PRELIMINARY DRAFT REPORT

AERONAUTICAL IMPACT ASSESSMENT
OBSTACLE LIGHTING REVIEW &
QUALITATIVE RISK ASSESSMENT

PROPOSED WIND FARM DEVELOPMENT
AT
YASS VALLEY WIND FARM,
NEW SOUTH WALES

J0334

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Report to:

SKM SINCLAIR KNIGHT MERZ

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AMBIDJI
AIR TRANSPORT INNOVATION

Melbourne, Australia

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EXECUTIVE SUMMARY

The Ambidji Group Pty Ltd (Ambidji) was engaged by Sinclair Knight Merz Pty Ltd (SKM) to undertake an Aeronautical Impact and Qualitative Risk Assessment for the proposed Yass Valley Wind Farm. The proposed wind farm project is made up of two precincts in the southern tablelands of NSW (Coppabella Hills and Marilba Hills) approximately 20km west of the township of Yass. The proposed wind farm site layout, in relation to Yass is shown in Figure 1.

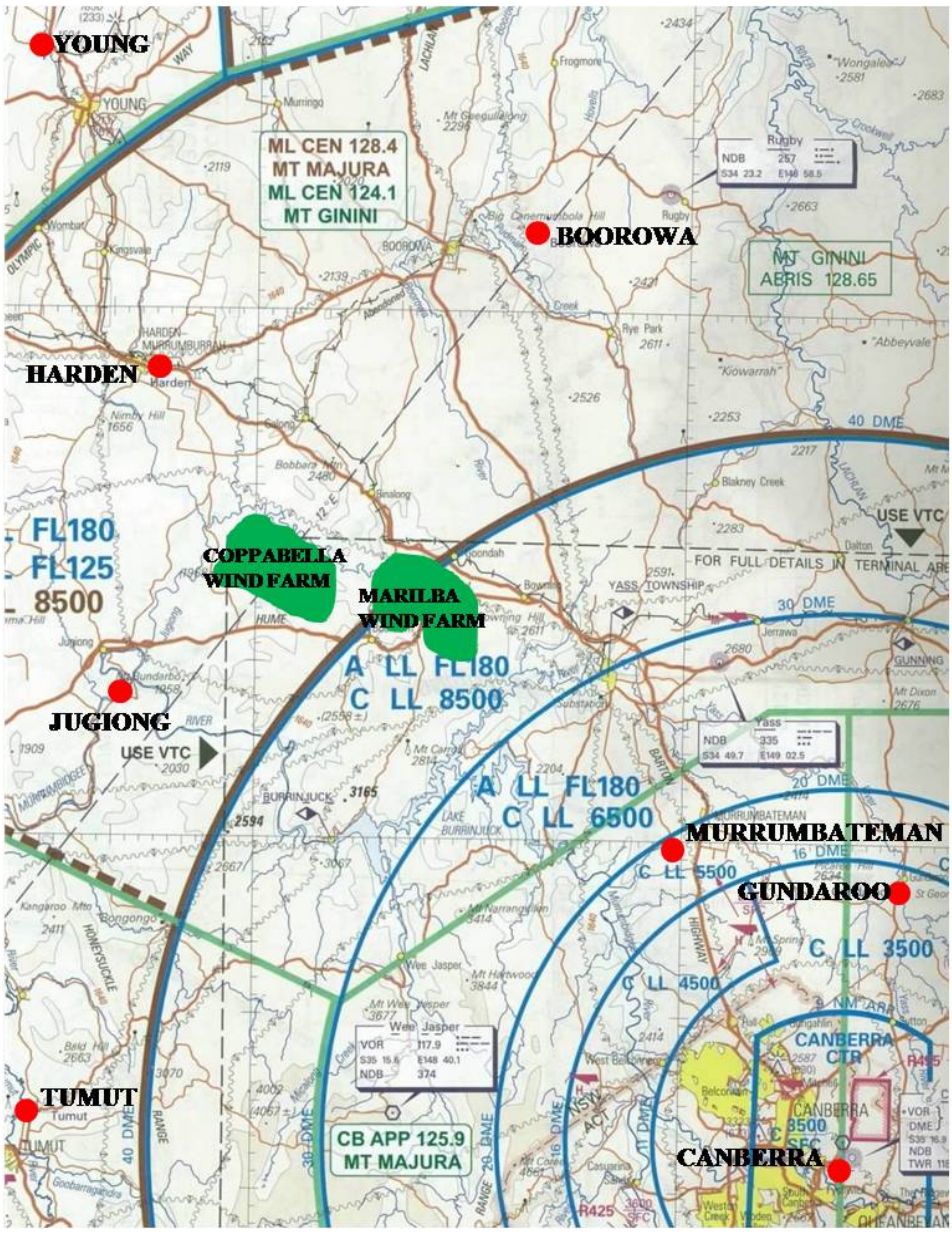

Figure 1: The proposed Yass Valley Wind Farm Site

The proposed Yass Valley Wind Farm will comprise up to 156 wind turbines generators (WTG) and this report will consider two turbine height options being:

- WTG with a maximum total height to blade tip of 135m (443ft) above ground level (AGL); and
- WTG with a maximum total height to blade tip of 150m (493ft) AGL.

Scope

The scope of this report was to examine the proposed Yass Valley Wind Farm development and to:

1. Undertake an Aeronautical Impact Assessment
2. Undertake an Obstacle Lighting Review which considers and comments on:
   i. Current international practice for lighting wind farms;
   ii. CASA's position and the applicability of their regulations or advice;
   iii. The status of trends in lighting decisions with other planned or operating wind farms in Australia; and
3. Undertake a Qualitative Risk Assessment[1] in regard to the need for obstacle lighting for the proposed Yass Valley Wind Farm.

Aeronautical Impact Assessment

The proposed Yass Valley Wind Farm does not infringe any PANS OPS surfaces of aerodromes; OLS for aerodromes; Air Route protection surfaces; Clearance Planes for Navigation Aids. or the ATC radar clearance plane for the MT Majura radar. The proposed wind farm also does not have an impact on engine inoperative flight paths from aerodromes in the region.

However, there are a number of turbines in the proposed Yass Valley Wind Farm that infringe upon the ATC radar clearance plane for the MT Bobbara radar.

It is likely that further consideration of the affects of the infringement of the MT Bobbara radar clearance plane will be required by Airservices and these consultations with AsA may lead to options for mitigation of the impacts.

Obstacle Lighting Review

Ambidji's review of the approach to lighting and consideration of present regulations for wind farms in a number of overseas countries shows that the heights that trigger them as obstacles and the approach to lighting varies widely.

In Australia, regarding those structures that are outside obstacle limitation surfaces of an aerodrome, and are more than 110m above ground level, CASA's Manual of

[1] Unlike a Quantitative Risk Assessment, a Qualitative Risk Assessment reflects the lack of recorded quantifiable data on aviation activity in a particular study area and places the emphasis on a qualified (non-mathematical) assessment of risk, based on information obtained from stakeholder consultations.

Standards Part 139 - Aerodromes, states that in general an obstacle would require obstacle lighting unless an aeronautical study, assesses it as being shielded by another object or *that it is of no operational significance.* In addition, previously CASA promulgated an Advisory Circular 139-18 (0) covering the marking and lighting of turbines outside the vicinity of an aerodrome but this has been withdrawn.

Ambidji's survey of the current trends in Australia shows that wind farm proponents are seeking not to light the farms and some existing operators are seeking to reduce or eliminate their existing lighting.

In the absence of the CASA advisory circular and with no consistent overseas lighting practice to adopt, the CASA 110m AGL obstacle threshold and the ICAO decision to define wind turbines as an obstacle at or above 150m AGL for wind farm lighting need to be considered for a given project in Australia. Either of these thresholds would then trigger a formal qualitative, semi-quantitative or full quantitative risk assessment to determine whether obstacle lighting is required.

As the proposed wind farm wind turbine generators heights are above both the 110m AGL (CASA MOS 139) and up to the 150m AGL (ICAO) threshold, this Qualitative Risk Assessment has been undertaken to assess the degree of risk posed by the wind farm and make recommendations regarding the requirement or otherwise of aviation obstacle lighting.

CASA's current position on obstacle lighting of wind farms that are remote from an aerodrome (as for the proposed Yass Valley Wind Farm) is summarised as:

a. CASA cannot mandate obstacle lighting for wind farms that are "not within the vicinity" of an aerodrome;

b. Provision of such lighting is a decision for, and the responsibility of, the developer;

c. Any associated requirements placed on developers by planning authorities, insurers or financiers are beyond CASA's scope;

d. A wind farm developer may have a duty of care to the aviation industry and local operators in terms of ensuring obstacles are made conspicuous;

e. Obstacle marking and lighting requirements as specified in the CASA Manual of Standards Part 139, Section 9.4 applies for developers choosing to light a wind farm, and

f. The Advisory Circular information (AC 139-18) is still valid as a recommendation if the proponent wishes to do so as a risk mitigator.

Qualitative Risk Assessment

The Qualitative Risk Assessment was undertaken to specifically address whether obstacle lighting can be eliminated from the project at the proposed Yass Valley Wind Farm with *no operational significance* to aircraft activity. The assessed level of risk is summarised in Table 1 below.

Risk Element	Assessed Level of Risk	Comment
Local aerodrome operations	Low	No aerodromes are in the vicinity of the proposed wind farm. There is no impact on aircraft operations into these aerodromes.
Private airstrip operations	Low	No impact on identified private airstrips or agricultural airstrips.
Agricultural Operations	Low/Medium	Operations are not unsafe provided pre-planning is undertaken and pilot is an experienced operator. Meteorological monitoring masts not unsafe if marked and operators notified of their erection with location and heights.
GA Pilot Training	Low	No safety issue for GA pilot training.
Recreational Flying	Low	No safety issue for recreational local or cross country flying.
Known Highly Trafficked Routes	Low	No highly trafficked routes in the vicinity of the wind farm.
Air Ambulance Operations	Low/Medium	Not an unsafe situation but operators need wind farm marked in operational documents
Fire Fighting Operations	Low/Medium	Not an unsafe situation but operators need wind farm marked in operational documents
ADF Military Operations	Low	No low flying operations in the area.
Published Tracks	Low	The lowest safe altitude of the published tracks are well above the highest wind turbine
Night Flying	Low	All night flying (Visual Flight Rules or Instrument Flight Rules) is required to remain at or above the calculated or published lowest safe altitudes. These are at least 1000ft above either the highest wind turbine or highest terrain in the area. The probability of an engine failure causing an aircraft to descent below LSALT over the wind farm area is very low.
Weather & Visibility Issues	Low	Probability of impact with turbine by aircraft in the infrequent event of being below 500ft AGL due stress of weather or visibility has been determined as low

Table 1: Qualitative Risk Assessment Summary

From Table 1 it can be seen that the risk from the qualitative assessment has been determined as low to low/medium.

The **low/medium risk** applies to approved low flying operations for aerial applications, emergency service activity and fire fighting activity. These operations are not unsafe provided pre-planning is undertaken in respect of aerial applications and the pilots are experienced operators and the location of the wind farm is depicted in the Aeronautical Publications in respect of all three low level operations.

All other aviation operations have been assessed as **low risk**.

Conclusions

Aeronautical Impact Assessment

With the exception of the MT Bobbara radar there are no aeronautical impacts caused by the location and proposed heights of the wind turbines.

Of major impact is that there are a **number of turbines in the proposed Yass Valley Wind Farm that infringe upon the ATC radar clearance plane** for the MT Bobbara radar.

Obstacle Lighting Review

In regard to those structures that are outside obstacle limitation surfaces of an aerodrome, and are more than 110m above ground level, CASA's Manual of Standards Part 139 - Aerodromes, states that in general an obstacle would require obstacle lighting unless, an aeronautical study assesses it as being shielded by another object or *that it is of no operational significance.*

The proposed Yass Valley Wind Farm proposes wind turbines greater than the CASA 110m and up to the ICAO recommended 150m obstacle height threshold where ICAO deems these to be obstacles that require consideration for lighting. However, the ICAO recommendation on wind turbines of 150m or higher states that they should be regarded as obstacles unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.

The Qualitative Risk Assessment in this report represents such a special aeronautical study as allowed by CASA and ICAO. It assessed the degree of risk (hazard) posed by the Yass Valley Wind Farm and made recommendations regarding the requirement or otherwise for aviation obstacle lighting.

Qualitative Risk Assessment

The Qualitative Risk Assessment has determined that there is minimal probability of an aircraft impacting with a turbine day or night or in poor weather as:

- The location of the wind farm and any of its individual turbines will not impact on the approach, circuit work or take-off of aircraft from any of the identified aerodromes, airfields or airstrips in the region;
- The location of the wind farm and its individual turbines will not impact on the safety of aerial applications by day and these applications do not occur at night in this area;
- The location of the wind farm and any of its individual turbines does not impact on the safety of General Aviation Fixed Wing Training nor helicopter training in the area;
- The location of the wind farm and its individual turbines does not impact on day recreational or commercial flying activity either within or transiting the area;
- The wind farm will not have any impact on the normal operations of Night VMC and IFR aircraft overflying at night. The probability of an event where either a single or twin aircraft has an engine failure at night over or near the wind farm is extremely low;
- The location of the wind farm and any of its individual turbines will not impact on the operation of emergency services helicopters provided the wind farm is marked in AIP publications;
- The location of the wind farm and any of its individual turbines will not impact on the operation of aerial fire fighting services provided the wind farm is marked in the AIP publications;
- The published air route's minimum altitudes are well above the height of the turbines; and
- The frequency of aircraft below 500ft AGL due stress of weather is considered low, that CASA views that the conspicuity of white turbines is acceptable in daylight and low visibility conditions and an analysis of data in regard to controlled flight into terrain shows the probability of impacting a turbine in poor weather as low.

It is concluded that the level of assessed risk does not support the requirement for installing obstacle lighting at the proposed Yass Valley Wind Farm.

Recommendations

Ambidji's makes the following recommendations:

- That aviation obstacle lighting for the proposed Yass Valley Wind Farm site ***is not required;***
- That Origin engages with Airservices Australia to pursue mitigation and approval of the Mount Bobbara radar clearance plane penetrations;
- That Origin engages with its legal, insurance and other relevant advisors in regard to its own corporate assessment of risk and duty of care responsibilities in regard to the requirement for aviation obstacle lighting;
- That Origin make contact with all relevant aviation stakeholders prior to the construction of turbines;
- That Origin notifies operators in the region of the location and height of the existing and any planned meteorological monitoring masts in the area; and
- That any meteorological monitoring masts in the Yass Valley Wind Farm area be fitted with swing flap reflector markers.

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1. INTRODUCTION

The Ambidji Group Pty Ltd (Ambidji) has been engaged by Sinclair Knight Merz Pty Ltd (SKM) to undertake an Aeronautical Impact and Qualitative Risk Assessment for the proposed Yass Valley Wind Farm. The proposed wind farm project is made up of two precincts in the southern tablelands of NSW (Coppabella Hills and Marilba Hills) approximately 20km west of the township of Yass. The proposed wind farm site layout, in relation to Yass is shown in Figure 1-1.

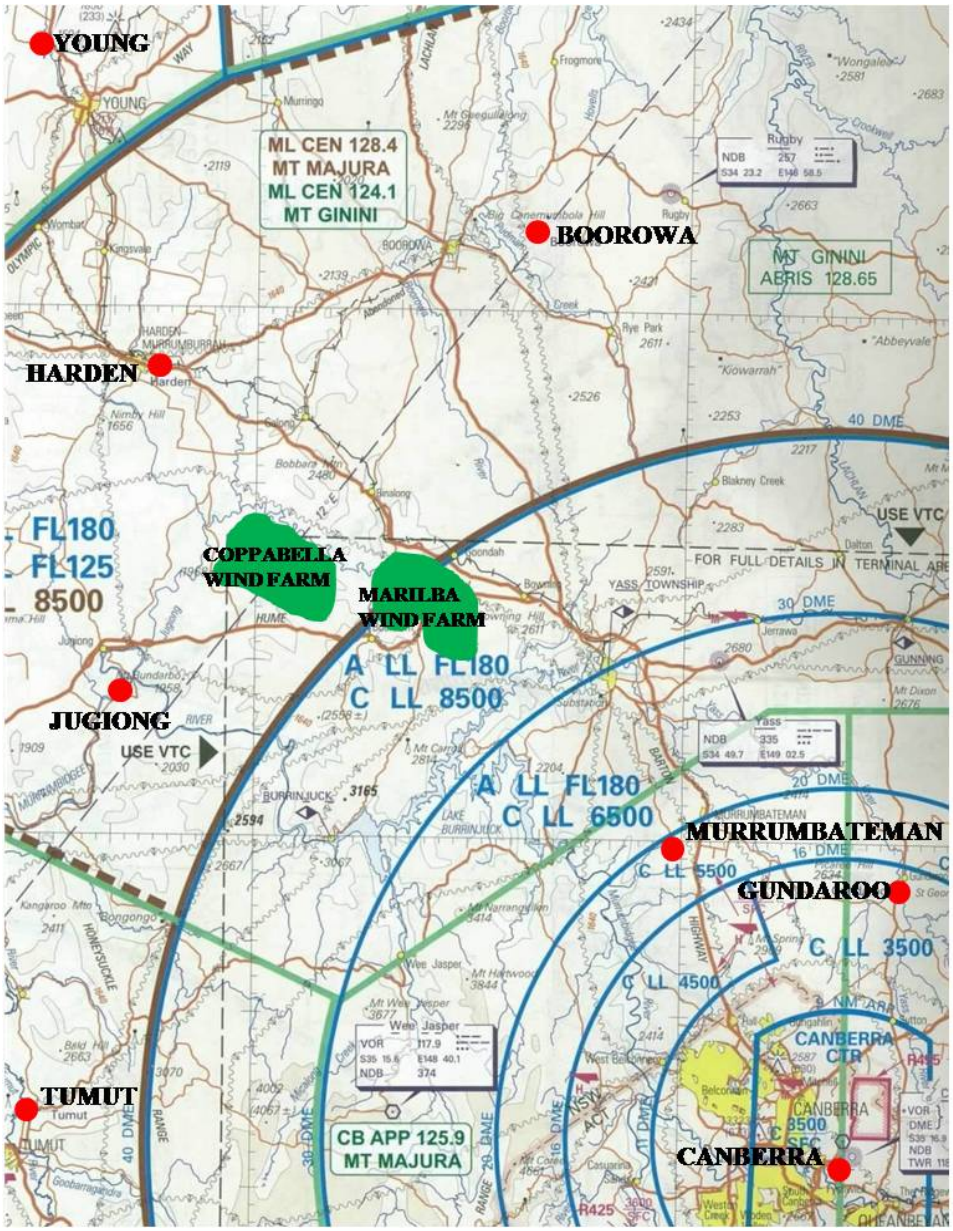


Figure 1-1: The proposed Yass Valley Wind Farm Site

The Ambidji Group Pty Ltd (Ambidji) has undertaken:

1. An Aeronautical Impact Assessment;
2. An Obstacle Lighting Review; and
3. A Qualitative Risk Assessment in regard to the need for obstacle lighting of the Yass Valley Wind Farm.

The proposed Yass Valley Wind Farm will comprise up to 156 wind turbines generators (WTG) and this report will consider two turbine height options being:

- WTG with a maximum total height to blade tip of 135m (443ft) above ground level (AGL); and
- WTG with a maximum total height to blade tip of 150m (493ft) AGL.

It should be noted that part of the Marilba site abuts the boundary of the proposed Conroys' Gap wind farm.

2. METHODOLOGY

This Aeronautical Impact Assessment, Obstacle Lighting Review and Qualitative Risk Assessment included the following evaluations and assessments:

2.1 Aeronautical Impact Assessment

1. Consideration of Civil Aviation Safety Regulations (CASR) Part 139 Manual of Standards (MOS), specifically:
    I. Chapter 7: Obstacle Restriction and Limitation; and
    II. Chapter 11: Standards for Other Aerodrome Facilities;
2. Consideration of the potential impact of the Yass Valley Wind Farm on relevant instrument approach procedure surfaces (PANS OPS);
3. Consideration of existing air routes to determine if there would be any influence on the Lowest Safe Altitudes published for these routes.
4. Assessment of potential impacts on navigational aids and air traffic control radar coverage;
5. Civil Aviation Order 20.7.1B as it relates to the minimum requirements for clearance of obstacles by an aircraft that has suffered a failure of a critical engine during take-off;
6. Consideration of the operation of military aircraft conducting low flying operations in the area, and the operation of civilian aircraft during recognised low flying activities;
7. Assessment of applicable Civil Aviation Regulations in respect to notification of tall structures that may present obstacles and hazards to aviation activities.

2.2 Obstacle lighting Review

The Obstacle Lighting Review included:

1. A review of international and national aviation documentation applicable to aeronautical hazard assessments and obstacle marking and lighting requirements, with particular consideration of wind farms and wind turbines;
2. Reference to previous and ongoing discussions with CASA and a review of their current position for marking and lighting of obstacles for wind farms; and
3. A review of other Australian wind farm developments and operations to consider recent approaches to the installation, removal or avoidance of obstacle lighting, including the identification of any issues relating to court determinations or relevant panel hearing reports.

2.3 Qualitative Risk Assessment

A Qualitative Risk Assessment was undertaken in regard to the need for obstacle lighting which included:

1. The identification and assessment of potential aviation risk elements through the Aeronautical Impact Assessment conducted above and;
    i. Reference to CASA Aeronautical Publications;
    ii. Site visits and regional appreciation, and
    iii. Consultations with key relevant stakeholders;
2. Assessment of the impacts of the turbines on the operation of aerodromes and airstrips in the immediate vicinity of the wind farm;
3. Assessment of perceived impacts of the turbines on agricultural flying (aerial applications) in regard to airstrips used and/or the safety of actual operations into adjoining properties;
4. Assessment of the impacts of the turbines on other aviation activity including;
    i. General aviation training;
    ii. Recreational aircraft activity;
    iii. Instrument Flight Rules (IFR) operations;
    iv. Any known Visual Flight Rules (VFR) highly trafficked routes;
    v. Published tracks;
    vi. Night Visual Meteorological Conditions (VMC) operations;
    vii. Emergency Services Air Ambulances (fixed and rotary wing);
    viii. Fire Fighting Operations (fixed and rotary wing); and
    ix. Military Low Flying Operations.
5. Assessment of any implications for the above from topographical, weather and visibility issues;
6. Assessment of other issues as identified through consultations and the assessment process, and
7. Conclusions on the degree of aviation risk posed by the above described issues with commensurate recommendations on whether any obstacle lighting is necessary with or without any mitigating actions.

3. AERONAUTICAL IMPACT ASSESSMENT

3.1 Introduction

The layout of the proposed Yass Valley Wind Farm is illustrated in relation to the closest aerodromes in Figures 3-1, 3-2 and 3-3. Details of the height and location of each of the turbines can be found in Appendix A.

The two precincts of Yass Valley Wind Farm include Coppabella Hills (86 turbines) and Marilba Hills (70 turbines), totalling 156 turbines.

3.2 Obstacle Limitation Surfaces (OLS) and PANS OPS and Air Route Assessment

The International Civil Aviation Organization (ICAO) Annex 14 and the Civil Aviation Safety Regulations (CASR Part 139 - Aerodromes) details the extent of Procedures for Air Navigation Services Operations (PANS OPS)[2] and Obstacle Limitation Surfaces (OLS) required at airports in Australia. The analysis of the proposed Yass Valley Wind Farm development has been undertaken with reference to these standards.

This assessment considered two options:

- A turbine maximum height of 135m AGL, at the tip of the blade, the highest of which is WTG No COP _06 at 955.63m/3136ft AMSL; and
- A turbine maximum height of approximately 150m AGL, at the tip of the blade, the highest of which is WTG No COP_06 at 970.63m/3185ft AMSL.

3.3 Aerodromes within 30NM of the proposed wind farm sites.

The aerodromes shown in Table 3-1 are located within 30nm (52km) of the boundaries of the proposed wind farm and have PANS OPS surfaces above the boundary of the wind farm.

Aerodrome	Location Ref Wind Farm	PANS OPS/OLS
Tumut	26nm South	PANS OPS To 30nm and OLS To 4500m
Young	29nm North West	PANS OPS To 30nm and OLS To 4500m
Cootamundra	23nm West	PANS OPS To 30nm and OLS To 4500m

Table 3-1: Aerodromes with PANS OPS surfaces above the Wind Farm

[2] Procedures for Air Navigation Services - Aircraft Operations which are the airspace protective surfaces for designed instrument approaches at specific airports. Such procedures are used to allow aircraft to land under Instrument Meteorological Conditions.

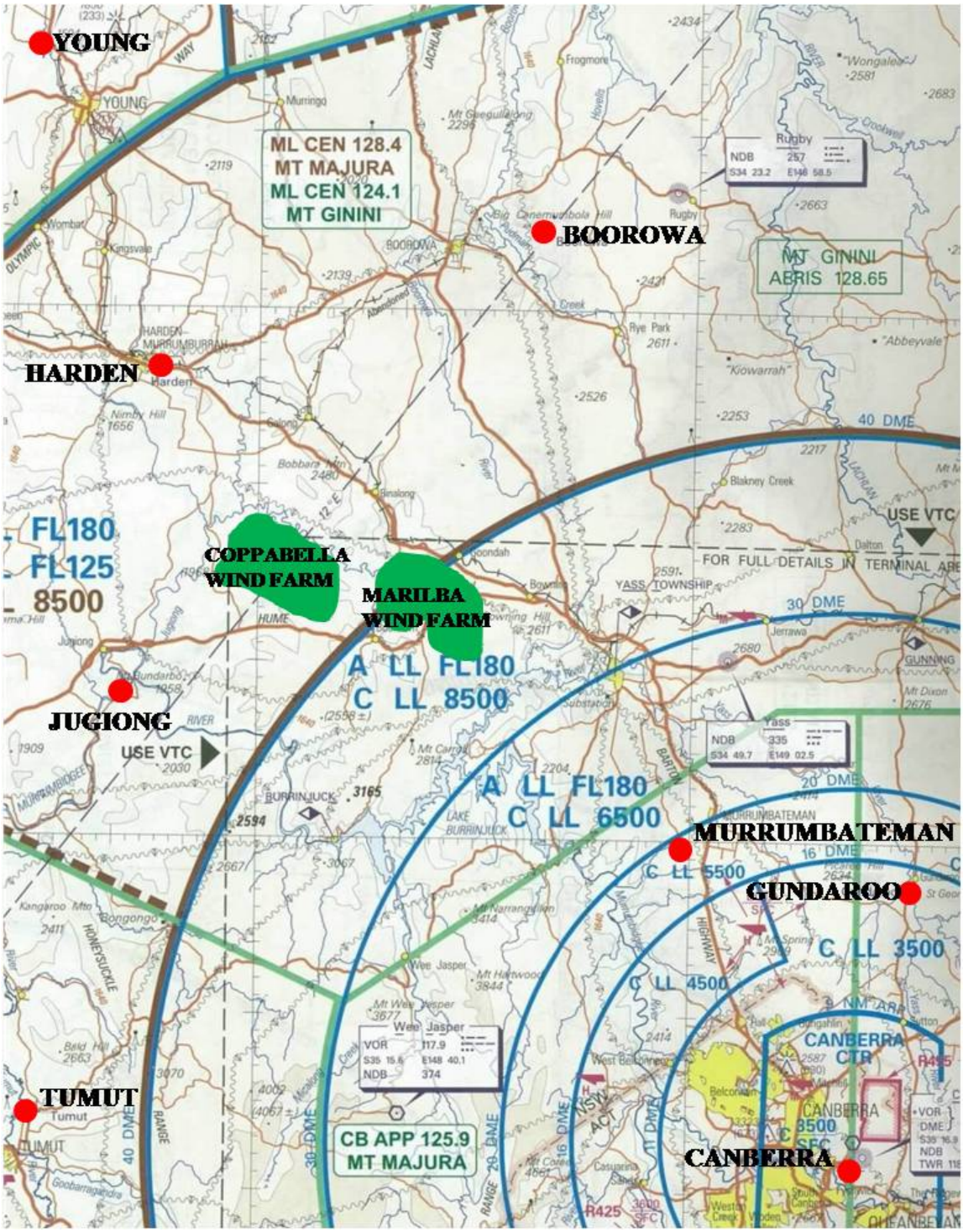


Figure 3-1: Location of Yass Valley Wind Farm in relation to aerodromes

Canberra Airport (35nm South-East), Goulburn (48nm West) and Cowra Aerodrome (55nm North) are more than 30nm from the south-east boundary of the wind farm and have no PANS OPS or OLS above the wind farm location.

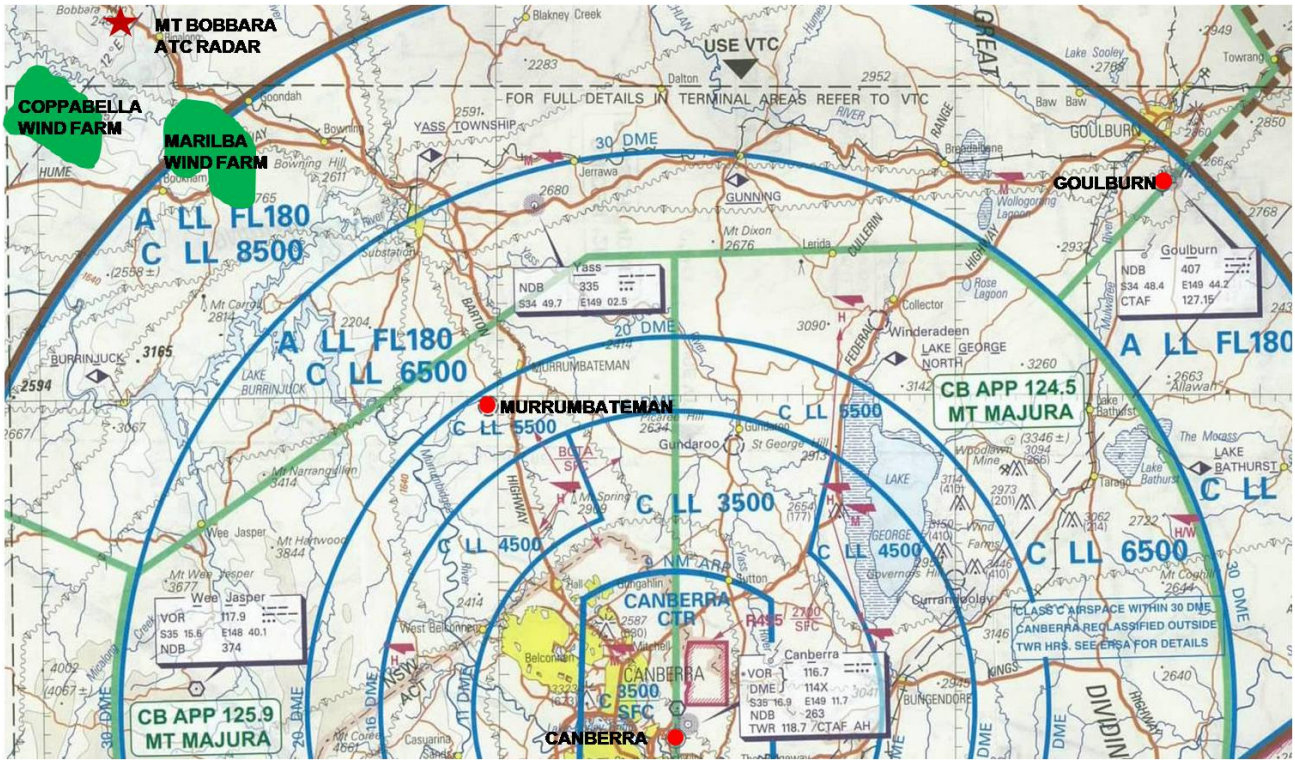


Figure 3-2: Location in relation to Goulburn Aerodrome

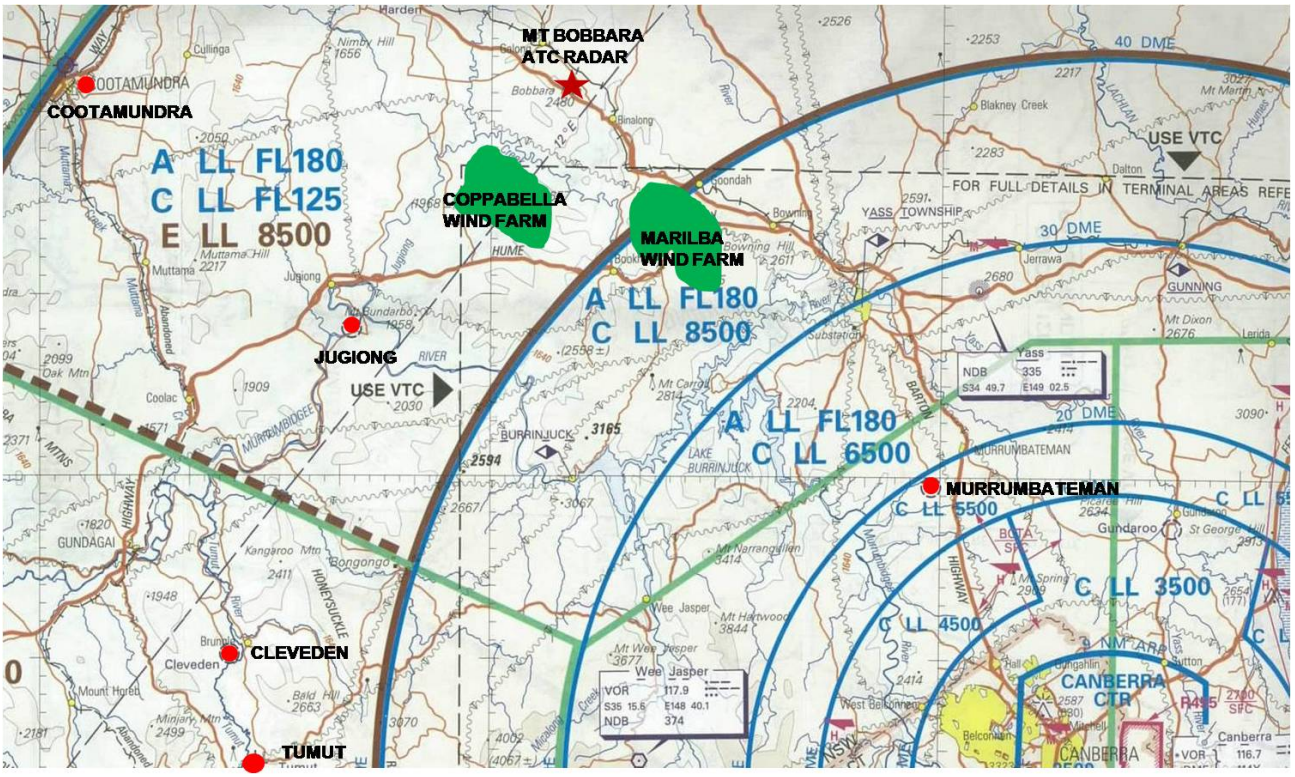


Figure 3-3: Location in relation to Cootamundra Aerodrome

3.4 PANS OPS Assessment

The PANS OPS assessment for this proposed wind farm is based on Instrument Flight Procedures published in Australia AIP DAP EAST[3] effective 26 August 2010, 18 November 2010 and associated NOTAMS.

Tumut Aerodrome

A section of the Tumut Aerodrome 25nm MSA[4] protection area exists above the proposed wind farm and some WTG's at an altitude of 6900ft. There is a protection surface of 1000ft lower which creates the surface to 5900ft. This altitude is above the highest 135m turbine at 3136ft AMSL and the highest 150m turbine at 3185ft AMSL.

The PANS OPS protection areas for the remaining Instrument Approach Procedures at Tumut do not cross the boundary of the proposed Yass Valley Wind Farm.

The proposed Yass Valley Wind Farm does not affect any PANS OPS surfaces at Tumut Aerodrome.

Young Aerodrome

A section of the Young Aerodrome 25nm MSA protection area is above the boundary of the Coppabella precinct but from the data provided not above any WTG. The 25nm MSA is contained within a circle of 25nm from the Young NDB[5] with a 5nm buffer added. This equates to a protection area for this PANS OPS surface being a circle of 30nm from the reference navigation aid - YNG NDB.

The Young 25nm MSA has an altitude of 3700ft with a protection surface 1000ft lower at 2700ft. The highest WTGs at either 135m AGL or 150m AGL have elevations above this protection altitude but none of the WTGs are underneath the protection surface. Figure 3-4 depicts the relationship of the MSA boundaries to the WTGs.

All other Instrument Approach Procedures at Young Aerodrome have surfaces that are not infringed by the proposed Yass Valley Wind Farm.

The proposed Yass Valley Wind Farm does not affect any PANS OPS surfaces at Young aerodrome.

However, as the wind farm is in close proximity to the 25nm MSA boundary and the highest WTG is above the PANS OPS surface (albeit outside the boundary), any future change to the layout of the wind farm, in the vicinity of the 25nm MSA boundary (30NM) should be assessed to determine if there is an impact upon the approach procedures at Young Aerodrome.

[3] Aeronautical Information Publications are produced by Airservices Australia. DAPs provide approach and departure guidance for IFR operations at nominated airports.
[4] Minimum Sector Altitude -
[5] Non Directional Beacon -

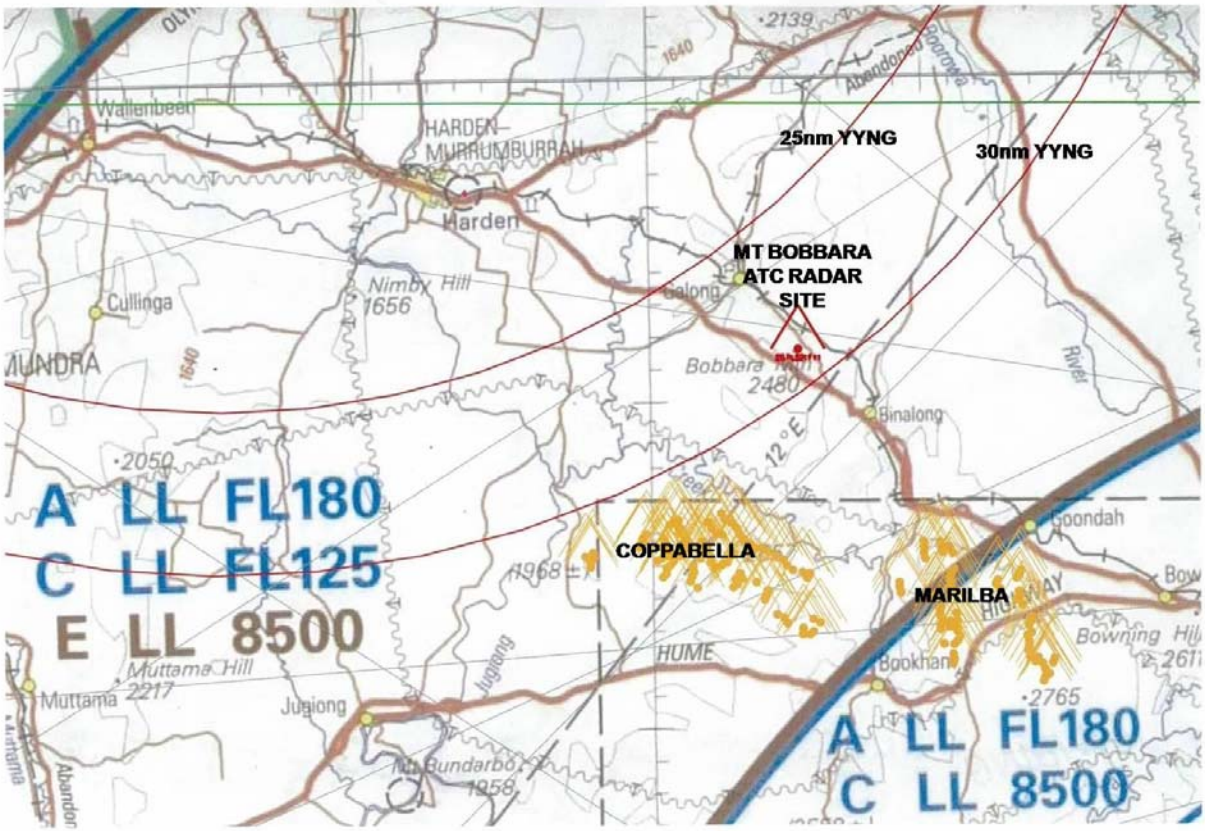


Figure 3-4: WTGs in relation to YOUNG 25nm MSA boundary at 30nm

Cootamundra Aerodrome

A section of the Cootamundra Aerodrome 25nm MSA protection area exists above the wind farm (and some WTG's) at an altitude of 4200ft with a protection surface 1000ft lower at 3200ft. This altitude is above the highest 150m WTG of 3185ft AMSL and the highest 135m WTG of 3136ft AMSL.

The 25nm MSA is contained within a circle of 25nm from the Cootamundra NDB with a 5nm buffer added, taking the total radius of this protection area out to 30nm from the Cootamundra NDB. Figure 3-5 shows the WTGs in relation to Cootamundra 25nm and 30nm MSA boundary.

The PANS OPS protection areas for the remaining Instrument Approach Procedures at Cootamundra do not cross the boundary of the proposed Yass Valley Wind Farm.

The proposed Yass Valley Wind Farm does not affect any PANS OPS surfaces at Cootamundra aerodrome.

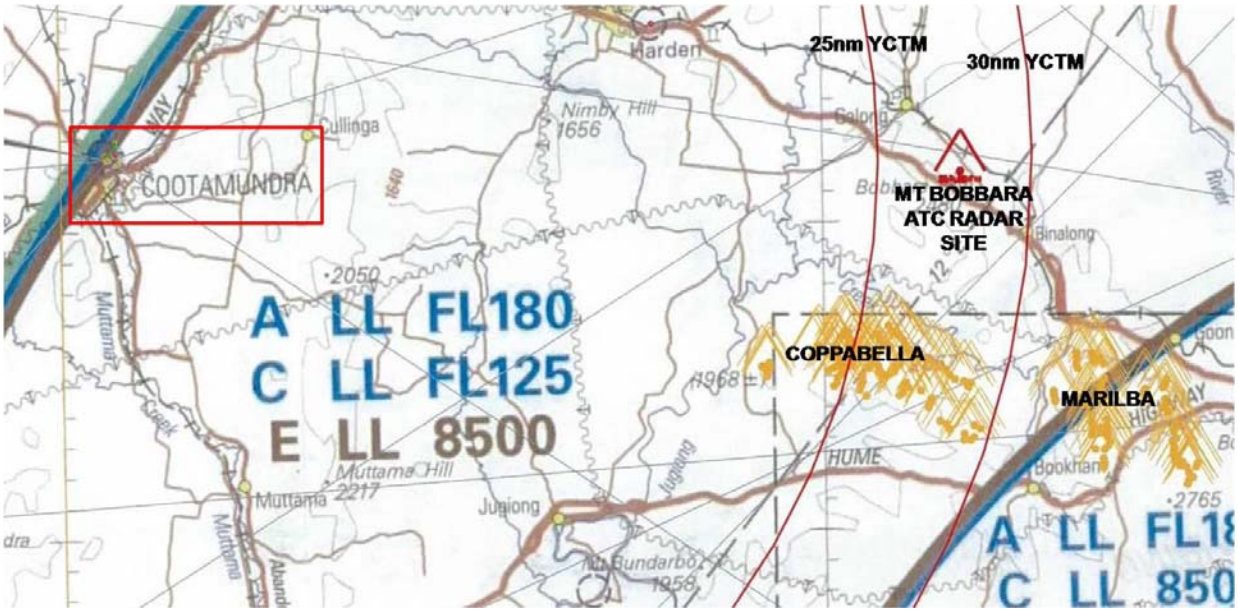


Figure 3-5: WTGs in relation to Cootamundra 25nm and 30nm MSA boundary.

3.5 Obstacle Limitation Surfaces

The aerodromes within 30nm of the boundaries of the Yass Valley Wind Farm that have published instrument approaches and non-precision instrument approach runways with OLS that exist to 4.5km from the end of each runway, were previously noted in Table 3-1.

Analysis of aviation documentation and stakeholder consultations did not identify any other aerodromes within 30nm of the boundaries of the Yass Valley Wind Farm that have instrument published approaches and non-instrument approach runways with OLS.

There are no aerodromes that have OLS above the wind farm and therefore the wind farm does not have an impact on the OLS at these aerodromes.

3.6 Private Airstrips, Airfields and Landing Areas

It is possible that private land owners have airstrips on their properties near to the boundary of the proposed wind farm. These airstrips are not required to be registered or even reported to CASA. The owner is responsible for the conduct of aviation operations at these airfields

The impact on private airstrips, airfields and landing areas by the proposed Yass Valley Wind Farm is discussed and evaluated in the Qualitative Risk Assessment, Section 5.1.

3.7 Air Routes

There are several Air Routes that exist with protection areas above the proposed Yass Valley Wind Farm. The lowest protection area associated with any of these Air Routes is at 3600ft.

This altitude is above the highest 150m WTG of 3185ft AMSL as well as the highest 135m WTG of 3136ft AMSL.

Figure 3-6 shows the location of the proposed wind farm in relation to the air routes in the vicinity of the wind farm.

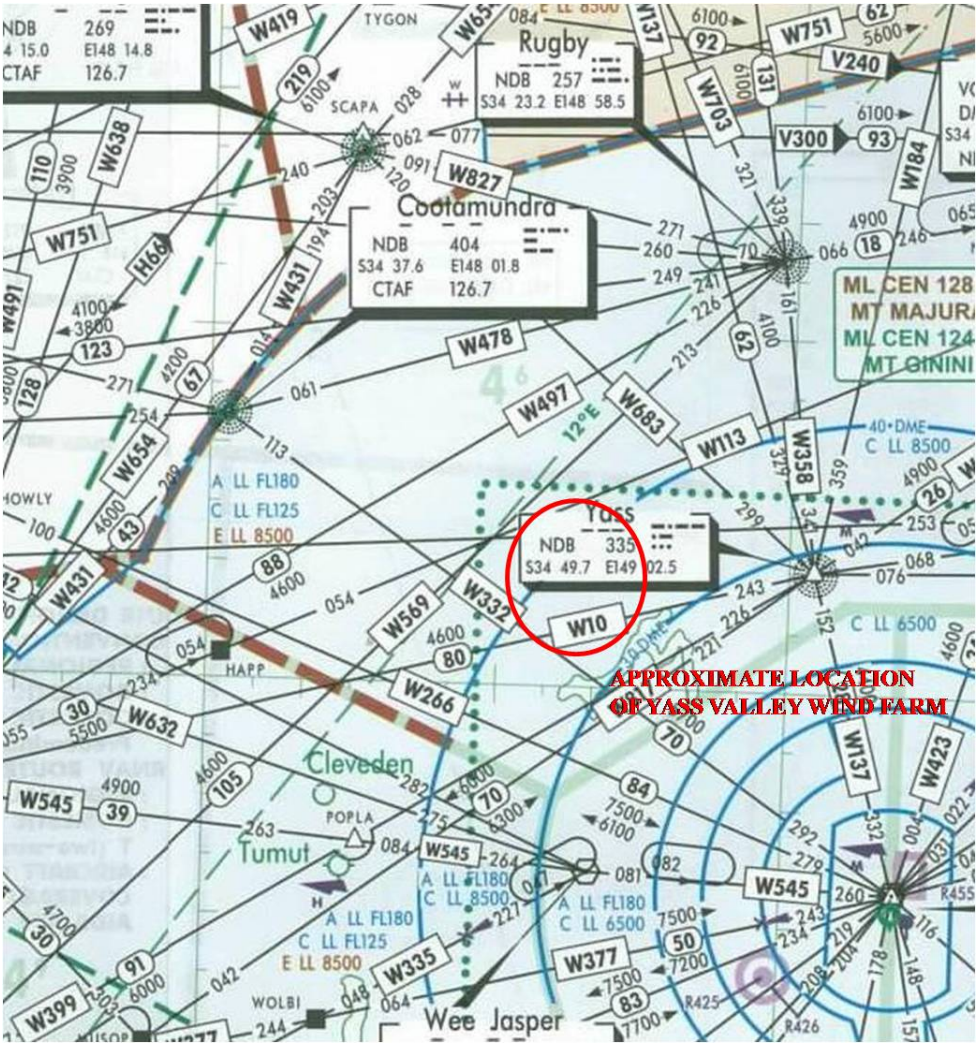


Figure 3-6: Air Routes in the vicinity of Yass Valley wind farm

In conclusion, the published route's minimum altitudes are well above the height the proposed site of turbines and do not present any safety issues.

3.8 Impacts on Military Aviation Activity

The previous proponent notified the Department of Defence on 5 August 2008 of the details of the wind farm. The response was as follows

> *The Department of Defence advised that the proposed development would be outside any areas affected by the Defence (Area Control) Regulations (DACR). The DACR control the height of objects both manmade structures and vegetation and the purpose of which they may be used within approximately 15km radius of Defence airfields. In addition the proposal has been assessed as unlikely to affect the existing defence communications within the region*[6]*.*

On 23 September 2010, Ambidji made contact with RAAF to confirm if the proposed Yass Valley Wind Farm will have any effect on operations. On October 6, the Directorate of Land Planning and Spatial Information (Department of Defence) responded in that, the above 5 August letter is still valid, even though aspects of the turbine boundary and layout have been altered. Refer to Appendix B for copy of original August 2008 letter and email dated 6 October 2010.

There are no safety issues with the Yass Valley Wind Farm turbines from military low flying operations.

3.9 RADAR INTERFERENCE AND SHADOWING

CASR Part 139 Manual of Standards (MOS) stipulates the siting criteria to ensure unrestricted performance of navigation aids, radar sensors and other aviation facilities located on and in the vicinity of aerodromes.

Buildings, structures or terrain that is higher than the radar coverage, or radar clearance plane, can hide aircraft behind the particular object, affectively placing a radar shadow in a particular area thus reducing the ability of Air Traffic Control (ATC) to effectively control aircraft within the area of the shadow.

Two Air Traffic Control radars are located in the vicinity of the proposed Yass Valley Wind Farm.

Mt Majura

A primary radar is located at Mt Majura, approx 33nm south-east of the southern boundary of the wind farm.

The Antenna is 900m AMSL with clearance plane of 0.5 degrees above the antenna at a height of 3486ft at the southern boundary of the wind farm. This is above the height of the highest WTG at 3035ft AMSL so there is no infringement of this clearance plane.

Mt Bobbara

A Secondary Surveillance Radar is located at Mt Bobbara, approx 5nm (10kms) north of the boundary of the Marilba precinct wind turbines with clearance planes in the

[6] Epuron Environmental Assessment: Proposed Yass Valley Wind Farms Coppabella Hills and Marilba Hills Precincts, November 2009

vicinity of the development proposal.

The Antenna height is 783.7m (2571ft) AMSL. This is below the height of several WTGs.

Tables 3-3 details the 135m AGL WTG's that would infringe the radar clearance plane and 3-4 detail the 150m AGL WTG's that infringe this radar clearance plane.

Turbine ID	Distance to Radar Station (Km's)	Ground Elevation (m)	Max tip height (m)	Max tip height (ft)	Distance (FT)	0.5DEG Plane Increase (FT)	Plane ALT (FT)	Clearance Plane Penetration (FT)
COP_06	11.23	820.63	955.632141	3135.4	36856.95	321.65	2692.97	442.46
COP_05	11.01	800.29	935.291259	3068.7	36124.48	315.25	2686.57	382.12
COP_07	11.42	782.16	917.161499	3009.2	37484.72	327.12	2698.44	310.76
COP_50	12.76	790.04	925.041992	3035.1	41850.69	365.23	2736.55	298.52
COP_84	11.51	776.09	911.094909	2989.3	37765.98	329.58	2700.90	288.40
COP_08	11.62	761.16	896.160156	2940.3	38133.67	332.79	2704.11	236.19
COP_44	13.13	771.77	906.772521	2975.1	43067.88	375.85	2747.17	227.95
COP_55	12.79	765.41	900.414001	2954.3	41954.27	366.13	2737.45	216.81
COP_43	12.76	759.51	894.511108	2934.9	41864.58	365.35	2736.67	198.22
COP_04	10.75	733.03	868.030883	2848.0	35276.85	307.86	2679.18	168.83
COP_53	13.28	743.53	878.534362	2882.5	43573.62	380.26	2751.58	130.89
COP_61	13.46	743.29	878.286376	2881.7	44161.93	385.40	2756.72	124.94
COP_57	13.18	740.71	875.711853	2873.2	43255.24	377.48	2748.80	124.41
COP_09	11.66	713.60	848.598449	2784.3	38243.59	333.75	2705.07	79.18
COP_25	12.62	717.86	852.864746	2798.2	41393.00	361.23	2732.55	65.70
COP_11	12.03	712.17	847.169982	2779.6	39470.27	344.45	2715.77	63.79
COP_12	12.34	712.21	847.2052	2779.7	40481.02	353.27	2724.59	55.09
MRL 64	22.51	800.67	935.667297	3069.9	73841.68	644.41	3015.73	54.20
COP_29	13.68	720.86	855.85968	2808.1	44875.53	391.62	2762.94	45.13
COP_30	13.95	721.07	856.074523	2808.8	45763.42	399.37	2770.69	38.09
COP_82	12.42	707.04	842.03656	2762.7	40763.98	355.74	2727.06	35.66
COP_58	13.56	714.95	849.946411	2788.7	44499.07	388.34	2759.66	29.02
COP_51	13.08	710.68	845.684143	2774.7	42909.57	374.47	2745.79	28.90
COP_03	10.62	688.17	823.171875	2700.8	34828.77	303.95	2675.27	25.56
COP_10	11.83	697.17	832.174438	2730.4	38830.07	338.86	2710.18	20.18
COP_23	12.18	700.13	835.127563	2740.1	39960.38	348.73	2720.05	20.00
MRL 62	22.09	781.85	916.847167	3008.2	72474.39	632.47	3003.79	4.38
MRL 68	23.24	791.71	926.712402	3040.5	76234.07	665.28	3036.60	3.94
COP_39	14.13	711.24	846.239318	2776.5	46361.78	404.59	2775.91	0.60
MRL 61	21.80	778.15	913.149353	2996.0	71533.78	624.27	2995.59	0.46

Table 3-3: 135m WTGs that infringe the Mt Bobbara ATC Radar Clearance Plane

Turbine ID	Distance to Radar Station (Km's)	Ground Elevation (m)	Max tip height (m)	Max tip height (ft)	Distance (FT)	0.5DEG Plane Increase	Plane ALT (FT)	Clearance Plane Penetration (FT)
COP_06	11.23	820.63	970.63	3184.6	36856.95	321.65	2692.97	491.68
COP_05	11.01	800.29	950.29	3117.9	36124.48	315.25	2686.57	431.33
COP_07	11.42	782.16	932.16	3058.4	37484.72	327.12	2698.44	359.98
COP_50	12.76	790.04	940.04	3084.3	41850.69	365.23	2736.55	347.73
COP_84	11.51	776.09	926.09	3038.5	37765.98	329.58	2700.90	337.62
COP_08	11.62	761.16	911.16	2989.5	38133.67	332.79	2704.11	285.41
COP_44	13.13	771.77	921.77	3024.3	43067.88	375.85	2747.17	277.17
COP_55	12.79	765.41	915.41	3003.5	41954.27	366.13	2737.45	266.02
COP_43	12.76	759.51	909.51	2984.1	41864.58	365.35	2736.67	247.44
COP_04	10.75	733.03	883.03	2897.2	35276.85	307.86	2679.18	218.05
COP_53	13.28	743.53	893.53	2931.7	43573.62	380.26	2751.58	180.10
COP_61	13.46	743.29	893.29	2930.9	44161.93	385.40	2756.72	174.16
COP_57	13.18	740.71	890.71	2922.4	43255.24	377.48	2748.80	173.62
COP_09	11.66	713.60	863.60	2833.5	38243.59	333.75	2705.07	128.40
COP_25	12.62	717.86	867.86	2847.5	41393.00	361.23	2732.55	114.91
COP_11	12.03	712.17	862.17	2828.8	39470.27	344.45	2715.77	113.01
COP_12	12.34	712.21	862.21	2828.9	40481.02	353.27	2724.59	104.30
MRL 64	22.51	800.67	950.67	3119.1	73841.68	644.41	3015.73	103.41
COP_29	13.68	720.86	870.86	2857.3	44875.53	391.62	2762.94	94.35
COP_30	13.95	721.07	871.07	2858.0	45763.42	399.37	2770.69	87.30
COP_82	12.42	707.04	857.04	2811.9	40763.98	355.74	2727.06	84.88
COP_01	10.30	672.76	822.76	2699.5	33783.29	294.82	2666.14	33.32
COP_58	13.56	714.95	864.95	2837.9	44499.07	388.34	2759.66	78.23
COP_51	13.08	710.68	860.68	2823.9	42909.57	374.47	2745.79	78.12
COP_03	10.62	688.17	838.17	2750.0	34828.77	303.95	2675.27	74.78
COP_10	11.83	697.17	847.17	2779.6	38830.07	338.86	2710.18	69.39
COP_23	12.18	700.13	850.13	2789.3	39960.38	348.73	2720.05	69.22
MRL 62	22.09	781.85	931.85	3057.4	72474.39	632.47	3003.79	53.60
MRL 68	23.24	791.71	941.71	3089.8	76234.07	665.28	3036.60	53.15
COP_39	14.13	711.24	861.24	2825.7	46361.78	404.59	2775.91	49.81
MRL 61	21.80	778.15	928.15	3045.3	71533.78	624.27	2995.59	49.67
MRL 67	22.85	786.83	936.83	3073.7	74956.42	654.13	3025.45	48.29
COP_54	13.01	700.68	850.68	2791.1	42694.34	372.59	2743.91	47.18
MRL 63	22.20	777.50	927.50	3043.1	72854.20	635.79	3007.11	36.01
COP_28	13.46	698.99	848.99	2785.5	44154.57	385.33	2756.65	28.90
COP_45	13.72	701.28	851.28	2793.0	45014.94	392.84	2764.16	28.88
COP_21	12.09	686.75	836.75	2745.4	39652.87	346.05	2717.37	28.00
COP_42	12.48	689.24	839.24	2753.5	40962.42	357.47	2728.79	24.74
MRL 57	20.74	759.28	909.28	2983.3	68055.92	593.91	2965.23	18.10
MRL 30	18.07	733.40	883.40	2898.4	59278.29	517.31	2888.63	9.79
MRL 58	21.05	756.88	906.88	2975.5	69049.40	602.59	2973.91	1.58
MRL 70	23.36	776.75	926.75	3040.7	76658.45	668.99	3040.31	0.35
MRL 69	23.22	775.41	925.41	3036.3	76192.57	664.92	3036.24	0.03

Table 3-4: 150m WTGs that infringe the Mt Bobbara ATC Radar Clearance Plane

In addition to the infringement of the radar clearance plane, it is likely that the WTG blades will interfere with the radar signals and is likely to cause ATC to have blind spots and unreliable radar coverage in the area around the wind farm and well beyond its boundaries.

The penetrations of the Mt Bobbara ATC radar clearance planes by the 150m WTGs are obviously larger than the penetrations for the 135m WTGs and will cause greater interference to the operation of this ATC radar site.

Advice will need to be sought from Airservices Australia as to the likely extent of this possible interference and potential approaches to mitigation.

3.10 POTENTIAL IMPACT ON NAVIGATION AIDS

CASR Part 139 Manual of Standards - Aerodromes, Chapter 11, sets out the general requirements for navigation aid sites and Air Traffic Control facilities, including the clearance planes for planned or existing facilities.

Table 3-5 details the navigation aids that are located in the vicinity of the proposed wind farm and were assessed in relation to any likely impact caused by the Yass Valley Wind Farm.

NAVIGATION AID	LOCATION (FROM WIND FARM)	CLEARANCE PLANE HEIGHT (ABOVE WIND FARM) (FT AMSL)
Rugby NDB	25NM North East	There are no special requirements beyond a 150m radius from the NDB.
Yass NDB	14NM East	There are no special requirements beyond a 150m radius from the NDB.
Young NDB	29 NM North West	There are no special requirements beyond a 150m radius from the NDB.
Cootamundra NDB	23NM West	There are no special requirements beyond a 150m radius from the NDB.
Wee Jasper VOR/NDB	26NM South	There are no special requirements beyond a 600m radius from the VOR and 150m from the NDB.

Table 3-5: Navigation Aids in the vicinity of the proposed wind farm

Accordingly, the proposed wind farm has no impact on navigational aids in the vicinity of the proposed wind farm.

3.11 CONTINGENCY PROCEDURES - ENGINE INOPERATIVE FLIGHT PATHS

In the context of the operations at Young and Cootamundra Aerodromes and the physical environment, the proposed Yass Valley Wind Farm development is considered as not having an impact on engine inoperative flight paths as it is located outside of the nominal IFR circling area for the highest category of aircraft likely to use the Aerodrome. Nor is it considered to have this type of impact at any other airfield in the vicinity of the wind farm.

Accordingly, the proposed wind farm has no impact on contingency procedures for engine inoperative flight paths.

3.12 NOTIFICATION OF TALL STRUCTURES

The proposed wind farm contains turbines which will exceed 110m AGL, therefore the developer is required to inform CASA of the development in accordance with Advisory Circular AC 139-08(0) "Reporting of Tall Structures" so that the details can be included on updated aeronautical charts, publications and navigation databases. Appendix C contains a copy of AC139-08(0) Reporting of Tall Structures.

The information to be provided to CASA and Defence by the developer includes:

- "As constructed" coordinates of each tower (in latitude and longitude);
- Final height in metres AHD of each tower; and
- The ground level of the site, in metres AHD for each tower.

3.13 CRANES

The Civil Aviation Authority (CASA), Airservices Australia, Department of Defence and the Local Aerodrome Operators will need to be informed of the use cranes in the construction of the wind farm to ensure any approvals or other requirements are met. It can be expected that the above aviation authorities will want full details well in advance of proposed works to ensure approvals and Notice to Airman (NOTAMS) follow due process.

3.14 CONCLUSION

From the data provided, the proposed Yass Valley Wind Farm does not infringe any:

- PANS OPS surfaces;
- OLS;
- Air Route protection surfaces;
- Clearance Planes for Navigation Aids. or
- The ATC radar clearance plane for the MT Majura radar.

However, there are a number of turbines in the proposed Yass Valley Wind Farm that infringe upon the ATC radar clearance plane for the MT Bobbara radar.

It is likely that further consideration of the affects of the infringement of the MT Bobbara radar clearance plane will be required by Airservices Australia prior to any decision being made to approve the construction of the Yass Valley Wind Farm. Consultations with AsA may lead to options for mitigation of the impacts.

4. OBSTACLE LIGHTING REVIEW

4.1 Comparative Summary of International Standards for Obstacle Lighting of Wind Farms

The relevant International Civil Aviation Organization (ICAO) recommendations regarding wind farms are detailed in Annex 14[7].

ICAO has recommended that a wind turbine shall be marked and/or lit if it is determined to be an obstacle. Section 4.3 of the Annex defines "*Objects outside the obstacle limitation surfaces",* and Section 4.3.2 in particular states inter-alia…

Annex 14 — Aerodromes

4.3.2 **Recommendation.**— *In areas beyond the limits of the obstacle limitation surfaces, at least those objects which extend to a height of 150 m or more above ground elevation should be regarded as obstacles, unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.*

Note.— This study may have regard to the nature of operations concerned and may distinguish between day and night operations.

Until recently wind turbines were treated as any other obstacle. However, ICAO has issued a new Section 6.4 to the Annex specifically dealing with marking and lighting of wind turbines, included in Appendix D.

Under ICAO's definition it is can be taken that the wind turbines at Yass Valley Wind Farm if constructed with 135m AGL wind turbines are not considered to be obstacles and under this definition and recommendation, would therefore, not be required to be lit. However 150m AGL turbines would be required to be lit, unless an aeronautical study determined that they do not constitute a hazard to aeroplanes. This contrasts with CASA's 110m threshold for obstacles, as will be discusses in Section 4.2.

As part of this assessment, a review has been undertaken of the standards and recommended practices in several countries and is included at Appendix E. The main issues that have emerged from this review of international practices are:

- There appears to be considerable variation between countries as to the determining criteria relating to the height and the spacing of wind turbines that are recommended to be lit;
- Some countries including New Zealand, UK and USA are taking into account the impact on visual amenity of obstacle lighting and require an assessment to be made of the wind farm in this regard *"by virtue of its nature and location"*. In essence, this has been interpreted to mean that if the wind farm is not within the vicinity of an aerodrome (i.e. more than approximately 30km from an airport) or air traffic routes, then the turbines should "not be routinely lit" but rather an

[7] Annex 14 - Aerodromes: contains ICAO's international standards and recommended practices for aerodromes

assessment made to assess the hazard based on its "nature and location" and to justify provision of obstacle lighting. Factors that are taken into account for such an assessment include the total height of the turbine, the wind farm location with regard to aerodromes and air routes, the volume and type of air traffic in the area, the surrounding terrain, the number of wind turbines in the wind farm and environmental restrictions; and

- Countries including Canada, Norway and USA have approved an alternative to continuous obstacle lighting of the wind farms. This alternative uses a radar-sensing obstacle lighting system that is activated by the presence of an aircraft in proximity of a wind farm during day or night operations of aircraft (www.ocasinc.com). This system results in the obstacle lighting being in a quiescent state until activated when it provides both a visual and aural warning to the pilot. As a consequence, the reduced periods of lighting results in an improved amenity for local residents.

4.2 Consideration of CASA's Current Views on Wind Farm Lighting

CASA is Australia's aviation safety regulator and is responsible for setting standards applicable to the protection of airspace and the safety of aircraft and airport operations. ICAO sets the international standards and recommended practices and Australia, as a member state, applies the international standards to Australian aviation except where a "difference" is formally lodged with ICAO.

For the Australian aviation environment, the general standards for obstacle marking and lighting are prescribed in CASA's Manual of Standards (MOS) Part 139 and apply in respect of obstacles or potential hazards, such as wind farms. In particular CASA may determine that an object or proposed object which intrudes into navigable airspace requires, or will be required to be provided with obstacle lighting[8].

In regard to those structures that are outside obstacle limitation surfaces of an aerodrome, and are more than 110m above ground level, CASA's Manual of Standards Part 139 - Aerodromes, states that in general an obstacle would require obstacle lighting unless, an aeronautical study assesses it as being shielded by another object or *that it is of no operational significance*[9].

The RAAF Aeronautical Information Services (AIS) is responsible for maintaining the database of tall structures of any obstacle that is above 30m within 30kms of a registered aerodrome, or above 45m everywhere else[10]

In December 2005, CASA produced a Draft Advisory Circular AC139-18(0) providing guidelines for "Obstacle Marking and Lighting of Wind Farms". After consideration of industry comment on the draft, the document was formally promulgated in July 2007[11].

This AC was withdrawn by CASA in September 2008 after CASA considered a number of complaints from stakeholders and identified a number of issues with the AC not the least being questionable legal grounds for the CASA AC.[12] At the time of withdrawal,

[8] MOS Part 139-Aerodromes, Section 9.4: Obstacle Lighting
[9] MOS Part 139-Aerodromes, Section 9.4.1.2: Requirements of Obstacle Lighting
[10] AC 139-08(0): Reporting of Tall Structures, April 2005.
[11] CASA AC 139-18(0) Obstacle Marking and Lighting of Wind Farms, July 2007.
[12] Hart Aviation: Wind Energy & Aviation Interests, Study for Sustainability Victoria, July 2009.

CASA issued a statement[13] on their web page which is reproduced in Appendix F.

CASA indicated that a review would be undertaken of safety issues associated with obstacles remote from an aerodrome. This review is still in progress and Ambidji has been unable to determine from CASA, a clear understanding of the status of this review. At some point a redrafted Advisory Circular or CASA regulation may be released to the industry for comment to be ratified either by CASA or the Department of Industry, Transport, Regional Development and Local Government (DITRDLG).

In addition to CASA advice, Ambidji has reviewed the National Aviation Policy White Paper that was released in December 2009 and has not found any recommendations that have a direct bearing on the analysis of the proposed Yass Valley Wind Farm.

Since issue of the CASA Briefing Newsletter, attached in Appendix C, there has been correspondence relevant to obstacle marking and lighting of wind farms between the wind farm industry, aviation consultants and CASA. The following summarises Ambidji's understanding of some of the applicable issues from this correspondence.

> The Civil Aviation Safety Authority's (CASA) statutory power to require obstacle marking and lighting on obstacles under Civil Aviation Safety Regulation Part 139 only applies within the vicinity of an aerodrome. CASA cannot mandate the lighting or marking of obstacles unless structures intrude into navigable airspace or are within the vicinity of an aerodrome. It is CASA's view that the decision for the lighting of obstacles outside the vicinity[14] of aerodromes is the responsibility of, the developer. Any associated requirements placed on developers by planning authorities, insurers or financiers are beyond CASA's scope.
>
> In 2007, CASA published Advisory Circular 139-18 (0) to provide guidance to wind farm developers on their hazardous potential for aviation and to provide guidance on means of marking or lighting them to mitigate such hazards. The advice contained within that circular gave the impression that CASA could require the lighting of obstacles not in or near the vicinity of an aerodrome.
>
> CASA's Industry Complaints Commissioner (ICC) considered industry complaints regarding AC 139-18 (0) which identified a number of issues with the circular. After considering the report of the ICC, the Chief Executive Officer (CEO) has directed that CASA withdraw Advisory Circular 139-18(0). The CEO also directed that CASA undertake an appropriate safety study into the risk to aviation posed by wind farms and develop a new set of guidelines. This process will include appropriate consultation with industry and stakeholders on wind farms and a risk management approach with respect to aviation[15].

Notwithstanding the withdrawal of the CASA AC; in response to specific queries as to lighting standards to apply to wind farms that are remote from an aerodrome, CASA has previously advised:

> "*Even though a CASA assessment is not required it is important to point out the wind farm developer may have a duty of care to local aviators, such as aerial*

[13] Source: CASA Briefing Newsletter, October 2008.
[14] For the purposes of this report, Ambidji defines, being in the vicinity of an aerodrome as within 15kms of any aerodrome with an OLS and/or PANS-OPS procedure.
[15] CASA's Industry Complaints Commissioner (ICC) Findings.

spraying and private flight operators, whose aeroplane landing area may be located in the vicinity of the wind farm, and who may want the wind turbines made conspicuous for night flying and during periods of low visibility.

If the wind farm developers wish to provide additional conspicuity this may be achieved by installing obstacle lighting which meets the standards set out in the CASA Manual of Standards (MOS) Part 139 Aerodromes, Chapter 9, Section 9.4 – Obstacle lighting."

and

"… *the Advisory Circular information (AC 139-18 (0)) is still valid as a recommendation if the proponent wishes to do so as a risk mitigator*…"

Based on the above, CASA's current position on obstacle lighting of wind farms that are remote from an aerodrome (as for the Yass Valley Wind Farm) is summarised as:

a. CASA cannot mandate obstacle lighting for wind farms that are "not within the vicinity" of an aerodrome;

b. Provision of such lighting is a decision for, and the responsibility of, the developer;

c. Any associated requirements placed on developers by planning authorities, insurers or financiers are beyond CASA's scope;

d. A wind farm developer may have a duty of care to the aviation industry and local operators in terms of ensuring obstacles are made conspicuous;

e. Obstacle marking and lighting requirements as specified in the CASA Manual of Standards Part 139, Section 9.4 applies for developers choosing to light a wind farm, and

f. The Advisory Circular information (AC 139-18) is still valid as a recommendation if the proponent wishes to do so as a risk mitigator.

4.3 Obstacle Lighting Arrangements at other Australian Wind Farms

Ambidji has reviewed the provision or non provision of obstacle lighting at 80 Australian wind farms, either existing or currently in the course of construction. A summary of this review is in Appendix G.

In general, existing obstacle lighting has been installed in accordance with the recommendations of the withdrawn AC139-18 (0) for wind farms with turbine heights in excess of 110m AGL. However, there are many instances of wind farms which do not have obstacle lighting installed where the height of the wind turbines exceeds the determining height of 110m AGL.

For example, Capital Wind Farm's submission to the State Government planning authority seeking approval for this wind farm indicated the following:

> "*CASA's submission did not find that the wind farm would be a hazard or an obstacle, nor is the wind farm located within the vicinity of an aerodrome, or in proximity to airspace used by aircraft at night. The wind farm is also located in hilly terrain, where numerous local features are taller than most of the turbines*" [16].

A similar finding by CASA appears to have been made in respect of the proposed wind farm at Gunning in NSW. This project, which is currently being constructed, will have 32 turbines with a maximum height of 120m AGL. The Environmental Impact Statement for this project indicated that:

> "*Based on the information supplied, CASA has assessed the potential for the proposed structures to represent hazardous objects due to location, height or lack of markings or lighting. CASA has advised that the structures do not represent obstacle or hazards and no restrictions or conditions have been applied to them. However, CASA has requested that details of the structures be provided prior to construction so that structures can be recorded on relevant databases and maps*"[17]

In addition to the wind farms mentioned above, Ambidji's research has also revealed the following as detailed in Table 4-1.

[16] Letter from Renewable Power Ventures to NSW Department of Planning, 26 May 2006.
[17] Gunning Wind Farm Environmental Impact Statement - Chapter 12, February 2004, Delta Electricity

Operating Wind Farms over 110m AGL, non-installation of aviation lighting or extinguished	Proposed Wind Farms over 110m AGL non-installation of aviation lighting
Alinta Wind Farm (WA) has 54 turbines at 118m AGL which are not lit.	The proponents of Lexton Wind Farm in Victoria have conducted assessments to determine whether their proposal will include obstacle lighting, and have yet to confirm if the turbines will be lit.
Hallett Wind Farm (SA) Stages1 and 2 have turbines at 124m AGL. Its aviation safety lights have been switched off.[18] Hallett Wind Farm (SA) Stages 3 and 4 have turbines at 124m AGL. The two stages are currently under construction and have no lighting planned.	The proponents of Dandaragan Wind Farm in WA are considering having assessment work undertaken to determine whether their proposal will include obstacle lighting.
Snowtown Wind Farm (SA) has 47 turbines at 124m AGL, its lights have or are about to be switched off.[19]	The proponents of the newly approved Macarthur Wind Farm in Victoria at this stage are not planning to fit the turbines with aviation lighting.
Clements Gap Wind Farm (SA) has 27 turbines at 123m AGL, are planned to be switched turned off.	The proponents of proposed Collaby Hill Wind Farm in SA are currently having assessment work conducted to determine if the wind farm will include aviation lighting.
Capital Hill Wind Farm (NSW) has 67 turbines at 125m AGL which are not lit.	The proponents of Allendale Wind Farm in Victoria are currently undertaking assessment work to determine whether their proposal will include obstacle lighting.
The proponents of Cullerin Range Wind Farm in NSW have extinguished the obstacle lighting.	The proponents of Mt Gellibrand Farm in Victoria are currently undertaking assessment work to determine whether their proposal will include obstacle lighting.
The proponents of Waubra Wind Farm in Victoria are planning to extinguish aviation lighting, once confirmation with DPCD and notification of CASA and Airservices Australia is complete.	The proponents of Coopers Gap Wind Farm in QLD are currently undertaking assessment work to determine whether their proposal will include obstacle lighting.

Table 4-1: Summary of wind farms in Australia relevant to Yass Valley Wind Farm

It should be noted that there have been instances in the past where wind farms with turbine heights less than 110m have been fitted with lighting. However, these wind farms were constructed during the 1990's and prior to the issue of the CASA Advisory Circular applicable to wind farms. Importantly it is understood that these wind farms are located in the immediate vicinity of airports - not remote as is the case of the proposed Yass Valley Wind Farm.

[18] Conversations with AGL in regards to Hallett Wind Farms confirmed that a risk assessment was commissioned to determine whether the lights could be extinguished without impacting on aviation safety. On the basis of an assessment concluding that the lights could be turned off, AGL sort a revision to the original planning permit with local council, to enable this action.
[19] Yorke Peninsula County Times, "Lights go out for turbines", 11th May 2010

It can be seen from the above, that many wind farm operators with developed or planned high structures greater than 110m (MOS 139 threshold) and remote from an aerodrome have determined that aviation lighting does not need to meet the withdrawn CASA Advisory Circular 139-18 and have acted accordingly.

Actions have included the switching off of lighting or seeking to switch off or reduce lighting, and the consideration of other alternatives as well as planning not to install lighting at the development proposal stage.

It is to be noted that the above examples of wind farms, (all not in the vicinity of an aerodrome) have wind turbines greater than the CASA 110m but, in the main, less than the ICAO recommended 150m obstacle height where ICAO deemed these to be obstacles that require consideration for lighting. However, the Yass Valley Wind Farm has an option for wind turbines that are 150m AGL which is the threshold of the ICAO recommendation.

Notwithstanding this, the ICAO recommendation on wind turbines of 150m or higher states that they should be regarded as obstacles unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.

The following Qualitative Risk Assessment represents such a special aeronautical study and will assess the degree of risk (hazard) posed by the Yass Valley Wind Farm and make recommendations regarding the requirement or otherwise for aviation obstacle lighting.

5. QUALITATIVE RISK ASSESSMENT

Ambidji undertook a Qualitative Risk Assessment based on stakeholder consultations, a site visit and its experience in undertaking aviation risk assessments.

A site visit was made with an Origin Energy project manager to both the Yass region and the proposed Yass Valley Wind Farm site environs to review local aviation activity and consider the topography and the proposed location of the turbines.

Face to face consultations were conducted with:

- President of the Canberra Aero Club;
- Proprietor of Yass Air (aerial applicator) at a private airstrip in Yass, and
- President of the Young Aero Club

Phone consultations and desk top research was conducted for all other stakeholders in the region and the outcomes of these consultations are contained in Appendix H.

Aerodromes and ALA's visited were;

- Canberra Airport
- Hall ALA
- Gundaroo ALA
- Yass Ag Strip
- Harden ALA
- Young Aerodrome
- Cootamundra Aerodrome

5.1 Impacts on the Operation of Aerodromes and Airstrips in the Region

The known aerodromes and identified private airstrips in the region surrounding the Yass Valley Wind Farm site are tabulated in Table 5-1 and depicted in Figure 5-1.

Aerodromes/Airfields/Airstrips	Approximate Distance to Wind Farm	Direction from Wind Farm
McIntosh Airstrip (Yass Air)	3kms	South-East
Jugiong	19kms	West
Harden	22kms	North-West
Murrumbateman	27kms	East
Boorowa	35kms	North
Gundaroo	42kms	East
Cootamundra	42kms	West

Cleveden	46kms	South-West
Tumut	48kms	South
Young	53kms	North West
Canberra	70kms	South
Crookwell Airstrip	75kms	North East
Goulburn	90kms	West
Cowra	100kms	South

Table 5-1: Approximate Distances of Airfields in the Region from Yass Valley Wind Farm

There are no registered or certified aerodromes in the immediate vicinity of the wind farm. The nearest major aerodromes and airfields, as listed in Table 5-1, are shown in Figure 5-1 and 5-2.

Figure 5-1: Yass Valley Wind Farm in relation to major Aerodromes in the Region

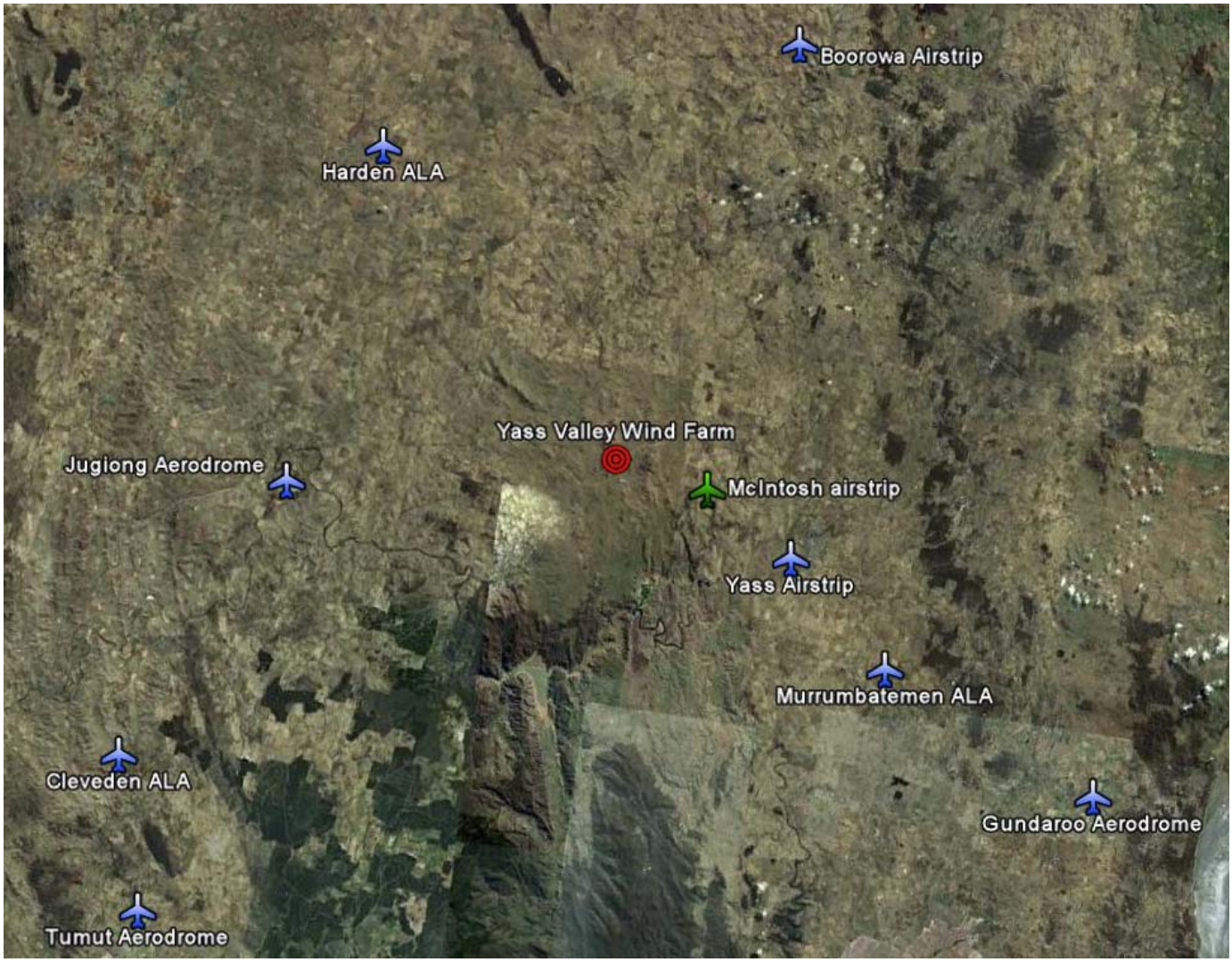


Figure 5-2: Yass Valley Wind Farm in relation to Airfields and Private Airstrips in the Region

The nature of aviation flying activity at the aerodromes and airstrips depicted in Figure 5-1 and Figure 5-2 is summarised in Table 5-2.

Aerodromes/Airfields/Airstrips	Nature of Aviation Flying Activity
McIntosh Airstrip (Yass Air)	Private Airstrip owner is proprietor of Yass Air. Conducts agricultural aerial work.
Jugiong Airstrip	Paddock strip alongside Murrumbidgee River, utilised as agricultural airstrip, some flight training students from Brindabella conduct touch and go's and forced landings here.
Harden Airstrip	Recreational GA strip in the middle of Harden Racecourse. Location of the Harden Gliding club.
Murrumbateman Airstrip	Up to three (3) different strips were mentioned during consultations. The view was that they were unmarked and basically paddocks. Ambidji was unable to locate any on its visit to region.
Boorowa Airstrip	Advice from Boorowa Council is that there is no defined airstrip, but a number of paddocks on private properties are used for light aircraft or ultra light activity.
Gundaroo Airstrip	Privately owned (Dick Smith) and sealed and lit. Named "Bowylie Homestead", pilots must request permission before landing.
Cootamundra Aerodrome	Certified Aerodrome, home to Aircraft Maintenance Services, Aerial Agricultural services, Aero club, charter work. No flight training schools operate here, closest is Temora and Wagga. Ultra lights from Tumut use the aerodrome.
Cleveden Airstrip	Private airstrip (listed in ERSA) fences at both ends. Paddocks grazed by cattle when not in use. Utilised by itinerants 3-6 per week.
Tumut Aerodrome	Tumut Ultra Light Club has 60 – 70 members all ultra lights, conduct only day VFR. Fly around local area, Cootamundra, Gundagai, Temora. They conduct some ultra light training in local area, flying cross country to Temora or Cootamundra.
Young Aerodrome	Mainly private general aviation is conducted at Young. There is an aero club with some training work. The aerodrome is used by RDFS, aerial spraying firms and the occasional fly-ins. A bank aircraft flies in and out every day.
Canberra Airport	Less General Aviation is being conducted in Canberra compared to a few years ago. Brindabella undertake only a limited amount of flight training now. The aero club continues to operate but has clubrooms off airport. Airline services, military movements, charter work, aircraft maintenance and freight, is conducted out of Canberra.
Goulburn Aerodrome	Two flights schools operate from the Aerodrome, one is currently not operational but in the process of an Air Operators Certificate Application.

Crookwell Airstrip	Council owned strip.
Cowra Aerodrome	Flying training, recreational flying, aerial application base, aircraft assembly and manufacture, charter work and RAA movements.

Table 5-2: Nature of Flying Activity at Aerodromes and Airfields in the Yass Region

The airstrip located in Ted McIntosh's property is some 3km from the wind farm boundary. Agricultural aircraft are based on the paddock used for landing and takeoffs All other identified airfields or airstrips in the region are further from the wind farm boundary. It was suggested during consultations that there may be a private airstrip and a number of agricultural airstrips within the wind farm area, but these were not able to be identified and confirmed during the site visit.

Nonetheless, pilots operating at such private airstrips are responsible for ensuring that they are aware of the conditions on and surrounding unpublished landing sites.

Discussions with stakeholders have not identified any other airstrips in the immediate vicinity of the wind farm used by general aviation, ultra light aircraft, rotor craft, and paragliding or hang gliding operations.

In summary, the location of the wind farm and any of its individual turbines will not impact on the approach, circuit work or take-off of aircraft from any of the identified aerodromes, airfields or airstrips in the region.

5.2 Impacts on Agricultural Flying (aerial applications) in regard to airstrips used or the safety of actual operations

As discussed in section 5.1, the McIntosh airstrip is located close to the boundary of the wind farm for the specific use of agricultural aircraft undertaking aerial application work. Advice from consultations with the operator was that the wind farm would present no operational issues for the agricultural operation.

What was advised as a significant hazard to agricultural flying was the wind farm meteorological monitoring masts and in particular the guy wires supporting the mast. It was viewed that they required to be more conspicuous.

From consultations it has been suggested that there may be various agricultural paddock airstrips within the wind farm site but these could not be confirmed during the site visit.

Appendix H lists consultations undertaken with agricultural flying operators.

There are aerial applications carried out in the general area of the proposed wind farm and it includes spraying and dusting.

In particular South West Helicopters conducts pest and weed control in the Yass area around spring time. Col and Scott Adams the proprietors of an aerial agricultural spraying business conduct spraying and fertilising during summer and winter. They utilise various airstrips closer to Cootamundra, Jugiong and Sandy Tates. The view of this operator was that it would affect business in the area as they would not spray or

dust close to wind farms This particular view is not in accord with most other agricultural operators views received in regard to other wind farm projects, nor the position of the Agricultural Aviation Association of Australia.

Agricultural pilots are required to survey and plan each operation to take into account terrain and obstacles – including wind turbines. Given this planning requirement and the knowledge of obstacles, including turbine locations and heights, their operations can be undertaken in relative safety. Pilots undertaking low level flight operations require special endorsement and are able to fly close to obstacles in their operations.

The same advice has been provided by other agricultural flying operators in South Australia and Victoria, and by the Agricultural Aviation Association of Australia (AAAA), the peak body for this part of the aviation industry.

In summary, the location of the wind farm and its individual turbines will not impact on the safety of aerial applications provided pilots conduct proper pre planning of operations.

However, the wind farm meteorological monitoring masts and in particular the guy wires supporting the mast should have aviation marking to be more conspicuous.

5.3 Impacts on General Aviation Training (Day Visual Flight Rules)

Visual Flight Rules (VFR) are rules governing flight during periods of generally good visibility and limited cloud cover. Aircraft flying under VFR are not required to be in contact with air traffic controllers and are responsible for their own separation from other aircraft and obstacles.

The closest airports where general aviation training is undertaken are at Canberra, Young, Cootamundra, Goulburn and Cowra. Ultra light training occurs at Tumut Aerodrome. There is a formal general aviation training area and low flying area designated south of Yass, in the vicinity of Murrumbateman, which is referred to as the Barton Training area. This area is to the south of the Yass Valley Wind Farm and will not impact on its operation.

Consultations also revealed that some of the cross country training (navex) routes did have legs that were near the proposed wind farm site, using the Hume Hwy as a navigational reference.

Importantly, consultations with flying training organisations confirmed that the wind farm area is not used for practising low level training procedures such as precautionary search and practice landings from simulated engine failure.

Consultations did not identify any helicopter training in the area.

Any impacts on night VFR training are discussed in Section 5.5.

In summary, the location of the wind farm and any of its individual turbines does not impact on the safety of General Aviation Fixed Wing Training nor helicopter training in the area.

5.4 Impacts on General Recreational or Commercial Aircraft Activity

Recreational general aviation fixed wing flying normally covers private pleasure and local sightseeing or cross country flying and the activity is generally under VFR.

Commercial general aviation fixed wing flying is mostly charter operations originating from airports in the region or otherwise transiting the region. The majority of charter operations would be undertaken using Instrument Flight Rules[20] (IFR) where lowest safe altitudes apply. However some pilots file IFR and then downgrade to VFR.

VFR operations must be flown in accordance with Civil Aviation Regulations (CAR) 157 which states (in part) that an aircraft must not fly lower than 152m (500ft) over a non-populated area (being terrain or obstacles on that terrain and not within 600m horizontally to the same) unless it is engaged in approved low private flying or aerial work.

Mindful of this requirement, a pilot undertaking a VFR recreational flight should only flight plan to transit the area where the wind farm is located if these vertical and horizontal distances can be maintained. Otherwise the pilot should avoid flying over this area

With the exception of authorised low flying operations (discussed in Section 5.2), all aircraft operating by day in the area (either by VFR or IFR) are required to operate at a height that exceeds the maximum height of the wind turbines at the Yass Valley Wind Farm:

- For VFR operations, the maximum turbine tip height above the ground is 121m and pilots are required to be at a minimum of 152m above terrain or obstacles - 152m or 500ft above any turbine tip; and
- For IFR operations, a minimum (LSALT) clearance of 1000ft (305m) above the turbine tip height is required highest terrain or obstacles in the sector is required. It will be calculated on the highest object or terrain over a prescribed envelope covering the whole aircraft route.

Consultations were undertaken with the aero clubs, flight training schools and other commercial operators to gain an appreciation of the profile of flying in the area. The results of these consultations are reflected in the following comments on local activity.

The nature of VFR recreational over-flight activity in the vicinity of the wind farm is summarised as:

- General aviation VFR trips from Young (and aerodromes to its north and east) to Canberra normally track to the north east of the proposed wind farm area directly to the VFR reporting points to the east of the Yass township and at Gunning. VFR trips to Sydney or Melbourne would normally track to the north east and north west of the wind farm, respectively;

[20] Instrument flight rules (IFR) are regulations and procedures for flying aircraft by referring only to the aircraft instrument panel for navigation. Even if nothing can be seen outside the cockpit windows, an IFR-rated pilot can fly while looking only at the instrument panel. .IFR-rated pilots are authorised to fly through clouds. Air Traffic Control procedures and airspace rules are designed to maintain separation from other aircraft.

- General aviation VFR trips from Cootamundra (or further to the north west) to Canberra would track to the south west of the proposed wind farm site to the VFR entry point at Lake Burrinjuck.
- VFR flights from the west from Melbourne may choose to fly north of the ranges through the Yass and Goulburn area to Sydney (and vice versa).
    - On days with low to mid level full cloud cover, where the aircraft must maintain visual navigation between 500 feet above terrain or obstructions and the cloud base, it has been suggested that it is likely that the pilot may elect to track along a corridor that follows the Hume freeway through the area of the wind farm. This approximate corridor is shown by the red dashed line in Figure 5-3.;
    - However, under these conditions, pilots would avoid the Coppabella and Marilba Hills irrespective of whether there are turbines present. This issue of adverse weather is discussed further in Section 5.10.

Figure 5-3 Typical Day VFR tracks [Tracks TBA]

Commercial operations predominantly file IFR and will operate at or above the specified or calculated lowest safe altitude for the planned route. IFR operations fly point to point and do track by VFR entry points.

No safety issues were identified through consultation with the local industry and stakeholders (Appendix H).

In summary, the location of the wind farm and its individual turbines will not impact on day recreational or commercial flying activity either within or transiting the area.

5.5 Light Aircraft Night Flying (IFR & VFR)

Both IFR and VFR aircraft flying at night are protected from obstacles and terrain by published or calculated Lowest Safe Altitudes (LSALT) and descent below them is restricted to within approximately 10km of the airport environs. The closest aerodromes that have aerodrome lighting facilities that allow night operations are Young, Canberra, Goulburn, Cootamundra, Cowra and Bathurst.

Night operations are undertaken by both single and multi-engine aircraft operating under Night Visual Meteorological Conditions (VMC) or IFR rules. For these operations, a minimum clearance[21] of 1000ft (305m) above the turbine tip height is required. If there is higher terrain in the area, the calculated lowest safe altitudes for night VMC or IFR operations is likely to be higher providing for a greater clearance.

In the event of an engine failure, multi (usually twin) engine aircraft have a single engine performance to be able to maintain operations at or above the lowest safe altitude above the wind farm site. Simultaneous multiple engine failures are extremely rare and therefore there is little likelihood of a twin engine aircraft being unable to maintain LSALT.

Some night VMC as well as night IFR flights are undertaken in single engine aircraft. However, the frequency or occurrence of engine failures in single engine aircraft in Australia is very small. Given this small occurrence Australia wide, the probability that such an engine failure might occur over or near the Yass Valley Wind Farm at night is extremely low. Consultations with flight training operators and aero clubs in the area disclosed that there is a very limited amount of night VMC in the vicinity of the propose wind farm site.

Irrespective of frequency, pilots in their flight pre-planning need to consider the nature of the terrain and natural or manmade obstacles in determining the most appropriate flight tracks at night. Pilots have the prerogative to choose flight tracks that limit their exposure to high terrain, forests and obstacles, as a risk mitigator in the very unlikely event of an engine failure. In addition, it is prudent for many pilots to plan well above LSALT at night, where cloud base permits, to aid navigation and provide increased gliding distance to achieve an improved landing area (such as roads and lake beds) in the very unlikely event of an engine failure.

In regard to sport aviation, comment received from Recreational Aviation Australia (RA Aus, the peak body representing owners and operators of home-built, ultra-light, non-CASA registered aircraft) revealed that their aircraft are not permitted to operate at night so lighting of the Yass Valley Wind Farm is not an issue for its membership.

In summary the wind farm will not have any impact on the normal operations of Night VMC and IFR aircraft overflying at night. The probability of an event where either a single or twin aircraft has an engine failure at night over or near the wind farm is extremely low.

[21] This is a minimum as the LSALT is calculated on the highest man-made or natural obstacles within the area or an envelope around a particular planned track. The Yass Valley turbines are not the highest obstacles in the region.

5.6 Any known VFR Highly Trafficked Routes

As is typical of consideration of sites that are remote from aerodromes with Air Traffic Control, there are no statistics recorded that provide information on the frequency of VFR traffic through the wind farm area.

As was noted earlier, there are two VFR entry points for Canberra Airport that are to the east and south west of the proposed wind farm site. There is also a propensity for VFR traffic travelling east west from the Sydney region toward Albury (in the Melbourne direction) to potentially fly a corridor in the vicinity of the wind farm that utilises Yass and the Hume Freeway for navigation.

The level of fixed base VFR traffic has declined at Canberra in recent years and consultations with operators in the region confirm that rural recreational pilots feel discouraged from visiting the airport.

Therefore whilst there are some tracks in the vicinity of the wind farm that are likely to be used by itinerant VFR aircraft, none of these are known to be highly trafficked.

5.7 Impacts on Emergency Services (Ambulance) Aerial Operations

The nearest airports used for Emergency Services by the RFDS are at Young, Cootamundra, Harden and Gundaroo Airports. The RFDS operations will not be impacted by the Wind Farm.

The NSW Ambulance services contract operators for air ambulance services, CHC helicopters and Snowy Hydro Southcare Helicopter conduct operations around the Yass region, SE NSW and the ACT.

The Police Air Wing in Canberra has fixed wing aircraft that also provide emergency services support from Canberra. There are two situations in which a helicopter could be in the vicinity of any wind farm. One would be if attendance at a vehicle accident on a road nearby was required and the other would be transiting the area.

[How often? Ambidji has been attempting to get more information over some months to fully describe these operations]

Knowledge of the proposed location and heights of the turbines would definitely be needed in the case of landing and taking off from a roadside accident in poor weather conditions as it also would be for transiting the area at low level in both good and poor weather conditions.

Operations such as search and rescue and emergency services may require to undertake low level operations but these tend to be a very occasional activity in the vicinity of wind farms. These pilots require specific endorsement for these operations and are normally very experienced operators.

In summary, the location of the wind farm and any of its individual turbines will not impact on the operation of emergency services fixed wing or helicopters provided the wind farm is marked in AIP publications.

5.8 Impacts on Aerial Fire Fighting Services - Aerial Operations

The NSW Rural Fire Service (RFS) contract all 100 fixed wing and helicopter aircraft, for fire observation and fire fighting duties across the state of NSW. These arrangements can either be fixed contracts or arranged so aircraft can be utilised on a 'when required' basis. All those operators that are contracted must meet a set of criteria set by NSW RFS including the pilots that operate the aircraft.

These operations occur at low levels and often in significantly reduced visibility through smoke. The pilots require knowledge of the location and height of manmade obstacles such as wind turbines.

Discussions with South West Helicopters whom are contracted by NSW RFS to conduct firebombing (bucketing and reconnaissance (infrared) flights) revealed that when planning for aerial fire fighting operations they take into account the location and height of obstacles and aircraft are required to maintain safe distances from these obstacles, particular during periods of reduced visibility (i.e. smoke). It was noted that as long as the obstacles are marked on appropriate maps the turbines do not pose any issues for South West Helicopters or their ability to undertake fire observation or fire fighting duties.

The Yass Valley area is predominantly made up of light to medium timbered farming land and according to NSW Rural Fire Department the region had high instances of fire in the early 2000's, but less over the last few years.

In summary, the location of the wind farm and any of its individual turbines will not impact on the operation of aerial fire fighting services provided the wind farm is marked in the AIP publications.

5.9 Published Tracks

The nearest published tracks or flight paths to the proposed Yass Valley wind farm can be seen in Figure 5-4.

There are several Air Routes that exist with protection areas above the proposed Yass Valley Wind Farm. The lowest protection area associated with any of these Air Routes is at 3600ft. The highest possible WTG within the proposed wind farm is 3185ft AMSL, well below this protection surface.

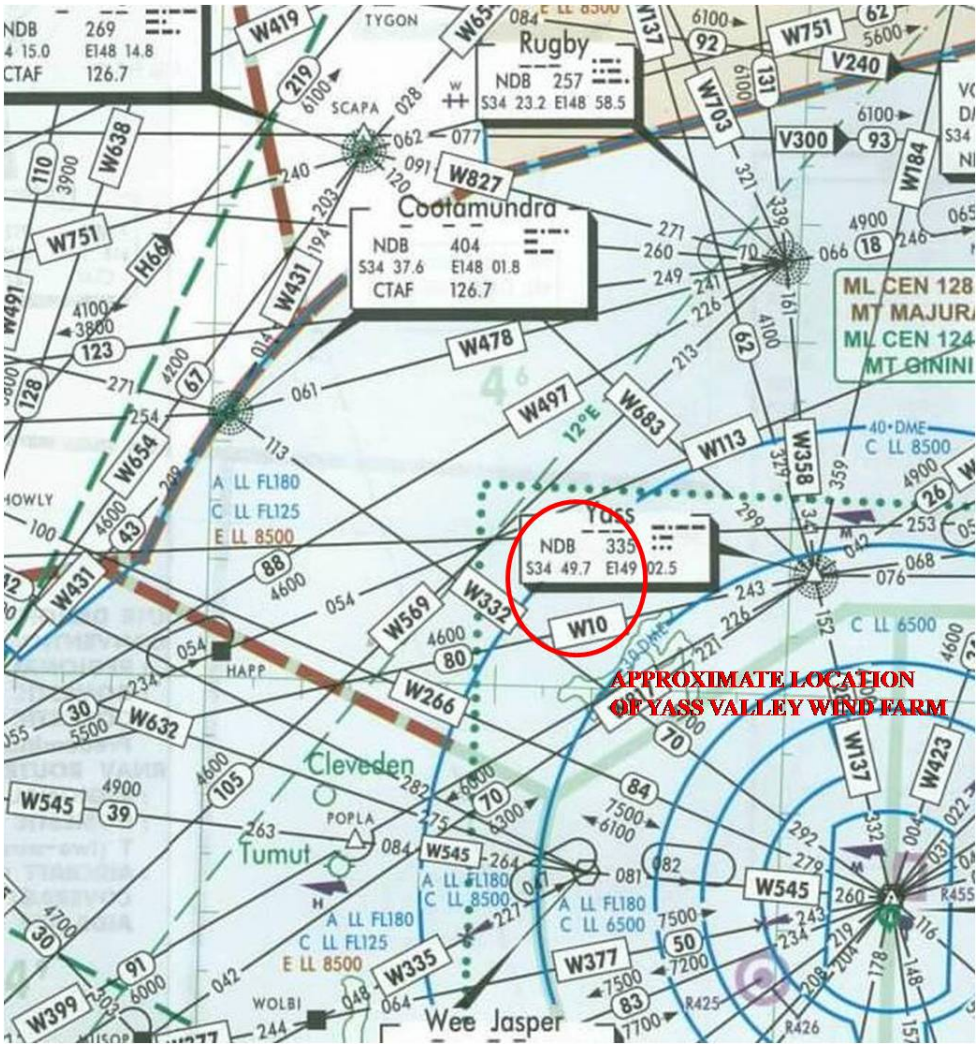


Figure 5-4: Published Air Routes for the Region

In conclusion, the published route's minimum altitudes are well above the height the proposed site of turbines and do not present any safety issues.

5.10 Topographical, Weather and Visibility Issues

Aircraft operating under Instrument Flight Rules (IFR) can operate in poor weather conditions and in cloud, which precludes visual acquisition of obstacles and terrain. These operations are protected from obstacles and terrain by PANS OPS surfaces and LSALT's that are designed to keep the aircraft well above obstacles and terrain.

Otherwise CAR 157 states (in part) that an aircraft operating under VFR must not fly lower than 152m (500ft) over a non-populated area (being terrain or obstacles on that terrain and within 600m horizontally to same) unless:

- Due stress of weather or any other avoidable cause it is essential that a lower height be maintained, or

- It is engaged in approved low flying private or aerial work, or
- It is undertaking a baulked approach, or
- It is flying in the course of actually taking-off or landing at an aerodrome.

In this regard, the Aeronautical Information Publication (AIP) states that a pilot of a fixed wing aircraft operating under VFR (by day in Class G airspace[22]) must have 5km forward visibility and remain clear of clouds and in sight of ground or water. Helicopters are approved in the regulations to operate with only 800m visibility if operating at a reduced speed.

In regard to the first bullet point above, it is possible that due to lowering cloud base and if, through poor airmanship the aircraft had pressed on to the point that it was unable to execute a turn and fly away from the weather, that an aircraft could find itself lower than 152m (500ft) above the ground.

Given the topography of the area it is likely that a pilot in this situation would follow the Hume Freeway to avoid the highest terrain and maintain navigation. Given this choice, that it is only a moderately trafficked route, the conspicuous colour of the turbines and the knowledge (from the AIP) of the presence of the wind farm the probability of the wind farm being hazardous is considered to be low.

In addition, a previous analysis[23] of two sets of Australian Transport Safety Bureau (ATSB) data regarding Controlled Flight Into Terrain (CFIT) and Wire Strikes indicated the probability of a VFR aircraft conducting a point to point flight, encountering weather conditions which would cause the aircraft to be flown below prescribed altitudes and then coming into close proximity of and/or colliding with a wind turbine generator is considered to be very low.

Notwithstanding this, it has been argued in some aviation circles that the presence of lit turbines may be a safety benefit to sight the turbines in reduced light conditions and visibility under a low cloud base. However, advice provided from operational staff of wind farms with obstacle lighting was that it is extremely uncertain whether the lights would be activated in low light conditions associated with cloud cover. What has been observed to happen in practice is that, on low cloud days, the lights are activated a little earlier than dusk.

Irrespective, even if the lights were illuminated the closest lights to an aircraft approaching the wind farm at low level due to the lowering cloud base may actually be in cloud and not be visible. This is because not all wind turbines are lit and the placement of turbines in wind farms tends to be on ridges and other high ground that could be in the cloud.

In summary, the likelihood of aircraft being below 500ft AGL due stress of weather over the wind farm site is considered low to medium. CASA views that the conspicuity of white turbines is acceptable in daylight and low visibility conditions. In addition the number and location of lit turbines (if activated and

[22] Class G: IFR and VFR flights are permitted and do not require an airways clearance. IFR flights must communicate with air traffic control and receive traffic information on other IFR flights and a flight information service. VFR flights receive a flight information service if requested.

[23] Semi Quantitative Risk Analysis, Review of Obstacle Lighting at Cullerin Wind Farm; Ambidji, 30 June 2010.

not obscured by cloud or terrain) is not a proven safety benefit to a pilot in this situation.

5.11 Impacts on ADF Operations

Military low level operations are rigidly controlled and undertaken by specially trained pilots, and military aircraft are fitted with terrain following radar or pilots use night vision goggles to undertake these low flying activities. In accordance with relevant CASA and Defence requirements, the proponent is required to notify the aviation authorities of the existence of the wind farms as a "Tall Structure"[24] and the location of the wind farms will be included on relevant civil and defence aeronautical charts and publications which Yass Valley is currently not marked on.

As discussed in Section 3.3, consultation with the Department of Defence has confirmed that the area around Yass Valley is not a regular training area for military operations.

There are no safety issues with the Yass Valley Wind Farm turbines from military low flying operations.

5.12 Impact from Meteorological Masts

It has been noted from the site visit to the Yass region and through telephone consultations with various low flying operators that the meteorological monitoring masts that are erected as part of wind farm projects are of real concern to pilots operating at low level. Further, it has been noted by these operators that these masts are often erected without notice and do not have any aviation obstacle markings.

Australian Standard AS3891.1 and AS3891.2 - 2008

These standards relate to Air Navigation - Cables and their supporting structures - Marking and safety requirements. Part 1 refers to permanent marking of cables for other than planned low-level flying and Part 2 refers to the marking of cables for planned low-level flying operations.

Examination of these standards, inter-alia, revealed that they were more pertinent to overhead power cables and their supporting towers. Whilst providing general guidelines with regard to the marking of obstacles, it could not be determined if they are applicable in the case of meteorological masts and their supporting structures. In general there is NO requirement for marking of cables with a height above terrain or obstacles of less than 90 m.

Discussion with the Agricultural Aviation Association of Australia (AAAA) has revealed that their preference is for mast guy wires to be marked with reflective swinging flap markers.

Power Engineers is an Australian company which manufactures flap markers for use in the power industry which are approved to AS 3891.2 standards (http://www.poweng.com.au/default.htm).

[24] CASA AC 139-08(0) Reporting of Tall Structures.

The meteorological monitoring masts will be an acceptable risk provided they have obstacle marking and their location and height is notified to all aviation operators and stakeholders in the region.

5.13 Qualitative Risk Assessment Summary

Based on the above discussion, the assessed level of risk is summarised in Table 5-3 below.

Risk Element	Assessed Level of Risk	Comment
Local aerodrome operations	Low	No aerodromes are in the vicinity of the proposed wind farm. There is no impact on aircraft operations into these aerodromes.
Private airstrip operations	Low	No impact on identified private airstrips or agricultural airstrips.
Agricultural Operations	Low/Medium	Operations are not unsafe provided pre-planning is undertaken and pilot is an experienced operator. Meteorological monitoring masts not unsafe if marked and operators notified of their erection with location and heights.
GA Pilot Training	Low	No safety issue for GA pilot training.
Recreational Flying	Low	No safety issue for recreational local or cross country flying.
Known Highly Trafficked Routes	Low	Not highly trafficked routes in the vicinity of the wind farm.
Air Ambulance Operations	Low/Medium	Not an unsafe situation but operators need wind farm marked in operational documents
Fire Fighting Operations	Low/Medium	Not an unsafe situation but operators need wind farm marked in operational documents
ADF Military Operations	Low	No low flying operations in the area.
Published Tracks	Low	The lowest safe altitude of the published tracks are well above the highest wind turbine

Night Flying	Low	All night flying (Visual Flight Rules or Instrument Flight Rules) is required to remain at or above the calculated or published lowest safe altitudes. These are at least 1000ft above either the highest wind turbine or highest terrain in the area. The probability of an engine failure causing an aircraft to descent below LSALT over the wind farm area is very low.
Weather & Visibility Issues	Low	Probability of impact with turbine by aircraft in the infrequent event of being below 500ft AGL due stress of weather or visibility has been determined as low

Table 5-3: Qualitative Risk Assessment Summary

From Table 5-3 it can be seen that the risk from the qualitative assessment has been determined as low to low/medium.

The **low/medium risk** applies to approved low flying operations for aerial applications, emergency service activity and fire fighting activity. These operations are not unsafe provided pre-planning is undertaken in respect of aerial applications and the pilots are experienced operators and the location of the wind farm is depicted in the Aeronautical Publications in respect of all three low level operations.

All other aviation operations have been assessed as **low risk**.

The Qualitative Risk Assessment has determined that there is minimal probability of an aircraft impacting with a turbine day or night or in poor weather as:

- The location of the wind farm and any of its individual turbines will not impact on the approach, circuit work or take-off of aircraft from any of the identified aerodromes, airfields or airstrips in the region;
- The location of the wind farm and its individual turbines will not impact on the safety of aerial applications by day and these applications do not occur at night in this area;
- The location of the wind farm and any of its individual turbines does not impact on the safety of General Aviation Fixed Wing Training nor helicopter training in the area;
- The location of the wind farm and its individual turbines does not impact on day recreational or commercial flying activity either within or transiting the area;
- The wind farm will not have any impact on the normal operations of Night VMC and IFR aircraft overflying at night. The probability of an event where either a single or twin aircraft has an engine failure at night over or near the wind farm is extremely low;
- The location of the wind farm and any of its individual turbines will not impact on the operation of emergency services helicopters provided the wind farm is marked in AIP publications;

- The location of the wind farm and any of its individual turbines will not impact on the operation of aerial fire fighting services provided the wind farm is marked in the AIP publications;
- The published air route's minimum altitudes are well above the height of the turbines; and
- The frequency of aircraft below 500ft AGL due stress of weather is considered low, that CASA views that the conspicuity of white turbines is acceptable in daylight and low visibility conditions and an analysis of data in regard to controlled flight into terrain shows the probability of impacting a turbine in poor weather as low.

It is concluded that the level of assessed risk does not support the requirement for installing obstacle lighting at the proposed Yass Valley Wind Farm. The level of risk will not be of operational significance to aircraft activity.

6. CONCLUSIONS

6.1 Aeronautical Impact Assessment

From the data provided, the proposed Yass Valley Wind Farm does not infringe any:

- PANS OPS surfaces of aerodromes;
- OLS for aerodromes;
- Air Route protection surfaces;
- Clearance Planes for Navigation Aids. or
- The ATC radar clearance plane for the MT Majura radar.

The proposed wind farm also does not have an impact on engine inoperative flight paths from aerodromes in the region.

However, there are a number of turbines in the proposed Yass Valley Wind Farm that infringe upon the ATC radar clearance plane for the MT Bobbara radar.

It is likely that further consideration of the affects of the infringement of the MT Bobbara radar clearance plane will be required by Airservices Australia prior to any decision being made to approve the construction of the Yass Valley Wind Farm.

Consultations with AsA may lead to options for mitigation of the impacts.

6.2 Obstacle Lighting Review

In regard to those structures that are outside obstacle limitation surfaces of an aerodrome, and are more than 110m above ground level, CASA's Manual of Standards Part 139 - Aerodromes, states that in general an obstacle would require obstacle lighting unless, an aeronautical study assesses it as being shielded by another object or that *it is of no operational significance*.

The proposed Yass Valley Wind Farm proposes wind turbines greater than the CASA 110m and up to the ICAO recommended 150m obstacle height threshold where ICAO deems these to be obstacles that require consideration for lighting. However, the ICAO recommendation on wind turbines of 150m or higher states that they should be regarded as obstacles unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.

The Qualitative Risk Assessment in this report represents such a special aeronautical study as allowed by CASA and ICAO. It assessed the degree of risk (hazard) posed by the Yass Valley Wind Farm and made recommendations regarding the requirement or otherwise for aviation obstacle lighting.

6.3 Qualitative Risk Assessment

The Qualitative Risk Assessment has determined that there is minimal probability of an aircraft impacting with a turbine day or night or in poor weather is very low.

The risk from the qualitative assessment has been determined as low to low/medium.

The **low/medium risk** applies to approved low flying operations for aerial applications, emergency service activity and fire fighting activity. These operations are not unsafe provided pre-planning is undertaken in respect of aerial applications and the pilots are experienced operators and the location of the wind farm is depicted in the Aeronautical Publications in respect of all three low level operations.

All other aviation operations have been assessed as **low risk**.

It is concluded that the level of assessed risk does not support the requirement for installing obstacle lighting at the proposed Yass Valley Wind Farm.

6.4 Duty of Care Disclaimer

The obstacle lighting review has determined that there are no regulatory requirements which would impact upon the decision to not install aviation lighting for the proposed Yass Valley Wind Farm. In addition, the Qualitative Risk Assessment has determined the assessed level of risk to aviation operations associated with the presence of the wind farm in general or the farm not being lit as low to low/medium.

Notwithstanding this outcome, as a function of corporate responsibility and duty of care, it is appropriate to formally advise all relevant stakeholders of the location and heights of the turbines and meteorological monitoring masts and when they would be constructed or decommissioned.

Acciona Energy's attention is also drawn to the following determination of the New South Wales Court of Appeal, in the case of Sheather vs Country Energy, where inter-alia the court determined the following[25].

> "Mr Sheather, the owner of the helicopter which crashed into a Country Energy owned spur line while flying well below the mandatory height regulations for aircraft, appealed an earlier decision on the grounds that Country Energy had failed to provide sufficient warning of the spur line. Despite Country Energy observing all legal compliance requirements, the NSW Court of Appeal held that Country Energy owed a duty of care to pilots and aircraft owners and had breached its duty of care".

Due cognisance of this decision should be taken by Origin Energy and its legal and insurance advisors in considering this Qualitative Risk Report.

[25] Sheather v Country Energy [2007] NSWCA 179

7. RECOMMENDATIONS

On the basis of a review of international and national aviation documentation, CASA's current position for marking and lighting of obstacles for wind farms, a review of the approach to lighting at other Australian wind farm developments, an OLS and PANS OPS aeronautical impact review and a qualitative risk assessment, Ambidji's makes the following recommendations:

- That aviation obstacle lighting for the proposed Yass Valley Wind Farm site is not required;
- That Origin engages with Airservices Australia to pursue mitigation and approval of the Mount Bobbara radar clearance plane penetrations;
- That Origin engages with its legal, insurance and other relevant advisors in regard to its own corporate assessment of risk and duty of care responsibilities in regard to the requirement for aviation obstacle lighting;
- That Origin make contact with the relevant aviation stakeholders as listed in Appendix H, prior to the construction of turbines and notifies operators in the region of the location and height of the existing and any planned meteorological monitoring masts in the area; and
- That any meteorological monitoring masts in the Yass Valley Wind Farm area be fitted with swing flap reflector markers. Discussion with a power industry reflective flag manufacturing company (Power Engineers) suggested the mast guy stays be marked as follows:
    - Fitting 3 x 30cm flags per guy stay;
    - In alternating colours yellow, white and orange; to each mast guy ;
    - Spaced equidistant along each guy wire; and
    - In addition to using the snap clamp supplied with each marker a proprietary brand construction adhesive such as Sika Flex (http://www.sika.com.au/) be used in conjunction with the clamp.

APPENDIX A

Yass Valley Wind Location & Elevation Information

THE AMBIDJI GROUP

APPENDIX A

Yass Valley Wind Farm Location and Height - Coppabella Precinct

Turbine Designation	GDA 1994 MGA Zone 55		GDA 1994		Height a.s.l (m, to base)
	Easting (m)	Northing (m)	Longitude	Latitude	
COP_01	641142	6156570	-34.723205	148.541494	672.755371
COP_02	641329	6156231	-34.726235	148.543593	660.764038
COP_03	641681	6155980	-34.728449	148.547478	688.171875
COP_04	641967	6155723	-34.730726	148.550644	733.030883
COP_05	642100	6155402	-34.733602	148.552151	800.291259
COP_06	642362	6155082	-34.73645	148.555065	820.632141
COP_07	642671	6154793	-34.739012	148.558489	782.161499
COP_08	642980	6154510	-34.74152	148.561911	761.160156
COP_09	643736	6154321	-34.743117	148.570199	713.598449
COP_10	644121	6154082	-34.745217	148.574444	697.174438
COP_11	644497	6153842	-34.747328	148.578592	712.169982
COP_12	644712	6153514	-34.750254	148.580996	712.2052
COP_13	645051	6153228	-34.752784	148.584748	649.467529
COP_14	645590	6153096	-34.753897	148.590657	636.390014
COP_15	646004	6153010	-34.754613	148.595194	621.348144
COP_16	645834	6152763	-34.756864	148.59338	626.003417
COP_17	640382	6156077	-34.727754	148.533278	606.042968
COP_18	640568	6155715	-34.730992	148.53537	655.692993
COP_19	640848	6155409	-34.733712	148.538478	666.254516
COP_20	641175	6155345	-34.734244	148.54206	662.567016
COP_21	638471	6156114	-34.727682	148.512407	686.746765
COP_22	638227	6155967	-34.72904	148.509766	674.398315
COP_23	638733	6155811	-34.730378	148.515317	700.127563
COP_24	638731	6156246	-34.726456	148.515224	642.131347
COP_25	639064	6155074	-34.736976	148.519053	717.864746
COP_26	638886	6154872	-34.738822	148.517143	649.335021
COP_27	639022	6154556	-34.741652	148.51868	676.577087
COP_28	638845	6154225	-34.74466	148.516801	698.994201
COP_29	638504	6154174	-34.745166	148.513086	720.85968
COP_30	638393	6153925	-34.747425	148.511914	721.074523
COP_31	638213	6153718	-34.749316	148.509982	679.476501
COP_32	638012	6153524	-34.751092	148.507819	661.925048
COP_33	637973	6153234	-34.753711	148.507441	622.617187
COP_34	637788	6153026	-34.755611	148.505454	611.916992
COP_35	637735	6154729	-34.740267	148.504597	690.507202
COP_36	638034	6154843	-34.739199	148.507843	689.194213

COP_37	638166	6154480	-34.742453	148.509344	685.843261
COP_38	638038	6154243	-34.744607	148.507985	686.633666
COP_39	637762	6154114	-34.745807	148.504992	711.239318
COP_40	637485	6153974	-34.747106	148.50199	679.203857
COP_41	640061	6154986	-34.737633	148.529955	646.451049
COP_42	640049	6154674	-34.740448	148.529876	689.235046
COP_43	640015	6154384	-34.743066	148.529553	759.511108
COP_44	639889	6154038	-34.746203	148.528234	771.772521
COP_45	639464	6153588	-34.750318	148.523667	701.277587
COP_46	639516	6153264	-34.753231	148.524289	670.688659
COP_47	639400	6153013	-34.75551	148.523063	626.519775
COP_48	639308	6152751	-34.757884	148.522102	600.089355
COP_49	639700	6152377	-34.761202	148.526445	595.442871
COP_50	640458	6154180	-34.744845	148.534424	790.041992
COP_51	640492	6153813	-34.748148	148.534857	710.684143
COP_52	641783	6154242	-34.744102	148.548884	664.625
COP_53	640693	6153510	-34.750852	148.537103	743.534362
COP_54	641114	6153633	-34.749685	148.54168	700.68225
COP_55	641398	6153769	-34.74842	148.544759	765.414001
COP_56	641556	6154081	-34.745585	148.546432	665.194274
COP_57	642115	6153126	-34.754116	148.552698	740.711853
COP_58	641849	6152809	-34.757011	148.549846	714.946411
COP_59	641695	6152354	-34.761134	148.548241	632.874328
COP_60	641924	6152503	-34.759759	148.550717	643.010375
COP_61	642214	6152813	-34.756924	148.553832	743.286376
COP_62	642992	6152607	-34.758672	148.562365	654.001892
COP_63	643511	6151854	-34.765387	148.568162	569.209716
COP_64	643442	6151582	-34.767849	148.567455	559.949829
COP_65	644493	6150530	-34.777184	148.579116	630.781127
COP_66	644670	6150209	-34.780052	148.581105	601.28125
COP_67	645540	6149910	-34.782624	148.590662	589.047058
COP_68	645507	6149549	-34.785882	148.590364	564.843383
COP_69	645913	6149538	-34.785924	148.594802	594.714538
COP_70	646131	6150401	-34.778113	148.597034	655.623046
COP_71	646492	6150200	-34.779873	148.601013	670.319946
COP_72	633941	6154540	-34.742475	148.463194	610.822875
COP_73	633980	6154224	-34.745319	148.46367	595.488769
COP_74	633501	6154331	-34.744417	148.458422	559.368408
COP_75	633765	6154029	-34.747105	148.461353	568.350708
COP_76	633780	6153720	-34.749889	148.461566	572.812988
COP_77	636938	6155490	-34.733514	148.495769	596.043579
COP_78	636766	6155274	-34.735484	148.493926	597.420532
COP_79	636525	6154800	-34.739789	148.491371	586.256042

COP_80	636702	6155005	-34.737917	148.493271	574.806579
COP_81	637923	6155172	-34.736248	148.506577	648.334045
COP_82	638731	6155516	-34.733037	148.515344	707.03656
COP_83	643623	6152121	-34.762965	148.56934	571.197875
COP_84	643344	6154543	-34.741171	148.56588	776.094909
COP_85	644107	6150725	-34.775481	148.574866	591.689086
COP_86	646110	6149704	-34.784399	148.596926	593.684997

Yass Valley Wind Farm Location and Height - Marilba Hills Precinct

Turbine Designation	GDA 1994 MGA Zone 55		GDA 1994		Height a.s.l (m, to base)
	Easting (m)	Northing (m)	Longitude	Latitude	
MRL 01	652382	6154635	148.664558	-34.739033	567.588012
MRL 02	652405	6154327	148.664865	-34.741805	575.450683
MRL 03	652379	6153987	148.664643	-34.744874	568.177917
MRL 04	652443	6153673	148.665399	-34.747695	539.062988
MRL 05	653312	6154603	148.674719	-34.739182	575.264648
MRL 06	653407	6154294	148.675813	-34.741953	575.025695
MRL 07	653429	6153999	148.676107	-34.744609	581.230896
MRL 08	653792	6154253	148.680025	-34.742264	603.252502
MRL 09	653997	6153919	148.682324	-34.745244	621.055664
MRL 10	654050	6153041	148.683064	-34.75315	607.30072
MRL 11	653921	6152861	148.681688	-34.754792	628.035278
MRL 12	653839	6152630	148.680834	-34.756887	609.206787
MRL 13	653842	6152346	148.680919	-34.759446	644.41455
MRL 14	653825	6152055	148.680786	-34.762072	652.062988
MRL 15	653835	6151755	148.68095	-34.764775	642.257202
MRL 16	650966	6152351	148.649506	-34.759831	545.676452
MRL 17	650970	6152060	148.649602	-34.762454	552.332458
MRL 18	651030	6151737	148.650315	-34.765356	557.989501
MRL 19	652880	6151508	148.670564	-34.767145	604.599304
MRL 20	653261	6150880	148.67484	-34.772748	642.799804
MRL 21	653187	6150629	148.674077	-34.775022	693.447448
MRL 22	653201	6150375	148.674277	-34.777309	692.373413
MRL 23	653360	6150101	148.676064	-34.779755	719.66156
MRL 24	653220	6149898	148.674571	-34.781606	712.241821
MRL 25	653181	6149617	148.674196	-34.784145	642.594116
MRL 26	653766	6150044	148.680509	-34.780208	721.201171
MRL 27	653709	6149738	148.679943	-34.782975	706.301635
MRL 28	654107	6150500	148.684151	-34.776046	658.556762
MRL 29	654155	6150037	148.684761	-34.780212	687.057739
MRL 30	654059	6149791	148.683757	-34.782444	733.397949
MRL 31	654126	6149499	148.684542	-34.785066	694.120178
MRL 32	654271	6149176	148.686186	-34.787956	631.05017
MRL 33	654138	6148935	148.684777	-34.790148	632.012329
MRL 34	653938	6148738	148.682628	-34.791954	636.979736
MRL 35	653374	6148775	148.676458	-34.791706	646.219238
MRL 36	653868	6148187	148.681964	-34.796931	712.998596
MRL 38	653909	6147881	148.682468	-34.799683	660.166564

MRL 39	653845	6147629	148.681815	-34.801964	676.481933
MRL 43	657772	6152855	148.723747	-34.754258	656.321655
MRL 44	657680	6152601	148.72279	-34.756562	662.330383
MRL 45	657519	6152393	148.72107	-34.758462	664.617431
MRL 46	656462	6152313	148.709541	-34.759345	656.052856
MRL 47	656351	6152106	148.708367	-34.761228	672.893127
MRL 48	656548	6151827	148.71057	-34.763713	671.530517
MRL 49	657628	6151652	148.722399	-34.765124	698.0885
MRL 50	657647	6151369	148.72266	-34.767672	699.732788
MRL 51	657475	6151155	148.720821	-34.769627	718.773559
MRL 52	657804	6150859	148.72447	-34.772245	712.350708
MRL 53	658275	6150211	148.729737	-34.778012	701.574829
MRL 54	658270	6149928	148.729736	-34.780564	738.469299
MRL 55	658118	6149706	148.728117	-34.782589	723.651611
MRL 56	658265	6149274	148.729804	-34.78646	736.383422
MRL 57	658027	6149116	148.727234	-34.787921	759.277648
MRL 58	658103	6148797	148.728124	-34.790784	756.884704
MRL 59	658095	6148516	148.72809	-34.793319	734.150573
MRL 60	658049	6148242	148.727639	-34.795795	730.581787
MRL 61	658137	6147895	148.728665	-34.798909	778.149353
MRL 62	658582	6147857	148.733535	-34.799183	781.847167
MRL 63	658436	6147613	148.731986	-34.801405	777.498779
MRL 64	658828	6147521	148.736287	-34.802173	800.667297
MRL 65	659501	6147765	148.743595	-34.799869	717.736083
MRL 66	659407	6147513	148.742615	-34.802155	733.892822
MRL 67	658958	6147197	148.737769	-34.805073	786.831665
MRL 68	659195	6146888	148.740417	-34.807821	791.712402
MRL 69	658964	6146742	148.73792	-34.809173	775.411621
MRL 70	658870	6146506	148.736938	-34.811315	776.746887

APPENDIX B

Department of Defence Letter (August 2008) and Email (October 2010)

APPENDIX C

Original Department of Defence Letter Received - 5 August 2008

Australian Government
Department of Defence
Defence Support Group

2004/1044160/3
LPSI/OUT/2008/110

Mr Anthony Micallef
Eupuron Pty Ltd
Level 11, 75 Miller St
North Sydney, NSW, 2060

Dear Mr Micallef

RE: PROPOSED 'COPPABELLA' AND 'MARILBA' WIND FARMS WEST OF YASS, NSW

Thank you for referring the abovementioned wind energy projects to the Department of Defence (Defence) for comment. Defence understands that these projects will be located at two sites known as 'Coppabella' and 'Marilba' located approximately 20-30km west of the town of Yass, NSW. Defence further understands that the wind farm projects will consist of a total of 90 wind turbines at Coppabella Wind Farm and 80 wind turbines at Marilba Wind Farm.

As per your letter, Defence has performed its assessment based upon the wind turbines being situated atop 80m towers and using 105m diameter blades. The maximum height at the blade tip zenith will be up to 135m above ground level. As discussed in a phone call on 22 July 2008, Defence has also allowed for 1 wind monitoring mast at each site and associated works (including an electrical substation and overhead wiring to connect with the National Electricity Grid).

Defence has assessed the proposal with respect to any impact on the safety of military flying operations and possible interference to Defence communications and radars.

The proposed development will be outside any areas affected by the Defence (Areas Control) Regulations (DACR). The DACR control the height of objects (both man-made structures and vegetation) and the purpose for which they may be used within approximately 15km radius of Defence airfields. In addition, the proposal has been assessed as unlikely to affect existing Defence communications and radars in the region.

However, it should be noted that tall structures present a hazard to flight safety for low level flying operations. Consequently, there is an ongoing need to obtain and maintain accurate information about tall structures so that risks associated with inadvertent collision by low flying aircraft can be reduced. RAAF Aeronautical Information Service (RAAF AIS) in Melbourne is responsible for recording the location and height of tall structures. The information is held in a central database managed by RAAF AIS and relates to the erection, extension or dismantling of tall structures the top measurement of which is:

Defending Australia and its National Interests

a. 30 metres or more above ground level - within 30 kilometres of an aerodrome; or
b. 45 metres or more above ground level elsewhere.

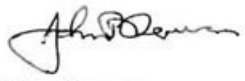
The proposed wind farm development will meet the above definition of tall structure. RAAF AIS has requested that the developer supply them with final design documentation before construction commences. After construction is complete, the Department of Defence requests that the developer provide RAAF AIS with "as constructed" details.

RAAF AIS has a web site with a Vertical Obstruction Report Form at www.raafais.gov.au/obstr_form.htm which can be used to enter the location and height details of tall structures. Any queries in regard to information about tall structures or the database should be directed to RAAF AIS.

The Civil Aviation Safety Authority (CASA) has produced an Advisory Circular, AC 139-18(0) *Obstacle Marking and Lighting of Wind Farms* dated July 2007, which provides amongst other things, guidance to proponents of wind farms. Wind turbines are tall structures which can be hazardous objects to aviation and AC 139-18(0) outlines measures on how to reduce the hazard including the use of obstacle marking and lighting. In accordance with the AC 139-18(0) CASA will need to be consulted on this proposal determination.

Overall, the Department of Defence has no concerns with the Coppabella Wind Farm and the Marilba Wind Farm at this time. Should you wish to discuss the content of this advice further, please contact Brenin Presswell, Executive Officer, Land Planning on (02) 6266 8128 or by email at brenin.presswell@defence.gov.au.

Yours sincerely



John Kerwan
Director Land Planning & Spatial Information
Department of Defence
BP3-1-A052
Brindabella Park
Canberra ACT 2600

5 August 2008

Cc. DSG - ACT/NSW
RAAF AIS
CASA

***Defending Australia** and its National Interests*

Email Recived 6 October from Department of Defence regarding current layout of Yass Valley Wind Farm

UNCLASSIFIED

Ref: LPSI/OUT/2010/120

Nicole

As discussed, the Department of Defence provided comments regarding the proposed Yass Valley Wind Farm comprising the Coppabella and Marilba Wind Farms to Eupuron Pty Ltd back in August 2008. The proposal was for the wind turbines to have a blade tip zenith of up to 135m above ground level (AGL). Refer to the attached Defence letter.

The above updated plan you supplied shows that the two wind farm project boundaries have increased in size since the Defence assessment back in 2008. The plan shows that the Coppabella project area has increased in size to the south east and to the west and the Marilba project area has increased in size to the north, south east and west from the boundaries previously assessed by Defence. The wind turbine blade tip zenith will remain at 135m AGL. You advised that the Conroy's Gap and Carroll's Ridge wind farms are not included in this assessment.

In consideration of the two larger Yass Valley wind farm project boundaries and the Defence assessments undertaken and outlined in 2008, Defence has no concerns subject to the conditions stated in the Defence letter LPSI/OUT/2008/110 dated 5 August 2008 and attached above.

Cheers

Gary Lee
Executive Officer Land Use Planning
Directorate of Land Planning and Spatial Information
Brindabella Business Park BP3-1-A048
Department of Defence
CANBERRA ACT 2600

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Fax. (02) 6266 8294
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APPENDIX C

Advisory Circular "AC 139-08(0) –Reporting of Tall Structures"

THE AMBIDJI GROUP

APPENDIX C

Advisory Circular "AC 139-08(0) – Reporting of Tall Structures"

Australian Government
Civil Aviation Safety Authority

Advisory Circular

AC 139-08(0) **APRIL 2005**

REPORTING OF TALL STRUCTURES

CONTENTS

1. REFERENCES

- CASR 139.360 and CASR 139.365
- MOS – Part 139 Aerodromes, Chapter 7- Obstacle Restriction and Limitation, Section 7.1 – General
- Airports (Protection of Airspace) Regulations 1996

2. PURPOSE

2.1 The purpose of this AC is to provide some guidance to those authorities and persons involved in the planning, approval, erection, extension or dismantling of tall structures so that they may understand the vital nature of the information they provide.

2.2 Information on tall structure is held centrally by the Royal Australian Air Force (RAAF) Aeronautical Information Service (AIS) who maintain a tall structure database. Information is also provided to a range of aviation organisations so that they can be identified on aeronautical charts, etc.

3. STATUS OF THIS AC

3.1 This is the first AC to be issued on this subject, however the content of this AC updates information previously published in CAAP 89W-2(0) — Reporting of Tall Structures.

Advisory Circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

Where an AC is referred to in a 'Note' below the regulation, the AC remains as guidance material.

ACs should always be read in conjunction with the referenced regulations.

5 April 2005

4. BACKGROUND

4.1 The Australian aviation community has identified a need to have information on tall structures available for publication on aeronautical charts.

4.2 The RAAF Aeronautical Information Service (AIS) has been assigned the task of maintaining a database of tall structures, the top measurement of which is:

- 30 metres or more above ground level — within 30 kilometres of an aerodrome; or
- 45 metres or more above ground level elsewhere

4.3 The database of tall structures will generally capture more information than what is required to be reported by the regulations.

4.4 The database will also be available for use by mapping agencies such as Australian Surveying and Land Information Group, and domestic and international aviation organisations.

5. WHY REPORT TALL STRUCTURES

5.1 Inadvertent collision with tall structures is a significant cause of aircraft accidents involved in low level flying operations. The risk posed by a tall structure to aircraft safety can be minimised if information on the tall structure is conveyed to pilots so that they can fly at a safe margin above the structure.

5.2 Low level flying operations are typically conducted during:

- approach, landing and take-off operations
- specialist flying activities (such as crop-dusting, cattle mustering, pipeline inspection, fire-fighting)
- search and rescue operations
- military low-level flying operations

5.3 Except for approach, landing and take-off operations (which are normally conducted in the vicinity of an aerodrome) low level operations can be conducted anywhere across Australia (subject to regulatory conditions/limitations).

5.4 In addition to the safety of aircraft operations, an inadvertent collision with a tall structure poses a number of other risks:

- business continuity if the services provided from the tall structure are unavailable e.g. communications services
- costs associated with the erection of a new structure
- liability issues

5.5 In the event of an aircraft hitting a tall structure, the role of persons and/or organisations associated with the operation of the tall structure would be a matter for the courts.

5 April 2005

6. WHAT ARE THE AVIATION REGULATIONS THAT APPLY TO TALL STRUCTURES?

6.1 CASR 139.360 requires the operator of a certified or registered aerodrome to notify CASA of any development or proposed construction in the vicinity of the aerodrome (normally 15km) that is likely to be a hazard to air navigation.

6.2 In the vicinity of major capital city airports, the *Airports (Protection of Airspace) Regulations 1996* also apply. Under these regulations, the operator of such an aerodrome has to notify the Department of Transport and Regional Services (DOTARS) of any potential infringement to the prescribed airspace established for that aerodrome. DOTARS has the power to prohibit or limit erection of tall structures within the prescribed airspace of a Federal Airport covered by the *Airports (Protection of Airspace) Regulations*.

6.3 In areas remote from an aerodrome, CASR 139.365 requires the owner of a structure (or proponents of a structure) that will be 110m or more above ground level to inform CASA. This is to allow CASA to assess the effect of the structure on aircraft operations and determine whether or not the structure will be hazardous to aircraft operations.

7. WHAT DO I NEED TO REPORT?

7.1 Details should be provided on the construction, extension or dismantling of tall structures the top of which is:

- 30 metres or more above ground level (within 30 kilometres of an aerodrome); and
- 45 metres or more above ground level elsewhere.

7.2 Information provided to the database should be accurate and readily interpreted. The "TALL STRUCTURE REPORT FORM" at Attachment A has been designed to help owners and/or developers in this respect.

8. WHERE WILL THE INFORMATION BE HELD?

8.2 The information on all tall structures is held in a central database that is managed by the RAAF AIS.

5 April 2005

9. HOW DO I REPORT?

9.1 Information on tall structures and any queries in regard to the database should be directed to:

Aeronautical Data Officer
RAAF AIS (VBM-M2)
Victoria Barracks
St Kilda Road
Southbank Vic 3006
Tel: (03) 9282-6400
Fax: (03) 9282-6695
Email: ais.charting@defence.gov.au

9.2 To assist all organisations to provide all of the necessary and complete information, use of the standard "Tall Structure Report" form attached to this AC (Attachment A) is encouraged.

Richard Macfarlane
Acting Executive Manager
Aviation Safety Standards

5 April 2005

APPENDIX D

ICAO Recommendations - Classification of Obstacles and Aviation Lighting of Wind Farms

APPENDIX D

ICAO Recommendations - Classification of Obstacles and Aviation Lighting of Wind Farms

4.3 Objects outside the obstacle limitation surfaces

4.3.1 **Recommendation.**— *Arrangements should be made to enable the appropriate authority to be consulted concerning proposed construction beyond the limits of the obstacle limitation surfaces that extend above a height established by that authority, in order to permit an aeronautical study of the effect of such construction on the operation of aeroplanes.*

4.3.2 **Recommendation.**— *In areas beyond the limits of the obstacle limitation surfaces, at least those objects which extend to a height of 150 m or more above ground elevation should be regarded as obstacles, unless a special aeronautical study indicates that they do not constitute a hazard to aeroplanes.*

Note.— This study may have regard to the nature of operations concerned and may distinguish between day and night operations.

6.4 Wind turbines

6.4.1 A wind turbine shall be marked and/or lighted if it is determined to be an obstacle.

Note.— See 4.3.1 and 4.3.2.

Markings

6.4.2 **Recommendation.**— *The rotor blades, nacelle and upper 2/3 of the supporting mast of wind turbines should be painted white, unless otherwise indicated by an aeronautical study.*

Lighting

6.4.3 **Recommendation.**— *When lighting is deemed necessary, medium-intensity obstacle lights should be used. In the case of a wind farm, i.e. a group of two or more wind turbines, it should be regarded as an extensive object and the lights should be installed:*

a) to identify the perimeter of the wind farm;

b) respecting the maximum spacing, in accordance with 6.3.14, between the lights along the perimeter, unless a dedicated assessment shows that a greater spacing can be used;

c) so that, where flashing lights are used, they flash simultaneously; and

d) so that, within a wind farm, any wind turbines of significantly higher elevation are also identified wherever they are located.

6.4.4 **Recommendation.**— *The obstacle lights should be installed on the nacelle in such a manner as to provide an unobstructed view for aircraft approaching from any direction.*

APPENDIX E

Comparison of International Standards for Obstacle Lighting of Wind Farms

APPENDIX E

Comparison of International Standards for Obstacle Lighting of Wind Farms

Obstacle Marking Requirements

As the Australian Civil Aviation Safety Authority (CASA) has determined that provided the turbines are of a colour that enables them to be readily conspicuous (preferably white), then marking of wind turbines for daytime visibility is not considered necessary in the Australian environment. Consequently, the following table not does make a comparison of marking requirements.

Obstacle Lighting Requirements

The table below has been prepared to indicate the variation between countries as to the obstacle lighting criteria applicable to wind farms. The purpose is to show that these criteria can vary considerably between countries. Only those factors that are pertinent to the proposed Yass Valley Wind Farm have been included in this review. This information is general in nature only and the reference document should be read in full to gain a full understanding of the complete requirements.

Country	*Turbine Height Criteria for Lighting*	*Obstacle Lighting Criteria*	*Reference*
Australia	Turbines >110m AGL.	Objective is to define the extent of the wind farm: a. spacing not more than 900m b. define the extremities and perimeter of the wind farm c. identify the highest terrain obstacle	Advisory Circular AC139-18(0) (Note: Although this AC has been withdrawn and the requirements being reviewed by CASA, the technical requirements can be used as a "risk mitigator" by wind farm developers)

Canada	Turbines 90m AGL.	Dependent on a number of factors, ". Including direction of air traffic and the nearness of aerodromes..." Longitudinal spacing "in the order of 900m" Deviation not more than 10%. Nav Canada has recently approved the use of the Obstacle Collision Avoidance System (OCAS®) as an alternative to obstacle lighting systems. OCAS® has been approved for use in Norway, USA and Canada.	Transport Canada. CAR621.19 Advisory Circular 1/06 (Draft). NAV CANADA Aeronautical Information Circular 45/08, 20 Nov 08.
Ireland	"potential en route air navigation obstacle" above 45m AGL. Offshore - above 90m AGL.	Onshore - No published regulations, Wind Farms planned away from the vicinity of aerodromes are considered 'case by case', requirement of lighting dependant on size, and vicinity to en-route aircraft.	S.I No. 423 of 1999.
New Zealand	Dependent on whether the structure is a hazard in navigable airspace Turbines of >60m AGL.	Selected turbines to be lit, "the highest turbines, … those at the extremities … and spacing not to exceed 1nm (1850m)" All wind farms must be marked on aeronautical charts.	Civil Aviation Authority of New Zealand, "Lighting and Marking of Wind Farms", May 2006.
Norway	Wind turbine overall height greater than 60m AGL.	Norwegian Civil Aviation Authority has approved the use of the Obstacle Collision Avoidance System (OCAS®) as an alternative to obstacle lighting systems.	Norwegian Civil Aviation Authority.
South Africa	Towers of heights over 45m.	Define periphery, not more than 800m spacing.	Civil Aviation Regulations, 1997.
Taiwan	Wind turbines >=60m AGL.	"Objects that are around the airport, airfield, and navigation aids and will affect safety…"	Article 32, Taiwan Civil Aviation Act.

United Kingdom	Various criteria: Depends on location, Onshore, Offshore, vicinity of aerodromes and whether it is assessed as a hazard to aviation. Onshore - within vicinity if an aerodrome, if assessed as a hazard - away from immediate vicinity of an aerodrome, 150m AGL.	Onshore 1. Within vicinity of an aerodrome, obstacle lighting is required if the obstacle is assessed as a hazard to air navigation. 2. Away from the immediate vicinity of an aerodrome – "In general terms, structures less than 150m high, which are outside the immediate vicinity of an aerodrome are not routinely lit; unless by virtue of its nature or location .. it presents a significant hazard to air navigation''.	CAP764 CAA Policy and Guidelines on Wind Turbines (February 2009).
United States	Wind turbine overall height greater than 200ft (approx. 61m).	Need to take into account "proximity to airports, VFR routes, extreme terrain and local flight activity… " Spacing "not more than ½ statute mile" (approx. 805m). FAA has recently approved the use of the Obstacle Collision Avoidance System (OCAS®) as an alternative to obstacle lighting systems.	FAA. AC 70/7460-1K (January 2007).

Many of the reference documents indicate that in determining the requirement for obstacle marking and/or lighting of a wind farm, an aeronautical assessment should be made to determine whether the wind farm is a hazard to aviation and that, in addition to the height AGL of the wind farm turbines, this will depend on such factors as:

- Number of wind turbines.
- Location and proximity to airports.
- Proximity to aeronautical routes and air operations in the area.
- Nature of terrain in the area.
- Proximity to navigational aids.
- Extent and type of air traffic.
- Environmental restrictions.

Overseas experience appears to be trending towards a more rigorous justification of obstacle lighting of wind farms that are remote from an aerodrome, taking into account *"its nature and location"* as part of the assessment process.

APPENDIX F

CASA Briefing Statement - October 2008
"Taking a fresh look at Wind Farms"

APPENDIX F

CASA Briefing Statement - October 2008

"Taking a fresh look at wind farms"

"CASA is reviewing the way in which wind farms located near aerodromes are assessed and regulated. An advisory circular relating to the marking and lighting of wind farms has been withdrawn. CASA CEO Bruce Byron has directed that an appropriate safety study into the risk to aviation posed by wind farms be conducted as a basis for developing a new set of guidelines. The advisory circular was published to provide guidance to wind farm developers on the potential hazards to aviation and to provide advice on the means of marking or lighting wind farms. Under Civil Aviation Safety Regulation Part 139, CASA's jurisdiction only applies to structures within approximately 30 kilometres of an aerodrome. That means CASA cannot currently mandate the lighting or marking of structures outside this distance. However, the advisory circular gave the impression CASA could require the lighting of obstacles not in or near the vicinity of an aerodrome.

In addition, some recent industry complaints considered by CASA's Industry Complaints commissioner identified a number of other issues with the circular. On this basis Bruce Byron directed Advisory Circular 139-18(0) be withdrawn and a safety study be conducted. This will include appropriate consultation with the aviation industry and other stakeholders."

APPENDIX G

Obstacle Lighting of Wind Farms in Australia

APPENDIX G

Lighting Arrangements for Operating or Approved Wind Farms in Australia - September 2010

The following table has been prepared from a review of power generation company web sites and discussions with representatives of the power generation companies. The purpose of the table is to identify whether or not wind farms in Australia have or will be provided with obstacle lighting. It is not claimed to be an exhaustive survey. No responsibility is accepted for the accuracy of the information contained herein. These wind farms are either fully operational and/or approved by relevant planning authorities.

Wind Farm	N.o T's	Height AGL	Location	Operator	Lighting Arrangements
Albany Wind Farm AKA Grasmere	12	100m	WA	Verve Energy	No Lighting
Alinta Wind Farm	54	118m	WA	Infigen Energy	No Lighting
Bald Hills Wind Farm	52	135m	VIC	Bald Hills Wind Farm Pty Ltd	Yet to be constructed. Undecided as to whether it will be lit.
Berrybank Wind Farm	99	131m	VIC	Union Fenosa	A layout for 50% of turbines has been developed however not yet approved.
Blayney Wind Farm	15	67.5m	NSW	Eraring Energy	No Lighting
Bremer Bay Wind Farm	1	69m	WA	Verve Energy	No Lighting
Canunda Wind Farm	23	108m	SA	International Power	No Lighting
Capital Wind Farm AKA Bungendore	67	125m	NSW	Infigen Energy	No Lighting
Capital II Woodlawn Wind Farm	20	124m	NSW	Infigen Energy	Yet to be constructed Possibly No Lighting
Carmody's Hill Wind Farm	70	138m	SA	Pacific Hydro	Approved, yet to be constructed. Pacific Hydro are undecided if turbines are going to be lit.

Cathedral Rocks Wind Farm	33	100m	SA	Hydro Tasmania / Acciona Energy	No Lighting
Challicum Hills Wind Farm	35	100m	VIC	Pacific Hydro / Origin	No Lighting
Clements Gap Wind Farm	27	123m	SA	Pacific Hydro	Lit – 50% of turbines, they are planning to turn off.
Cocos Island	4	25m	AUS	Power station	No Lighting
Codrington Wind Farm	14	81m	VIC	Pacific Hydro	No Lighting
Collgar Wind Farm	127	135m	WA	Colgar Wind Farm P/L	Yet to be constructed undecided if going to light.
Coober Pedy Wind Farm	1	43.5m	SA	Energy Generation P/L	No Lighting
Coral Bay Wind Farm	3	71m	WA	Verve Energy	No Lighting
Crookwell Wind Farm I	8	67m	NSW	Eraring Energy	No Lighting
Crookwell Wind Farm II	46	128m	NSW	Union Fenosa	Approved however still assessing if going to light turbines.
Crookwell Wind Farm III	25-35	152m	NSW	Union Fenosa	Approved however still assessing if going to light turbines.
Cullerin Range Wind Farm	15	125m	NSW	Origin Energy	9 of 15 Turbines were lit. – Now extinguished.
Dandaragan Wind Farms - Yaddi Wind Farm - Wandin Wind Farm	 97 57	 132m 132m	WA	Wind Prospect	Both farms are approved however they are still assessing if they are going to be lit.
Denham Wind Farm Turbines - 1,2,3 Turbine - 4	4	 65m 62.5	WA	Verve Energy	Lit – All 4 Turbines Tourist Area
Devon North Wind Farm	7	130m	VIC	Synergy Wind Developments	Approved, yet to be constructed, will be lit 3 of 7.

Emu Downs Wind Farm	48	80m	WA	Griffith Energy	No Lighting
Esperance Wind Farms - Nine Mile Beach Wind Farm - Ten Mile Lagoon	 6 9	 69m 45m	WA	Verve Energy & Horizon Power	No Lighting or either farms
Exmouth Advanced Mini Wind Farm	3	35.2m	WA	Verve Energy Horizon Power	No Lighting
Gunning Wind Farm	31	120m	NSW	Acciona	Under construction No Lighting
Hallett Wind Farm 1 – Brown Hill	45	124m	SA	AGL Energy	Lit - 17 of 35 Turbines NOW TURNED OFF
Hallett Wind Farm 2 – Hallett Hill	34	124m	SA	AGL Energy	Lit - 40% of Turbines NOW TURNED OFF
Hallett Wind Farm 3 – Mount Bryan	38	130m	SA	AGL Energy	No Lighting
Hallett Wind Farm 4 – Nth Brown Hill	63	124m	SA	AGL Energy	No Lighting
Hallett Wind Farm 5 – Bluff Range	25	124m	SA	AGL Energy	No lighting
Hampton Wind Farm	2	74m	NSW	Hampton Park Wind Farm (Private)	No Lighting
Hepburn Wind Park aka Leonards Hills	2	109m	VIC	Hepburn Wind	No Lighting
Hopetoun Wind Farm	1	69m	WA	Verve Energy	No Lighting
Huxley Hill Wind Farm AKA King Island	5	44m - 86m	TAS	Hydro Tasmania	Lit - 1 of 5 Turbines 5kms from airport

Kalbarri Wind Farm	2	74m	WA	Verve Energy	No Lighting
Kings Creek Hotel	1	>30m	VIC	Victoria Cellars	No Lighting
Kooragang, Newcastle	1	>110m	NSW	Energy Australia Dept Water & Eng NSW	No Information
Lake Bonney – Stage 1	46	106m	SA	Infigen Energy	No Lighting
Lake Bonney – Stage 2	53	125m	SA	Infigen Energy	Turbines lit
Lake Bonney – Stage 3	13	125m	SA	Infigen Energy	Not yet constructed, turbines will be lit
Lal Lal Wind Farm	64	130m	VIC	West Wind Energy	Yet to be constructed, 44 of 64 turbines to be lit
Lexton Wind Farm	19	126m	VIC	Origin Energy	Yet to be constructed, Aeronautical Impact Assessment has been conducted, proponent deciding if they will be lit.
Longwood Wind Power Station	2	36m	VIC	Elgo Estate Winery	No Lighting
Macarthur Wind Farm	150	135m	VIC	AGL & Merridian (NZ)	To be constructed by 2013 Not to be lit
Mawson – Antarctic	2	49m	AAD	Australian Antarctic Division	No Lighting
Moorooduc Wind Farm	1	>110m	VIC	Atlanta Fruit Sales P/L	No information
Mortlake Wind Farm	96	141m	VIC	Acciona Energy	No decision has been made to lit

Mount Gellibrand wind farm	116	141m	VIC	Acciona Energy	No more than 20 turbines are to be lit (condition of consent by Minister of Planning).
Mount Millar Wind Farm	35	120m	SA	Meridian	Lit – 11 out of 35 Turbines
Musselroe Wind Farm	56	125m	TAS	Roaring 40's	Not yet fully approved undecided if going to be lit.
Newfield Wind Farm	15	>110m	VIC	Acciona Energy	No Lighting
Portland Project Stage I - Yambuk Stage II - Cape Bridgewater Stage III - Cape Nelson South, Stage IV - Cape Nelson North, Sir William Grant	 20 29 22 11 16	 106m 109.9m 109.9m 126m 110-126m	VIC	Pacific Hydro	Stage IV – Not yet constructed Only section to possibly be lit 16 out of 26 turbines. Still undecided. Have reduced number by one. Since 2008 layout.
Rottnest Island	1	69m	WA	Verve Energy	No Lighting
Snowtown Wind Farm (Barunga Ranges)	47	124m	SA	Trust Power	Lit – 24 of 47 Turbines Up to 83 turbines to be constructed TO BE TURNED OFF
Starfish Hill Wind Farm	23	100m	SA	Transfield Services	No Lighting
Thursday Island	2	>110m	QLD	Ergon Energy	No Information
Toora Wind Farm	12	100m	VIC	Transfield Services Infrastructure Fund	No Lighting

Waterloo wind farm	37	125m	SA	Roaring 40's	Near completion, no aviation lighting
Wattle Point Wind Farm	55	109.5m	SA	AGL Energy	No Lighting
Waubra Wind Farm	128	110m – 120m	VIC	Acciona Energy/ANZ	Lit – 48 of 128 Turbines, Acciona currently assessing ability to reduce or turn off lighting
Windy Hill Wind Farm	20	69m	QLD	Transfield Services Infrastructure Fund	No Lighting
Wonthaggi Wind Farm	6	110m	VIC	Wind Power Pty Ltd / now Origin Energy now Transfield	Lit 2 of 6 turbines are lit Seeking confirmation
Woolnorth Wind Farm Stage 1 – Bluff Point 6 Stage 2 – Bluff Point 31 Stage 3 – Studland Bay 25	62	 110m 110m 125m	TAS	Roaring 40's / Hydro Tasmania	Operational, with no aviation lighting.
Yaloak Wind Farm	14	126.25m	VIC	Pacific Hydro	Yet to be constructed, still undecided on lighting
Yass Valley Wind Farm	200	160m	NSW	Origin/SKM	Assessment taking place in regards to lighting

APPENDIX H

Stakeholder Consultations - Yass Valley Wind Farm Region

APPENDIX H

Stakeholders Consultations - Yass Valley Wind Farm Region

Generic Stakeholders: NSW

Stakeholder	Contact Person	Comment
RAAF	RAAF Base Wagga Sturt Highway Wagga Wagga NSW 2651 Switchboard: (02) 6937 4111 mediaops@defence.gov.au RAAF Aeronautical Data Officer RAAF AIS (VBM-M2) Victoria Barracks St Kilda Road, Southbank, VIC 3006 Ph: (03) 9282 6400 ais.charting@defence.gov.au	RAAF Aeronautical Information Service (RAAF AIS) Greg Lee called back, confirmed the DoD already stated that Yass is not a problem.
Royal Flying Doctor Service (RFDS)	Mr. Nigel Milan AM National Chief Executive Officer: Level 8, 15-17 Young Street, Sydney NSW 2000 Ph: (02) 8259 8100 Email: Aviation: aviation@rfdsno.com Craig Nethery, Senior Base Pilot Dubbo Base, SE Section	Only certain strips are landed on and audited every 2 years. Broken Hill office – (08) 8080 3777 Dubbo Office – (02) 6841 2555 Craig Nethery, Senior Base Pilot is going to contact me – 6/10 Emailed again on 19/10 Syd rang left message on 24/11 Craig to ring me .
Agricultural Aviation Association of Australia	Phil Hurst - CEO PO Box 353 Mitchell, ACT 2911 Ph: (02) 6241 2100	Australian Standard AS 3891 for marking of guy wires. Give overview of view point. Not a concern for his organisation and its members. Commented that careful planning and preparation is conducted prior any operation; operators are mindful of all known obstructions and conduct pre operational visits to sites. Made mention of CASA regulations re LSALTs, minimum height AGL, VMC and visual flights etc.
Aircraft Owners and Pilots Association (AOPA)	Brian Hannan Vice President Ph: (03) 5968 3311 0413 506 977	AOPA has no formal policy on lighting of obstacles remote from aerodromes. No objections to wind farms per se – commented on lack of consultation in past regarding proposed development of WFs. Raised the regulatory requirements/issues associated with flying at night e.g. LSALTS, minimum heights AGL and noted for a collision with a turbine to occur a pilot must be flying illegally.
Australian Parachuting Federation (APF)	Kim Ph: (07) 3457 0100	Not aware of any parachuting activity conducted in that area. No PJE conducted at night. Stringent APF regulations regarding risk and safety assessment and clearance from obstacles

Hang Gliding Federation ACT HG and PG Association	Matthew Smith 0402 905 554	Nil Night Flying permitted; nil flying in cloud permitted. Wind farms per se not a problem.
Glider Flying Australia	Dr Bob Hall 0438 675 051 and Ph: (02) 6332 2072 Head Office Melbourne Ph: (03) 9303 7805	Dr Hall confirmed the comments from Southern Tablelands Gliding Club. He indicated that wind farms were not a problem for gliders per se. He also provided feedback from the HG and PG national body which echoed the comments from Matthew Smith ACT HG & PG Assoc.
Civil Aviation Safety Authority	Kim Jones Manager Airways and Aerodromes Branch	Advice re status of AC, developments with DITRDLG; responsibilities of developers.
Recreation Aviation – Australia RA - Aus	Steve Tizard CEO	RA Aus aircraft are not permitted to operate at night so the removal of lighting at CRWF is not an issue for his membership. Made the general comment that lighted obstacles assist air safety at night/during low visibility.
New South Wales Rural Fire Service Aviation Section	Sam Crotchers Keith Mackay Operations Officer Ph: (02) 8741 5243	Contracts in all aircraft, over 100 in total all NSW approx 60 helicopters 40 fixed wind 802/502/602 Air Tractors, Dromandra's, some are fixed contracts others called when needed. Helicopters range from Light/Medium/Heavy. All firms and pilots contracted go through vigorous approval process. Pilots must have 3000hours on type. Flying under max weight, heat and low sometime zero viz, so must be highly experienced. Fire season 1st Oct to 31st March, for Yass region Dec-Feb. Hasn't been a high frequency of fire over last few years, but was in the early 2000's. They will conduct fire spotting after a lighting band goes through area. There is what is referred to as Section 52 operations plan between local fire control centre and property owners, which is an agreement to use certain properties as landing strips. This is necessary to be as close to any fire as possible. Issue of aircraft comes from Sydney office as all properties that hold these agreements are listed. Wind farms need to be marked esp those close to airports. Wind farms could be an issue if the area where the wind farm is on fire. They have a 100 line under choppers for the buckets, 3NM buffer with no obstacles required??? Masts are a problem when in smokey conditions, but can be seen when clear. He stated that they are not usually marked.
NSW CFA	Ian Kennerly 0429 402 151	Information provided on use of airstrips in the Yass Region. No issue with proposed Wind Farm.

NSW Police Air Wing	Inspector Tim Calman Deputy Chief Pilot 1800 725 631 calm1tim@police.nsw.gov.au	[Emailed 23/09 Called customer service line, put through but rang out. Emailed from Thin blue line website 6/10 Rang and finally got hold of Tim, he asked me to email request, which i did on 19/10. Tim to ring me back 25/11]
NSW Ambulance Service Air Ambulance (Helicopters)	Glenn Higgins Chief Pilot CHC Australia (CHC) Ph: (02) 9722 1600 ghiggins@chcaustralia.com	Previous conversations with Glenn regarding Cullerin Wind Farm indicated the ACT Ambulance Service (ACTAS) and Southcare Helicopter operate in the vicinity of Yass. CHC is contracted by the NSW Ambulance service to conduct air operations, they are based in Bankstown, Orange and Wollongong and operate Two Bell 412EPs, one Bell 412 classic and one AW139 (new AW139 and EC145 being introduced to replace the Bell412EPs). He indicated that careful pre-flight planning is conducted prior to any operation and maintaining adequate clearance from ground obstacles is always taken into consideration. In the absence of any published data (e.g. obstacles, private air strips etc) on aeronautical charts it is CHC company policy to apply 360 feet above highest terrain as the minimum operating altitudes.
Snowy Hydro Southcare Helicopter www.snowyhydrosouthcare.com.au	Craig Thomas Canberra Base Manager canbmgr@chc.ca Ph: (02) 6207 9923	Bell 412 Helicopter operates in ACT and SE NSW. Primarily Medical Rescue @ accident scenes. Secondary, patient transfers. Search and Rescue, Aerial Fire Fighting. [Craig emailed me 11/10 going to request details of stats. Craig passed me onto Jon Wood - General Manager Operations ACT Ambulance Service. John said to contact Ambulance Service NSW medical retrieval unit – (02) 9553 2222 Syd rang on 24/11 and left message for a Chris to ring back.]

Yass Valley Wind Farm Region GA Operators:

Organisation	Contact	Comment
Yass Airstrip Unregistered Airstrip Yass Air	Ted Macintosh Owner Jindalee, Yass NSW 2582 Ph: (02) 6227 6007 M: 0417 212 520	Runs Yass Air and aerial Ag work Wind farm will not impact on his operations Meteorological monitoring masts are of great concern to he and other ag pilots. Wants to see them marked on guy wires. Would prefer to have lighting of wind farm but did not provide any safety arguments.
Harden Gliding Club	Richard Hart M: 0419 279 476	Rang and left 2 messages regarding site visit. No return call made.
Young Aerodrome Registered	Phillip Glover Young Shire Council Town Hall Building, Young NSW 2594 Ph: 02 6382 1200 Email: mail@young.nsw.gov.au Website: www.young.nsw.gov.au	All private aviation Some training work, aero club Aero medical Aerial spraying Occasional Fly-ins Bank Plane flies in and out everyday
Young Aero Club	Craig Sergeant Ph: (02) 6382 5255	Mainly general aviation recreational movements, the daily bank aircraft and charter. No training. Careflight and Air ambulance uses airport. VFR aircraft flying to Canberra or toward Melbourne normally stay clear of the range. Use Yass VFR entry away from proposed wind farm. Minimal night VMC movements. Around 2-3 flights pd during week and 5-6 pd on weekend – mainly to the west and north west.
Cootamundra Airport Certified Airport	Gary Arthur Cootamundra Shire Council Wallendoon St Cootamundra, NSW, 2590 Ph: (02) 6940 2100 mail@cootamundra.nsw.gov.au	Emailed query to Gary 22/9 Spoke to another maintenance organisation. Advice was that there isn't any flight training or Aero Club - it's all out of Temora.
Aviation Technology (Avtec) Maintenance & Central Air Services	Tom Schade Cootamundra Airport, Cootamundra NSW 2590 Ph: (02) 6942 3626 Ph: (02) 6942 6626	The operate 9 aircraft – Warriors and Cessna's Mainly operate these out of SA. Only conduct some scenic flights in local area. Very rarely over Yass, only day VFR. Gunning is operating not an issue as they would never operate that low.
South West Helicopters	Terry and Jenny McKenzie PO Box 171 Cootamundra Ph: (02) 6942 2133	Ops apparently all over Australia. Conducts Aerial spraying in Yass region weeds and pests. Around Spring time for approx a month Rural Fire Fighting – chartered by Rural NSW Fire for Spotting, Air Attack, Bucketing, Bombing, infrared, hot spots. Charter work Wind farms not an issue.

Martel Air Charter	Kim Martel 41 Cooper Street, Cootamundra Ph: (02) 6942 1200 M: 0409 424 100	Major charter operator. Only flies IFR and his advice was that the wind farm will have no impact on his operations. No view on lighting.
Lesley Walkerden President of Australian Women Pilots Association (AWPA)	PO Box 466 9 Queen Street, Cootamundra Ph: (02) 9642 2683 M: 0419 286 228	Owns a Cessna 150, flies around Yass area day VFR. Would prefer turbines to be lit, and marked on maps. Noted that any information on the development of the wind farm would be welcomed to the AWPA, their members would be interested in keeping informed.
Keith Berryman	Keith Berryman (infrequent user) Wyuna, Stockinbingal Ph: (02) 6943 1468	Left messages numerous times, but did not respond.
Col & Scott Adams Ag Aerial Spraying	Col & Scott Adams PO Box 515 Cootamundra Ph: (02) 6942 1723 a/h: (02) 6943 2615 M: 0427 432 615	Dromandra's / Fletchers / Grummun Ag Cats / 180's, all ops day VFR. Spraying and Fertilising in Yass Region, during Winter and Summer. Masts are a major issue; they're not marked and extremely dangerous. Must be marked and informed of when putting up or taking down. Operate out of Cootamundra use many paddock strips all over, west of site and around Cootamundra, Jugiong, Sandy Tates. No maps of strips all in head. WF's not an issue as yet, but will affect business in area and farmers. He's concerned about wind turbulence what they've read from the US.
Masling Industries	John Hill GM Cootamundra Ph: (02) 6942 3155	They don't have any aircraft, make components for aircraft parts. They noted there isn't any flight training or Aero Club out of Cootamundra it's all out of Temora.
Tumut Aerodrome Registered Tumut Aero Club Ltd Tumut NSW	Ph: (02) 6947 1148	Club has 60 – 70 members all ultra lights. All day VFR, WF's not an issue, fly very rarely in the Yass area. Fly around local area, Cootamundra, Gundagai, Temora. "Air escape" conduct some ultra light training in local area, if they go cross country it's to Temora or Cootamundra.
Canberra Aero Club	Les Sullivan Ph: (02) 6223 7132 les.sullivan@mindweb.com.au	Only a small number of aircraft and membership is low. Club headquarters is now off airport. Advised that Canberra Airport management is discouraging general aviation flying. Would prefer lights from a navigational point of view.
Brindabella airlines Flight Training	Brian Candler CFI Nicole Masters nicole.masters@brindabellaairlines.com.au	Not officially operating, but conducting training for limited students. 172's / 182's / Duchess Training area North of Canberra along the Barton Hwy Northern boundary Hume hwy to Bookham then western boundary is the Burrinjuck lake and back to Canberra. He's personally been in training area 3 times this week, overall staff and students 6 times a week. They are only FTO out of Canberra now. Made a comment about scud runners from Wagga use the Hume hwy until they see Bookham or Yass. Would not want

		LSALTS increased as they are verge of icing issues in winter due to climate and alt. No real issue, as aircraft shouldn't be down that low anyway. He finds lights at Cullerin are actually a distraction. No need to light, so long as marked on maps. They use Harden sometimes for touch and go's etc. Sometimes use Jugiong for forced landings.
Monaro Aviation Services	Richard Krege PO Box 1660, Queanbeyan ACT 2620 M: 0402 539 864	They dry lease aircraft, twins, some singles when they do aerial photography. Fly over Yass a couple of time for aerial photography, but not often. They would track over area, but at cruising level. WF's not an issue they are no way near that level. Lightning makes no difference to their ops, not relevant Use aerodromes @ Young, Coota, Harden, Tumut.
Goulburn Mullwarree Council	Ian Aldridge Ph: (02) 4823 4464	Nil comment - requested to be kept informed of developments
Goulburn Aviation (Learn to Fly)	Teraya Miller CFI/Owner Also local area CASA Aviation Safety Advisor Ph: (02) 4821 7798 (sat only) M: 0418 165 813	Suggested it might impact upon aircraft operations inpoor weather. They conduct flight training: Students Navigate: GLB – WAGGA (over Yass) GLB – Cowra (via Harden) GLB – Canberra But these tracks do not go directly over teh wind farm. Wary of Yass because of proximity to WAGGA /TEMORA /COWRA to GOLBURN flight paths (particularly during reduced visibility associated with bad weather. When tracking to Cowra = GLB – HARDEN – COWRA Their training area is south of Goulburn, btw GLB and CAN. In particular Ultra Light have to stay below 5000ft, cannot track IFR. Considers this East to West Route Wagga - Yass - Goulburn to be a high traffic density area. But no numbers available. GA tracking from VIC, track up to Wagga, Yass, then to Goulburn then to Sydney or coast. Suggested to speak to Ward Air in Bathurst, large training org and Corporate Air in Goulburn. (Sally Anne Ward) Has a training navex that is GLB- CB-WG-Yass- GLB. But none of these legs go directly over the wind farm.
Goulburn Flight Training Centre (New Flight Training Centre)	Malcolm Poulton 43 Airport Rd, Goulburn NSW 2580	Used to work at Brindabella, wind farms not an issue. Would prefer lighting from a navigational, not a safety perspective.

	Ph: (02) 4822 1766 M: 0404 132 757 John Fareiar owner in process of applying for AOC ERSA fuel @ Goulburn	
Corporate Air Spoke with Marshall Ross Head of Maintenance	Head Office Suite 4, John McEwen House, 7 National Circuit, Barton, ACT Ph: (02) 6249 7044 MRO Facility Delivery Lot 1 Cummins Close, Goulburn Airport, Goulburn NSW 2580	Charter and MRO, fly at least 2 aircraft a week for MRO. Aircraft fleet 12 totals, 2 Metros, Conquests, Cessna 402, Titans and Barons. They track direct from Canberra to Goulburn. All IFR, no real requirement for lighting, however depending on where they are. Only Flight training they do is for their own staff. Charter, Freight, Ground Handling, MRO, Aircraft Management. Charter, Bankstown, Melbourne, Canberra etc mostly.
Southern Tablelands Gliding Club	Peter Jolly M: 0428 848 654	All day VFR gliding - 10NM North East of Goulburn, mainly operate. They would conduct some cross country over Yass but will above the WF's and wouldn't conduct any landing or take offs in area.
Gundaroo Airstrip	"Bowylie Homestead" Manager number as listed in AOPA Airfield Directory M: 0429 443 260	Property is owned by Dick Smith. Spoke with the property manager who is also a VFR pilot. He advised that the aircraft operations from the airfield are predominantly IFR. When VFR heading west though, he had some concerns in regard to low cloud days and turbines. He held view that the wind farm should be lit.
Cleveden Airstrip	Russell Skerritt Cleveden Pastoral Company PO Box 50, Gundagai, NSW Ph: (02) 6944 9100 M: 0418 202 609	Private airstrip, itinerants' ring to ask permission to land. Utilised approx 3-6 times a week, mainly by those that would like to get close to Gundagai. Aircraft 4-8 seaters. Russell noted that Gundagai doesn't have an aerodrome. All day VFR flights, some Ag aerial sprayers use strip. Russell owns single engine a/c. Wind farms not an issue.
Heliquip Pty Ltd Ag services	Tim Turner Bowral NSW 2576 M: 0417 668 879	Doesn't really operate in Yass region. Conducts helicopter pasture improvement and herbicide. Tim suggested Yass region would probably have guys from Cootamundra and they would conduct herbicide, weeds and barley. WF's not an issue; they are so big you can easily work around them.
Ward Air Flight Training	Sally Anne Ward Bathurst Airport, Raglan PO Box 926 Bathurst NSW 2795 Australia Ph: (02) 6337 3400 M: 0418 963 013	Undertake training navex's to Canberra via Young or direct to VFR entry points at Yass and Gunning. Do not fly west of Yass. Recreational pilots heading SW normally track Young to Wagga to the north west of the proposed wind farm.

APPENDIX I

Glossary of Terms and Abbreviations

APPENDIX H

Glossary of Terms and Abbreviations

Abbreviations used in this report, and the meanings assigned to them for the purposes of this report are detailed in the following table:

Abbreviation	Meaning
AC	Advisory Circular (document support CAR 1998)
ACFT	Aircraft
AD	Aerodrome
AHD	Australian Height Datum
AHT	Aircraft height
AIP	Aeronautical Information Publication
AIRPORTS ACT	Airports Act 1996, as amended
AIS	Aeronautical Information Service
ALA	Aeroplane Landing Area
ALT	Altitude
AMSL	Above Mean Sea Level
A(POFA)R	Airports (Protection of Airspace) Regulations, 1996 as amended
APARs	Airports (Protection of Airspace) Regulations, 1996 as amended
ARP	Aerodrome Reference Point
AsA	Airservices Australia
ATC	Air Traffic Control(ler)
ATM	Air Traffic Management
CAO	Civil Aviation Order
CAR	Civil Aviation Regulation
CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulation
Cat	Category
DAP	Departure and Approach Procedures (charts published by AsA)
DER	Departure End of (the) Runway
DEVELMT	Development
DME	Distance Measuring Equipment
Doc nn	ICAO Document Number nn
DITRDLG	Department of Infrastructure, Transport, Regional Development and Local Government. Also called “Infrastructure”. (Formerly Department of Transport and Regional Services (DoTARS))
DoTARS	See DITRDLG above
ELEV	Elevation (above mean sea level)
ENE	East North East
ERSA	Enroute Supplement Australia
FAF	Final Approach Fix
FAP	Final Approach Point
ft	feet
GNSS	Global Navigation Satellite System

Abbreviation	Meaning
GP	Glide Path
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organisation
IHS	Inner Horizontal Surface, an Obstacle Limitation Surface
ILS	Instrument Landing System
ISA	International Standard Atmosphere
km	kilometres
kt	Knot (one nautical mile per hour)
LAT	Latitude
LOC	Localizer
LONG	Longitude
m	metres
MAPt	Missed Approach Point
MDA	Minimum Descent Altitude
MGA94	Map Grid Australia 1994
MOC	Minimum Obstacle Clearance
MOS	Manual of Standards, published by CASA
MSA	Minimum Sector Altitude
MVA	Minimum Vector Altitude
NDB	Non Directional Beacon
NE	North East
NM	Nautical Mile (= 1.852 km)
nnDME	Distance from the DME (in nautical miles)
NNE	North North East
NOTAM	Notice To AirMen
OAS	Obstacle Assessment Surface
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OHS	Outer Horizontal Surface
OIS	Obstacle Identification Surface
OLS	Obstacle Limitation Surface
PANS-OPS	Procedures for Air Navigation Services – Operations, ICAO Doc 8168
PRM	Precision Runway Monitor
QNH	An altimeter setting relative to height above mean sea level
REF	Reference
RL	Relative Level
RNAV (GNSS)	aRea NAVigation (Global Navigation Satellite System)
RNP	Required Navigation Performance
RPA	Rules and Practices for Aerodromes — replaced by the MOS Part 139 — Aerodromes
RPT	Regular Public Transport
RWY	Runway
SACL	Sydney Airport Corporation Limited
SFC	Surface

Abbreviation	Meaning
SID	Standard Instrument Departure
SOC	Start Of Climb
STAR	Standard ARrival
TAR	Terminal Approach Radar
TAS	True AirSpeed
THR	Threshold (Runway)
TNA	Turn Altitude
TODA	Take-Off Distance Available
V_n	aircraft critical Velocity reference
VOR	Very high frequency Omni directional Range
WTG	Wind Turbine Generator