



Hokonui Hills Wind Farm Aviation Assessment

Report to Hokonui Energy Limited

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1 Overview

Hokonui Energy Limited (HEL) is proposing to build a wind farm in the Hokonui Hills, 20km north-west of Gore, in Southland. The proposed design is for a 500 MW wind farm with up to 83 wind turbines. Initial design is for wind turbines with a hub height of 130 m and rotor diameter of 170 m giving a total height above ground level of 215 m and possibly up to 240 m.

Mike Haines Aviation (MHA) has been requested to undertake an aviation assessment for the Hokonui Wind Farm project.

In accordance with Civil Aviation Rule (CAR) Part 77 the wind farm will need to be notified to the Director of Civil Aviation and a CAR Part 77 Determination issued. This assessment looks at two aspects:

1. Any impact on aircraft operations in navigable airspace.
2. The lighting and marking requirements for the wind turbines resulting from the above assessment.

2 Aeronautical Information

2.1 Location

The proposed windfarm is located in a rural area in northern Southland and is remote from most major aviation activity. See location superimposed on the Southland Visual Navigation Chart (VNC)¹ in Appendix A.

There are four aerodromes and a heliport located close to the proposed wind farm location as published in the Aeronautical Information Publication New Zealand (AIPNZ), which the Civil Aviation Authority (CAA) publishes as the official aeronautical information for pilots.

- Mandeville Aerodrome is located to the north east of the proposed wind farm approximately 2 nautical miles from the northernmost turbine.
- Gore Aerodrome is located approximately 8 nautical miles to the southeast of the easternmost turbine.
- Gore Hospital Heliport is located in the Gore township approximately 8 nautical miles east of the easternmost turbine.
- Centre Bush Aerodrome is approximately 13 nautical miles to the west of the site.
- Invercargill Airport is approximately 25 nautical miles to the south west.
- The wind farm is located in uncontrolled airspace where Air Traffic Control (ATC) is not provided, and pilots must "see and avoid" to avoid collisions with other aircraft, terrain, and obstacles.
- Controlled airspace is above the area and there are two different controlled airspace levels. One in the south starts at 5,500 feet above mean sea level (AMSL) and the northern area starts at 6,500 AMSL.
- The Maximum Elevation Figure (MEF) shown on the Aeronautical Charts is 2700 feet AMSL for the windfarm area. This indicates the highest known terrain or obstacle within that quadrangle.
- There is an instrument route (departure and arrival) directly over the site with a minimum altitude of 4,400 ft AMSL. A departure instrument route is east of the site with a minimum altitude of 6000 ft AMSL.
- There is no special use airspace or other identified specific aviation activities in the area close to the proposed windfarm site.

¹ Visual navigation Chart C14: Invercargill. Effective 27 November 2026

AVNC provides pilots with essential information on airspace, hazards and obstacles for navigational purposes. The Southland VNC is the applicable aeronautical chart and shows the terrain in the area of the proposed farm to be up to 2041 ft AMSL. Currently a microwave tower (cell phone tower) shown on the chart as 2493 m AMSL is the controlling obstacle.

If a turbine with a tip height greater than 215 m was erected at the 2041 ft AMSL location the turbine would be approximately 2746 ft AMSL and would become the controlling obstacle.

Figure 1 shows the probable wind turbine locations in relation to the neighbouring aerodromes and airspace.

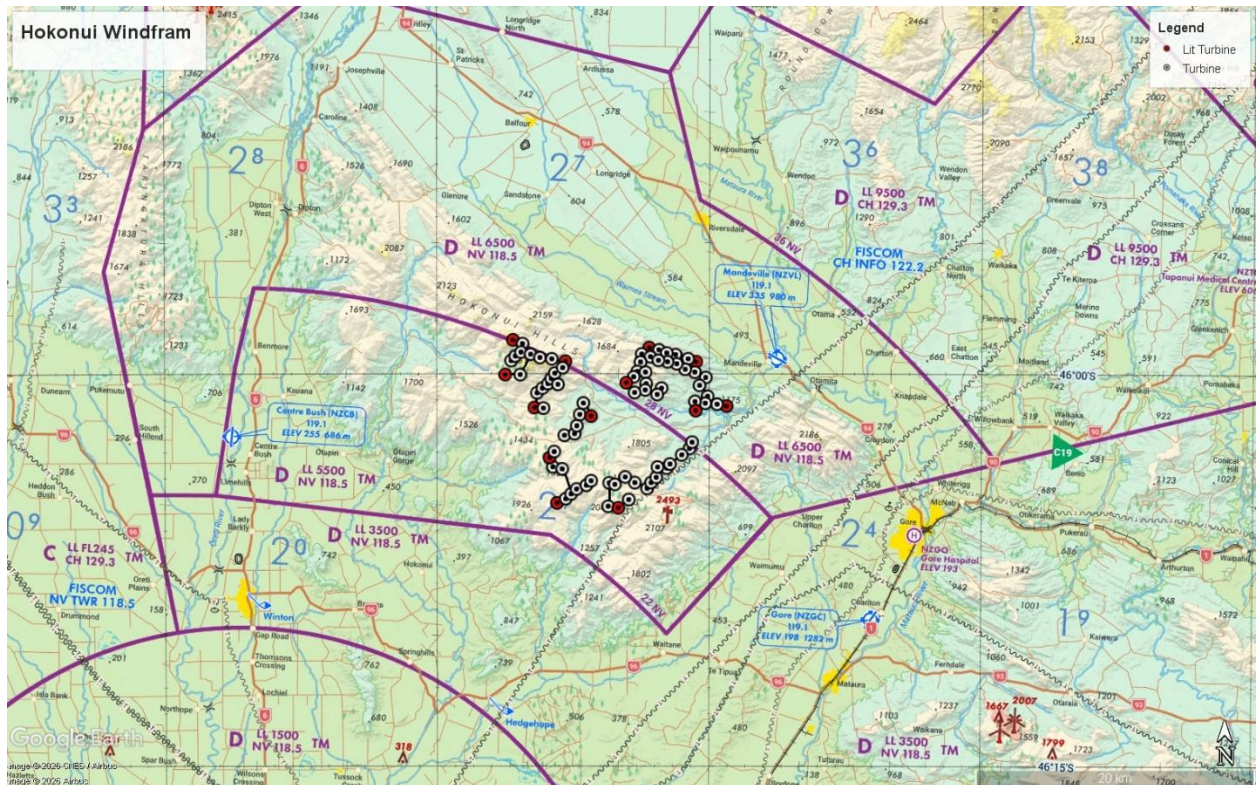


Figure 1 - Wind Farm Location

2.2 Aerodromes

2.2.1 Mandeville Aerodrome

Mandeville Aerodrome² (NZVL) is a non-certificated aerodrome which has a single 980 m grass runway. Mandeville Aerodrome is the home of the Croydon Aircraft Company, which restores vintage aircraft and provides training, scenic, and aerial experience flights in vintage aircraft. General aviation³ aircraft also operate at the airfield.

The aerodrome is only available with the prior permission of the operator. There is no night lighting and no instrument flight procedures, so aircraft are restricted to day, visual flight rule (VFR⁴) operations.

² https://www.aip.net.nz/assets/AIP/Aerodrome-Charts/Mandeville-NZVL/NZVL_51.1_52.1.pdf

³ General aviation includes "private transport" and recreational components of aviation, most of which is accomplished with light aircraft. This does not involve commercial or air transport operations.

⁴ Visual Flight Rules (VFR) are a set of aviation regulations under which a pilot operates an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going. VFR requires navigating by visual reference to the ground and maintaining separation from clouds, obstacles, and other aircraft.

2.2.2 Gore Aerodrome

Gore Aerodrome⁵ (NZGC) is a non-certificated aerodrome which has three grass runways with the longest at 1282 m. General aviation aircraft operate at the airfield and it is available for general use with no prior permission required.

There is no night lighting and no instrument flight procedures, so aircraft are restricted to day, visual flight rule (VFR) operations.

2.2.3 Gore Hospital Heliport

Gore Hospital Heliport⁶ (NZGO) is a non-certificated heliport located at Gore Hospital. The heliport is for use Helicopter Emergency Medical Services (HEMS) helicopters only and any other helicopters require specific approval.

There is night lighting and also published instrument approach and departure flight procedures.

2.2.4 Centre Bush Aerodrome

Centre Bush Aerodrome⁷ (NZCB) is a non-certificated aerodrome which one grass runway at 661 m. General aviation aircraft operate at the airfield.

The aerodrome is only available with the prior permission of the operator. There is no night lighting and no instrument flight procedures, so aircraft are restricted to day, visual flight rule (VFR) operations.

2.2.5 Invercargill Aerodrome

Invercargill Airport⁸ (NZNV) is a CAR Part 139 Certificated Aerodrome that has regular scheduled air transport operations of turboprop aircraft (Q300, ATR72) and also jet operations of Airbus A320. The aerodrome has one main sealed runway 2160 m and two grass runways.

An air traffic control service is provided with a control zone, and there are night operations and also instrument approach and departure flight procedures. The aerodrome is some distance from the wind farm and outside the aerodrome control zone and circuit area.

2.3 Visual Flight

The three aerodromes that are close to the proposed wind farm are all restricted to day, VFR operations. The helicopters operating to or from the Gore Hospital heliport would also be operating under VFR.

There is extensive terrain in the area of the proposed wind farm and based on the location and terrain, aircraft movements would be limited within that area as most aircraft would operate down the flat area around Gore.

If aircraft were to be operated within the proposed wind farm area, pilots would need to ensure they remain above and clear of the terrain as per CAR 91.311:

CAR 91.311 Minimum heights for VFR flights

(a) *A pilot-in-command of an aircraft must not operate the aircraft under VFR—*

- (1) *over any congested area of a city, town, or settlement, or over any open air assembly of persons at a height of less than 1000 feet above the surface or any obstacle that is within a horizontal radius of 600 metres from the point immediately below the aircraft; or*
- (2) *over any other area—*

⁵ https://www.aip.net.nz/assets/AIP/Aerodrome-Charts/Gore-NZGC/NZGC_51.1_52.1.pdf

⁶ https://www.aip.net.nz/assets/AIP/Aerodrome-Charts/Gore2Hospital-NZGO/NZGO_51.1_52.1.pdf

⁷ <https://www.aip.net.nz/assets/AIP/Aerodrome-Charts/Centre-Bush-NZCB/NZCB.pdf>

⁸ https://www.aip.net.nz/assets/AIP/Aerodrome-Charts/Invercargill-NZNV/NZNV_51.1_51.2.pdf

- (i) at a height of less than 500 feet above the surface; or
- (ii) at a height of less than 500 feet above any obstacle, person, vehicle, vessel, or structure that is within a horizontal radius of 150 metres from the point immediately below the aircraft; and
- (3) for any operation, at a height less than that required to execute an emergency landing in the event of engine failure without hazard to persons or property on the surface.

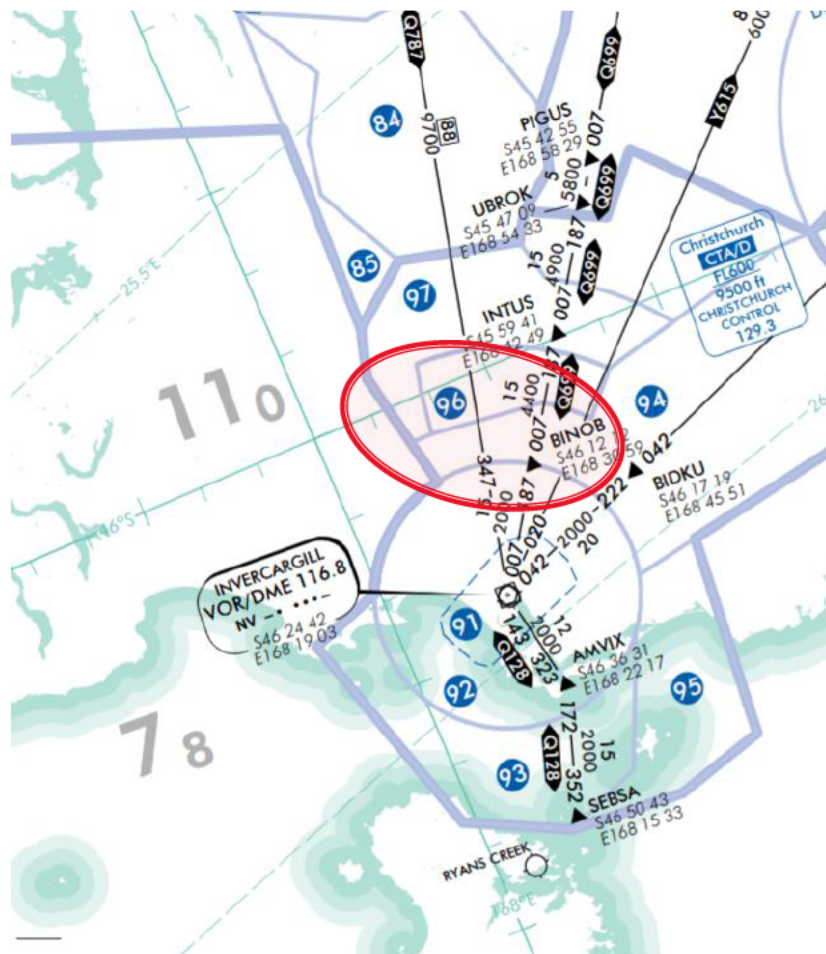
As noted in Section 2.1 the Maximum Elevation Figure for the area is 2700 feet AMSL which would need to be raised if a turbine is located on the highest point and the height of the turbine blade tip is above the current microwave (cell phone) tower. The windfarm and approximate area will also be published on the AIPNZ visual navigation charts for pilot awareness.

2.4 Instrument Flight Route

Aircraft operating under instrument flight rules (IFR) follow instrument flight procedures to navigate in bad weather or low visibility. The proposed windfarm is directly below a published instrument approach and departure route for Invercargill Airport. The route Q699⁹ is shown in Figure 2.

The minimum safe altitude (MSA) for the route above the windfarm location is 4400 ft AMSL. Aeropath New Zealand design and publish instrument flight procedures, including Q699, to international design standards.

The instrument route will have accounted for the microwave tower at 2493 ft AMSL. If any wind turbines are higher than the microwave tower, Aeropath may need to review the instrument route minimum altitude and possibly need to increase the minimum safe altitude.



⁹ National enroute instrument chart - Effective: 27 NOV 25

3 Civil Aviation Rule Part 77

3.1 Notification under CAR Part 77

Civil Aviation Rule 77.5 requires the notification of a proposal to construct or alter a structure that could constitute a hazard in navigable airspace¹⁰ to the Director (of Civil Aviation) if the proposed structure or alteration to a structure—

- (1) extends more than 60 m in height above the ground level at its site; or
- (2) exceeds the general tree height in the area by 18 m and is located in an area of low level aerial activity or other low flying activity, or in a low flying zone or low level route as prescribed under Part 71; or
- (3) is located below the approach or take-off surfaces of an aerodrome as outlined in figures A.1 and A.2 of Appendix A, and extends to a height greater than a surface, outlined in Appendix A, extending outward and upward at 1 of the following:
 - (i) a slope of 1:83 from the fan origin of the take-off surface of a runway where the runway is used or intended to be used by aircraft with a MCTOW above 5700 kg;
 - (ii) a slope of 1:50 from the fan origin of the take-off surface of a runway where the runway is used or intended to be used by aircraft with a MCTOW at or below 5700 kg;
 - (iii) a slope of 1:25 from the nearest point of the safety area of a heliport; or
- (4) penetrates the conical, inner horizontal, or transitional side surface of an aerodrome as—
 - (i) outlined in figure A.1 of Appendix A; or
 - (ii) specified in Part 139; or
 - (iii) as defined in the local district scheme.

For the Hokonui Wind Farm, CAR 77.5(1) would apply, and notification to the Director is required 90 days before the proposed date of commencement of construction as required in CAR 77.13.

This would be needed for the wind turbines and also any meteorological monitoring masts or transmission lines or associated equipment.

3.2 Determination of Hazard

Under Part 77 the Director must conduct an aeronautical study to determine whether the specific proposal, if executed, will constitute a hazard in navigable airspace.

In accordance with CAR 77.19(a) the Director would determine the proposed windfarm to be a hazard as the structures are 120 metres or higher above ground level. In accordance with CAR 77.19(h) the instrument procedure minimum obstacle clearance may also be infringed.

As the wind turbines are intended to have a tip height up to about 240 m from the ground level, they will be subject to marking and lighting requirements.

The marking and lighting conditions are detailed in CAR Part 77 Appendix B as visual aids for denoting obstacles.

¹⁰ Navigable airspace means airspace at or above the minimum flight altitudes prescribed by the Civil Aviation Rules, including all legitimate low level operations but not including restricted, danger, and military operations areas activated for use by the New Zealand Defence Force:

Appendix B – B.2()(3)(ii) is the applicable in this case:

- (3) the marking or lighting may be omitted when—
 - (i) the obstacle is shielded by another fixed obstacle already marked or lighted; or
 - (ii) an aeronautical study shows the obstacle not to be of operational significance.

It should be noted the Part 77 requirements were first published in January 1998. Since then, the lighting and marking requirements in Appendix B have not been amended or updated. The marking and lighting requirements of Part 77 are intended primarily for large towers, structures or buildings, not multiple structures or wind turbines with rotating rotor blades.

3.3 Part 77 requirements

As noted, the marking and lighting requirements of Part 77 are intended primarily intended for large towers, structures, or buildings, not wind turbines where the highest point of the obstacle comprises rotating blades and where it is not feasible to place a series of obstacle lights on the highest point.

The lighting requirements for wind farms is not very specific as the CAA guidance is based on aerodrome designated obstacle limitation surface hazard marking and lighting, not remote locations where wind farms are often located.

CAR Part 77 Appendix B.7 details the low, medium, or high intensity obstacle lights.

CAR Part 77 Appendix B.8(g) details the location of lights for an extensive group of obstacles however this refers to an extensive group of obstacles located within or close to an aerodrome obstacle limitation surface.

3.4 Marking

Due to the location of the Hokonui Windfarm there will be few aircraft operations at low level, and those that will operate would generally be during the day under visual flight rules, requiring specific meteorological conditions¹¹, weather minima and to visually scan for aircraft and obstacles.

Due to the height the turbines will extend above the minimum VFR operational height of 500 feet above ground level. Pilots will need to be aware of these obstacles and publication on the appropriate Visual Navigation Chart will be required.

As pilots need to scan for aircraft and objects due to the turbine size, they should also be able to visually acquire them in flight and would be required to operate 500 feet above them and at least 150 metres laterally.

The turbines will be white or similar industry accepted colour for additional visual identification as normally accepted by the CAA.

3.5 Lighting

In 2002 a Policy document was prepared by the CAA that set out the marking and lighting requirements for wind turbines and windfarms. This was due to the increased construction of wind farms and was to provide CAA staff with some guidance by way of an “internal policy”.

At that time ICAO did not have any Standards and Recommended Practices (SARP’s) for wind turbines or wind farms. It was not until 2009 that ICAO published Edition 5 of Annex 14 Volume 1, Aerodromes, which included recommended practices for the marking and lighting of wind turbines and wind farms. The recommended practices were very similar to the guidance material prepared by the CAA in 2002.

¹¹ VFR weather minima 600 ft ceiling and 1500m and night VFR 1500 feet and 8 km.

The CAA policy document was updated on 2 March 2020 to include additional guidance detailed in Section 6.2.4.3 of Annex 14 Volume 1, 7th Edition of July 2016, not the 6th Edition published in July 2013 as indicated by CAA. This policy is referenced on the CAA website¹² “Wind farm guidance document: Lighting and marking of wind farm turbines”.

The ICAO Annex 14 amendment included a number of additions to the lighting requirements for wind turbines that exceed 150 m AGL and are less than 315 m AGL. CAA amended the 2002 policy document to include these additional requirements.

This is unusual as any CAA acceptable means of compliance would normally be promulgated as a formal Advisory Circular and be subject to industry feedback before it is published. The CAA website details information on Advisory Circular <https://www.aviation.govt.nz/rules/advisory-circulars/>

“Civil Aviation Authority (CAA) Advisory Circulars (ACs) contain information about standards, practices, and procedures that the Director has found to be an acceptable means of compliance with the associated rule.”

CAA document Lighting and Marking of Wind Farm Turbines Level 4 – Group Management Policies and Procedures dated 2 March 2020 is clearly marked as an internal CAA Level 4 – Group Management Policies and Procedures. It is not an Advisory Circular and has not been through the normal CAA consultation process.

The CAA policy for the lighting and marking of wind turbines is particularly for those higher than 150 m AGL. Section 5 of the policy covers Conditions and Limitations.

For the distance of 900 m that CAA have used as the spacing between lit turbines around the perimeter this appears to have been taken from the requirements in ICAO Annex 14.

6.2.3.15 Where lights are applied to display the general definition of an extensive object or a group of closely spaced objects, and

- a) low-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 45 m; and*
- b) medium-intensity lights are used, they shall be spaced at longitudinal intervals not exceeding 900 m*

These requirements for the spacing of lights are predominately based on an extensive object or group of closely spaced objects that are penetrating an obstacle limitation surface or located in close proximity to an aerodrome. These objects would also not generally be published on aeronautical charts.

Hokonui Energy Limited has proposed an initial lighting plan and per Figure 3. The red circles show the proposed lit wind turbines.

This proposed plan aligns to the CAA guidance with lit turbines on the wind farm perimeter and also the highest turbines.

A full lighting plan and lighting type will need to be developed including lighting intensity low, medium, or high, and type of light flashing or solid.

There will also need to be assessment of whether the lighting should be active all the time or at night only, or maybe activated by aircraft operations close to the windfarm using a radar system.

Given the location where there is no established communities and no large areas of artificial lighting, then the lighting requirements may be for low intensity, and the spacing may be greater than if close to an aerodrome.

¹² <https://www.aviation.govt.nz/airspace-and-aerodromes/airspace/airspace-hazards/>

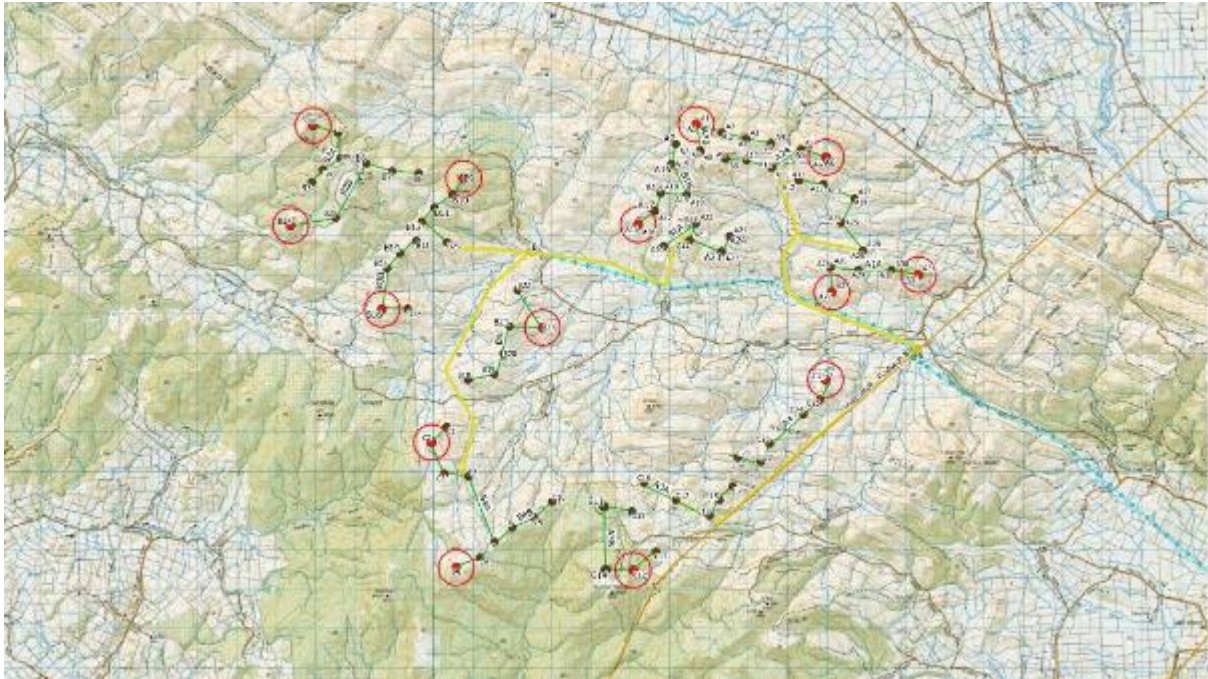


Figure 3 - Hokonui Energy Proposed Turbine Lighting Plan

3.6 Summary

The Director of Civil Aviation will require marking and lighting of some wind turbines and any other tall structures e.g. meteorological masts.

We have reviewed the requirements for lighting as if the internal CAA policy were applied for lighting of the Hokonui Wind Farm and it would seem greater than required as the windfarm is not beside an aerodrome or in an aerodrome obstacle limitation surface.

A windfarm lighting plan appropriate to the location, aircraft activity and risks will be developed and consulted with the local aerodrome operators before being provided to the CAA.

4 Wind turbine risk assessment

4.1 Overview

Wind turbines are a renewable energy resource which are increasingly being installed by energy companies across New Zealand. The wind turbines are often well above the 60 metre AGL notification height under CAR Part 77, and also above the 120 m AGL height where the Director must determine a structure to be a hazard that may therefore require aeronautical lighting.

CAR Part 77 was first published on 1 January 1998 and has not been fully reviewed since that date and amendments have been minimal. Currently wind turbines are normally within a larger “wind farm” with multiple turbines across a large area.

The lighting of wind turbines has become a complex issue with environmental concerns of local residents and that some wind farms are in areas of no significant population with very little background lighting and effectively dark sky areas. Intermediate turbine lighting is also a cost for the companies planning the farms with the lighting required to be installed at the time that the wind turbines are manufactured. Lighting is also an environmental issue as lights can attract insects which in turn attract bats and other wildlife.

Additionally, use of medium and high intensity lighting well outside of aerodromes, heliports and flight routes needs to be questioned for effectiveness and necessity i.e. no operational significance.

The Civil Aviation Authority have issued an internal CAA Level 4 Policy as guidance to industry for wind turbine lighting with no industry consultation. The policy is based on the ICAO Annex 14 for aerodromes in relation to wind turbines.

In most cases wind turbines and wind farms are not located within the obstacle limitation surfaces (OLS) of an aerodrome or heliport, this is the case for the proposed Hokonui Hill Wind Farm.

Mike Haines Aviation and Evans Aviation have assessed other areas where lighting has been required and believe the aviation risk does not constitute aviation lighting at such sites away from an aerodrome and from areas of aviation operational significance.

4.2 Australian Information

The Civil Aviation Safety Authority (CASA) of Australia has issued guidance material on wind turbines in CASA AC 139.E-05 Version 1.1. <https://www.casa.gov.au/sites/default/files/2021-08/advisory-circular-139-e-05-obstacles-including-wind-farms-outside-vicinity-casa-certified-aerodrome.pdf>

This Advisory Circular notes the risk to be assessed for wind turbines in section 2.2.6.2 and provides lighting requirements aligned to the Manual of Standards for Part 139 Aerodromes.

Outside of aerodrome OLS CASA provides guidance and also allows low intensity lighting see section 2.5.5.

In Australia, CASA has accepted the use of 200 candela lighting in some circumstances due to a lack of back lighting in rural and remote areas, meaning that a lower intensity light is still visible to pilots at an acceptable distance to permit a pilot to see and avoid the obstacle.

The Department of Infrastructure also issues guidance in NASF Guideline D.

https://www.infrastructure.gov.au/sites/default/files/documents/4.1.3_Guideline_D_Wind_Turbines.pdf

4.3 Risk assessment

As Part 77 was not initially developed with wind turbines and wind farms being taken into account, it is appropriate to assess the lighting requirements from a risk aspect. Additionally the CAA internal policy is based on wind farms close to an aerodrome.

The recent Australian guidance for windfarms uses a risk based approach, which is consistent with modern aviation system requirements based on risk assessment, mitigations, and individual assessment.

The risk assessment in Appendix B is generic to wind farms outside of aerodrome or heliport OLS where CAR 91.311 Minimum heights for VFR flight and CAR 91.301 for VFR meteorological minima apply. It contains a standard aviation risk matrix and then a risk assessment based on wind turbines and wind farms. It is based on similar Australian assessments which were accessed on the internet:

Dundonnell Wind Farm Project Assessment it was noted the Victoria Government , Minister for Planning, decision:

Minister for Planning, February 2016

4.4.1 Conclusions on amenity - Lighting of WTGs for aviation safety reasons, while recommended by CASA, would make the wind farm more visually intrusive at night and should only be required where a clear safety benefit would result

https://www.planning.vic.gov.au/data/assets/pdf_file/0018/642060/Dundonnell-Wind-Farm-Ministers-Assessment.pdf

The risk assessment has assessed various five hazards to aviation from the wind turbines:

- Aircraft collision with wind turbine – VFR Day
- Aircraft collision with wind turbine – VFR Night
- Aircraft collision with meteorological monitoring mast – VFR Day/Night
- Pilot takes avoiding action and crashes – VFR Day/Night
- Aircraft collision with wind turbine – IFR

All the hazards are risk assessed for likelihood and consequence to produce the risk. Then risk controls are added which results in all five hazards being “low” with controls in place. The mitigations are outlined and where appropriate an action plan for implementation will be developed.

5 Conclusion

The proposed Hokonui Wind Farm is more than 60 metres in height and would be determined to be a hazard in navigable airspace in accordance with CAR Part 77.

The location is well away from Invercargill Airport and local aerodromes are limited to day, VFR operations with no night operations. The Gore hospital heliport does operate at night, but the flight routes will be well away from the proposed windfarm area.

The instrument route that is above the site is well above the proposed height of the turbines and there should be no impact. Aeropath would need to review this and would amend any minimum flight levels.

In accordance with Part 77, the Director of Civil Aviation will need to be notified of the structures above 60 metres. An aviation hazard lighting plan will need to be developed and accepted by the CAA.

The current CAA internal wind turbine lighting policy is based on requirements for obstacles close to aerodromes and in particular within the obstacle limitation surfaces. It is not designed for remote areas with no aerodromes and a “dark sky” environment.

A risk assessment identifies low residual risk if appropriate mitigations are in place for notification to pilots, and lighting would not be appropriate.

When developing the finalised aviation lighting plan discussion with the airport users at Mandeville, Gore and Centre Bush would need to be undertaken. Appropriate lighting will be supported by the wind farm being depicted on the applicable Visual Navigation Chart.

Based on our assessment with appropriate mitigations including lighting and depiction on the VNC we see no impacts on aviation at this location given the low level of aircraft traffic.



Mike Haines

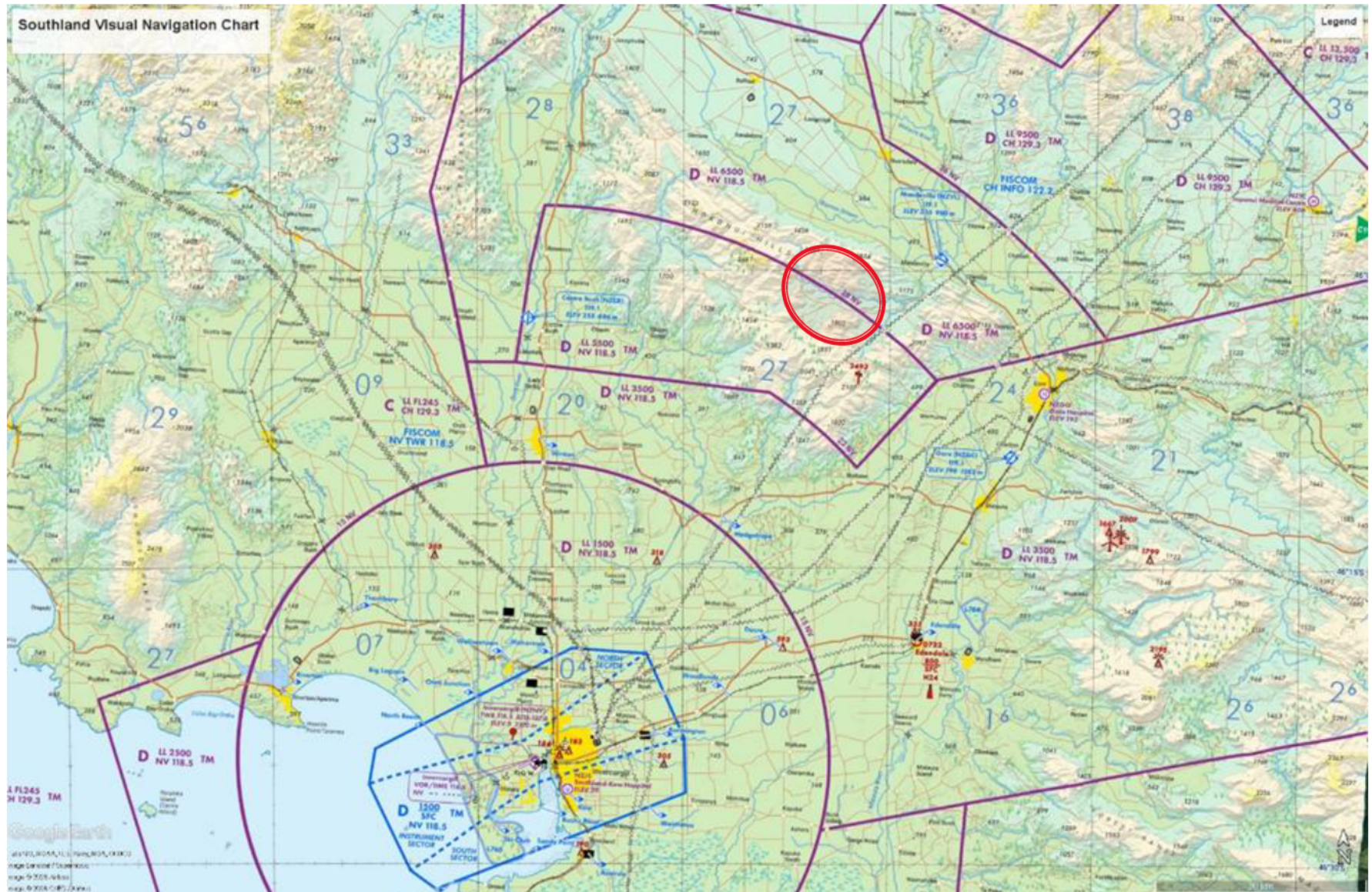
Aviation Consultants

16 April 2026



Max Evans

Appendix A – Wind farm location



Appendix B - Risk assessment

Hazard — A condition that could foreseeably cause or contribute to an accident.

Risk — the composite of predicted severity and likelihood of the potential effect of a hazard.

Outcome — the potential undesirable result of a hazard or the ill effects potentially resulting from exposure to a hazard. In this guidebook, outcome is used rather than consequence or effect.

Risk Control — anything that mitigates or reduces the risk severity and/or likelihood.

Risk assessment matrix						
Risk = likelihood of the harm occurring x consequence of the harm						
Consequence - the severity of the potential injury/harm						
		Insignificant damage to property, equipment, or minor injury	Non-reportable injury, minor loss of process or slight damage to property	Reportable injury, moderate loss of process or limited damage to property	Major injury, single fatality, critical loss of process / damage to property	Multiple fatalities, catastrophic loss of business
		Insignificant	Minor	Moderate	Major	Severe
Likelihood - the chances of the injury/harm occurring	Almost Certain	LOW	MEDIUM	HIGH	EXTREMELY HIGH	EXTREMELY HIGH
	Will probably occur	LOW	MEDIUM	HIGH	EXTREMELY HIGH	EXTREMELY HIGH
	Possibly occur	LOW	MEDIUM	MEDIUM	HIGH	HIGH
	Remote possibility	LOW	LOW	MEDIUM	MEDIUM	MEDIUM
	Extremely unlikely	LOW	LOW	LOW	LOW	LOW

Wind Turbine Risk Assessment Table

Hazard	Outcome	Likelihood	Severity	Risk without controls	Risk Control	Risk analysis with controls
Aircraft collision with wind turbine – VFR Day	- Damage to aircraft - Damage to equipment - Injury to pilot	Possibly occur	Major	High	- Wind turbine on Aeronautical Chart - Aeronautical Chart includes the highest point of the wind farm as the quadrant obstacle height - Wind Turbines are white or similar industry accepted colour.	Low
Aircraft collision with wind turbine – VFR Night	- Damage to aircraft - Damage to equipment - Injury to pilot	Possibly occur	Major	High	- Wind turbine on Aeronautical Chart - Aeronautical Chart includes the highest point of the wind farm as the quadrant obstacle height - Night flying for cross country flight requires more planning	Low
Aircraft collision with meteorological monitoring mast – VFR Day/Night	- Damage to aircraft - Damage to equipment - Injury to pilot	Remote possibility	Moderate	Medium	- Wind turbine on Aeronautical Chart/AIP or NOTAM - Aeronautical Chart includes the highest point of the wind farm as the quadrant obstacle height	Low
Pilot takes avoiding action and crashes – VFR Day/Night	- Damage to aircraft - Damage to equipment - Injury to pilot	Remote possibility	Moderate	Medium	- Wind turbine on Aeronautical Chart - Aeronautical Chart includes the highest point of the wind farm as the quadrant obstacle height - Wind Turbines are white or similar industry accepted colour. Wind turbine on Aeronautical Chart/AIP or NOTAM - Aeronautical Chart includes the highest point of the wind farm as the quadrant obstacle height	Low

Hazard	Outcome	Likelihood	Severity	Risk without controls	Risk Control	Risk analysis with controls
Aircraft collision with wind turbine – IFR	- Damage to aircraft - Damage to equipment - Injury to pilot	Remote possibility	Major	Medium	Instrument Route MSA is 1,000 ft above obstacle height on route segment.	Low

Mitigations:

- Outside Aerodrome OLS
- Terrain in area
- Minimum altitude 500 feet above obstacle and 150 metre horizontally.
- Highest wind turbine lit medium intensity.
- Local aerodrome and users advised.
- Flight training organisations advised.
- VNC quadrant obstacle altitude raised.
- Vector article.
- Rescue helicopter operators advised.
- Agricultural pilots advised.
- Windfarm on VNC.
- Flight checking.