wind turbine WT07 at 1,509m.

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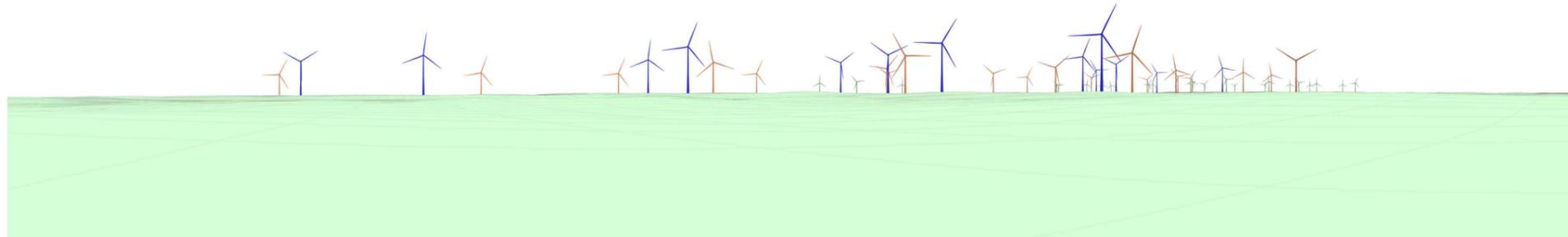
Woolsthorpe Wind Farm, Dwelling I viewpoint. Amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green)



Notes:
The wireframe model does not account for existing tree cover and/or planting which may screen views toward the wind turbines.

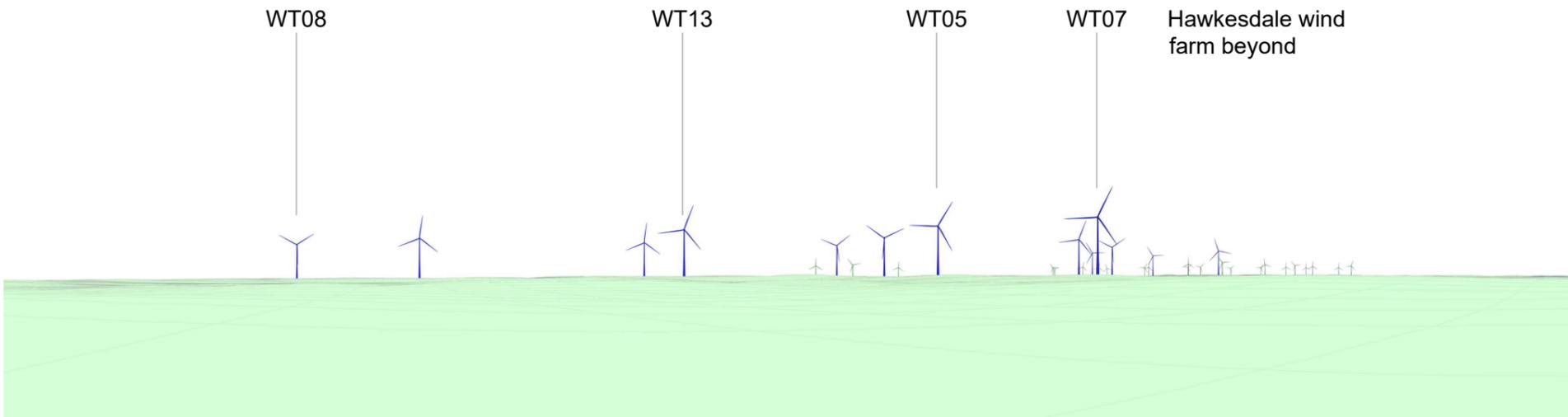
Figure 12 - Dwelling I wireframe

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Woolsthorpe Wind Farm, Dwelling J viewpoint: Approved 168m tip of blade wind turbines (orange), amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green). Closest amended wind turbine WT07 at 1,803m.

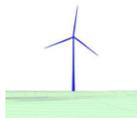
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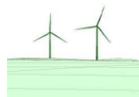
Woolsthorpe Wind Farm, Dwelling J viewpoint. Amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green)



WWF approved wind turbine at 168m tip height



WWF amended wind turbine at 230m tip height



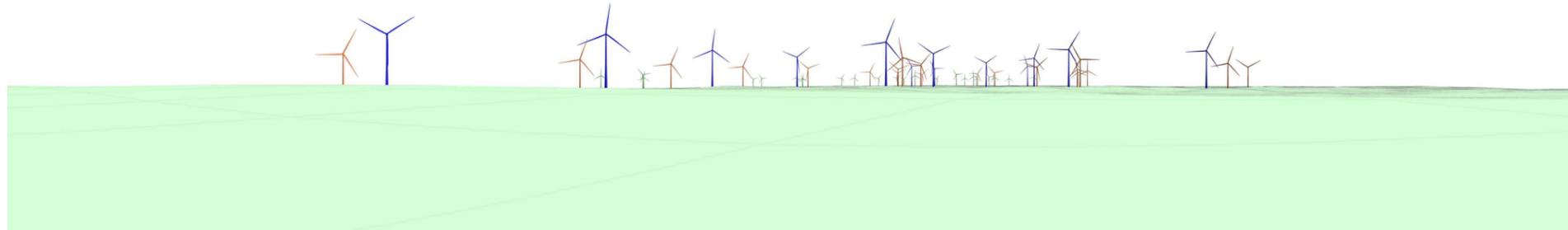
Hawkesdale wind turbine at 180m tip height

Notes:

The wireframe model does not account for existing tree cover and/or planting which may screen views toward the wind turbines.

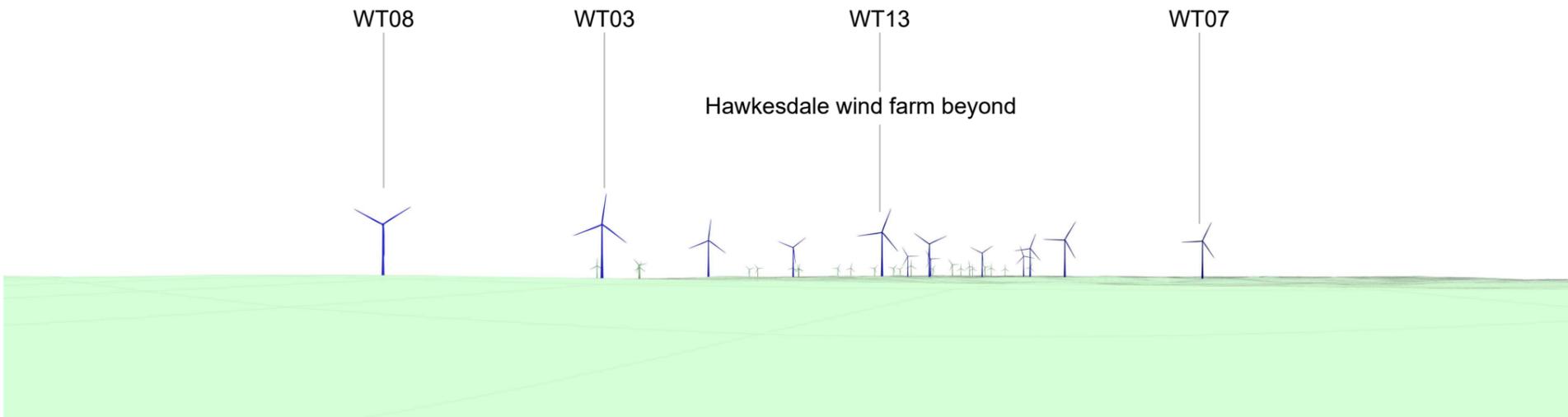
Figure 13 - Dwelling J wireframe

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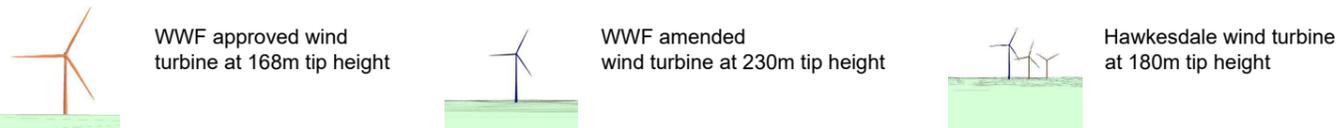


Woolsthorpe Wind Farm, Dwelling K viewpoint: Approved 168m tip of blade wind turbines (orange), amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green). Closest amended wind turbine WT08 at 1,872m.

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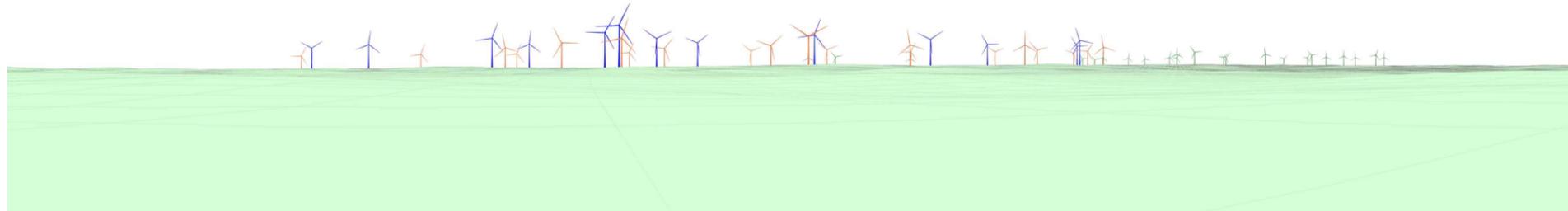
Woolsthorpe Wind Farm, Dwelling K viewpoint. Amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green)



Notes:
The wireframe model does not account for existing tree cover and/or planting which may screen views toward the wind turbines.

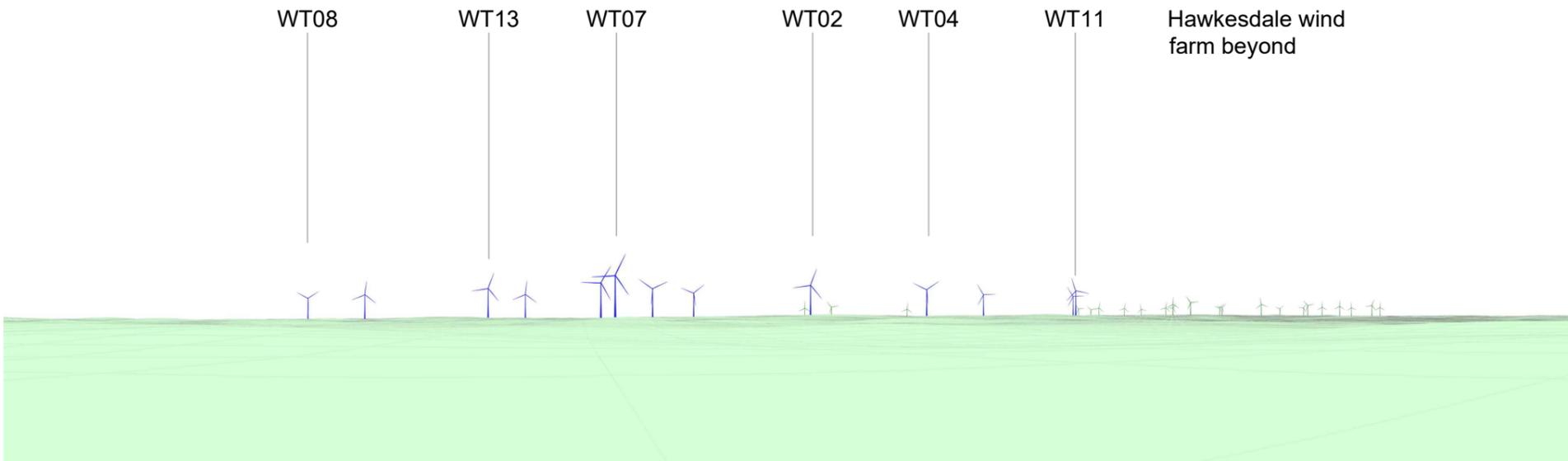
Figure 14 - Dwelling K wireframe

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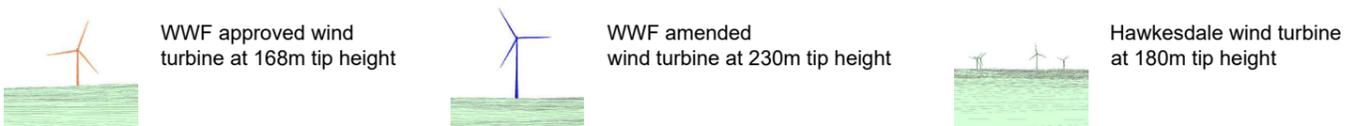


Woolsthorpe Wind Farm, Dwelling P viewpoint: Approved 168m tip of blade wind turbines (orange), amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green). Closest amended wind turbine WT07 at 2,555m.

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Woolsthorpe Wind Farm, Dwelling P viewpoint. Amended 230m tip of blade wind turbines (blue) and Hawkesdale wind turbines (green)



Notes:
The wireframe model does not account for existing tree cover and/or planting which may screen views toward the wind turbines.

Figure 15 - Dwelling P wireframe



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Photomontage PM 1 view south to west from Camerons Road toward Woolsthorpe amended (230m tip height) and Hawkesdale wind turbines (180m tip height)
Closest amended wind turbine WT06 at around 2,760m.



Photomontage PM 1 detail view from Camerons Road toward Woolsthorpe amended (230m tip height) and Hawkesdale wind turbines (180m tip height)

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Figure 16 -
Photomontage PM 1

GREEN BEAN DESIGN
landscape architects



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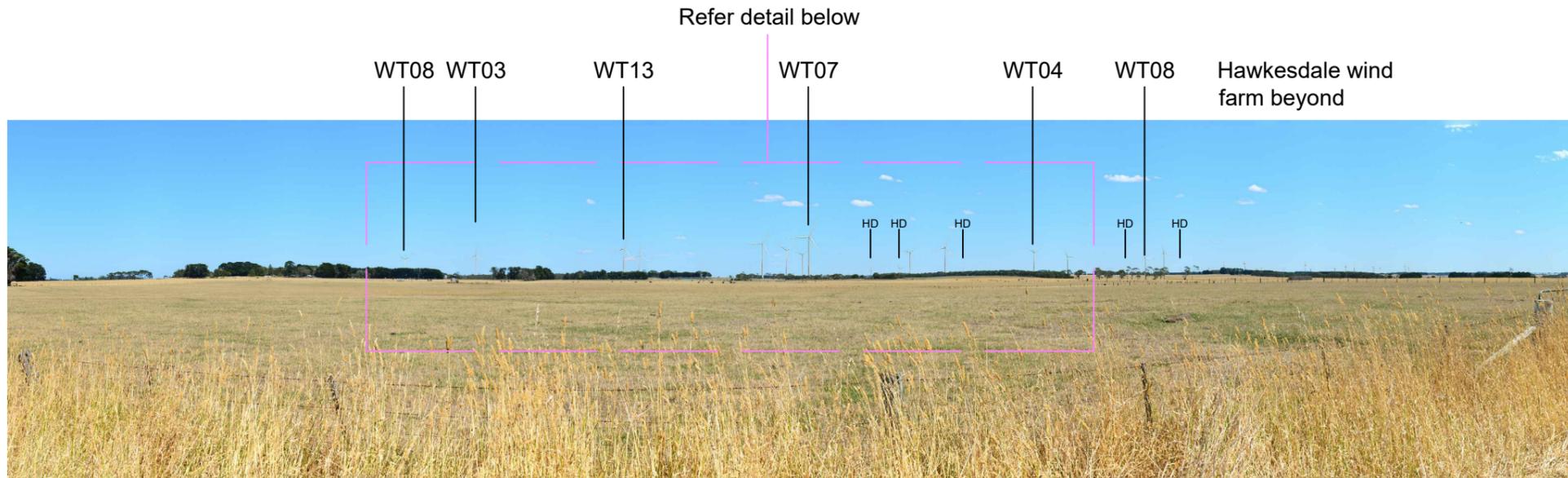
Photomontage PM 2 view east to south east from Woolsthorpe Heywood Road toward Woolsthorpe amended (230m tip height) and Hawkesdale wind turbines (180m tip height)
Closest amended wind turbine WT06 at 2,140m.



Photomontage PM 2 detail view from Woolsthorpe Heywood Road toward Woolsthorpe amended (230m tip height) and Hawkesdale wind turbines (180m tip height)

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Figure 17 -
Photomontage PM 2



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Photomontage PM 3 view south west to north west from Reeves Road toward Woolsthorpe amended (230m tip height) and Hawkesdale wind turbines (180m tip height)
HD= Hawkesdale wind turbine beyond Woolsthorpe amended wind turbines. Closest amended wind turbine at around 2,570m.



Photomontage PM 3 detail view from Reeves Road toward Woolsthorpe amended (230m tip height) and Hawkesdale wind turbines (180m tip height)

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Figure 18 -
Photomontage PM 3

8 Review of Permit Conditions**8.1 Introduction**

The approved WWF Permit Conditions have 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 wind turbine amendments.

8.2 Review of Permit Conditions

The following Table outlines the existing Permit Conditions relevant to mitigate the potential visual effects of the proposed wind turbine amendments.

Table 6 Permit Conditions

Condition	Description	Comment
Specifications 3.	h) The wind turbine towers, nacelles and rotor blades must be pale grey or other colour that blends with the landscape to the satisfaction of the Minister for Planning, and must be of a non-reflective finish to the satisfaction of the Minister for Planning;	This condition remains valid.
Landscape/Visual Amenity 5.	Before the use and development starts, an Off-site Landscaping Program must be submitted to, approved and endorsed by the Minister for Planning. When endorsed, the Off-site Landscaping Program will form part of this permit.	This condition remains valid.
	<p>The Off-site Landscaping Program must:</p> <p>a) Outline a program of voluntary landscape mitigation works to be offered to the owners of dwellings existing on 7 June 2016 within 4 kilometres of any turbine excluding any dwellings within the Woolsthorpe Township Zone. This is to include a process for making offers to affected landowners to undertake landscaping on the landowner's land.</p> <p>b) Provide:</p> <ul style="list-style-type: none"> • Details of planting or other treatments that will be used to reduce the visual impact of the wind turbines at the dwellings of the participating landowners; • Details of the plant species to be used, including the height and spread of plants at maturity; • A methodology for determining; <ul style="list-style-type: none"> i. The type of landscaping treatments to be proposed. ii. A timetable for establishing and maintaining the landscaping for at least two years. <p>c) Include a process for recording:</p> <ul style="list-style-type: none"> • Offers that have been made to landowners. • Whether or not the offers are accepted. • Details of consultation with the land owner. • When and how offers are actioned following acceptance. 	<p>The condition to offer landscape mitigation works to dwelling owners within 4 kilometres of any turbines is considered valid, without the need to extend landscape mitigation beyond 4 km.</p> <p>Views toward the amended wind turbines (at a 230m tip height) would be screened or filtered with shrub or small tree planting up to 6m in height at 100m from a dwelling.</p>

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Condition	Description	Comment
	d) Include a process for the preparation and provision of progress reports regarding the implementation of the endorsed Off-site Landscaping Program to be provided to the Minister for Planning annually, from when this document is endorsed and at other times on request.	
6.	The endorsed Off-site Landscaping Program: a) Must be implemented to the satisfaction of the Minister for Planning. b) Must not be altered or modified without the written consent of the Minister for Planning.	These conditions remain valid.
7.	All access tracks associated with the wind farm must be constructed with local gravel and/or other surface material that will not unduly contrast with the landscape to the satisfaction of the Minister for Planning.	This condition remains valid.

There would be no significant increase in visual magnitude from view locations between 2km and 4km from the WWF amended wind turbines and overall, the existing conditions imposed on the Planning Permit are considered appropriate to manage the visual effects from the amended wind turbines.

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9 Conclusion

9.1 Conclusion

The change to visual effects of the approved WWF has been based upon professional judgement in consideration of:

- the proposed amendments to the approved WWF wind turbines
- the overall visual magnitude of the amended wind turbines compared to the approved WWF wind turbines and
- the overall visual effect of the amended wind turbines compared to the approved WWF wind turbines.

This VIA has compared the WWF approved wind turbines against the amended wind turbine design/layout and concludes that:

- the amendments to wind turbine design would be discernible from some surrounding and proximate view locations including some dwellings and curtilage where views toward the WWF approved wind turbines exist and may result in an additional medium level of visual effect
- the removal of 7 wind turbines would reduce the overall level of wind turbine visibility and reduce the potential for cumulative visual impacts with the Hawkesdale wind farm project
- the WWF amended wind turbine visual magnitude would recede with increasing view distance. The wireframes demonstrate that views toward the WWF amended wind turbines beyond 2km would have no significant visual effect over and above the approved WWF wind turbines
- wind turbine visibility would be generally limited and largely confined to portions of rotor blades and blade tips where vegetation screens and filters views toward approved WWF wind turbine locations. Visibility toward wind turbine hubs may increase where hubs are currently partially visible or located just below or above tree canopies
- existing privacy and wind break tree planting surrounding dwellings within, and beyond, 2km from the amended wind turbines would provide effective screening and filtering of views toward the amended wind turbines
- the amended wind turbines are not considered to be of a magnitude that would significantly increase visual effects associated with the WWF approved wind turbines
- mitigation measures included in the Planning Permit are considered appropriate to manage the visual effects from the amended wind turbines.

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Limitations

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The methodology adopted and sources of information used are outlined in this report. GBD has made no independent verification of this information beyond the agreed scope of works and GBD assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to GBD was false.

This report was prepared between January 2022 and June 2022 and is based on the conditions encountered and information reviewed at the time of preparation. GBD disclaims responsibility for any changes that may have occurred after this time.

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