

Memorandum

To Glenn Starr, Ventus Energy (NZ) Ltd. (Applicant)

Copy Craig Shearer, Applicant's Planner

From Jeremy Head

Office Christchurch

Date 23 August 2021

File 3-C2022.00 Taumatotara (T4) Wind farm

Subject Visual effects at 'House 26' and 'House 28' arising from of an increase in structure height of proposed wind turbines

Background

This memorandum responds to a Waitomo District Council RFI to discuss any potential visual effects of the proposal relative to 'House 26' and 'House 28'. Both houses are located on Te Waitere Road to the northwest of the site for the Proposal. Ventus Energy NZ's seeks to increase the size of the eleven 'northern' wind turbines¹ from what is currently consented at the site at Taumatotara West Road, Te Anga (the 'T4' wind farm). It is understood that the eleven turbines are consented to be 121.5 m tall. The consent also included another eleven 110 m tall turbines to the south which are no longer proposed.

It is acknowledged that the primary issue is whether an eleven-turbine windfarm can be appropriately located in this setting or not. This decision has already been made. The currently consented turbines at 121.5 m tall are very large structures. Given the relatively sparsely lived-in receiving environment, it is anticipated that an increase in height (within reason) of the turbines are not likely to trigger additional landscape character or visual effects that would be unacceptable given the existing consented environment and its landscape character, and values. Generally, the more turbines visible, the greater the adverse effects.

Proposal

The proposal is to increase the maximum height² of the retained eleven turbines to an overall height of 172.5 m. The turbines are a 'narrow blade' type, which reduces the shadow flicker effect compared to what has been consented.

The effects considered in this memo concern only the parts of the turbines that extend above 121.5 m in height. It is understood that the reason for the change of conditions sought (turbine size) is to respond to recent changes in wind farm technology which in turn will provide better energy production and overall improved economic benefits.

Methodology

This report provides advice on any potential change in the visual effects arising from the additional turbine height 'in principle' This report has been carried out via a desktop analysis, using information provided by the Applicant being a Turbine Layout Plan at

¹ 'Turbines' refers to the mast, nacelle, hub and blades (the entire structure).

² From the ground to the tip of the blade when in a vertical position.

Appendix 1, site photographs at **Appendix 2** and photomontages at **Appendix 3** and earlier ZTV analysis mapping. The photomontages show 121.5 m tall turbines³ and the proposed 172.5 m turbines seen from 'House 28'. The site photographs and photomontages have been studied which has assisted in determining the landscape and visual effects, discussed shortly.

With regards to 'House 26', a photomontage was not provided. Instead, 1:10,000 line-of-sight cross-section diagrams were prepared by the assessor based on the elevation of the house relative to the elevation of each turbine site. The consented and proposed turbines were overlain. The intervening topography was assessed along a direct line of sight between the house and each turbine using GoogleEarth. This way it could be established how much of the Proposal would be screened from view from the house due to rising topography.

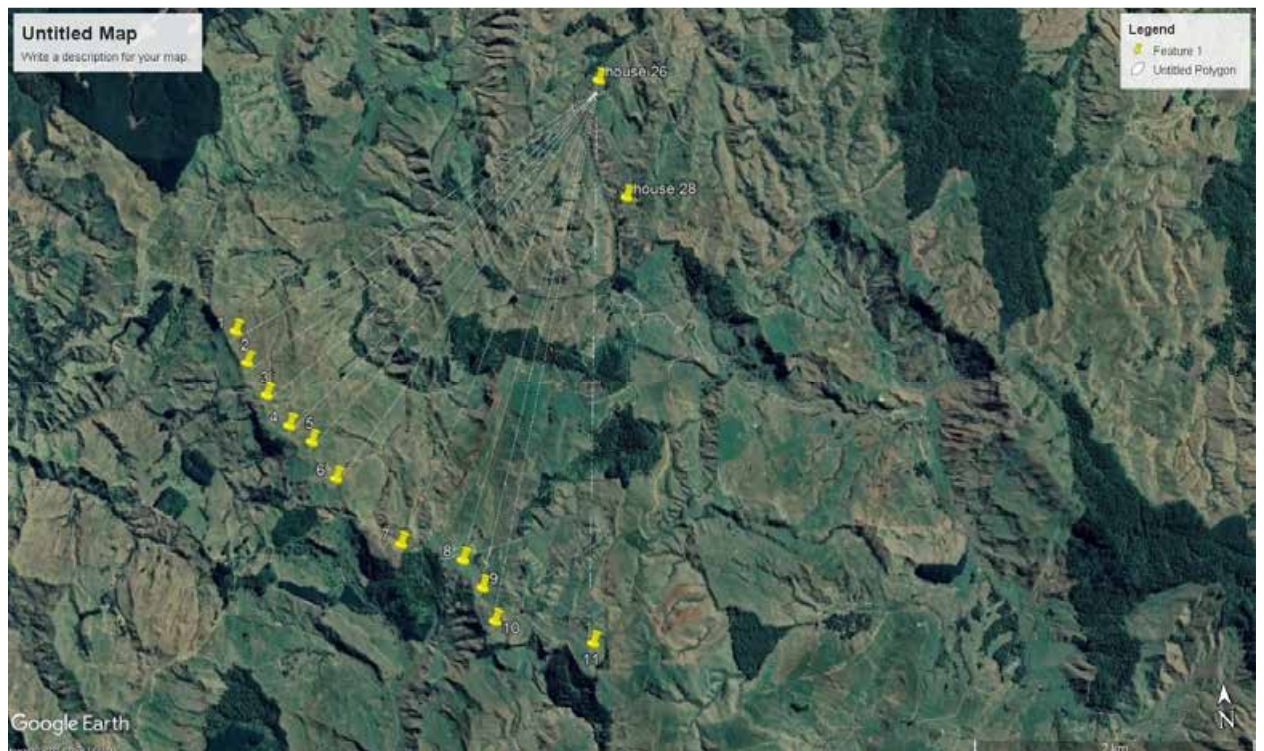


Figure 1 Google Earth map showing line-of-sight from 'House 26' to each turbine location. By methodically tacking the Google Earth 'Ruler' function along each line of sight, it was possible to see the high elevation points in the landscape and how far these points were from the house.

Visual effects on the two houses

The houses referred to below are identified in **Appendix 1**, at the very top of the image. The actual views from within each house were not assessed. However, the Applicant has provided some site photographs taken from each house⁴ which are useful.

It is also acknowledged that intervening vegetation and structures - which may partially or fully obscure views to the proposal from 'House 26' was not considered in the line-of-sight assessment. For this reason, the findings in the following assessment of visual effects will be conservative.

It is acknowledged that there is a consent in place for eleven turbines. Therefore, it can be assumed that the occupants of or previous occupants of 'House 26' and '28' have accepted the levels of landscape and visual effects that would be generated by the consented windfarm through the earlier consenting process. The next section discusses the implications of the increased turbine heights. Separation distances between houses and turbine locations are also an important consideration as are relative elevations in the

³ 110 m turbines are consented, however.

⁴ Taumatotara Turbines Photomontage Report; Russell Meek Photography (photographs taken July 1, 2021).

landscape, including the height of intervening topography between houses and turbine locations. Any potentially adverse visual effects of the proposal beyond what has been consented are discussed below.

House '26':

From the selection of site photographs provided by the Applicant, 'House 26' appears to be a modestly constructed home located on a localised high point in the landscape with panoramic views including in the southwest direction where the windfarm site is located. The location of this house is shown at the top of the image in **Appendix 1**.

A detailed desktop study has been carried out, preparing eleven 'line-of-sight' diagrams between the house and each of the proposed eleven turbines. It was observed that between the house and all eleven turbines, high points in the landscape to the southwest of the house ranging between approximately 275 m and 320 m asl screen parts of or all of the turbines from view to varying degrees.

The eleven turbines are located between 3.3 kms and 4.2 kms from this house.

From House 26 two of the proposed taller turbines (turbines 2 and 3) will be fully screened from view due to topography. Of the remaining nine taller turbines proposed it is expected that between 25 m and 95 m of the upper parts of these turbines will be visible.

In the consented scheme the upper parts of three turbines (turbines 6, 8 and 11) ranging between 10 m, 45 m and 30 m respectively would be visible.

Therefore, the Proposal includes the upper parts of six additional turbines (Turbines 1, and 4 - 11), that will be visible from this house compared with what is consented.

The lower parts of the proposed turbines, and the full extent of most of the consented turbines are screened by an intervening undulating ridge, the crest of which has an elevation of approximately 275 m - 320 m whereas the house sits at a lower elevation of approximately 240 m. The turbines are located on high points that are generally 300 m in elevation. The ridgeline will obscure approximately the lower 45% to 85% of all turbines other than turbines 2 and 3 which will be fully screened by the ridge. It is also acknowledged that intervening vegetation located between the house and each turbine has been discounted. This vegetation located along or close to the ridgeline has the potential to further reduce the visibility of turbines 7 - 11 in particular.

As discussed previously, the primary adverse effect is generated by the presence of the turbines - rather than how tall they are. The reduction in the consented turbine numbers from twenty-two to eleven is less relevant in terms of the visual effects from 'House 26' in that the 'southern eleven' are substantially distant, where the reduction will have minimal benefits.

Therefore, in respect of the 'northern eleven', and 'House 26', the proposed taller turbines will visibly extend above the ridge line, where the consented turbines did not. Six more turbines will be visible. It is concluded that the difference between the consented wind farm and what is proposed will generate conservatively '**Moderate**'⁵ adverse visual effects on the seven-point scale of effects⁶. Actual effects may be less than this depending on the

⁵ **Moderate:** A moderate level of effect on the character or key attributes of the receiving environment and/or the visual context within which it is seen; and/or have a moderate level of effect on the perceived amenity derived from it. (Oxford English Dictionary Definition: Moderate: adjective-average in amount, intensity or degree).

⁶ Between: 'Very Low' to 'Low' to 'Moderate to Low' to 'Moderate' to 'Moderate to High' to 'High' to 'Very High'. New Zealand Institute of Landscape Architects Te Tangi a te Manu - Aotearoa New Zealand Landscape Assessment Guidelines, April 2021. It is generally understood that 'less than minor' effects are equivalent to 'Very Low', and 'Low' effects are equivalent to 'minor' effects in an RMA 1991 context within the NZ Landscape Guidelines, although the two scales do not align absolutely. 'Very Low' and 'Low' effects in this case are considered to be less than minor.

height and extent of any intervening structures and vegetation and also house layout. It has been assumed that there are internal living areas facing towards the site.

House '28':

From the selection of site photographs provided by the Applicant, 'House 28' appears to be a modestly constructed house/s of different parts/eras. The house is set on a terrace which is on the southwest face of rising/undulating topography. There appear to be views to the southwest direction where the windfarm site is located. The location of this house is shown near the top of the image in **Appendix 1**.

A photomontage has been provided by the Applicant illustrating the proposed turbines, and separately with 121.5 m tall turbines. It is understood that the consented turbines are 110 m tall. Of note only turbines 2 - 8 inclusive are modelled. Turbines 1 and 9 - 11 are excluded off either side of the base photograph/photomontage. However, to 'fill in the gaps', additional detailed desktop study has been carried out, preparing four 'line-of-sight' diagrams between the house and each of the proposed turbines 1 and 9 - 11 (**Figure 2**). It is also observed that the photomontages are based on a site photograph taken at a higher elevation, overlooking the house/s. Therefore, the degree of visibility of the turbines in the photomontage is greater than it would be from the house itself. This is due to the intervening ridge to the southwest, and vegetation on that ridge. This is due to the intervening ridge to the southwest, and vegetation on the ridge. From the line-of-sight diagrams it was observed that between the house and turbines 1 and 9 - 11, high points in the landscape to the southwest of the house ranging between approximately 290 m and 325 m asl screen parts of turbines 9 - 11 from view to varying degrees. All of turbine 1 would be screened by the ridge.

The eleven turbines are located between 3 kms and 3.3 kms from 'House 28'.

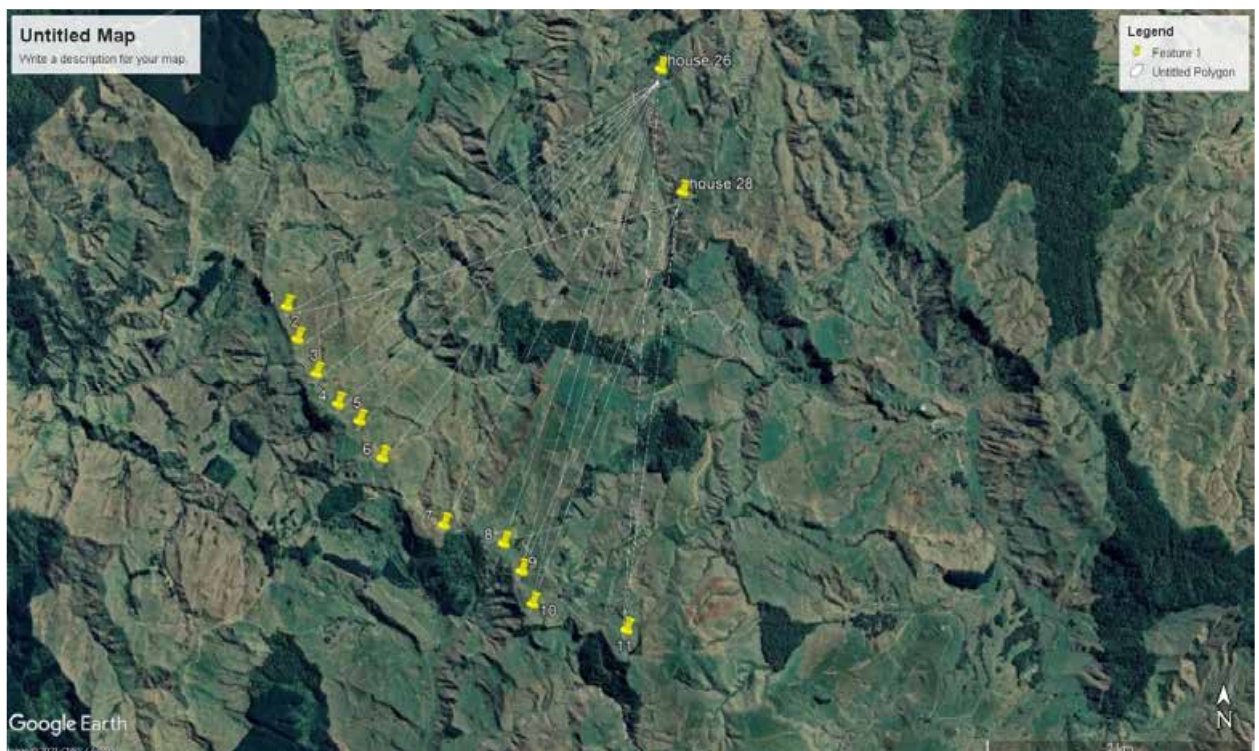


Figure 2 Google Earth map showing line-of-sight from 'House 28' turbines 1 and 9-11. By methodically tacking the Google Earth 'Ruler' function along each line of sight, it was possible to see the high elevation points in the landscape and how far these points were from the house.

From 'House 28' one of the proposed taller turbines (turbine 1) will be fully screened from view due to topography. Of the remaining ten taller turbines proposed, varying degrees of the upper parts of all will be visible.

In the consented scheme, two turbines (1, and 7) will be screened from the modelled viewpoint above 'House 28'. This can be seen in the photomontage. The upper parts of

nine turbines would therefore be visible according to the photomontage and the line-of-site study.

Therefore, the Proposal includes the upper blades of one turbine (Turbine 7), that will be visible from this house compared with what is consented.

The lower parts of the proposed and consented turbines are screened by an intervening undulating ridge. The line-of-sight study assessed the crest of this ridge having an elevation of approximately 290 m to 325 m whereas the house sits at a lower elevation of approximately 255 m. The turbines are located on high points that are generally 300 m in elevation. The photomontage demonstrates that the ridgeline will obscure the lower parts of turbines 2 – 8. The line-of-sight study regarding turbines 1 and 9 – 11 finds that turbine 1 will be fully screened by the ridge and turbines 9, 10 and 11 will have approximately 55%, 65% and 85% respectively of the lower parts of their structures screened by the ridge. It is also acknowledged that intervening vegetation located between the house and each turbine has been discounted. This vegetation located along or close to the ridgeline has the potential to further reduce the visibility of turbines 4 – 11 in particular.

As per the effects on 'House 26', discussed above, the primary adverse effect is generated by the presence and number of turbines – rather than how tall they are. The numbers of turbines visible also contributes to effects. The reduction in the consented turbine numbers from twenty-two to eleven is less relevant in terms of the visual effects from 'House 28' in that the 'southern eleven' are substantially distant, where the reduction will have minimal benefits.

Therefore, in respect of the 'northern eleven', and 'House 28', the proposed taller turbines will extend higher above the ridge line compared to what is consented. It is concluded that this increase in height will not generate additional adverse visual effects greater than 'Low'⁷. This is evident in the photomontage. The blade tips of one more turbine will be visible compared to what is consented. Actual effects from the house will be less than what is depicted in the photomontage as the modelled viewpoint is taken above the house. A lower viewpoint height at house level combined with the steeper viewshaft past the ridge to the turbines will give the ridge more of a screening effect. Effects may lessen further depending on the height and extent of any intervening structures and vegetation and house layout. It has been assumed that there are internal living areas facing towards the site.

ZTV mapping

As another desktop 'check', the earlier ZTV mapping was studied with regards to 'House 26' and 'House 28'. Of note, the visibility of all twenty-two turbines was programmed in to the ZTV analysis at 170 m tall and the consented 121.5 and 110 m heights for the 'northern' eleven and 'southern' eleven turbines respectively. Where 'House 26' is concerned, the consented scheme included 1 to 5 visible turbines, compared to the taller 170 m turbines where 6 to 11 turbines would be visible⁸.

With regards to 'House 28' the ZTV mapping shows 17 to 22 turbines visible regardless of consented or 170 m height. While the ZTV mapping does not make a distinction between the visibility of the 'northern' eleven turbines - subject to this assessment, the ZTV mapping does indicate a relative consistency between the numbers of turbines visible from 'House 26' and 'House 28'.

⁷ **Low:** A low level of effect on the character or key attributes of the receiving environment and/or the visual context within which it is seen; and/or have a low level of effect on the perceived amenity derived from it. (*Oxford English Dictionary Definition: Low: adjective-below average in amount, extent, or intensity*).

⁸ 172.5 m tall turbines were not programmed in when the ZTV mapping was carried out earlier. Nonetheless, a 2.5 m difference in height would not have any discernible differences in visual effects, given the overall height of the structures and the distance.

Summary – visual effects on ‘House 26’ and ‘House 28’

The wider scheme includes the deletion of eleven ‘southern turbines’ which were originally proposed. This would potentially help offset the visual effects of the increase in turbine height of the eleven remaining turbines relative to the two houses - the subject of this effects memorandum. However, due to the distances from these houses to the southern turbines which exceed 3.5 kms and the southern orientation of views, any benefits of the removal of the southern eleven, relative to the outlook from these two houses, will be small. For the purposes of this assessment, a conservative approach has been taken where ‘House 26’ and ‘House 28’ will receive no discernible benefit from the reduction in turbine numbers from twenty-two, to eleven.

Any potentially adverse visual effects of the variation to increase the turbine heights by 51 m is greatest at ‘House 26’ where views from this house will see nine taller turbines compared to three smaller turbines as proposed. This is due to the taller turbines being seen rising above an intervening ridge, which previously screened the lower height structures. The levels of adverse visual effects beyond what has been consented are considered to be ‘**Moderate**’.

Any adverse visual effects of the increase in turbine height at ‘House 28’ will be ‘**Low**’. One taller turbine will be visible compared to what was consented where nine turbines would be visible. Two of the consented lower turbines would be screened from view by an intervening ridge. The increase in height of the ten turbines remaining visible (one tall turbine will remain screened) has less of an effect as views from this house already included nine turbines - albeit of lesser height. The ‘Low’ adverse visual effect of the height increase can be seen in the photomontages. Both turbine heights, consented and proposed are very large structures.

As this report is currently desktop-based, a reliance has been placed on the photomontages provided regarding the appearance of the consented and proposed turbines from ‘House 28’. Additional line-of-sight study has found that turbines 1 and 9 – 11 would have their upper parts visible – similar to the extent shown in the photomontages. In this regard the extent of turbines shown in the photomontages can be confirmed.

Key findings from previous reporting remains relevant. This earlier assessment considered the visual effects generated by increasing the eleven ‘northern’ turbines height from 110m to 121.5m tall and included:

- The site is not included within an Outstanding Natural Landscape/Feature or High Amenity landscape within the Waikato Regional Landscape Assessment.
- The site has a low to medium degree of ‘naturalness’.
- Pastoral farming is the predominant land use with scattered exotic trees and native vegetation present.
- Rural residential buildings and associated farm buildings are sparsely located away from ridgelines, generally within associated sheltered planted enclaves.
- Landscape character has moderate amenity value, which takes into account the consented (unbuilt) windfarm.
- Generally, no discernible change in the effects on landscape character or amenity arising from the earlier increase in height for the ‘northern’ eleven turbines from 110m to 121.5m.
- The area has capacity to absorb change due to its remoteness, relatively low population and its modified character.

The consented wind farm includes 22 turbines; the ‘northern’ eleven at 121.5m tall to tip height and the ‘southern’ eleven at 110m to tip height. These structures are considered part of the baseline environment.

Conclusion

It is concluded that regardless of the size of the turbines whether they are 121.5 m or 172.5 m tall, all are very large structures. The purpose of this memorandum is to assess the visual effects of the difference in height and numbers of turbines visible between what is consented and what is proposed for the 'northern' eleven turbines. It is found that the difference between the consented 121.5 m tall turbine and the proposed at 172.5 m tall will have '**Low**' or '**Moderate**' adverse visual effects from 'House 28' and 'House 26' respectively. '**Low**' adverse visual effects are generated by the similar numbers of turbines visible combined with a height increase when the consented and proposed are compared. '**Moderate**' adverse visual effects are generated by the greater numbers of turbines visible combined with a height increase when the consented and proposed are compared.

It is noted that there were no photomontages from House 26 provided by the Applicant. The desktop study has partly relied on Google Earth for the line-of-sight study in absence of this information. Google Earth as an assessment tool is relatively 'coarse'. In addition, existing vegetation has not been considered in the assessment of effects which may buffer or screen some views to the turbines from the two houses. For these reasons, the determination of visual effects is conservative.

Appendix 1

CONSENTED TURBINE locations plan

Taumatototara Windfarm

11 Turbine Layout

Separation distances to 3rd Party Houses



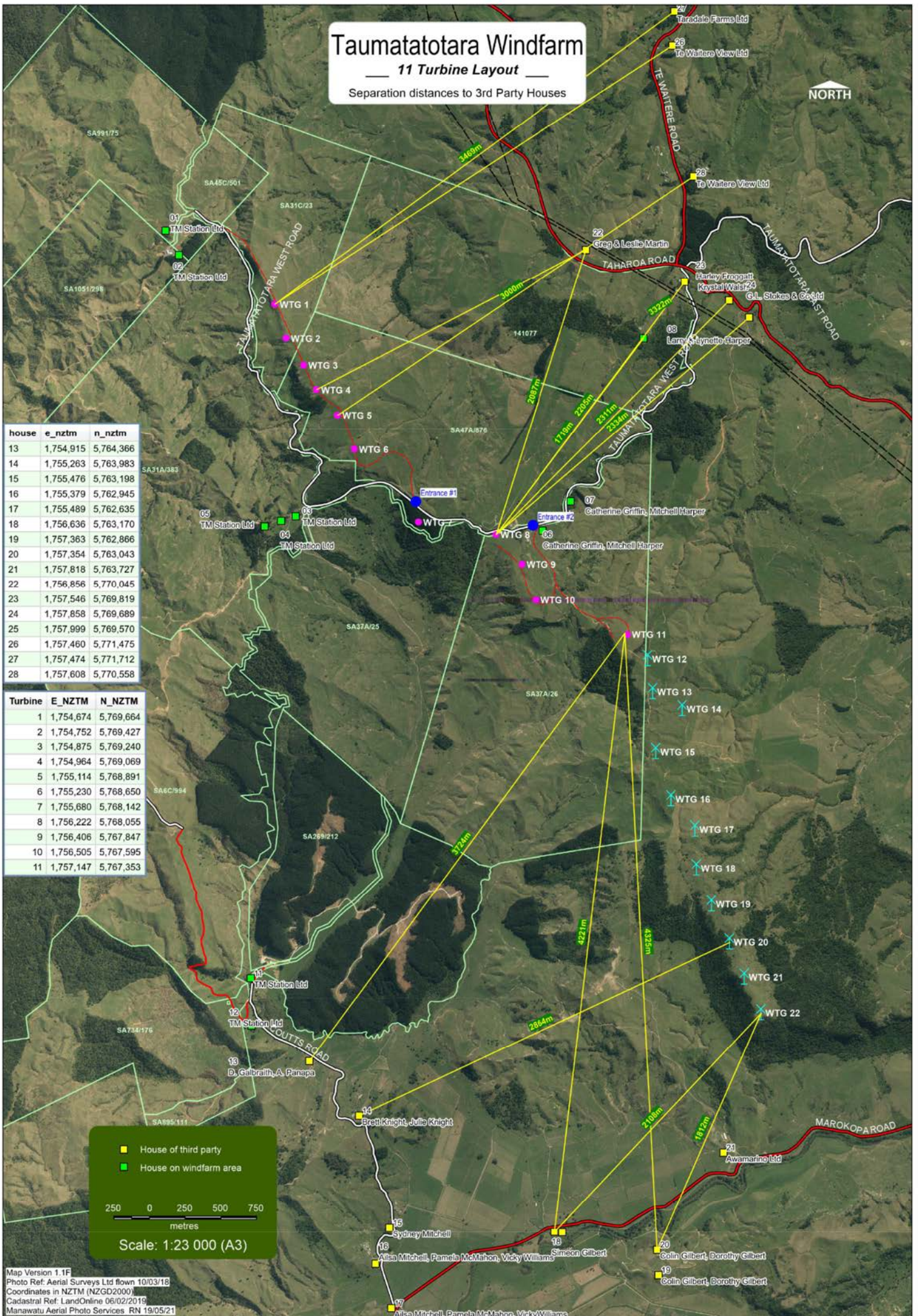
house	e_nztm	n_nztm
13	1,754,915	5,764,366
14	1,755,263	5,763,983
15	1,755,476	5,763,198
16	1,755,379	5,762,945
17	1,755,489	5,762,635
18	1,756,636	5,763,170
19	1,757,363	5,762,866
20	1,757,354	5,763,043
21	1,757,818	5,763,727
22	1,756,856	5,770,045
23	1,757,546	5,769,819
24	1,757,858	5,769,689
25	1,757,999	5,769,570
26	1,757,460	5,771,475
27	1,757,474	5,771,712
28	1,757,608	5,770,558

Turbine	E_NZTM	N_NZTM
1	1,754,674	5,769,664
2	1,754,752	5,769,427
3	1,754,875	5,769,240
4	1,754,964	5,769,069
5	1,755,114	5,768,891
6	1,755,230	5,768,650
7	1,755,680	5,768,142
8	1,756,222	5,768,055
9	1,756,406	5,767,847
10	1,756,505	5,767,595
11	1,757,147	5,767,353

■ House of third party
■ House on windfarm area

250 0 250 500 750
 metres

Scale: 1:23 000 (A3)



Appendix 2

SITE IMAGES – HOUSE 26 AND HOUSE 28



Context Photos, looking toward the windfarm from the property.



Right side of house



Right side of house, from the driveway



Front of house

Context Photos, toward the windfarm from the house.



Context Photos, overlooking the house toward the windfarm from the farm.

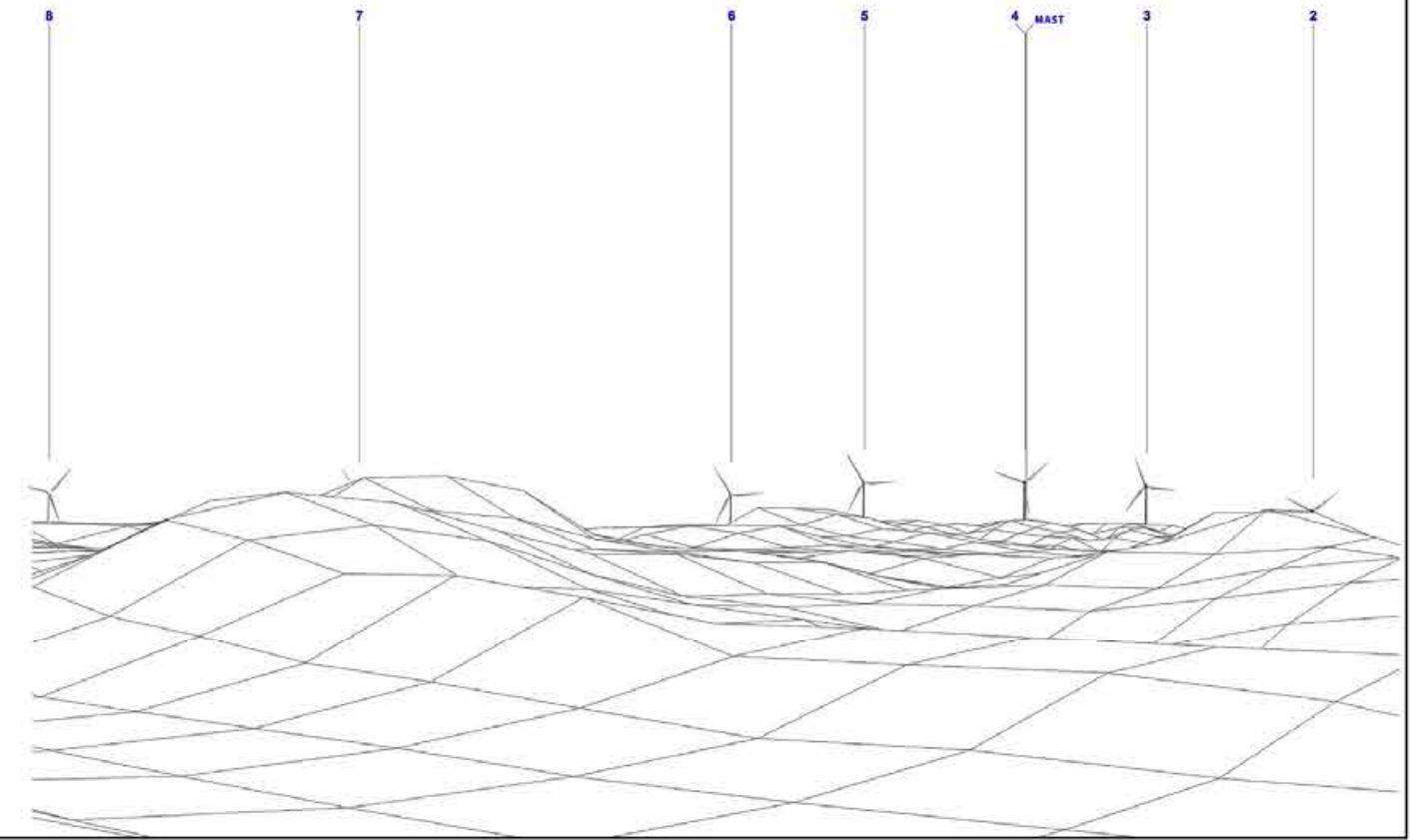
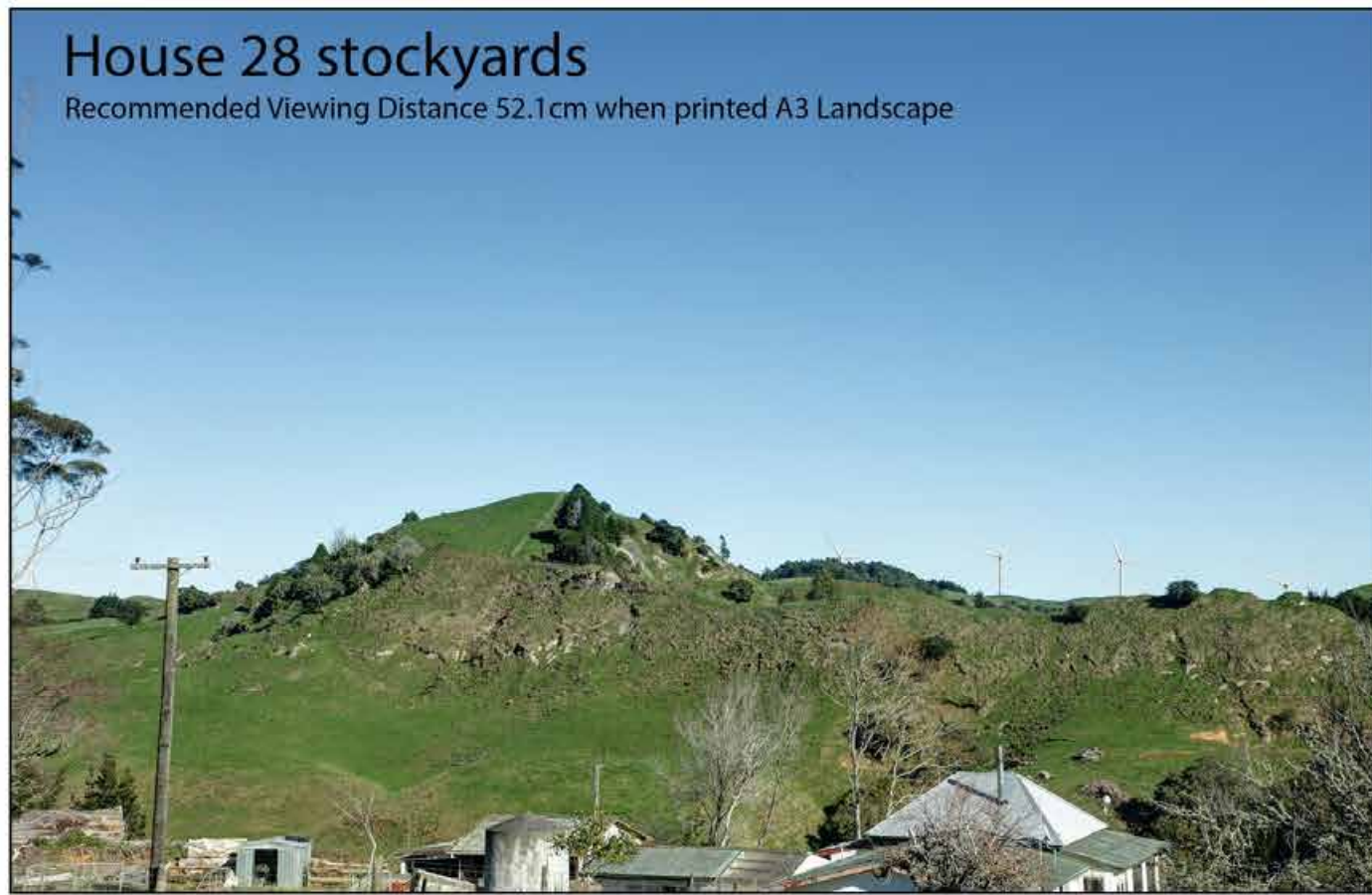


Appendix 3

PHOTOMONTAGES - HOUSE 28

House 28 stockyards

Recommended Viewing Distance 52.1 cm when printed A3 Landscape



0	View direction	360	-40
0	Included angle	180	Pitch angle
		228.4	4.8
		42	0
			-40

Tuamatotara Windfarm

Photomontages from House 28 - stockyards

Photomontage details:

- Grid Reference - 2667881 East
- 6332489 North
- Nearest Turbine - 3158 m
- Turbines Visible - 7
- Rotor Diameter - 110 m
- Tip Height - 121.5 m

Viewpoint Map



Prepared By:

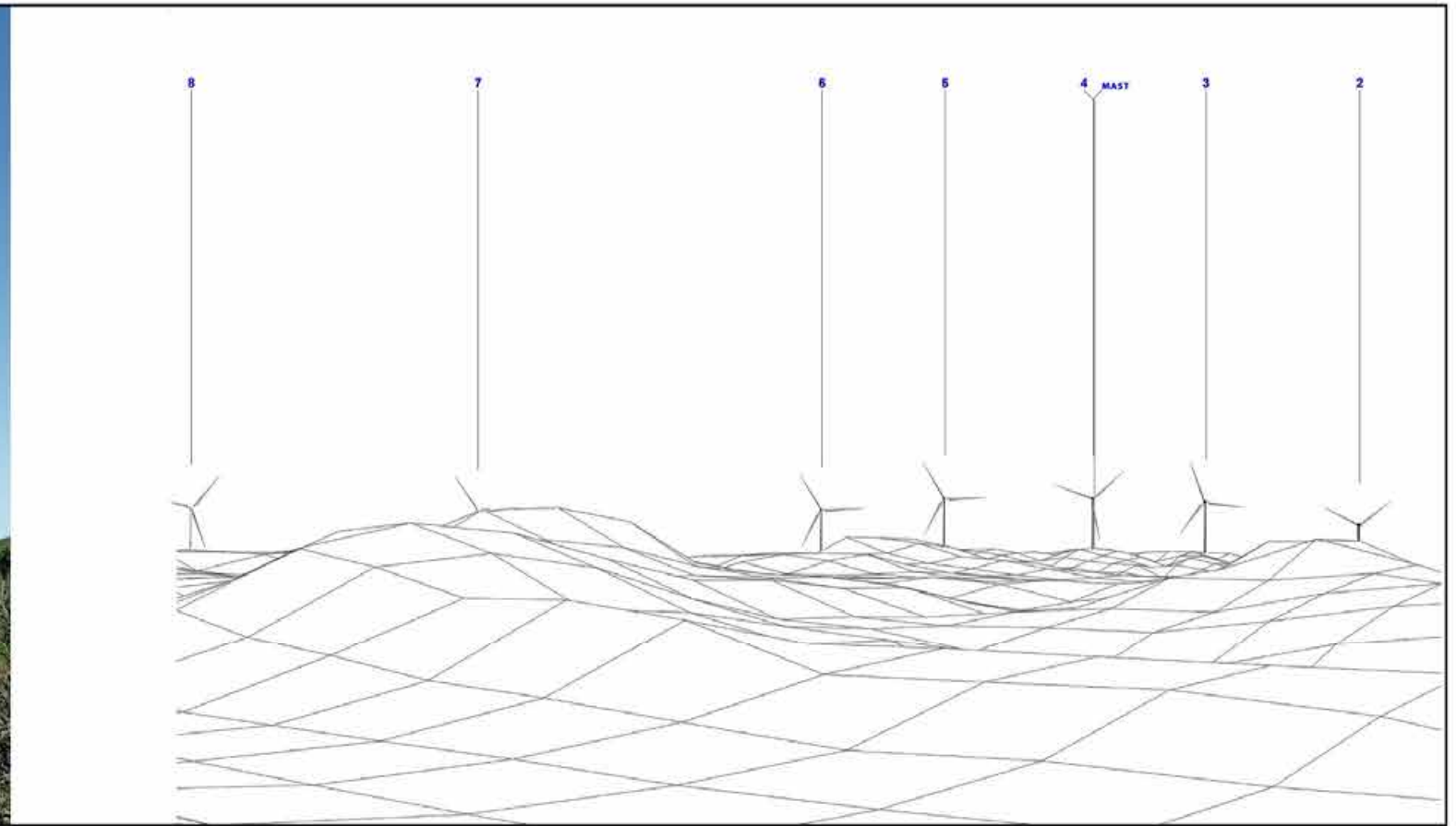
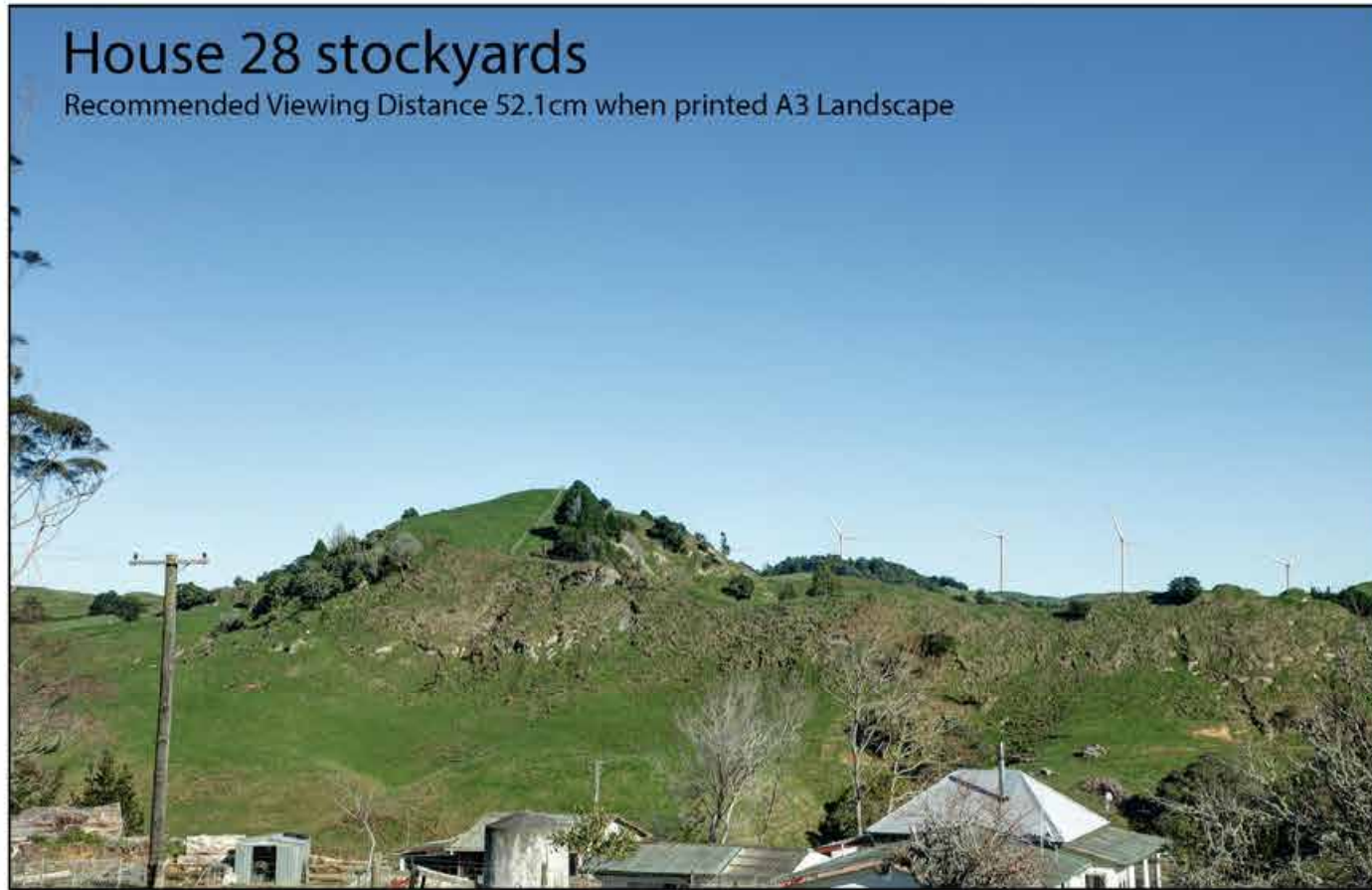
Energy3 Services Limited



For:

House 28 stockyards

Recommended Viewing Distance 52.1 cm when printed A3 Landscape



0	View direction	360	40
228.4			Pitch angle
0	Included angle	180	4.8
42			0
			-40

Tuamatatotara Windfarm

Photomontages from House 28 - stockyards

Photomontage details:

- Grid Reference - 2667881 East
- 6332489 North
- Nearest Turbine - 3158 m
- Turbines Visible - 7
- Rotor Diameter - 155 m
- Tip Height - 172.5 m

Viewpoint Map



Prepared By:

Energy3 Services Limited



For: