

SOUTHLAND WIND FARM

AVIATION WARNING SYSTEM

ASSESSMENT OF ENVIRONMENTAL EFFECTS OF PROPOSED LIGHTING

Prepared for

Contact Energy Limited

I N D E P E N D E N T E L E C T R I C A L & I L L U M I N A T I O N E N G I N E E R S

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CONTENTS

DOCUMENT VERSION HISTORY	2
DOCUMENT QUALITY ASSURANCE.....	2
CONTENTS	3
EXECUTIVE SUMMARY	4
1.0 INTRODUCTION	5
2.0 REPORT AUTHOR	5
3.0 STANDARDS.....	6
4.0 EXISTING ENVIRONMENT	6
5.0 PROPOSED LIGHTING.....	7
6.0 STATUTORY PROVISIONS	9
7.0 VISIBILITY OF LIGHTS	9
8.0 POTENTIAL EFFECTS	13
8.1 Observers.....	13
8.2 Potential Effects	13
9.0 ASSESSMENT OF EFFECTS	14
9.1 Terminology.....	14
9.2 Residents	15
9.3 Motorists	17
9.4 Biota	17
9.5 Summary of effects	18
10.0 CONCLUSIONS	18

APPENDIX A: PROPOSED LIGHTING EQUIPMENT

APPENDIX B: ZTV DIAGRAM

APPENDIX C: CAA DETERMINATION

EXECUTIVE SUMMARY

In my opinion, the lighting effects of the Aviation Warning Lights will be low to moderate, or no more than minor.

Appendix B includes a plan showing all of the existing residences with 10km of the proposed wind turbines. The appendix also includes a chart identifying which of those residences may potentially have visibility of the wind turbines, and in each case, how many wind turbines may be visible. Visibility of a wind turbine will invariably result in visibility of the Aviation Warning Light on top of the nacelle.

The likely effects at those residences are described in sections 8 and 9.

1.0 INTRODUCTION

LDP Limited (**LDP**) has been engaged by Contact Energy Limited (**Contact**) to provide an assessment of lighting effects associated with the proposed Aviation Obstruction Warning Light (**AWL**) System to be mounted on selected wind turbines at the proposed Southland Wind Farm.

The Southland Wind Farm (**SWF**) will be located at Slopedown Hill and will include a total of 55 wind turbines, each with a 'tip height' of up to 220m. The Civil Aviation Authority (**CAA**) has now confirmed that 16 of the wind turbines will need to be fitted with an AWL, to be located on top of the nacelle, and that no other measures are required. This represents a significant reduction in the number of lights that would have been required if the applicant were required to follow CAA's default guidance (i.e. up to 55 turbines with up to four lights each).

This has been achieved through an application by Contact to the CAA for a review of the application of the default guidelines, and supported by independent aviation safety assessment of a significantly reduced lighting arrangement. The CAA decision to reduce the original lighting requirement, (all 55 turbines being lit at nacelle and intermediate lights at half tower height) has greatly reduced potential impacts on dwellings in the vicinity of the wind farm without increasing risk to aircraft. The CAA determination in accordance with Civil Aviation Rules Part 77, Appendix B, B.2(b)(3)(ii) (dated 16 August 2024) is included as Appendix C to this report.

Contact has commissioned this report to provide further information in relation to the EPA request for further information dated 10/07/2024. In particular, this report addresses question 2 of that request as repeated below;

The Panel note there is no conclusion reached in section 6.5.3 of the AEE (page 103) on the level of visual effect of the night time lighting, except that this will vary depending on the viewpoint and presence of surrounding intervening light sources. Please identify which dwellings will potentially be affected by night lighting and the likely level of effect on each.

2.0 REPORT AUTHOR

John Mckensey is the author of this report, acting on behalf of LDP. LDP are an independent Electrical and Illumination Engineering Consultancy, established in 1994. I hold the position of Executive Engineer and have over 40 years' experience in relation to lighting design and the assessment of effects of lighting.

I hold a Bachelor of Engineering (Electrical), am a Member of the Illuminating Engineering Society of Australia and New Zealand Inc. (MIES) and hold a number of relevant affiliations including CMEngNZ, MIEAust, CPEng(Aust), NER, APEC Engineer, IntPE(Aust). I am a member of the Resource Management Law Society of NZ Inc. and the International Dark-Sky Association.

I have received 19 awards for lighting design from the Illuminating Engineering Society and other learned bodies, including 3 International awards and 3 lighting

design awards from the Royal Astronomical Society of New Zealand (for “efficient, effective and sustainable lighting design – protecting the night environment”).

In addition to advising local government in relation Plan Changes (Auckland – AUP, Christchurch – DP updates, Hamilton – DP plan changes PC5 and PC9), I have provided evidence in the Environment Court for a number of applications.

I am currently advising Horizons Regional Council in relation to lighting effects associated with the Meridian Energy Mt Munro Wind Farm application, which is due to be heard by the Environment Court later this year.

3.0 STANDARDS

There are no New Zealand or Australian standards controlling the nature and effects of Aviation Warning Lights. The Australia/New Zealand standard that is ordinarily relevant for addressing lighting effects is AS/NZS 4282:2023 (Control of the obtrusive effects of outdoor lighting) (**AS/NZS 4282**). However, AS/NZS 4282, under section 1.1 Scope, states;

“The document does not apply to the following:

(c) Lighting for aviation safety”

This is understandable since by necessity, lighting for aviation safety generally directs light upwards to warn approaching aircraft, whereas AS/NZS 4282 endeavours to minimise upward light. Further there are minimum luminous intensity requirements for such lighting set by the CAA for safety reasons that therefore cannot be mitigated.

However, there are definitions and principles stated in AS/NZS 4282 which have been referenced in this report where considered appropriate, such as the classification of night time ambient light conditions and the impact of the spectral content of the light.

These principles have been used to assess the potential effects of the CAA determination outlining the AWL requirements for the Southland Wind Farm and is addressed at section 6.

4.0 EXISTING ENVIRONMENT

The existing environment surrounding the SWF is described in detail in the Mitchell Daysh Resource Consent Application and Assessment of Environmental Effects (**AEE**) at Section 2.

In general terms, the SWF wind turbines (**Site**) will be located on rural land (zoned Rural in the SDP). The immediate surrounds are sparsely populated and also zoned Rural. The ZTV diagram at Appendix B identifies all existing residences within 10km of the proposed wind turbines.

Consistent with the Visual Effects assessment undertaken by Isthmus, this report assesses the Lighting Effects to those residences.

Using the guidelines provided in AS/NZS 4282:2023, the ambient light conditions could best be described as shown in Table 1.

LOCATION	ENVIRONMENTAL ZONE (per AS/NZS4282:2023)	AMBIENT LIGHT CONDITIONS
Site [Relatively uninhabited rural area]	A1	Dark
Surrounds		
<ul style="list-style-type: none"> Wyndham Township 	A3	Medium District Brightness
<ul style="list-style-type: none"> DOC Conservation Estate 	A1	Dark
<ul style="list-style-type: none"> All other areas [Sparsely inhabited rural or semi-rural area] 	A2	Low District Brightness

Table 1. Ambient light conditions

5.0 PROPOSED LIGHTING

The only exterior lighting proposed to be affixed to the wind turbines will be an AWL, mounted on top of the nacelle. This will apply to 16 of the 55 wind turbines, located as marked in Appendix B.

The remaining 39 wind turbines will have no external lighting equipment.

Each AWL will:

- Be a medium-intensity obstacle light
- Produce monochromatic red light
- Flash between 20 and 60 times per minute
- Generate light with a distribution akin to that shown in Appendix A and repeated in Fig. 2, with;
 - a horizontal maximum light intensity of 2,000 candela (**cd**) at night and 20,000cd during the day
 - gradually reduced intensity below the horizontal, reducing to no more than 3% (i.e. 60cd at night) at 5 degrees below horizontal

A typical installation is shown in Figure 1.



Figure 1. Typical AWL installation (red light on the left)

Figure 2 demonstrates the optical control expected for each AWL.

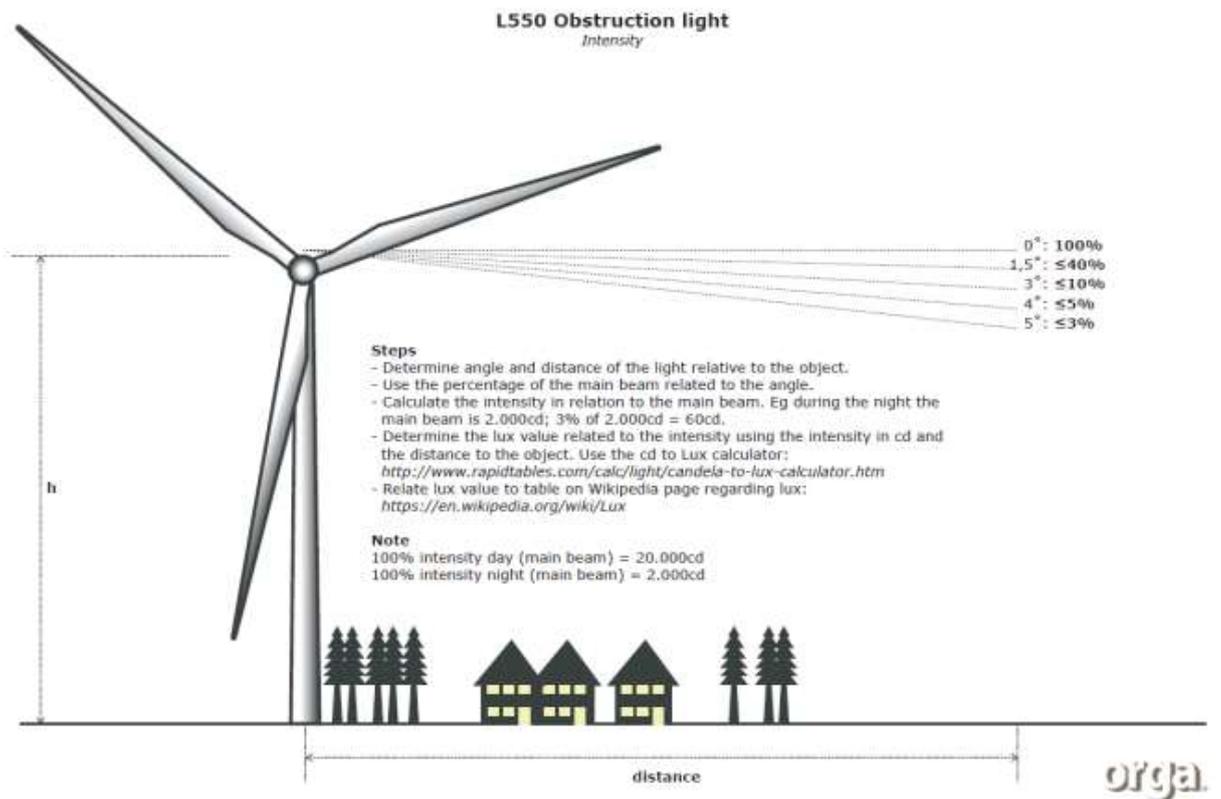


Figure 2. Indicative AWL light distribution

6.0 STATUTORY PROVISIONS

The CAA has provided a determination in relation to the SWF. A copy of the determination is included at Appendix C.

Based on the determination, each of the 16 selected turbines will have 1 medium-intensity flashing red light on top of the nacelle.

The AWLs are a mandatory safety requirement and the CAA determination on 16 August 2024 has now established the required number and arrangement needed to maintain aeronautic safety. In addition, the proposed lights will include optical control to minimise lighting effects to locations below the height of the AWL.

7.0 VISIBILITY OF LIGHTS

Each AWL, by its intended nature, will be visible to aircraft approaching from any direction.

However, each light will include optical control to reduce light intensity at angles below horizontal. Optical control consists of a progressive type of lens covering the LED chips, allowing unencumbered emission of light at and above horizontal, but progressively restricting light as the angle below horizontal increases. Thus, the system maximises visibility to aircraft while minimising visibility to observers below the light.

Optical control is far superior to physical shielding in terms of the ability to graduate the reduction in intensity as the angle below the horizontal increases, whereas a physical shield will only provide a single step (i.e. visible or not visible), tends to be imprecise due to the size of the light source and increases maintenance.

During the day, the peak light intensity will be 20,000cd – i.e. 10x that of the night time intensity. However, that is necessary to enable the light to be seen in contrast with the bright ambient environment generated by sunlight.

For context, the peak luminous intensity a typical digital billboard during the daytime is also approximately 20,000cd, while the luminous intensity of the sun is approximately 2.2×10^{27} cd.

While the AWL will be visible, when viewed in contrast against the daytime sky, the day time effects will be very low in my opinion.

At night, the intensity of the AWL will be a maximum of 2,000cd. This will diminish as the viewing angle below horizontal increases.

For context, an LED roadway light can typically be in the order of 2,000cd for a 25 watt residential road light or 9,000cd for a 100 watt highway light. The luminous intensity of a vehicle headlight on low beam is approximately 30,000cd.

The smallest commercially made incandescent lamps tend to be 15 watt (e.g. for an oven light, salt lamp, or similar), which would produce a luminous intensity of approximately 240cd. As indicated in figure 2 and table 2, a maximum luminous intensity of 60cd will be experienced when viewing from 5 degrees below the horizontal plane. This would equate approximately to a 4 watt incandescent lamp, or approximately 1/4th the luminous intensity of a typical oven light.

Table 2 shows the indicative night time intensity at various angles.

VIEWING ANGLE BELOW HORIZONTAL (Degrees)	PROPORTION OF MAXIMUM INTENSITY (%)	MAXIMUM LUMINOUS INTENSITY (cd)
0	100	2,000
1.5	≤40	800
3	≤10	200
4	≤5	100
5	≤3	60
>5	0-3	≤60

Table 2. Luminous intensity vs viewing angle

While AS/NZS 4282 is not applicable to AWLs, it is potentially useful to understand that the maximum luminous intensity considered acceptable for static white light during the night time per the standards is as shown in Table 3.

ENVIRONMENTAL ZONE	MAXIMUM LUMINOUS INTENSITY (cd)
A1	500
A2	1,000
A3	2,500

Table 3. AS/NZS4282 Night Time Luminous Intensity limits

As indicated in Table 2, at angles below horizontal, the luminous intensity will be below the A2 limit – A2 being the zone considered applicable to the area adjacent the Site out to 10km.

The light emitted will be monochromatic red.

The human eye is most sensitive to yellow and green in the centre of the visible light spectrum and least sensitive to red and violet¹ at the upper and lower ends of the visible light spectrum. Hence, red light will result in less effects than broad spectrum white light of similar intensity. The sensitivity of the human eye is shown in figure 3.

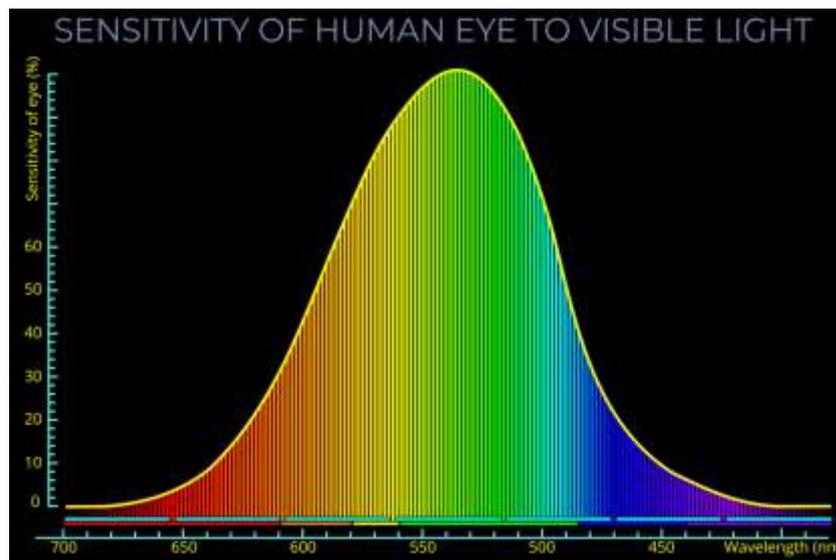


Figure 3. Human eye sensitivity to visible light²

However, the fact that the light will be flashing will increase effects.

Isthmus has analysed the site and produced the Zones of Theoretical Visibility (ZTV) diagrams included at Appendix B. These show the dwellings within 10km of the Site that could potentially have views of the AWLs (i.e. views of the top of the nacelle on the associated 16 wind turbines to be fitted with an AWL) and how many of the 16 AWLs would be theoretically possible to see.

Isthmus has advised the following in relation to the ZTV modelling;

The dimensions assume a wind turbine tip height of 220m, and a nacelle height of 135m. A conservative approach has been taken to the analysis and simulation work, thus leaning towards the side of greater effect during the technical decision making process.

Geodesic Zones of Theoretical Visibility (ZTV) Analysis Assumptions:

¹ Legibility of web page on full high definition display – AA Hashim, et al

² <https://lightcolourvision.org/diagrams/sensitivity-of-human-eye-to-visible-light/>

- Observer height 135m + Digital Elevation Model (DEM) Ground Level (Lights on turbine nacelles)
- Raster Surface offset 2m (human height)
- Digital Elevation Model (DEM) information: Jan 2012 LINZ Topo 50, 8m resolution
- Dwelling height and location info is point extraction from DEM mentioned above.

ZTV frequency analysis determines the raster surface locations visible to a set of observer features using geodesic methods.

ZTV (using a DEM) does not consider above ground screening features such as buildings and vegetation.

ZTV should not be interpreted as a representation of levels of visual effect (i.e. It is not the case that 'light pink = good vs dark pink = bad'). The data indicate areas where points are visible, and do not consider other factors such as distance, and visual context.

The locations and relative heights of the 16 wind turbines are summarised in Table 4 and shown in the ZTV diagram in Appendix B.

Label	Easting	Northing	Design RL	GL Elev
GLE 03	1292778	4859573	429.5	430.3
JED 01	1293606	4861961	403.5	404.6
JED 06	1295208	4859280	515	515.2
JED 17	1297911	4857882	597.3	598.6
JED 18	1294936	4862702	378.1	380.3
JED 26	1297411	4859041	629.2	630.3
JED 29	1298194	4860047	578.9	581.4
JED 34	1297160	4862018	493.1	496.8
MAT 01	1299417	4861319	577.6	579.1
MAT 05	1299618	4863426	511.8	512.7
MAT 06	1300674	4862615	590.3	596.3
MAT 08	1300635	4864117	504.7	509.1
MAT 09	1302147	4865780	548.1	551.6
MAT 15	1304001	4864284	610.3	611.4
MAT 16	1305105	4864880	602	605.4
MAT 18	1304989	4865838	505.4	508.3

Table 4. AWL wind turbine locations

The locations and relative heights of dwellings within 10km of the Site are summarised in Table B1 at Appendix B.

A total of 166 residences have been identified within 10km of the Site. Of these, 33 will have no visibility of the AWLs.

As mentioned in the assumptions above, the modelling ignores anything above bare ground (such as trees, buildings, etc), so there will likely be less visibility of the AWLs than suggested by Table B1. I understand that the model assumes a clear sky.

The presence of mist will soften the luminous intensity of each light, although the diffusing effect of the water vapour will increase the apparent size of the light source. As the mist thickens, it will progressively obscure the light. Comparisons can be drawn with approaching vehicle headlights in a foggy conditions. These effects have been considered in my assessment and conclusions.

Since the wind turbines are all higher than the dwellings, the general trend is that the closer the dwelling, the steeper the viewing angle.

The dwelling likely most affected would be at ID#126 which is the highest dwelling that has visibility of the wind turbines and may see up to 15 of the AWLs – the lowest elevation AWL being on JED18, some 9.5km distant, and the closest being JED01, some 9.2km away. An analysis of potential effects is given in section 9.

I note that this dwelling is closer to the existing Kaiwera Downs Stage 1 Wind Farm at some 6.7km from the closest wind turbine in the SWF.

8.0 POTENTIAL EFFECTS

I have considered the potential effects of the lighting with respect to potential sensitive receivers (**Observers**).

8.1 Observers

Observers could include;

- Occupants of residential dwellings with direct visibility of the AWLs (**Residents**)
- Motorists on public roads (**Motorists**)
- Nocturnal biota (**Biota**)

When considering nocturnal Biota, particular regard is typically afforded to the national critical endangered NZ long-tailed bat (**Bats**), migratory sea birds (**Birds**) and nocturnal insects (**Insects**).

8.2 Potential Effects

While not all types of obtrusive light effects will necessarily affect Residents, the following potential effects have been considered;

1. **Sky glow**: Light scattered in the atmosphere reducing visibility of the night sky;
2. **Light spill**: Direct light trespass, as measured in lux, typically at the window of a dwelling;
3. **Glare**: Brightness of a light source when viewed in contrast to the immediate surrounds;

4. **Amenity:** Views of the night sky; and
5. **Health:** Sleep disturbance & seizures.

Effects on Motorists could potentially include;

1. **Glare:** The relative brightness of a light source in the driver’s field of view and the potential of this to affect vision; and
2. **Distraction:** The potential for a flashing red light to distract the driver’s attention.

Effects on Biota could potentially include;

1. **Bats:** Discourage roosting and foraging and potential habitat displacement;
2. **Birds:** Disrupt instinctive flight paths and increase risk of bird strike; and
3. **Insects:** Attracted to light and thereby attract predators.

9.0 ASSESSMENT OF EFFECTS

9.1 Terminology

I have based my assessment of effects on a scale typically used to compare technical assessments with planning determination terminology. A comparison is shown in Table 5.

EFFECT RATING	PLANNING DETERMINATION
Very high	Significant
High	Significant
Moderate-high	More than minor
Moderate	More than minor
Low-moderate	Minor
Low	Less than minor
Very low	Less than minor

Table 5. Technical vs planning effects terminology

9.2 Residents

Sky glow

Sky glow is typically noticed as the glow visible above a town or city at night when viewed from a distance, as a result of direct and reflected upward light from artificial lighting, striking particles in the atmosphere and scattering the light.

The blue content of white light has an impact on sky glow as it scatters more in the atmosphere than light at the red end of the spectrum. Hence, red light will generate less sky glow than white light of similar intensity.

In addition, the total quantity and intensity of the proposed lighting are such that, in my opinion, sky glow effects on Residents will be very low.

Light Spill

The nominal illuminance (spill light) at the window of a dwelling from a point source can be calculated by the formula;

$$E = I/d^2 \text{ (E=Illuminance, I=Luminous Intensity, d=distance)}$$

For the range of separation distance and viewing angles proposed, I calculate that the maximum spill light from an AWL at a dwelling could theoretically be up to 0.00002 lux. If all 16 lights were visible, the theoretical maximum at a residence could be no greater than 0.0003 lux.

Starlight on a clear evening produces approximately 0.0001 lux. Typical moonlight with a full moon on a clear night is approximately 0.3-0.5 lux, but can range up to 1 lux. Hence, the spill light effects will be much closer to starlight than moonlight.

In my opinion, spill light effects to Residents will be very low.

Glare

Glare (luminous intensity) will vary with viewing angle but not distance. For the range of viewing angles noted in section 7, I calculate that the luminous intensity could range approximately between 60cd-2,000 cd. Since the light intensity reduces as the viewing angle increases below horizontal, the lower values will occur at the closer Residences and the higher values typically at the further Residences.

The potential worst case would be at dwelling ID#126 as mentioned in section 7. The smallest vertical viewing angle from this location to the lowest AWL (at JED18) would be 1.23 degrees and to the closest AWL (at JED01) would be 0.71 degrees. While the effects will vary for each AWL location, it is likely that the range of luminous intensity will be between 1,000-2,000cd from each AWL as seen from ID#1. However, the closest AWL is some 9.2km away.

While it is true that the numerical value of luminous intensity does not vary with distance, the actual effect of the apparent brightness does lessen as distance increases, since the source occupies a progressively smaller part of the view.

A comparison could be made with our Sun. It is a star, with a similar size and order of brightness as many others we see in the night sky. However, our Sun is much closer than the other stars and thereby too bright to look at directly. Whereas other more distant stars are comfortable to view.

In my opinion, glare effects to Residents will be very low-low.

Amenity

When considering enjoyment of views of the night sky, if viewed through a device such as a telescope, unless looking directly towards an AWL, the angle of view is typically such that the AWL will have no effect.

However, naked eye viewing will change from that presently experienced. Views in directions other than towards AWLs will not be affected, but a view that includes the AWLs will include intermittently flashing red lights that will compete with less bright stars. Any such effect will lessen as the view rotates away from the direction of the SWF and will be non-existent when looking directly away from the SWF.

In my opinion, amenity effects to Residents will be low-moderate.

Health

The separation distances involved will ensure that effects, if any, are limited to awareness of the change of state of the light, but not direct illuminance or spill light effects for the reasons mentioned earlier.

Hence, only if the Observer has a bedroom window providing a direct line of sight to a turbine and there is no screening (e.g. curtains / blinds / foliage / buildings / topography / etc), could there be a potential for sleep disturbance.

Even so, in my opinion, the effects on sleep disturbance to Residents will be very low-low.

In addition, flashing lights can trigger seizures in a small percentage of people. However, the maximum frequency of the AWL will be 1 cycle per second, whereas the range of frequency that would typically trigger a seizure is in the range of 3-60 cycles per second³. Hence, this will not be a concern.

Overall, in my opinion, the effects on health to Residents will be very low-low.

³ Visually sensitive seizures: An updated review by the Epilepsy Foundation – Fisher et al – 2022

9.3 Motorists

Glare

An analysis of glare effects to motorists is similar to that for Residents. The effect will lessen with distance due to the reduction in the size of the light source size in the motorist's view. As a motorist gets closer to an AWL, the vertical viewing angle will increase and the luminous intensity will diminish.

The maximum intensity of the AWL is less than that produced by a typical residential LED streetlight. In addition, the human eye is less sensitive to red coloured light than white light.

In my opinion, glare effects to Motorists will be very low in consideration of the nature of the public roads in proximity to the wind farm site.

Distraction

If a motorist were very close to an AWL and at a similar height, then the flashing red light would be a potential distraction and therefore a possible safety concern.

However, the separation distances and relative heights between public roads and the AWLs will ensure that any such effects to motorists are very low-low in my opinion.

9.4 Biota

Bats

While there has been little research on the New Zealand long-tailed bat (**LTB**) in relation to light sensitivity, it is generally accepted that the LTB is light shy and sensitive to excess light at night at levels down to 0.1 lux.

However, bats are generally understood to have little or no perception of red light. In fact, red light is used in some instances to light spaces to minimise effects on bats.

As such, the AWL is expected to have little if any effect on the LTB.

In my opinion, lighting effects on Bats will be very low.

Birds

Bright artificial light at night has been known to disrupt the flight path of migratory birds and in some cases with highly illuminated buildings, can cause birds to fly into the building and be killed (i.e. bird strike).

However, in this situation, the wind turbine towers themselves will not be illuminated and the only lights will be the red AWLs.

Birds tend to be more sensitive to light at the blue end of the spectrum and as such tend to be less attracted to red light⁴.

In my opinion, lighting effects on birds will be very low.

Insects

Insects can be attracted to bright light, gather and die and then attract predators.

However, these effects tend to be experienced with white light in particular, whereas insects tend not to see red light⁵. Therefore, they are unlikely to be attracted to the AWLs.

Hence, in my opinion, effects on insects will be very low.

9.5 Summary of effects

In my opinion, effects from the Aviation Warning Lights in most respects will be very low-low. The most significant potential effects are related to Residential Amenity, where I consider effects could be low-moderate.

10.0 CONCLUSIONS

Overall, it is my opinion that lighting effects from the Aviation Warning Lights will be low-moderate, or no more than minor.

⁴ National Light Pollution Guidelines for Wildlife – Australian Government – 2020

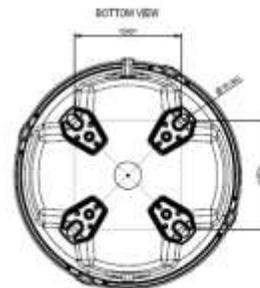
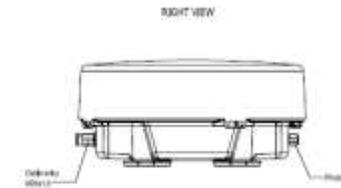
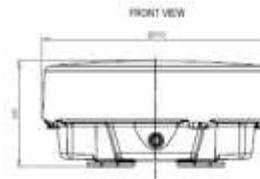
⁵ National Light Pollution Guidelines for Wildlife – Australian Government – 2020

APPENDIX A: PROPOSED LIGHTING EQUIPMENT

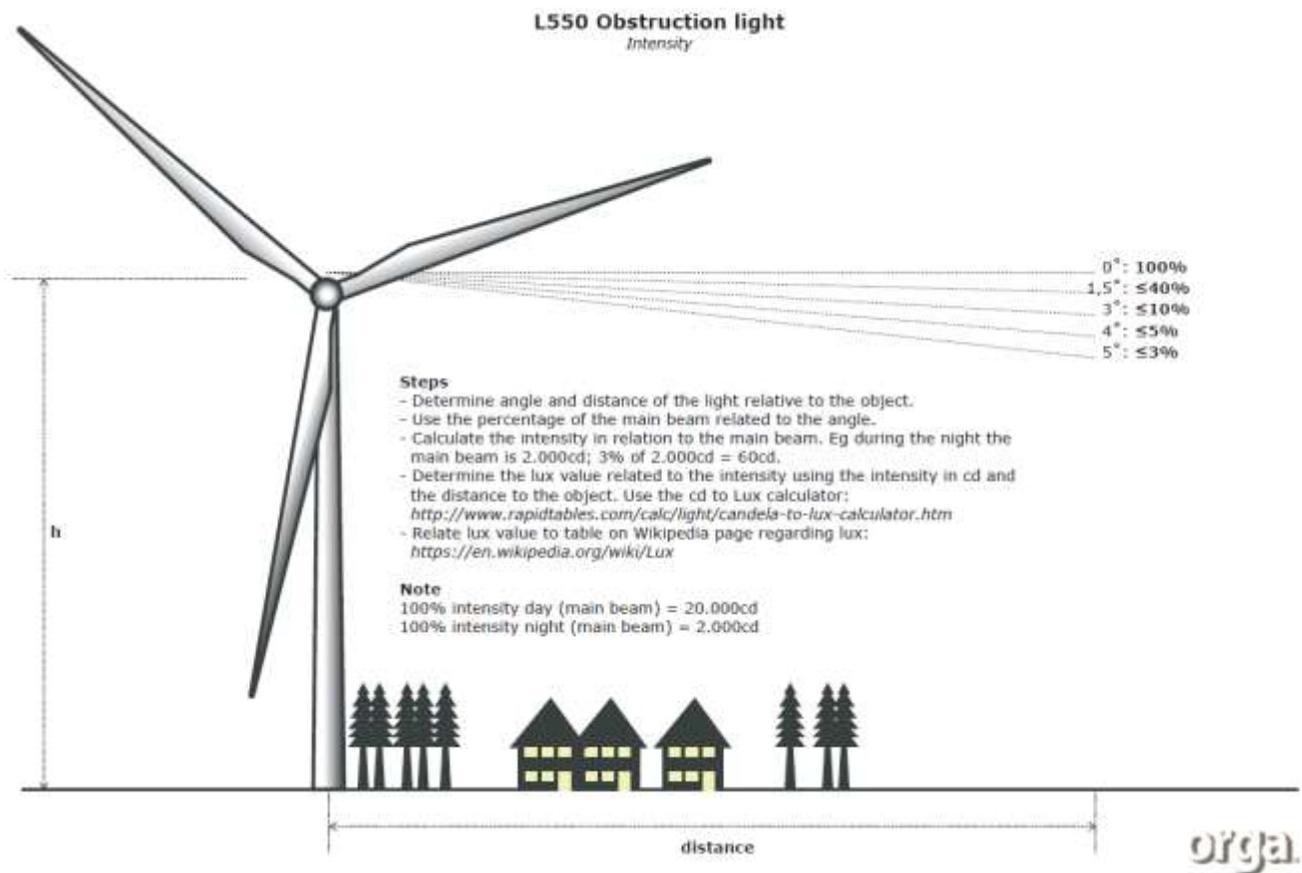
- Obstruction Light Details

Obstruction Light Example: Orga L550 Medium Intensity Obstruction Light

NOTE: The Obstruction Light will be located on top of the wind turbine nacelle. Beam pattern 360 degrees horizontal and minimum 3 degrees vertical. The light output will be monochromatic red. The physical luminaire characteristics are shown below.



Optical control to limit downward light is demonstrated in the diagram below.



APPENDIX B: ZTV DIAGRAM

- Table B1. Residences within 10km of the Site
- ZTV model – at 5km (dashed line) and 10km

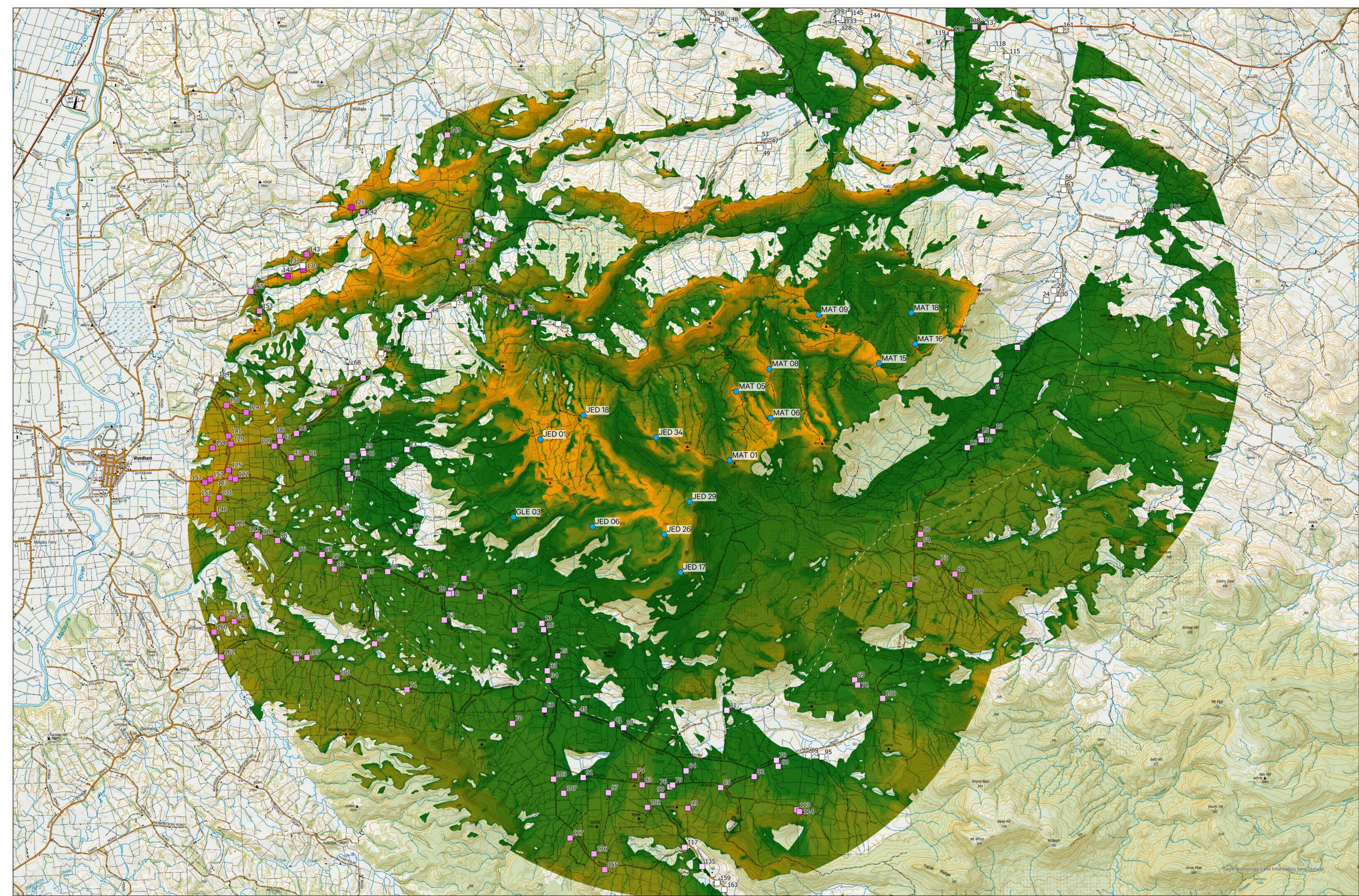
House ID	Address	E	N	Number of turbines visible (Max 16)	Extracted GL (ex DEM)
1	1403 Wyndham-Mokoreta Road, Redan 9892	1292812	4857284	3	119
2	1281 Wyndham-Mokoreta Road, Redan 9892	1291257	4857698	4	92
3	1282 Wyndham-Mokoreta Road, Redan 9892	1291758	4857133	4	92
4	1380 Slopedown Road, Clinton 9583	1307601	4863775	1	217
5	267 Venlaw Road, Oware 9892	1294161	4865504		122
6	1382 Slopedown Road, Clinton 9583	1307494	4863409	2	216
7	1205 Wyndham-Mokoreta Road, Redan 9892	1290848	4857331	4	80
8	1206 Wyndham-Mokoreta Road, Redan 9892	1290879	4857235	4	81
9	1288 Slopedown Road, Clinton 9583	1308245	4864776	1	255
10	1200 Wyndham-Mokoreta Road, Redan 9892	1290788	4857219	4	83
11	248 Venlaw Road, Oware 9892	1293406	4865546	3	119
12	676 Woods Road, Oware 9892	1289609	4859135	1	140
13	1528 Wyndham-Mokoreta Road, Redan 9892	1293651	4856318	3	123
14	1099 Wyndham-Mokoreta Road, Redan 9892	1289936	4857802	4	83
15	1561 Slopedown Road, Clinton 9583	1307106	4862057	2	161
16	1542 Wyndham-Mokoreta Road, Redan 9892	1293701	4856124	3	123
17	1403 Wyndham-Mokoreta Road, Redan 9892	1292814	4856110	4	163
18	1610 Slopedown Road, Clinton 9583	1306706	4861706	2	160
19	1511 Slopedown Road, Clinton 9583	1307491	4862204	2	168
20	1561B Slopedown Road, Clinton 9583	1307134	4861946	2	162
21	215 Venlaw Road, Oware 9892	1293132	4865836	6	123
22	68 McDonald Road, Redan 9892	1290656	4856419	4	101
23	232 Campbell Road, Oware 9892	1289510	4861648	1	101
24	1048 Slopedown Road, Clinton 9583	1309129	4866217		260
25	170 Venlaw Road, Oware 9892	1292729	4866017	6	128
26	1623 Wyndham-Mokoreta Road, Redan 9892	1294140	4855315	3	107
27	24 Irwin Road, Oware 9892	1288957	4861167	1	102
28	1000 Wyndham-Mokoreta Road, Redan 9892	1288919	4857902	4	60
29	972B Slopedown Road, Clinton 9583	1309367	4866515		248
30	1071 Slopedown Road, Clinton 9583	1309489	4866257		242
31	48 Rodgers Road, Mokoreta 9892	1299331	4853650	1	142
32	972 Slopedown Road, Clinton 9583	1309478	4866983		241
33	1667 Wyndham-Mokoreta Road, Redan 9892	1293817	4854857	3	89
34	1710 Wyndham-Mokoreta Road, Redan 9892	1293842	4854563	3	89
35	26 Scott Road, Wyndham 9892	1288201	4857743	4	61
36	934 Waiarikiki-Mimihau Road, Oware 9892	1290942	4866107		107
37	13 Story Road, Oware 9892	1291431	4866407	5	114
38	1989 Wyndham-Mokoreta Road, Redan 9892	1296164	4853118	1	116
39	99 Campbell Road, Oware 9892	1288154	4861608	2	78
40	96 Campbell Road, Oware 9892	1288180	4861531	2	81

41	1964 Wyndham-Mokoreta Road, Redan 9892	1295812	4853210	2	117
42	414 Woods Road, Oware 9892	1287776	4860767	2	72
43	156 Waiarikiki-Mimihau Road, Oware 9892	1285623	4861903	6	60
44	836 Waiarikiki-Mimihau Road, Oware 9892	1290170	4865756	1	122
45	1850 Wyndham-Mokoreta Road, Redan 9892	1294737	4853533	3	92
46	403 Woods Road, Oware 9892	1287697	4860893	2	69
47	165 Davidson Road West, Otarara 9772	1300619	4870945		292
48	12 Lawrence Road, Oware 9892	1287416	4859697	5	102
49	135 Davidson Road West, Otarara 9772	1300357	4870888		290
50	1979 Slopedown Road, Clinton 9583	1305278	4859049	6	160
51	39 Campbell Road, Oware 9892	1287667	4861299	2	73
52	634 Waiarikiki-Mimihau Road, Oware 9892	1288712	4864602		226
53	176 Davidson Road West, Otarara 9772	1300318	4871157		280
54	1995 Slopedown Road, Clinton 9583	1305256	4858731	6	148
55	820 Wyndham-Mokoreta Road, Wyndham 9892	1287277	4857981	6	65
56	506 Waiarikiki-Mimihau Road, Oware 9892	1288164	4863834	4	220
57	810 Wyndham-Mokoreta Road, Wyndham 9892	1287145	4858215	5	59
58	247 Scott Road, Wyndham 9892	1288517	4855686	5	102
59	58 Tinker Road, Ferndale 8992	1291984	4867917	7	152
60	1366 Wyndham Valley Road, Redan 9892	1293727	4853660	3	80
61	16 Davidson Road East, Otarara 9772	1302027	4871779		250
62	57 Davidson Road East, Otarara 9772	1302435	4871884	1	244
63	548 Dodds Road, Slopedown 9583	1309672	4869607		222
64	2231 Wyndham-Mokoreta Road, Mokoreta 9892	1298082	4851796	3	99
65	785 Wyndham-Mokoreta Road, Wyndham 9892	1286905	4858428	5	59
66	550 Dodds Road, Slopedown 9583	1309626	4869842		220
67	181B Waiarikiki Road, Ferndale 9892	1291101	4867677	9	109
68	471 Waiarikiki-Mimihau Road, Oware 9892	1287795	4864160		193
69	751 Wyndham Station Road, Wyndham 9892	1303254	4854581	4	122
70	1292 Wyndham Valley Road, Redan 9892	1292746	4853247	4	95
71	820 Wyndham Valley Road, Redan 9892	1289511	4854279	6	99
72	751A Wyndham Station Road, Wyndham 9892	1303343	4854424	4	124
73	86 Morven Road, Slopedown 9583	1305807	4858170	6	162
74	122 Klondyke Road, Mokoreta 9892	1296503	4851648	6	98
75	181A Waiarikiki Road, Ferndale 9892	1291149	4868044	8	108
76	16 Mokoreta-Tahakopa Road, Mokoreta 9892	1297580	4851305	3	101
77	413 Waiarikiki-Mimihau Road, Oware 9892	1287272	4863382	8	218
78	321 Wyndham Station Road, Wyndham 9892	1300853	4852120	2	115
79	6 Mokoreta-Tahakopa Road, Mokoreta 9892	1297667	4851360	3	101
80	318 Wyndham Station Road, Wyndham 9892	1300907	4851935	2	121
81	59B Oware Road, Oware 9892	1286432	4861382	7	62
82	110c Foster Road, Mokoreta 9892	1300169	4851621	4	116
83	103 Klondyke Road, Mokoreta 9892	1296734	4851368	5	99
84	500 Kaiwera Downs Road, Gore 9772	1301049	4872504	1	247
85	130 Murray Road, Mokoreta 9892	1299140	4851285	4	123
86	712 Wyndham-Mokoreta Road, Wyndham 9892	1286105	4858436	6	63

87	2124 Slopedown Road, Clinton 9583	1304939	4857508	7	186
88	117 Morven Road, Slopedown 9583	1306328	4857826	7	180
89	420 Wyndham Station Road, Wyndham 9892	1301835	4852268		101
90	51 Mokoreta-Tahakopa Road, Mokoreta 9892	1297353	4851039	4	109
91	281 Klondyke Road, Mokoreta 9892	1294923	4851593	2	83
92	623 Slopedown Road, Clinton 9583	1311474	4868456	1	280
93	59A Oware Road, Oware 9892	1285957	4861399	7	61
94	384 Dodds Road, Slopedown 9583	1309924	4871003	1	207
95	448 Wyndham Station Road, Wyndham 9892	1302251	4852219		105
96	606 Waiarikiki-Mimihau Road, Oware 9892	1286119	4862141	6	63
97	209 Klondyke Road, Mokoreta 9892	1295701	4851128	4	94
98	642 Wyndham-Mokoreta Road, Wyndham 9892	1285536	4858855	6	50
99	54 Murray Road, Mokoreta 9892	1298134	4850649	6	168
100	732 Wyndham Station Road, Wyndham 9892	1304112	4854013	4	125
101	594 Wyndham Valley Road, Redan 9892	1287370	4854647	6	78
102	84 Mokoreta-Tahakopa Road, Mokoreta 9892	1296896	4850676	5	100
103	40 Matheson Road, Mokoreta 9892	1294007	4851541	4	85
104	587 Slopedown Road, Clinton 9583	1312023	4868831		227
105	473 Wyndham Valley Road, Redan 9892	1286442	4855266	6	63
106	151 Waiarikiki-Mimihau Road, Oware 9892	1285601	4862058	7	60
107	109 Matheson Road, Mokoreta 9892	1294323	4851110	4	85
108	187 Morven Road, Slopedown 9583	1306781	4857137	7	228
109	132 Waiarikiki-Mimihau Road, Oware 9892	1285435	4861752	8	61
110	582 Wyndham-Mokoreta Road, Wyndham 9892	1284982	4858970	7	49
111	564 Wyndham-Mokoreta Road, Wyndham 9892	1284914	4859014	7	48
112	448 Wyndham Valley Road, Redan 9892	1286118	4855227	6	80
113	238A Murray Road, Mokoreta 9892	1301477	4850597	6	164
114	238B Murray Road, Mokoreta 9892	1301559	4850543	6	159
115	2658 Old Coach Road, Slopedown 9772	1307918	4873694		215
116	495 Slopedown Road, Clinton 9583	1312848	4868930	1	245
117	226 Mokoreta-Tahakopa Road, Mokoreta 9892	1298036	4849449	2	142
118	2658B Old Coach Road, Slopedown 9772	1307480	4873927		203
119	33 Hurst Road, Otaraiia 9772	1306123	4874266	1	220
120	7 Hurst Road, Otaraiia 9772	1306216	4874381		208
121	478 Wyndham-Mokoreta Road, Wyndham 9892	1284145	4859226	7	73
122	40 Wood Road, Wyndham 9892	1284245	4860742	10	78
123	25 Woods Road, Wyndham 9892	1284104	4860782	11	81
124	87 McMillian Road, Mimihau 9892	1284575	4862785	10	115
125	40 Mimihau School Road, Mimihau 9892	1284034	4861016	11	82
126	19 Frazer Road, Tuturau 9774	1287807	4869066	15	291
127	218 Matheson Road, Mokoreta 9892	1294522	4849733	6	98
128	58 Jeff Farm Road, Kaiwera 9772	1302780	4874746		224
129	122 Mimihau School Road, Mimihau 9892	1284108	4861820	11	84
130	516 Davidson Road, Tuturau 9774	1286326	4867157	14	224
131	365 Wyndham-Mokoreta Road, Wyndham 9892	1283748	4860171	10	81
132	521 Davidson Road, Tuturau 9774	1286311	4867282		226

133	57 Jeff Farm Road, Kaiwera 9772	1302869	4874806		217
134	57A Jeff Farm Road, Kaiwera 9772	1302845	4874819		216
135	314 Mokoreta-Tahakopa Road, Mokoreta 9892	1298572	4848863	1	142
136	339 Matheson Road, Mokoreta 9892	1295256	4849249	6	113
137	2579 Old Coach Road, Slopedown 9772	1307206	4874568	3	198
138	2579B Old Coach Road, Slopedown 9772	1306944	4874595	2	200
139	59 Jeff Farm Road, Kaiwera 9772	1302761	4874875		213
140	216 Leonard Road, Glenham 9892	1284208	4856378	9	103
141	145 Mimihau School Road, Wyndham 9892	1284029	4862063	11	82
142	30 Frazer Road, Tutarau 9774	1288153	4868926	6	262
143	582 Davidson Road, Tutarau 9774	1286436	4867628	11	266
144	25B Jeff Farm Road, Kaiwera 9772	1303630	4874784		262
145	25 Jeff Farm Road, Kaiwera 9772	1303079	4874979		203
146	3 Doctors Road, Wyndham 9892	1283582	4859650	10	81
147	470 Davidson Road, Tutarau 9774	1285851	4866956	15	201
148	186 Kaiwera Downs Road, Gore 9772	1299268	4874670		201
149	148 Knowsley Park Road, Ferndale 9772	1290750	4871287	5	167
150	17 McMillian Road, Mimihau 9892	1283974	4863003	10	101
151	376 Wyndham-Mokoreta Road, Wyndham 9892	1283351	4860127	11	80
152	283 Wyndham-Mokoreta Road, Wyndham 9892	1283473	4860735	12	73
153	71 McDougall Road, Tutarau 9774	1284985	4865892	8	124
154	115 Mimihau School Road, Wyndham 9892	1283546	4861695	11	81
155	380 Matheson Road, Mokoreta 9892	1295585	4848765	7	120
156	189 Leonard Road, Glenham 9892	1283852	4856454	9	105
157	264 Wyndham-Mokoreta Road, Wyndham 9892	1283307	4860634	12	70
158	134 Kaiwera Downs Road, Gore 9772	1298887	4874823		206
159	384 Mokoreta-Tahakopa Road, Mokoreta 9892	1299039	4848358		127
160	82 Calder Road, Glenham 9892	1283590	4856051	9	101
161	2858 Old Coach Road, Slopedown 9772	1309565	4874504		201
162	178 Wyndham Valley Road, Redan 9892	1283815	4855280	8	82
163	420 Mokoreta-Tahakopa Road, Mokoreta 9892	1299253	4848158		135
164	29 Diack Road, Mimihau 9892	1283650	4863808		101
165	2 McDougall Road, Tutarau 9774	1284722	4866494	6	146
166	62 Waiarikiki Road, Ferndale, Tutarau, Southland, 9892, NZL	1291210	4867266	6	100

Table B1. Residence locations



APPENDIX C: CAA DETERMINATION

- Determination
- Aeronautical Study

24/77/54 AERONAUTICAL STUDY

Contact Energy Limited – Review of 24/77/35 - Wind Farm at 650 Venlaw Road, Oware, Southland

1. Study Team Composition

Hamish McKoy, Julia Fitness, Jerry Nicholas, Sean Rogers

2. Proposal Overview

Contact Energy is planning to construct and operate a wind farm of up to 55 wind turbines. The project is the Southland Wind Farm (SWF). The proposed SWF will have up to 55 wind turbines and supporting infrastructure including two meteorological masts of up to 140m in height and a transmission line. The proposed turbines will have a maximum tip height of 220m. The wind turbines will have a hub height of approximately 135m and a rotor diameter of approximately 170m but with a maximum tip height of 220m. The turbines are spaced at distances of between 500m and 900m apart. Construction is planned to commence 1 February 2025.

Notably, the wind farm is separated into three groups comprising a large group of 37 turbines at the western end, a group of 8 turbines in the middle and a group of 10 turbines at the eastern end.

This study and corresponding Determination is the result of a review requested for 24/77/35 – In particular requesting revised conditions on lighting requirements for the proposal.

3. Matter Considered

Aeropath submitted the following in the original submission, which has not changed since the original Determination was issued:

Instrument Flight Procedures Impact Assessment (55x Wind Turbines - 650 Venlaw Road, Oware, Southland)

26/01/2024

Obstacle Details

Obstacle information:	Wind farm (55 turbines) located 11nm south east of Gore aerodrome and 25nm south west of Balclutha aerodrome. The details of the highest turbine #29 is listed:
Site coordinates:	46°21'16.26"S, 169°04'00.75"E
Start / Completion Date:	01022025 / PERMANENT
MAX. Site elevation:	630.3m AMSL
MAX. Turbine height (including blade):	220m AGL
MAX. Turbine altitude (including blade):	850.3m AMSL
Rotor diameter:	170m
Site Area / Horizontal radius:	85m

Aerodromes/Heliports Assessed

NZBA - Balclutha
 NZGO - Gore Hospital
 NZJS - Southland - Kew Hospital
 NZLM - Lumsden Medical Centre
 NZNV - Invercargill
 NZTC - Tapanui Medical Centre
 NZDN - Dunedin

Conclusion:

The proposed Windfarm (55x wind turbines) at 650 Venlaw Road, Oware, Southland with a maximum elevation of 850.3m AMSL will impact on several Instrument Flight Procedures at Balclutha, Invercargill and Dunedin aerodromes.

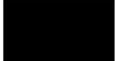
The proposed windfarm will also impact arrival and departure procedures at NZJS Southland - Kew Hospital heliport.

Aeropath requests the determination to state that NZJS IFPs are redesigned as coordinated and agreed with HeliOtago and Aeropath.

The affected procedure/s and associated required changes are detailed in the table below:

NZBA - Balclutha	TAA OLGEX	Increase MSA to 3700ft (currently 3500ft)
NZJS - Southland, Kew Hospital	SOSLO4 Dep. BOTKA Trans.	Redesign to keep the current MSA and to accommodate the windfarm after coordination with users and Contact energy.
	BOTKA2H Arr.	
NZNV - Invercargill	25NM MSA ARP	Increase MSA to 3400ft (currently 2800ft)
	25NM MSA VOR	
	TAA DUNAX	199°-309° 12-25nm: Increase MSA to 3800ft (currently 3500ft)
	Hold BIDKU	Increase MSA to 3500ft (currently 3000ft)
	VORSEC	R040-R075-R100 15-25-30nm: Increase MSA to 3800ft (currently 3500ft)
NZDN - Dunedin	EPDAB2A Arr.	EPDAB-ALBOX: Increase MSA to 3800ft (currently 3500ft)
	EPDAB2B Arr.	

This assessment has not considered ANNEX 14 / Part 139 OLS's, marking, lighting, and NOTAM action requirements.

Prepared by:	(Name/Sign/Date) Shijir Buyandelger		26.01.2024	Navigation Procedure Designer
Reviewed by:	Vladimir Stanar		31.01.2024	Navigation Procedure Designer
Certified by:	John Willingham		31 Jan 2024	Team Leader

CAA ASA Carlton Campbell made the following submission in the original proposal:

I have spoken to both an Ag fixed wing and a rotary operator, both local to the area regarding this wind farm and they are torn with having these obstacles but also their clients may get some money from these to spend on Ag. Apparently if they are conducting ag ops in the immediate area the power company is prepared to turn relevant windmills off temporarily to permit the ag ops which is great. They are both more concerned about single high towers than a farm which is clearly visible.

The only concern is as already acknowledged that being the low level IFR EMS ops between Invercargill and Dunedin.

Airways New Zealand made the following submission in the original proposal:

“The only concern with this is (as noted by Contact Energy in the proposal) is the potential effect on MSA for the IFR heli route above and any effect it might have on the lower level (3,500ft) of controlled airspace in this area. Otherwise, all good from an NV ATM perspective.”

Additionally, Invercargill (NV) TWR want ATS Policy and Standards to ensure they are consulted on any proposed changes to the IFR heli routes that Aeropath have been requested to carry out.

CAA assessment:

Contact Energy provided a report by Mike Haines Aviation to support the lighting requirements of the wind farm. As a result of the request for review of the original Determination, CAA requested and received an updated report titled “Southland Wind Farm Assessment of Aviation Lighting Options” dated 15 July 2024.

New Zealand has a historically established best practice for wind farm entities to light obstacles, in what are often hazardous to aviation activities and well mitigated throughout the industry.

On receiving the petition for review, Contact Energy were provided guidance that further discretion would be based off the following advice that mitigates the risk to aviation:

Develop a lighting plan, acceptable to CAA, where the highest turbines, those at the extremities of the site, and other turbines around the perimeter of the site will be lit to enable pilots to identify the extent of the windfarm.

To provide a consistent approach to wind farm lighting principles, CAA propose that the following further considerations be applied to be acceptable:

1. All unlit masts are contained within a line created by joining all masts that are lit (as much as practicable)
2. Large gaps of unlit masts are avoided to the maximum extent possible
3. The mast that demarcates the highest point AMSL is lit.

The 15 July report subsequently provided three lighting options with varying degrees of spacing between lights to mark the wind farm, however rather than being constructive is mainly critical of current CAA lighting guidance for wind farms (CAA level 4 policy), whereas the policy itself provides some relaxation from the Part 77 rule.

The recent consultant report also does not take into account the overall wider responsibilities of a wind farm to eliminate and mitigate risks to aviation so far as is reasonably practicable in accordance with the Health and Safety at Work Act (HSWA 2015).

CAA acknowledge the original Determination and lighting conditions may have some discretion applied where the risk to aviation has been satisfactorily addressed and the aviation risks mitigated with lighting costs not being 'grossly disproportionate' to the wind farm investment, potential profit and level of aviation risk involved.

CAA assessed the lighting plan and the proposed 'Lighting Plan Option A' in the latest Mike Haines report is the most acceptable to CAA with the following considerations:

1. This plan identifies a slightly larger distance between lit turbines than the CAA internal policy document;
2. The lighting configuration provides for the wind farm extent to be seen from all directions by aircraft;
3. In addition, the highest turbine at the site, labelled 29, is omitted from the proposed lighting plan and contradicts CAA advice above to the proponent;
4. Turbine '45' has been omitted from the lighting plan, however, delineates the perimeter within the middle 'group' of turbines and has an extensive distance between this group and the group to the east. This is important to be lit to meet the requirements of the intent for lighting the perimeter appropriately.
5. Turbine '53' has been omitted from the lighting plan, however delineates the outside perimeter of the wind farm.

The proposed lighting plan most acceptable to CAA is shown below as extracted from the report. Additional turbines to be lit are shown in green:

Table 2 – Lighting Plan Option A Turbine list

Turbine No	Height (m)	Distance to next turbine (Approx)	
		Nautical Mile	Metres
20	814.40	1.21	2241
32	801.40	0.95	1759
38	799.10	0.97	1796
43	816.30	2.01	3723
52	831.40	0.96	1778
55	728.10	1.54	2852
46	771.60	1.87	3463
42	732.70	1.54	2852
37	716.80	1.26	2333
21	600.30	0.82	1519
4	624.60	1.39	2574
3	650.30	1.32	2444
9	735.20	1.67	3092



Figure 10 - Lighting Plan Option A

4. Determination

A Determination of Hazard in Navigable Airspace, attached to this paper, has therefore been submitted for consideration and issue to Contact Energy:

1. The wind turbines are to be lit with appropriate obstacle lights as follows:

- a. The windfarm must be lit in accordance with Option A of the “Southland Wind Farm Assessment of Aviation Lighting Options” dated 15 July 2024 conducted by Mike Haines Aviation Limited. In addition to the plan this includes:
 - i. The 13 identified turbines around the perimeter of the site will be lit to identify the extent of the windfarm; and
 - ii. In addition, the turbine marked ‘45’ must also be lit to delineate the middle ‘group’ of turbines and account for extensive distance between this group and the group to the east; and
 - iii. In addition, the turbine marked ‘29’ must also be lit to demarcate the highest wind turbine at the site; and
 - iv. In addition, the turbine marked ‘53’ must also be lit to delineate the outside perimeter of the wind farm.
 - b. Lighting will be medium intensity red as defined in Rule Part 77, Appendix B10, that is an effective intensity of not less than 1600 candela of red light and will flash between 20 and 60 times per minute. The lights should be coordinated between all the lights in the wind farm so that they flash simultaneously; and
 - c. The obstruction lights shall be located on or above the top of the nacelle, shall be visible from all directions, and may be shielded below the horizontal plane; and
 - d. The painting of turbines with obstruction marking will not be required. The rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, or a similar industry accepted colour, so that they are visible to aviators during hours of daylight.
2. Prior to construction, Contact Energy Limited is to provide details of the wind turbine locations and erection dates to Aeropath - Quote 24/77/35 (Part77@aeropath.aero) and request the instrument flight procedures (IFP) are adjusted as identified in the Aeropath assessment for this proposal; and
 3. Upon receipt of the information in (2) above from Contact Energy Limited, Aeropath is to amend the relevant IFPs for this proposal; and
 4. Contact Energy Limited is to provide CAA (Aeronautical.services@caa.govt.nz) with notice of the wind turbine construction commencing and again when the construction of all turbines with associated compliant lighting/markings is completed; and
 5. Prior to the wind farm construction, Contact Energy Limited are to promulgate with Aeropath Part77@aeropath.aero an appropriate NOTAM and/or AIP supplement for situational awareness of aviators and are to comply with the following temporary lighting solutions during construction:
 - a. A red medium intensity light is to be installed and operational on any crane above 60m AGL until such time that the permanent light is

operational within the area of the turbine (that is either on this turbine or an adjacent turbine).

- b. A temporary light is to be installed on the turbine nacelle until such time as a permanent light is operational within the area of the turbine.
6. Contact Energy Limited is to liaise with the relevant landowners that use aircraft to perform agricultural operations in the vicinity of the wind farm. They are to agree a process to temporarily turn off relevant wind turbines, as required by the aircraft operators.
7. This Determination voids and replaces that issued for the same site under CAA work request 24/77/35.

Hamish McKoy
Senior Technical Specialist – Aeronautical Services
16 August 2024



NAVIGABLE AIRSPACE DETERMINATION: Contact Energy Limited – Review of Determination - Wind Farm at 650 Venlaw Road, Oware, Southland

PURSUANT TO Rule Part 77 of the Civil Aviation Rules I, Sean Turangarau Kere Rogers, Manager Aeronautical Services, having received from Contact Energy Limited notification of intention to construct and operate the Southland Wind Farm, conducted an aeronautical study in consultation with such persons, representatives and organisations as I considered appropriate.

After completing the aeronautical study, I am satisfied that the proposed action, if executed, could constitute a hazard in navigable airspace.

THEREFORE I HEREBY ISSUE a

DETERMINATION OF HAZARD IN NAVIGABLE AIRSPACE

in respect of the above notification.

The following conditions are specific to this Determination:

1. The wind turbines are to be lit with appropriate obstacle lights as follows:
 - a. The windfarm must be lit in accordance with Option A of the “Southland Wind Farm Assessment of Aviation Lighting Options” dated 15 July 2024 conducted by Mike Haines Aviation Limited. In addition this includes:
 - i. 13 identified turbines around the perimeter of the site will be lit to identify the full extent of the windfarm; and
 - ii. In addition, the turbine marked ‘45’ must also be lit to delineate the middle ‘group’ of turbines and account for extensive distance between this group and the group to the east; and
 - iii. In addition, the turbine marked ‘29’ must also be lit to demarcate the highest wind turbine at the site; and
 - iv. In addition, the turbine marked ‘53’ must also be lit to delineate the outside perimeter of the wind farm.
 - b. Lighting will be medium intensity red as defined in Rule Part 77, Appendix B10, that is an effective intensity of not less than 1600 candela of red light and will flash between 20 and 60 times per minute. The lights should be coordinated between all the lights in the wind farm so that they flash simultaneously; and

The provisions of this determination are in addition to and not in derogation of the provisions of any other Act, or any orders or regulations made thereunder.

- c. The obstruction lights shall be located on or above the top of the nacelle, shall be visible from all directions, and may be shielded below the horizontal plane; and
 - d. The painting of turbines with obstruction marking will not be required. The rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, or a similar industry accepted colour, so that they are visible to aviators during hours of daylight.
2. Prior to construction, Contact Energy Limited is to provide details of the wind turbine locations and erection dates to Aeropath - Quote 24/77/35 (Part77@aeropath.aero) and request the instrument flight procedures (IFP) are adjusted as identified in the Aeropath assessment for this proposal; and
3. Upon receipt of the information in (2) above from Contact Energy Limited, Aeropath is to amend the relevant IFPs for this proposal; and
4. Contact Energy Limited is to provide CAA (Aeronautical.services@caa.govt.nz) with notice of the wind turbine construction commencing and again when the construction of all turbines with associated compliant lighting/markings is completed; and
5. Prior to the wind farm construction, Contact Energy Limited are to promulgate with Aeropath (Part77@aeropath.aero) an appropriate NOTAM and/or AIP supplement for situational awareness of aviators and are to comply with the following temporary lighting solutions during construction:
 - a. A red medium intensity light is to be installed and operational on any crane above 60m AGL until such time that the permanent light is operational within the area of the turbine (that is either on this turbine or an adjacent turbine).
 - b. A temporary light is to be installed on the turbine nacelle until such time as a permanent light is operational within the area of the turbine.
6. Contact Energy Limited is to liaise with the relevant landowners that use aircraft to perform agricultural operations in the vicinity of the wind farm. They are to agree a process to temporarily turn off relevant wind turbines, as required by the aircraft operators.
7. This Determination voids and replaces that issued for the same site under CAA work request 24/77/35.

This Determination of Hazard shall become final on 13th September 2024 unless a petition for review is received by the Director prior to that date.

The provisions of this determination are in addition to and not in derogation of the provisions of any other Act, or any orders or regulations made thereunder.

This Determination of Hazard shall not expire but may be revoked, in writing, by the Director.

Dated at Wellington this 16th August 2024



Sean Turangarau Kere Rogers
Manager Aeronautical Services

The provisions of this determination are in addition to and not in derogation of the provisions of any other Act, or any orders or regulations made thereunder.