APPENDIX 15

Bango Wind Farm Aviation Impact Assessment

REHBEIN Airport Consulting

UPDATES TO THE ENVIRONMENTAL IMPACT STATEMENT

During the preparation of this Environmental Impact Statement, a number of changes occurred.

Please consider these changes while reviewing this Appendix.

- The Assessment Type of the Bango Wind Farm has transitioned from Part 3A, after its repeal, and is now being assessed as a State Significant Development under Part 4 of the EP&A Act. Any reference to a Part 3A assessment in attached technical assessments may be disregarded, and considered as State Significant Development;

- Rugby Wind Farm, a wind farm that was proposed to the north of the Project has been withdrawn. Where references are made to cumulative impacts with the Rugby Wind Farm, please disregard these;

- Slight changes have occurred to the Rye Park Wind Farm layout, a wind farm under development to the east of the Project. The changes made to the layout are not significant and therefore sit within the cumulative impact assessment undertaken for this EIS. The revised layout has been considered in the Environmental Noise Assessment and Landscape Visual Impact Assessment. Where further references are made to the Rye Park Wind Farm layout, these will be incorporated into future documentation where required;

- Four turbines at the south east extent of the Project, situated in the Mt Buffalo cluster have been removed through consultation with landowners. This change has been highlighted in maps and a review of all technical assessments has deemed that the removal of the four turbines has resulted in a reduced. This change will be incorporated into future documentation. These wind turbines are identified as “removed wind turbines” in the Project maps in Volume 2; and

- A number of changes were made to the residence information for the Project, as a result of construction of houses and change in occupancy status of existing buildings. These changes have been incorporated into the EIS.

LAMBERT & REHBEIN
ENGINEERS • MANAGERS • SCIENTISTS

6 September, 2016
Our File Ref: B13019AL001
Contact: Nick Borley

CWP Renewables Pty Ltd
Level 6, Suite A.
41 - 45 Hunter St
Newcastle NSW 2300

Attention: Siobhan Isherwood

RE: ASSESSMENT OF INCRESED WIND TURBINE GENERATOR BLADE TIP HEIGHT

1. INTRODUCTION

REHBEIN Airport Consulting was appointed by CWP Renewables Pty Ltd to undertake a review of the Bango Wind Farm, Aviation Impact Statement undertaken in May 2013 (Attached) due to a planned increase in wind turbine generators blade tip height. The May 2013 AIS was based on a maximum blade tip height of 192m Above Ground Level (AGL) however; it is now proposed to increase the blade tip height to 200m AGL. This letter sets out the results of the review undertaken against the original AIS. The proposed increase in blade tip height has been assessed against each of the risks documented in Section 6 of the AIS and are discussed below.

2. RISK ASSESSMENT

2.1 Aerodromes and OLS

The increased blade tip height will not impact on any registered, certified or unregistered aerodromes Obstacle Limitation Surfaces (OLS) as the wind farm will be located beyond lateral extent of the applicable OLS.

2.2 Protected Airspace

A review of the protected airspace associated with the instrument approach procedures for Young Airport was undertaken in light of the increased blade tip height. The 25 nautical mile minimum safe altitude (25Nm MSA) was confirmed as being the most restrictive surface in relation to the proposed wind farm. Based on the original AIS the highest turbine to be located within the 25Nm MSA inspection area had a planned height of 2667ft AMSL. With an increase in blade tip height by 8 metres this turbine will have a revised height of 2694ft AMSL. The protected airspace associated with the 25Nm MSA is located at 2700ft AMSL therefore the revised tip height will not impact on the MSA.

2.3 Published IFR and NVFR Air Routes

The published IFR air routes have been reviewed against the amended blade tip height of 200m AGL. The protection surface associated with the published air routes is calculated to be at 1097m (3,600ft) AMSL. In consideration of the

increased blade tip height, the highest turbine within the wind farm development will have an amended height of 952m (3123ft) AMSL and will not impact on the lower safe altitudes associated with published tracks or LSALTS associated with IFR and NVFR flights.

2.4 VFR Air Routes

There are no published VFR air routes in the vicinity of the proposed wind farm. The increase in blade tip height will therefore not impact on VFR flight.

2.5 Military Low Flying

The magnitude of the increase in turbine blade tip height is minimal relative to the original assessment and is unlikely to impact on military low flying activities should defence undertake operations in the area. The planning of MLJ operations would be undertaken mindful of the obstacle environment over which the routes are planned to operate and would consider the Bango wind farm during the planning stages.

2.6 Designated Airspace

There is no designated airspace in the vicinity of the Bango Wind Farm.

2.7 Radar

The change in overall blade height was assessed against potential impacts on radar performance. The assessment indicated that the wind farms highest turbine at 952m (3123ft) AGL would not penetrate the 0.5 degree radar protection surface associated with the Mt Majura radar facility. The location of the wind farm is such that it will not impact on the performance of the Mt Bobbara RSR nor the Mt Majura SSR.

2.8 Radio Navigation Aids

The revised blade tip height was assessed against radio navigation aids in the vicinity of the proposed Bango windfarm development. Both the Young and Rugby NDB's have been decommissioned. Therefore, the increased blade tip height will not impact any radio navigation aids.

2.9 Airborne Radio

Based on available literature, the increased blade tip height will not have an impact on the performance of airborne radio.

2.10 Aerial Agriculture

The impact on aerial agricultural operations was assessed against the increase in blade tip height. Since there is no increase in blade diameter, the changed tip height should have no further impact on aerial agricultural operations with regard to turbulent airflows potentially present downwind of the WTG.

3. CONCLUSSION

REHBEIN Airport Consulting has reviewed the previously completed Aviation Impact Statement for a proposed wind farm to be located at Bango NSW against an amended blade tip height of 200m AGL. The findings of the review are;

- The increase in tip height will not impact on any airport within the vicinity Obstacle Limitation surfaces;
- The increased tip height will not impact on any PANS-OPS protection surfaces at Young Airport;
- The increased tip height will not impact on any published IFR or VFR air route;
- The increased tip height will not impact on any Minimum Safe or Lower Safe Altitude;
- The increased tip height will not impact on the performance of any radio navigation aid, radar facility or airborne radio; and
- The increase in blade tip height will not have an unacceptable impact on aerial agricultural, recreation, air ambulance or military low jet operations.

Yours faithfully
For and on behalf of
LAMBERT & REHBEIN (SEQ) PTY LTD

NICK BORLEY
PRINCIPAL AVIATION CONSULTANT

REHBEIN AIRPORT CONSULTING

DATE 21 MAY, 2013

CONTACT MICHAEL WARD

Bango Wind Farm Aviation Impact Statement

For Bango Wind Farm Pty Ltd

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Revision	Date	Description	Author	Signature	Verifier	Signature	Approver	Signature
0	26/02/2013	DRAFT	MMW		MCW		BJH	
1	22/03/2013	DRAFT	MMW		MCW		BJH	
2	15/05/2013	FINAL	MMW		MCW		BJH	
3	21/05/2013	FINAL	MMW		MCW		BJH	

1.0 INTRODUCTION

Bango Wind Farm Pty Ltd is proposing to develop a wind farm in the area between Boorowa NSW and Rye Park NSW, east of Lachlan Valley Way. The Bango Wind Farm (BWF) will consist of a maximum 122 Wind Turbine Generators (WTGs) in three (3) main clusters as shown at Appendix A.

The proposed WTGs have a hub height of 120m Above Ground Level (AGL) with a rotor diameter of 144m giving a ground to maximum blade tip height of 192m AGL. The coordinates and elevations for each proposed WTG are shown at Appendix B.

Bango Wind Farm Pty Ltd has commissioned REHBEIN Airport Consulting to conduct an Aviation Impact Study (AIS) to assess the impact the proposed wind farm will have on aviation. The findings of the assessment are provided in this report.

This AIS has been developed using the advice promulgated in the Civil Aviation Safety Authority (CASA) Advisory Circular AC 71-1(0), *Guidelines for Airspace Risk Management and Associated Aeronautical Study Methodology* and consideration to other relevant standards and guidelines including but not limited to:

- CASA Civil Aviation Regulations (CARs);
- CASA Civil Aviation Safety Regulations (CASRs);
- CASA Manual of Standards Part 139 – Aerodromes (MOS Part 139);
- Aeronautical Information Publication;
- Current Civil Aviation Safety Authority (CASA) Approach to the Impact of Tall Structures, including Wind Turbines and Wind Monitoring Masts on Aviation;
- International Civil Aviation Organisation (ICAO) *Procedures for Air Navigation Services — Aircraft Operations;*
- Draft NSW Planning Guidelines Wind Farms;
- National Airports Safeguarding Framework Guideline D – Managing the Risk to Aviation Safety of Wind Turbine Installations (wind farms) and Wind Monitoring Towers;
- Wind Farm Aviation Impact Studies – Requirements for Airservices Australia Assessment; and
- EUROCONTROL Guidelines on How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors.

2.0 AVIATION REGULATORY REQUIREMENTS

Under the provisions of the *Civil Aviation Act 1998,* the *Civil Aviation Regulations* (CAR) or the *Civil Aviation Safety Regulations* (CASR)*,* the CASA is not empowered to approve or reject the erection of structures on or near an aerodrome. In limited circumstances which are not relevant to this assessment, the CASA has power to order the removal of an object or potential hazard which is classified as an obstruction or hazardous to aircraft operations within 3,000m of an aerodrome (CAR 95).

CASR Part 139.E promulgates the requirements to be met in relation to obstacles and hazards. CASR 139.365 requires the proponent of a proposed structure *"…the top of which will be 110m or more above ground level…"* to notify the CASA of their intention and to provide the proposed height and location of the building or structure.

In accordance with CASR 139.370 CASA may determine after conducting an aeronautical assessment that an obstacle, building or structure is, or will be, hazardous to aircraft operations. If the proposed obstacle, building or structure is deemed to be hazardous to aircraft operations, the CASA may direct the proponent to light or mark the hazard in accordance with the *CASA Manual of Standards (MOS) - Part 139 Aerodromes.*

With respect to the lighting of wind farms in particular, the CASA formerly provided guidance material in Advisory Circular AC 139-18(0) *Obstacle Marking and Lighting of Wind Farms,* which has subsequently been withdrawn*.* Currently, the National Airports Safeguarding Framework (NASF) *Guideline D: Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation* provides guidance to State/Territory and local government decision makers to address the risk to civil aviation, including outlining mitigation measures such as marking and lighting.

If a wind turbine is found to penetrate prescribed airspace surrounding an airport, it will be defined as an obstacle and shall be dealt with in accordance with the requirements set out in Chapters 7, 8 and 9 of the CASA MOS Part 139. If the aerodrome is used for night operations, lighting of the obstacle must be in accordance with the provisions of Chapter 9 of the CASA MOS Part 139.

Input from the Department of Defence (DoD) may be required if the proposed activity has a potential impact on military flying operations. The CASA may liaise with the Royal Australian Air Force (RAAF) Aeronautical Information Service (AIS), as that organisation maintains the tall structure database on behalf of the aviation community.

Likewise Airservices Australia, the provider of Air Traffic Control (ATC) services and air navigation services, has an interest in assessing proposed tall structures to ensure there is no impact upon the performance on aviation surveillance, communication, and guidance systems.

3.0 OVERVIEW OF THE AERONAUTICAL STUDY METHOD

The framework proposed by the CASA for the conduct of an Aeronautical Study is intended to provide a systematic means of analysing potentially complex risk issues and to provide the decision-maker with the information necessary to make a decision with confidence. Risk and alternative control strategies for minimising risk need to be evaluated.

The three key issues for consideration are:

- The consequence of risk,
- The frequency of occurrence of risk, and
- The perception of risk.

While consequence and frequency may be assessed by statistical analysis, perception needs to be addressed by reference to the needs, issues and concerns of the key stakeholders.

AC 71-1(0) states that in assessing risk in relation to airspace matters the CASA criteria is based on establishing “acceptable risk”, i.e. one chance in 10,000 each year of having one fatality due to, in this case, an aircraft in flight colliding with a wind turbine. The AC also states that in Australia mid-air and air-ground collisions are fairly uncommon.

4.0 STAKEHOLDER ISSUES

In carrying out the assessment REHBEIN Airport Consulting considered the likely impact of the location, height and blade rotation of the proposed WTGs on the following stakeholder activities.

4.1 AIRPORT OPERATORS

REHBEIN Airport Consulting considered registered and certified aerodromes within 30NM of and Aeroplane Landing Areas (ALAs) nearest to the proposed wind farm in terms of:

- The types of flying activities conducted there;
- Their airspace protection requirements established by the Obstacle Limitation Surfaces (OLS); and
- Any existing aircraft instrument procedures published in the *Aeronautical Information Publication – Departure and Approach Procedures* (AIP-DAP).

4.2 CIVIL AND MILITARY PILOTS

REHBEIN Airport Consulting considered the effect of the proposed development on transiting air routes used by:

- Civil pilots operating under instrument flight rules (IFR);
- Civil pilots operating under visual flight rules (VFR); and
- Military aircraft.

A copy of the draft AIS (Ref: B13019AR001Rev1) was provided to the CASA and the DoD for review and comment. Their responses have been incorporated into this report and are provided at Appendix C and Appendix D respectively.

4.3 AIRSERVICES AUSTRALIA

REHBEIN Airport Consulting considered the impacts on air navigation and air traffic management services provided by Airservices Australia including:

- Radar;
- Ground based navigation aids; and
- Airborne radio.

A copy of the draft AIS (Ref: B13019AR001Rev1) was provided to Airservices Australia for review and comment. They conducted further assessment with regards to Precision/Non-Precision Navigation Aids, HF/VHF Radio, Advanced Surface Movement Guidance and Control System (A-SMGCS), Radar, Precision Runway Monitor, Automatic Dependent Surveillance-Broadcast (ADS-B), Wide Area Multilateration (WAM) or Satellite/Links. A copy of their response is provided at Appendix E and has been incorporated into this report.

4.4 OTHER AVIATION ACTIVITY

REHBEIN Airport Consulting considered the effect of the proposed development on those engaged in agricultural, air ambulance, and recreational aviation activities in the area.

A copy of the draft AIS (Ref: B13019AR001Rev1) was provided to the Aerial Agricultural Association of Australia (AAAA) and Royal Flying Doctor Service (RFDS) for review and comment. Their responses have been incorporated into this report and are provided at Appendix F and Appendix G respectively.

5.0 POTENTIAL RISKS TO AVIATION

Like any tall structures wind turbines must be assessed as potential obstacles in airspace and for hazards to aircraft operations. This is particularly critical in the vicinity of aerodromes and within designated military low flying areas.

5.1 AIRSPACE AROUND AERODROMES

The airspace associated with an aerodrome may comprise OLS and surfaces to protect instrument flight procedures, referred to as PANS-OPS surfaces.

5.1.1 OBSTACLE LIMITATION SURFACES

The OLS is a set of imaginary surfaces associated with an aerodrome. They define the volume of airspace that should ideally be kept free from obstacles in order to minimise the danger to aircraft during an entirely visual approach or during the final visual segment of an instrument approach procedure. These surfaces are of a permanent nature and comprise the reference datum which defines an obstacle. Anything above the vertical limits of the OLS is regarded as an obstacle. Obstacles are reported so that the CASA can determine if they are “hazardous” and therefore need to be marked and/or lit to ensure they are prominently identified.

These airspace requirements will depend on the nature and scale of activities at an aerodrome but could extend to a radius of 15km. The OLS for both current and future aerodrome developments and activities need to be considered.

Wind turbines may be acceptable in areas covered by the OLS but will need to be assessed in relation to critical manoeuvres such as the approach to land and possible low level missed approaches, and a reduced power take-off following an engine failure.

5.1.2 PANS-OPS SURFACES

Airspace associated with aircraft instrument approach and departure procedures is defined by the PANS-OPS surfaces for an aerodrome. These surfaces are ascertained in accordance with the procedures in the International Civil Aviation Organisation (ICAO) *Procedures for Air Navigation Services — Aircraft Operations* (Doc 8168, PANS-OPS).

The PANS-OPS surfaces are intended to safeguard an aircraft from collision with obstacles when the pilot is flying by reference to instruments. The designer of an instrument procedure determines the lateral extent of areas needed for an aircraft to execute a particular manoeuvre. He/she then applies minimum obstacle clearance to structures, terrain and vegetation within that area to determine the limiting altitude at which the manoeuvre can be safely executed. As a result, PANS-OPS surfaces cannot be infringed in any circumstances.

These airspace requirements will depend on the nature and scale of activities at an aerodrome but could determine the acceptable obstacle heights to a radius of 10km - 20km from the aerodrome.

5.1.3 AIRSPACE PROTECTED BY THE DACRS

The Defence (Areas Control) Regulations (DACRs) are designed to ensure airspace around military airfields and their associated navigation aids and radio communication facilities are kept free from obstacles.

They impose various height restrictions in the vicinity of military airfields by means of zones ranging in height from 0m to 90m. In general the zones extend to the limit of the OLS i.e. around 15km from the airfield.

The regulations do not prohibit all buildings or structures within a zone exceeding these heights but provide a mechanism by which the DoD can assess a proposal against technical criteria and topographical conditions in relation to the safe operation of military and any civil aircraft using the airfield. Applications must be made to the Minister who can approve, refuse or approve an application subject to certain conditions.

5.2 TRANSITING AIR ROUTES

5.2.1 IFR

Aircraft operating under IFR are navigated by reference to flight instruments which process data from aircraft systems, ground-based navaids or satellites. All Regular Public Transport (RPT) jet aircraft operating into or between major Australian cities operate only in controlled airspace and under IFR.

In contrast, turboprop or piston engine regional RPT aircraft travelling to or from a smaller city may operate route sectors Outside Controlled Airspace (OCTA) and even under the Visual Flight Rules (VFR).

Charter and business aircraft may operate in controlled airspace under IFR or VFR or OCTA under the VFR. General aviation training aircraft are most likely to operate under the VFR. Military aircraft may operate anywhere and may be flying at very low levels.

Aircraft operating under the IFR may do so either OCTA or within controlled airspace. If flying below 10,000ft pilots must select, or will be assigned, cruising altitudes which are multiples of 1,000ft – odd thousands if their track is 0 - 179ºM and even thousands if their track is 180 - 359ºM. IFR traffic will in most cases select or be assigned to a designated air route published on air navigation charts.

Since IFR pilots may be relying solely on flight instruments and have no outside visual reference, a Lowest Safe Altitude (LSALT) is published for each air route. It is determined by adding 984ft minimum vertical clearance to the highest terrain or known structure en route or within calculated tolerance areas.

It is conceivable that a new wind farm, if located on prominent terrain, may require an increase in LSALT for a particular IFR route.

5.2.2 VFR

Aircraft operating under the VFR may do so only in Visual Meteorological Conditions (VMC). VMC varies depending on the altitude and airspace classification. However, between ground and 1,000ft AGL OCTA, VMC is defined as a flight visibility of 5,000m, horizontal cloud clearance of 1,500m and vertical cloud clearance of 1,000ft.

VFR traffic is most likely to operate OCTA but may fly in controlled airspace. VFR pilots must ordinarily select altitudes which are multiples of 500ft - odd thousands plus 500ft if their track is 0 - 179ºM and even thousands plus 500ft if their track is 180 - 359ºM. This rule ensures a minimum 500ft vertical separation between IFR and VFR traffic using the same airspace.

The minimum statutory height for VFR flight is 500ft above ground level in non-populous areas. Night VFR pilots must fly at or above the LSALT for that route.

VFR traffic in daylight hours is not confined to air routes and may operate anywhere provided they do so in VMC.

In these conditions wind farms should be easily visible and have no impact on VFR flying activity.

5.3 MILITARY LOW FLYING

Military pilots must conduct low level flying training. Low level jet flying may be required for concealment or humanitarian operations involving low level air drops. Helicopters also use very low altitudes to reduce noise and for concealment. For this reason military helicopter pilots may need to fly very close to ground level.

Low level flying exercises are carried out by military aircraft from a number of defence airfields. Routes at or below 5,000ft AGL used by military jet aircraft for low level, high speed navigation or terrain following exercise are designated as Military Low Jet Routes (MLJR).

Routes are planned to avoid controlled airspace, civil restricted areas and danger areas, civil aerodromes by at least 5 Nautical Miles (NM) laterally and 4,000ft vertically, and aerodromes with a Common Traffic Advisory frequency (CTAF) unless the military aircraft are equipped with the appropriate radio frequency.

A small number of MLJR are notified in the Aeronautical Information Publication – En Route Supplement Australia (AIP-ERSA) and are permanently activated. In all other instances routes and duration of MLJR operations are advised by the Notice to Airmen (NOTAM) system.

This policy means that MLJRs are more flexible and new installations such as wind farms would be considered by DoD when planning low level flight.

5.4 DESIGNATED AIRSPACE

Special use airspace, extending to varying heights, is defined on air navigation charts and identified as Prohibited (P), Restricted (R), or Danger (D) areas. For safety reasons flight into this airspace may be prohibited or restricted or the airspace may be designated as a danger area to warn pilots to take additional care.

WTGs will not be permitted within prohibited or restricted areas as these are usually set aside for military training and weapons firing and often extend upwards from ground level.

Danger areas will often relate to mining or quarrying sites, chimneys or stacks with high velocity or high temperature discharges, special aviation activities such as aerobatic training and the like. While pilots may elect to avoid these areas there is no restriction on entry.

Wind turbines may not be compatible with some activities conducted within a designated Danger area but, more importantly, the CASA may elect to designate a Danger area around a wind farm in order to alert pilots to avoid low altitude flying.

5.5 RADAR

Tall structures may also interfere with electromagnetic transmissions. Steel towers and rotating turbine blades can cause reflection and/or deflection of radiated signals and cause interference with aviation communication, navigation and surveillance (CNS) systems established for air traffic management. The CNS system includes aerodrome based and en route navigation aids (navaids) and radar used for Air Traffic Control (ATC) at an aerodrome and/or en route surveillance.

Two types of radar are used for ATC and surveillance – Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR). Route Surveillance Radar (RSR) is a type of SSR.

Primary radar works by radiating electromagnetic energy and detecting a return signal from reflecting objects. Comparison of the return signal with the original transmission provides information such as the direction and range of the target from the radar site. ATC radars are designed to filter returns from stationary objects to avoid moving targets, primarily aircraft, being obscured by radar clutter. Other than this means of differentiating between stationary and moving targets, primary radar cannot identify the type of object and has no means of determining the height of the object.

SSR emits radio frequency (RF) interrogation messages that trigger automatic responses from a “transponder” on board an aircraft. The transponder reports aircraft identification and altitude.

Airservices Australia provides a network of 19 radars. Those associated with major airports – 8 in total – are combined PSR and SSR units. These are referred to as Terminal Area Radar (TAR). These are augmented by 11 SSR or route surveillance radars (RSR) strategically located along the busier air corridors. Their coverage is augmented by radar data from 6 military radar sites.

PSR can detect aircraft up to 50NM from the airport while TAR SSR and RSR can detect aircraft up to 250NM from their location. This is referred to as the radar coverage. Radar coverage extends along the eastern seaboard from Cairns to Adelaide and is provided for Perth, Darwin and Tindal.

Vertical coverage depends on the line of sight of each radar, which may be interrupted by terrain or tall structures. Coverage must be guaranteed within controlled airspace which extends from ground level in airport control zones (CTR) and from 8,500ft in en route airspace.

Only aircraft equipped with transponders are permitted to operate in controlled airspace, and should therefore be detected by SSR. The primary radar is provided at busy airports as a back-up to detect non-transponder equipped aircraft that may accidentally stray or deliberately fly into a control zone.

The blades of a wind turbine may be detected if within the coverage and line of sight of a PSR. A grouping of blades will return intermittent reflections that create the impression of a moving target. Since the primary radar gives no height information the air traffic controller may be forced to divert aircraft which may be in the vicinity of the wind farm within PSR coverage regardless of their flight level.

The turning blades may also reflect or deflect the primary radar signals and prevent aircraft flying in their “shadow” from being detected. In this case the co-located SSR would also detect the aircraft but even then the reflection of SSR transmissions in some instances could cause the aircraft to be wrongly identified or inaccurately located.

Weather radar can similarly be affected and this too impacts on flight safety which relies on accurate forecasting of major weather events and wind shear at higher altitudes.

5.6 RADIO NAVIGATION AIDS

Ground based navaids could suffer from similar reflection and deflection affects as an SSR which means that an aircraft may not be tracking accurately towards the navaid on the designated air route. This has air safety implications if an aircraft deviates even briefly from the air route towards high terrain.

Line of sight principles again apply but this type of facility will normally be protected by preventing new structures from extending above an elevation angle of 1º as seen from the navaid site.

This means that on level ground a 120m high AGL WTG could be safely located at around 7km from the navaid site.

5.7 AIRBORNE RADIO

Large scale power generation activities may cause electromagnetic interference (EMI) with on-board radio communication equipment of aircraft overflying and/or flying in the vicinity of the wind farm.

The available literature indicates that this affect may be considered negligible because of the standards which apply to wind turbine construction. Wind turbines have been installed worldwide with very few instances of EMI being recorded.

5.8 OTHER AVIATION ACTIVITY

WTGs can pose a special hazard to aircraft such as agricultural aircraft operating at low level and high weights during application of chemicals and seeding. This is due to wind shear, turbulence and downdrafts in the wake of the turbine rotors.

A wind farm can also pose a special hazard to air ambulance if they regularly overfly the wind farm or must conduct operations such as rescues within wind farm.

Special use areas for recreational aviation including hang-gliding, parachuting or radio controlled model aircraft flying are marked by symbols on air navigation charts. Although these do not usually justify the designation of a Danger Area the symbol serves to alert pilots to overfly these sites at a safe height. Since a wind farm shares low level airspace it could seriously curtail these types of recreational activities in its general locality. Wind farms are now being indicated on charts by a symbol in the same manner.

5.9 CUMULATIVE IMPACTS

There are two (2) other proposed wind farms in the region of the proposed BWF and it is appropriate to consider the potential cumulative affect created by up to four (4) wind farms.

6.0 RISK ASSESSMENT

An extract from the Sydney Visual Navigation Chart (VNC) published by Airservices Australia Aeronautical Information Service (AIS) is shown in Figure 1 included at Appendix H. It illustrates the proposed BWF and a number of the aviation sites/activities discussed below.

6.1 AERODROMES AND OLS

There are no certified aerodromes within 30NM of the proposed BWF. Young Airport near Young NSW is a registered aerodrome and is less than 30NM from the proposed BWF. Additionally, there is one (1) known ALA in the vicinity of the proposed BWF known as Harden.

6.1.1 YOUNG AIRPORT

Young Airport is located approximately 7.5km north west of Young, NSW and approximately 50km north west of the nearest WTG. The airport is owned and operated by Young Shire Council and is classified as a registered airport by the CASA.

The airport has one runway. Runway 01/19 is 1,220m long and 18m wide and is sealed. The airport caters for general aviation activity only.

Since the greatest lateral extent of the OLS for any certified or registered aerodrome is 15km, the proposed height and location of the turbine structures will not infringe the OLS for Young Airport.

There are published aircraft instrument procedures for Young Airport which are discussed further in Section 6.2.

6.1.2 HARDEN ALA

Harden ALA is approximately 2.5km south east of Harden NSW and 32km south west of the nearest WTG. The ALA is owned and operated by Harden Shire Council and consists of one (1) runways. Runway 08/26 is 850m long and has a gravel surface. The ALA caters for light general aviation activity only.

Since the greatest lateral extent of the OLS for any ALA is 900m, the proposed height and location of the turbine structures will not infringe the OLS for Harden ALA.

There are no published aircraft instrument procedures for Harden ALA.

6.2 PRESCRIBED AIRSPACE

6.2.1 YOUNG AIRPORT

Currently there are four (4) instrument procedures available for Young Airport published in the Aeronautical Information Publication – Departure and Approach Procedures (AIP-DAP) which are:

- GPS Arrival;
- NDB RWY 19
- RNAV (GNSS) RWY 01; and

- RNAV (GNSS) RWY 19.

The critical PANS-OPS surface above the proposed BWF is associated with what is known as the 25NM MSA or the 25NM Minimum Safe Altitude. The PANS-OPS protection surfaces for the 25NM MSA actually extend to 30NM from the Young Non-Directional Beacon (NDB). The 25NM MSA for Young Airport is 3,700ft. Allowing for minimum obstacle clearance, a WTG would need to be greater than 2,700ft AMSL in height to potentially require an increase in LSALT. There are seventeen (17) WTGs within 30NM of the Young Airport NDB, however the highest blade tip height is 2,667ft AMSL and therefore there is no impact.

These findings have been confirmed by Airservices Australia following their assessment of the proposal in their response included at Appendix E.

6.3 APPLICATION OF THE DACRS

There are no DoD areas promulgated within the vicinity of the proposed Bango Wind Farm.

6.4 TRANSITING CIVIL AIR ROUTES

6.4.1 IFR AIR ROUTES

There are spot heights of 2,422ft, 2,523ft, and 2,612ft for terrain in the area of the proposed wind farm.

There are two (2) IFR air routes that pass over the proposed BWF site. Air routes W497 and W569 both have an LSALT of 4,600ft AMSL over the area of the proposed wind farm. Allowing for minimum obstacle clearance, a WTG would need to be greater than 3,600ft AMSL in height to potentially require an increase in LSALT.

As the maximum height of the proposed turbine blades will be 3,097ft (944m) AMSL, the published IFR air routes will not be affected.

These findings have been confirmed by Airservices Australia, following their internal assessment of the proposal, in their response included at Appendix E.

6.4.2 NIGHT VFR FLIGHTS

As noted earlier, when flying a designated IFR route, night VFR traffic is required to fly at an appropriate cruising level above the published LSALT which, in this case, is at least 4,600ft.

The proposed BWF will have no impact on night VFR flying activity.

6.4.3 VFR AIR ROUTES

There are no published VFR routes in the vicinity of the proposed wind farm site. VFR aircraft over non populated areas such as the BWF region are required to remain 500ft from terrain or obstacles.

The NASF Guideline B indicates that wind turbines are sufficiently conspicuous by day not to require painting in obstacle marking colours and/or patterns to alert VFR pilots.

The proposed WTGs will have no impact on day VFR flying activity.

6.5 MILITARY LOW FLYING OPERATIONS

It is conceivable that DoD may consider designating MLJRs in the proposed BWF area. However, any MLJR which DoD may require in the area can be designed to avoid the proposed BWF with minimal impact on military operations.

The DoD has reviewed the proposal and has no objections to the wind farm development provided final WTG location and height details are included in the RAAF AIS before construction. A copy of their response is included at Appendix D.

6.6 DESIGNATED AIRSPACE

The proposed BWF is not within or near any designated airspace.

6.7 RADAR

The impact the proposed wind farm will have on radar facilities has been assessed with consideration to the Eurocontrol Guidelines on *How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors* as required by Airservices Australia for its review of Aviation Impact Studies.

The closest radar to the proposed wind farm is the RSR at Mt Bobbara NSW. The closest PSR and SSR are collocated at Mt Majura ACT. The Mt Bobbara RSR is approximately 9.6NM from the nearest WTG and the Mt Majura PSR & SSR is located approximately 38NM from the nearest WTG.

The Eurocontrol guidelines divide the area between the PSR or SSR radar antennae and the maximum instrumented range of the radar (60NM for PSR and 250NM for SSR) into zones based on distance from the antennae. Assessment requirements are less complex as distance from the radar antennae increases or the amount of the WTG structure in line of sight of the antennae reduces.

The assessment criteria for PSR outlined in the Eurocontrol guidelines is described in Table 1.

Table 1 – PSR Assessment Criteria for Wind Farms

Zone	Zone 1	Zone 2	Zone 3	Zone 4
Description	0 – 500m	500m – 15km and in radar line of sight	Further than 15km but within maximum instrumented range and in radar line of sight	Anywhere within maximum instrumented range but not in radar line of sight or outside the maximum instrumented range
Assessment Requirements	Safeguarding	Detailed Assessment	Simple Assessment	No Assessment

Assessment criteria for SSR outlined in the Eurocontrol guidelines is described in Table 2.

Table 2 – SSR Assessment Criteria for Wind Farms

Zone	Zone 1	Zone 2	Zone 4
Description	0 – 500m	500m – 16km but within the maximum instrumented range and in radar line of sight	Further than 16km or not in radar line of sight
Assessment Requirements	Safeguarding	Detailed Assessment	No Assessment

The proposed BWF would be within 60NM operational range of the Mt Majura PSR and parts of all the proposed WTGs would be within line of sight. However, the 3,036ft elevation of the Mt Majura radar site ensures that the highest turbine blade zenith at 3,097ft (944m) AMSL located approximately 38NM from the sensor will not penetrate the 0.5 degree radar protection surface originating from the base of the antenna.

As the proposed BWF is greater than 16km from the Mt Bobbara RSR and Mt Majura SSR no further assessment is required with respect to the SSR.

Following their own internal assessment of the proposal Airservices Australia confirms the proposed BWF will not have an unacceptable impact on radar facilities. A copy of their response is included at Appendix E.

6.8 RADIO NAVIGATION AIDS

The closest radio navigation aid to the proposed wind farm site is the Rugby NDB which is located approximately 10NM north east of the nearest WTG.

As the greatest extent of restriction zones for objects in the vicinity of NDBs is 150m and the nearest WTG subtends an angle less than 3 degrees from the antennae as outlined in CASA MOS Part 139, WTG associated with the proposed BWF will not have an impact on the performance of the Rugby NDB.

These findings have been confirmed by Airservices Australia, following their internal assessment of the proposal, in their response included at Appendix E.

6.9 AIRBORNE RADIO

Available literature indicates that this affect may be considered negligible because of the standards which apply to wind turbine construction. Wind turbines have been installed worldwide with very few instances recorded of EMI affecting aircraft radio systems.

Following their internal assessment of the proposal Airservices Australia confirm that the proposed BWF will not have an impact on airborne radio. A copy of their response is included at Appendix E.

6.10 OTHER AVIATION ACTIVITY

6.10.1 AERIAL AGRICULTURAL OPERATIONS

Wind turbines can pose a special hazard to aircraft such as agricultural aircraft operating at low level and high weights during application of chemicals and seeding. This is due to wind shear, turbulence and downdrafts in the wake of the turbine rotors.

Studies suggest that a wake length equivalent to 6 times the rotor diameter is considered a minimum in wind conditions of 10-15 knots (18-28 km/h)[1]. Aerial agricultural spreading and spraying operations are normally conducted at very low levels and often require calm or very light wind conditions of less than 8 knots (15km/h). At these wind speeds it is reasonable to assume the wake can extend for a distance of 6 rotor diameters or 864m downwind of the nearest turbine based on the proposed rotor diameter of approximately 144m. Given the distances from wind turbines to cultivated areas of land on adjacent properties outside the wind farm boundary there should be minimal impact on aerial agricultural operations during the periods of wind speeds at which these aircraft operate.

The Aerial Agricultural Aviation Association (AAAA) has adopted a wind farm policy which is included in Appendix F. The policy advises the AAAA opposes all wind farm developments in areas of agricultural production or elevated bushfire risk.

6.10.2 AIR AMBULANCE

The RFDS reviewed the proposal and had no issues. A copy of their response is included at Appendix G.

6.10.3 RECREATIONAL AVIATION

Symbols on aviation charts indicate that there is no recreational aviation or miscellaneous aviation activity in the vicinity of the proposed BWF.

[1] L.J Vermeer, J.N. Sorenson, A Cresp, *Wind Turbine Wake Aerodynamics,* Progress in Airspace Sciences 39 (2003).

Hand M, Simms D, Finger L, Jager D, Coteril J, Schreck S, Larwood S *Unsteady aerodynamics experiments phase VI: Wind tunnel test configuration and available data campaigns.* Technical Report BREL/TP-500-29955, NREL (December 2001).

Wind Turbine Wakes – Control and Vortex Shedding by Davide Medici. Technical Reports from KTH Mechanics Royal Institute (2004)

6.11 CUMULATIVE IMPACTS

The proposed Rugby Wind Farm is northeast of the proposed BWF, approximately 50km north of Yass with a proposed size of 52 WTGs. The proposed Rye Park Wind Farm is east of the proposed BWF and south of the proposed Rugby Wind Farm, approximately 4km east of Rye Park NSW with a proposed size in excess of 100 WTGs.

As Rugby and Rye Park Wind Farms are not being developed by Wind Prospect CWP detailed assessment of the cumulative impact cannot be undertaken. However, the developers of the Rugby and Rye Park Wind Farms will be required to prepare an AIS similar to this one as part of the planning approval process.

As the potential impact on OLS, PANS-OPS protections surfaces, DACRs, and air routes (LSALT) by WTGs is assessed with consideration to the elevations of individual WTGs, assessment of these aviation elements is not subject to cumulative effect. As stated in Sections 6.1 - 6.4 the WTGs associated with the proposed BWF will have no impact on these aviation elements and therefore any impact on these aviation elements by Rugby and Rye Park Wind Farms will be exclusive to them.

It is conceivable that the DoD may consider designating MLJRs in the Bango, Rye Park, and Rugby Wind Farm region. However, any MLJR which DoD may require in the area can be designed to avoid the wind farms with minimal impact on military operations.

The impact of wind farm on designated airspace would not be subject to cumulative effect and exclusive to the individual wind farms. As stated in Section 6.6 there is no designated airspace in the area of the proposed BWF.

As WTGs are large metallic structures with rotating carbon fibre blades the impact of WTGs on radar coverage and performance is subject to potential cumulative effect. Preliminary assessment suggests that the Rugby and Rye Park wind farms would be well beyond 16km from the nearest SSR, as is the proposed BWF and therefore would have no impact. However, the Rugby and Rye Park wind farms may also be within the 60NM instrumented range of the nearest PSR and within line radar line of sight. Airservices Australia is aware of the Rugby and Rye Park wind farm proposals but confirmed that the proposed BWF will not have an unacceptable impact on radar which suggests that the cumulative effect of all three (3) wind farms on radar has been considered.

Other aviation activities such as aerial agricultural operations and recreational aviation are typically subject to the cumulative effect of obstructions as the available area of operation becomes more restricted as the number of obstructions increases. As stated in Section 6.10, aerial agricultural and recreational aviation in the area of the proposed BWF is considered minimal.

7.0 SUMMARY

REHBEIN Airport Consulting has assessed the proposed Bango Wind Farm as having no impact on the safe conduct of civil or military aircraft operations.

The proposed wind farm does not impact on the OLS of any airport.

The proposed wind farm does not impact on the PANS-OPS protection surfaces for Young Airport.

The proposed wind farm will have no impact on civil air traffic operating under either IFR or VFR.

The proposed wind farm will provide a prominent topographical feature which may assist visual navigation.

Any low level military activity can be planned to avoid the area of the wind farm.

The department of defence has no objections to the proposed BWF provided final WTG location and height data is included in the RAAF AIS before construction commences.

The proposed wind farm is not within or near any designated airspace.

The proposed wind farm will have no impact on Precision/Non-Precision Navigation Aids, HF/VHF Radio, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links.

The proposed wind farm should not have an unacceptable impact on aerial agriculture operations.

The proposed wind farm will not have an unacceptable impact on air ambulance operations.

The proposed wind farm will not affect the safety of recreational aviation activity in the area.

As the proposed WTGs will be concentrated in a defined area and conspicuous because of their size, shape and colour they should not be required to be marked to notify pilots of their presence during daylight hours.

There is no statutory or legislative requirement to provide obstacle lighting on the proposed BWF and the risk the BWF poses should be adequately discharged through adherence to the Civil Aviation Regulations by pilots. However, as the proposed WTGs are greater than 152m (500ft) AGL in height it may be prudent to install medium intensity obstacle lighting on the top of some of the WTGs in accordance with NASF Guideline D to reduce the risk the WTGs pose to as low as reasonably practical , particularly for times of reduced visibility or low light.

8.0 INFORMATION SOURCES

Airservices Australia, Aeronautical Information Publication – Departure and Approach Procedures 133, Affective 15 November 2012

Airservices Australia, Aeronautical Information Publication – Enroute Supplement Australia 133, Affective 15 November 2012

Airservices Australia, Designated Airspace Handbook, 15 November 2012

Airservices Australia, Visual Navigation Chart – Melbourne. Affective 15 November 2012.

CASA Civil Aviation Regulations (CARs)

CASA Civil Aviation Safety Regulations (CASRs);

Civil Aviation Safety Regulation 139

CASA Manual of Standards – Part 139 Aerodromes, May 2012

CASA Advisory Circular AC71-1(0) (Issued for consultation purposes only) February 2002

CASA Advisory Circular AC139-18(0) (Draft), 21 September 2004

Defence (Areas Control) Regulations

Current Civil Aviation Safety Authority (CASA) Approach to the Impact of Tall Structures, including Wind Turbines and Wind Monitoring Masts on Aviation;

International Civil Aviation Organisation (ICAO) Procedures for Air Navigation Services — Aircraft Operations

Draft NSW Planning Guidelines Wind Farms;

National Airports Safeguarding Framework Guideline D – Managing the Risk to Aviation Safety of Wind Turbine Installations (wind farms) and Wind Monitoring Towers

EUROCONTROL Guidelines on How to Assess the Potential Impact of Wind Turbines on Surveillance Sensors

Wind Farm Aviation Impact Studies – Requirements for Airservices Australia Assessment; and

Wind Energy, Defence and Civil Aviation Interests Working Group (UK), Wind Energy and Aviation Interests - Interim Guidelines, 2002

9.0 GLOSSARY

Advisory Circular (AC): Advisory documents issued by CASA suggesting preferred methods for complying with the CASR. The advice contained in the AC is meant to be read in conjunction with the CASR and Manual of Standards.

Aeronautical Information Publication (AIP): A publication issued by or with the authority of a State and containing aeronautical information of a lasting nature essential to air navigation. The AIP for Australia and its Territories is published under Section 8 of the *Air Services Act 1995.*

Aeronautical Information Service (AIS): A service provided by AA to collect, collate, edit and publish aeronautical information.

Air Route: The navigable airspace between two points and the terrain beneath such airspace identified, to the extent necessary, for application of flight rules.

Air Traffic Control (ATC): A service established by Airservices Australia pursuant to section 8 of the *Air Services Act 1995*. ATC functions are chiefly to prevent collisions between aircraft (and on the manoeuvring area, between aircraft and obstructions), and to expedite and maintain an orderly flow of air traffic.

Civil Aviation Advisory Publication (CAAP): Advisory documents issued by CASA suggesting preferred methods for complying with the CAR and CASR. The advice contained in the CAAP is meant to be read in conjunction with the CAR, CASR and Manual of Standards.

Civil Aviation Regulations (CAR): Regulations made by the Governor-General under the *Civil Aviation Act 1988*.

Civil Aviation Safety Regulations (CASR): Regulations made by the Governor-General under the *Civil Aviation Act 1988*.

Common Traffic Advisory Frequency (CTAF): A frequency for pilots to exchange traffic information while operating to or from an airport without an operating control tower, or within a designated area.

Controlled Airspace: Airspace of defined dimensions within which ATC service is provided to controlled flights. A control area or control zone.

Danger Area: An airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times.

Departure and Approach Procedures (DAP): An aeronautical information publication (AIP-DAP) which contains aerodrome/landing charts, instrument approach and landing procedures, standard instrument departures, DME or GPS arrivals and noise abatement procedures.

En Route Supplement Australia (ERSA): This AIP supplement (AIP-ERSA) is a joint military/civil publication containing the aerodrome and facility directory for military aerodromes and civil public aerodromes. ERSA contains aerodrome diagrams (ADDGM) and other information such as physical characteristics, visual ground aids, aeronautical lights, MBZ and CTAF boundaries.

General Aviation (GA): All civil aviation operations other than RPT operations.

IFR Operation: An operation conducted in accordance with the Instrument Flight Rules prescribed in Part XII of the Civil Aviation Regulations. These operations (landings and take-offs at an airport) are made in periods of inclement weather and poor visibility and under these conditions, positive control on approach and climb-out is maintained by the use of electronic navigational aids.

Instrument Approach Procedure: A series of pre-determined manoeuvres by reference to flight instruments with specified protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route, to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en-route clearance criteria apply. The approved procedure to be followed by aircraft in letting down from cruising level and landing at an aerodrome.

Instrument Flight Rules (IFR): A set of rules, as outlined in Part XII of the CAR, governing the conduct of flight under instrument meteorological conditions (IMC). See also "IFR operation".

Instrument Meteorological Conditions (IMC): Meteorological conditions expressed in terms of visibility, distance from cloud and ceiling less than minima specified for visual meteorological conditions (VMC).

Lowest Safe Altitude (LSALT): The lowest altitude that will provide safe terrain clearance at a given place.

Nautical Mile (NM): A length of 1,852 metres.

Navigation Aid: A ground based or airborne facility or equipment relying primarily on the transmission/reception of radio or radar signals to provide information used to determine the location of an aircraft. Navaids are designed to be used either for en-route navigation or to assist in approach and landing in reduced visibility conditions.

Non-Directional Beacon (NDB): A ground radio station emitting continuous signals and providing an omni-directional radiating pattern which is used in conjunction with airborne ADF equipment to provide directional guidance to aircraft.

Notice To Airmen (NOTAM): A notice containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations. NOTAM are published under Section 8 of the *Air Services Act 1995*.

Obstacles: All fixed (whether temporary or permanent) and mobile objects, or parts thereof, that are located on an area intended for the surface movement of aircraft, or which extend above a defined surface intended to protect aircraft in flight. See also "obstacle limitation surfaces (OLS)".

Obstacle Lights: Lights mounted on or adjacent to obstacles or potential hazards to aircraft moving on the ground or in the navigable airspace, for the purpose of indicating the obstructions or hazards by night.

Obstacle Limitation Surfaces (OLS): A series of planes associated with each runway of an airport, or the airport itself, which define the desirable limits to which objects may project into the airspace around the airport. Objects penetrating an OLS are defined as obstacles and may need to be marked and/or lit in accordance with CASA requirements.

PANS-OPS criteria: Specifications in ICAO *Procedures for Air Navigation Services —Aircraft Operations* (Doc 8168, PANS-OPS) for obstacle assessment or identification and allowances for minimum obstacle clearance used in the design of each stage of an instrument departure or approach procedure.

Primary Surveillance Radar: A radar system which uses reflected radio signals.

Prohibited Area: An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited.

Radar: A radio detection device which provides information on range, azimuth and/or elevation of objects.

Regular Public Transport (RPT): The transport of persons generally, or cargo for persons generally, for hire or reward in accordance with fixed schedules and to and from fixed terminals over specific routes.

Restricted Area: airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions.

Route: A way to be taken in flying from a departure to a destination airport, specified in terms of track and distance for each route segment.

Route Surveillance Radar (RSR): long range radar which is used for en route surveillance by ATC personnel.

Secondary Surveillance Radar (SSR): A system of secondary radar using ground transmitters/receivers (interrogators) and airborne transponders.

Terminal area radar (TAR): High definition radar used for air traffic control purposes in the terminal area.

VHF Omni-directional Radio Range (VOR): A VHF radio navigation aid which provides a continuous indication of bearing from the selected VOR ground station. It provides 360 degree radial tracks to the beacon corresponding to the points of the magnetic compass and which may selected at one degree intervals by the pilot.

Visual Flight Rules (VFR): Rules of flight to permit operations on a see and be seen basis in visual meteorological conditions (VMC). These rules are prescribed in Part XII of the CAR.

Visual Meteorological Conditions (VMC): Meteorological conditions in which the flight visibility and distances from cloud during a flight are equal to, or greater than the applicable distances determined by the (Civil Aviation Safety Authority) under CAR 172(2).

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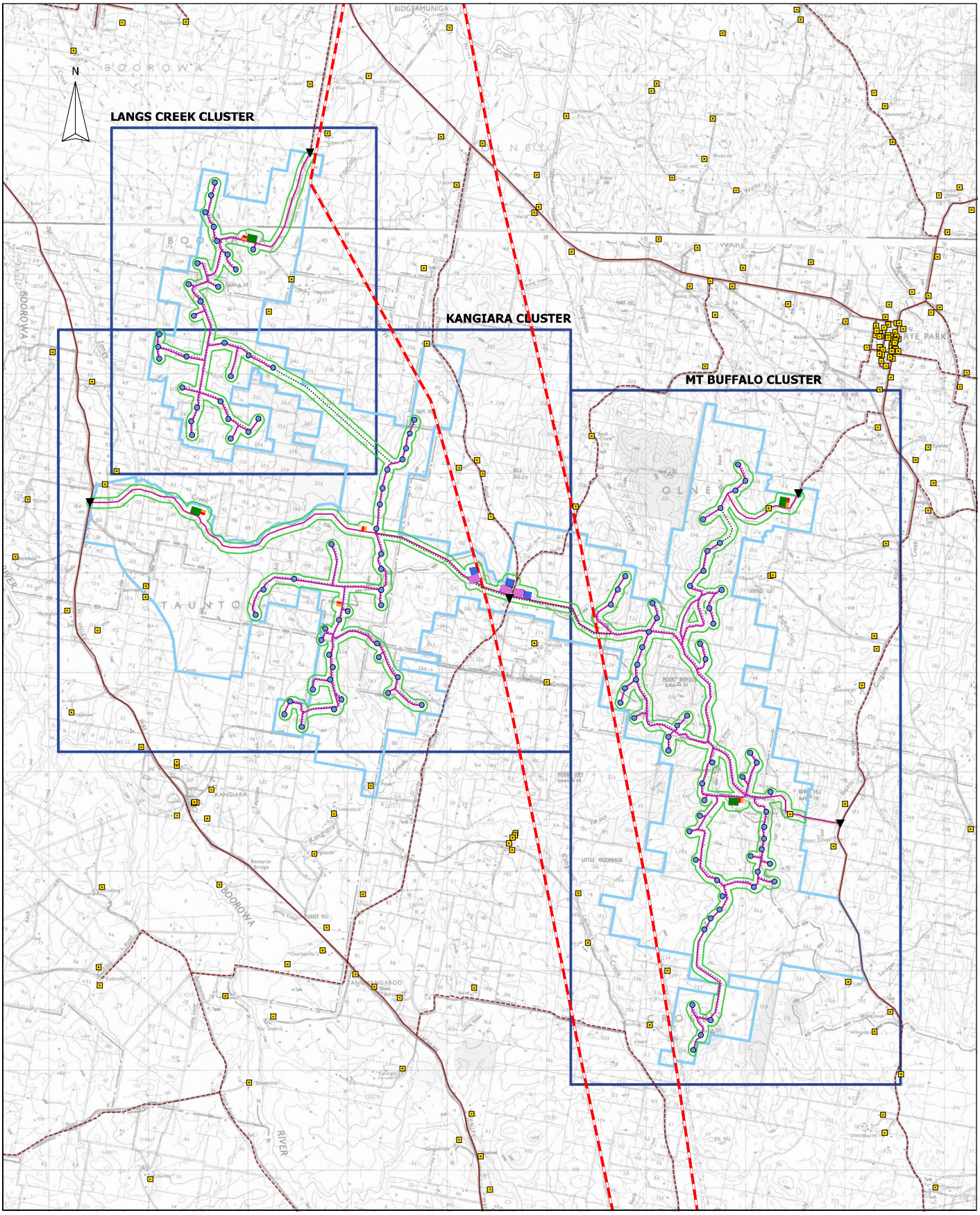
APPENDIX A

SITE LAYOUT



LEGEND

Layout Option 1 (122 WTG)
- WTG
- Access Point
- Access Track
- Overhead Transmission Line
- Underground Transmission Line
- 132 kV Transmission Line

Construction Facilities
- Construction Compound
- Concrete Batching Plant
- Rock Crushing Facility
- Collector Substation
- Switching Station

- Residence
- Study Area
- Project Site
- Cluster
- Unsealed Road
- Sealed Road

Image, roads and houses: derived from GEODATA Topo250K; Transmission lines: 132kV and 330kV - TransGrid, 66kV - Essential Energy; All other data: WPCWP

COMPANY: BANGO WIND FARM PTY LTD

TITLE: FIGURE 3.1: LAYOUT OPTION 1, OVERVIEW

DATE	DRAWN BY	CHECKED BY	SIZE	SHEET
25 MAR 2013	N FINLAYSON	A MADDOCKS	A3	1 OF 1

SCALE BAR: 0 — 4 km

SCALE: 1:75000

FIGURE 3.1: LAYOUT OPTION 1, OVERVIEW

2013

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APPENDIX B

WTG COORDINATES AND ELEVATIONS

Turbine #	Easting	Northing	WTG Base Elevation (m/AMSL)	WTG Blade Tip Elevation (m/AMSL)
1	671618	6174752	701	893
2	672551	6169350	742	934
3	671220	6172725	682	874
4	661436	6181108	609	801
5	672506	6168805	722	914
6	661266	6181406	601	793
7	671261	6169917	722	914
8	661038	6179320	621	813
9	661656	6178780	641	833
10	671081	6164555	688	880
11	664944	6171739	650	842
12	672635	6169745	710	902
13	671656	6173805	661	853
14	664721	6172733	661	853
16	661717	6180555	604	796
17	672377	6168142	711	903
18	663601	6172799	661	853
19	664006	6171605	631	823
20	660319	6178696	602	794
21	662281	6173305	627	819
22	670581	6170580	701	893
24	671306	6169580	698	890
25	671131	6168379	680	872
26	669892	6171233	713	905
27	664756	6172455	648	840
28	670262	6173541	631	823
29	662856	6171305	600	792

Turbine #	Easting	Northing	WTG Base Elevation (m/AMSL)	WTG Blade Tip Elevation (m/AMSL)
30	660342	6178460	601	793
31	660339	6178953	585	777
32	672716	6167943	721	913
33	672070	6170045	712	904
34	672357	6170336	699	891
35	663756	6172505	650	842
36	672238	6168456	713	905
37	660889	6178505	611	803
38	663206	6171055	600	792
41	664931	6176230	650	842
43	671063	6165463	688	880
44	664806	6174230	674	866
45	671006	6168951	699	891
46	671465	6170340	717	909
47	671217	6169267	710	902
48	669615	6171540	698	890
49	664831	6175855	642	834
50	671015	6173890	646	838
51	661500	6180824	591	783
52	661572	6177598	621	813
53	670056	6172655	722	914
54	671370	6174593	708	900
55	669956	6172305	729	921
56	665381	6176955	660	852
57	670581	6170855	752	944
58	671287	6174189	682	874
59	670190	6172964	662	854

Turbine #	Easting	Northing	WTG Base Elevation (m/AMSL)	WTG Blade Tip Elevation (m/AMSL)
60	671481	6173130	654	846
61	672625	6168300	732	924
62	671668	6167651	722	914
63	663056	6174030	640	832
64	661781	6178105	622	814
65	663781	6172005	642	834
67	672228	6170535	696	888
68	662976	6171569	610	802
69	669424	6173513	692	884
70	671231	6164855	722	914
71	669565	6173814	651	843
72	663856	6171405	631	823
73	665140	6172054	631	823
74	660806	6177880	610	802
75	661106	6180380	602	794
76	665306	6176655	651	843
77	662230	6180655	588	780
78	661383	6181745	562	754
79	663431	6171805	631	823
80	671402	6173443	671	863
81	669706	6171830	733	925
83	669931	6172005	698	890
85	670956	6171280	713	905
86	665621	6171497	632	824
87	663831	6172255	642	834
88	663806	6174730	651	843
89	663681	6173030	657	849

Turbine #	Easting	Northing	WTG Base Elevation (m/AMSL)	WTG Blade Tip Elevation (m/AMSL)
91	669715	6174088	628	820
92	671306	6166980	681	873
93	671981	6176330	609	801
94	664806	6174530	649	841
95	670351	6173243	641	833
96	664131	6173380	651	843
97	664781	6175530	629	821
98	665231	6176430	651	843
99	671631	6175455	650	842
100	670756	6171080	731	923
101	672131	6176005	631	823
102	672301	6167831	721	913
103	671281	6175230	680	872
104	664806	6173505	666	858
105	671431	6165155	711	903
107	672458	6168591	721	913
108	661531	6179905	621	813
109	660931	6179955	602	794
110	671328	6172413	663	855
111	671558	6167971	695	887
112	671931	6175805	617	809
113	661456	6182005	562	754
114	663956	6173205	649	841
115	664704	6175039	633	825
116	661174	6179613	590	782
117	662631	6178280	621	813
118	664806	6173805	677	869

Turbine #	Easting	Northing	WTG Base Elevation (m/AMSL)	WTG Blade Tip Elevation (m/AMSL)
119	662440	6173814	622	814
120	671606	6167380	732	924
121	665471	6177230	638	830
122	672508	6169040	732	924
123	671431	6167205	721	913
124	661881	6180255	621	813
125	662139	6178525	631	823
126	661100	6177474	619	811
127	660985	6177199	648	840
128	661000	6176924	625	817
129	661775	6176851	620	812
130	661729	6177247	621	813
131	662136	6176984	623	815
132	662336	6177256	621	813

Note: the original WTG numbering system has been maintained although WTGs have been removed from the proposal and therefore continues to 132 when there are only 122 WTGs proposed.

REHBEIN Airport Consulting

APPENDIX C

CASA RESPONSE

Mike Ward

From: LEONARDI, FRANK <FRANK.LEONARDI@casa.gov.au>
Sent: Thursday, 28 March 2013 2:23 PM
To: Mike Ward
Subject: Bango Wind Farm and Uungala Wind Farms [SEC=UNCLASSIFIED]
Attachments: CASA approach impact of wind farms on aviation (2).doc

UNCLASSIFIED

Hi Mark

Thank you for providing CASA with details of the proposals to construct a wind farm in the Dubbo - Mudgee area (Uungala Wind Farm) and another in the Young – Harden area (Bango Wind Farm) in NSW.

Your report states that both wind farms will be located outside the obstacle limitation surfaces of the nearest CASA regulated aerodromes. As well, several Aeroplane Landing Areas (ALAs) have been identified in the vicinity of the proposed wind farms with the closest ALA to a wind turbine generator being 14.7 km.

Please find attached CASA's current approach to the impact of tall structures including wind turbines on aviation. Of particular importance with both proposed wind farms is the exceptionally high 192m maximum blade tip height above ground level of the wind turbines which surpasses the height of any previous wind farms that CASA has assessed.

Mention is made in the attached guidelines of the likely hazard to aviation of structures that are 150m or more above ground level. In areas beyond the limits of the obstacle limitation surfaces, CASA is guided by the International Civil Aviation Organisation (ICAO) recommended practice which states at least those objects which extend to a height of 150m 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. This study may have regard to the nature of operations concerned and may distinguish between day and night operations.

With regards to the 192m AGL wind turbines CASA will also be guided by the assessment to be conducted by Airservices Australia (AA) and comments from the CASA Flying Operations Division. I will get back to you once I have a response from CASA Operations.

I hope this has been helpful and if you need further information or have any questions please do not hesitate to contact me.

Regards

Frank Leonardi
Aerodrome Engineer (BE Civil)
Airways and Aerodromes
Civil Aviation Safety Authority
Canberra

P: 02 6217 1740
E: frank.leonardi@casa.gov.au

From: Mike Ward [mailto:Mike.W@lar.net.au]
Sent: Friday, 22 March 2013 1:47 PM
To: LEONARDI, FRANK
Subject: Bango Wind Farm - Draft Aviation Impact Statement

Hi Frank,

Please find attached a copy of the draft aviation impact statement for the proposed Bango Wind Farm near Rye Park, NSW for review and comment by the CASA.

To assist with your review please find attached wind turbine information in the following additional formats:

- MGA94 Zone 55 coordinates for each turbine in excel .xlsx format;
- ESRI Shape File (.shp); and
- Google Earth (.kmz).

Can you please confirm receipt of this email. I have also sent the attached information to Airservices Australia and the Department of Defence for their review and comment.

Please do not hesitate to contact me if you have any questions.

Regards,

Mike Ward
Senior Aviation Consultant
REHBEIN AIRPORT CONSULTING
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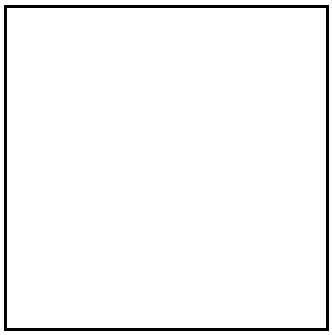
Email: Mike.W@lar.net.au
Web: www.lar.net.au



Message protected by MailGuard: e-mail anti-virus, anti-spam and content filtering.
http://www.mailguard.com.au/mg

Current Civil Aviation Safety Authority (CASA) approach to the impact of tall structures, including wind turbines and wind monitoring masts on aviation

CASA has no specific authority to require action for the obstacle marking and lighting of tall structures, including Wind Turbines and Monitoring Masts, located away from certified, registered or certain other aerodromes (regulated aerodromes). CASA cannot impose a requirement for the provision of obstacle lights, nor can CASA comment on the location or design of tall structures that are located away from the vicinity of a regulated aerodrome.

Notwithstanding CASA's regulatory authority, owners of structures which could be hazardous to aviation may have a duty of care to aviators. Wind monitoring masts erected as part of the wind farm development are normally tall slender skeletal structures which can be near invisible to pilots of low flying aircraft.

The proponent should undertake, at least, the following consultation to assess the potential hazard posed to aviation by the proposed development:

- Identify any regulated aerodrome within 30 nm of the boundaries of the proposed wind farm and consult with the aerodrome operator to determine any impact on Obstacle Limitation Surfaces (OLS) and designated flight procedures at such aerodromes. Penetration of these surfaces is likely to pose a hazard to normal aviation operations at the aerodrome. Please contact the aerodrome operators to discuss possible infringements of the OLS.

- Consult with Airservices Australia to have them assess any potential impact on enroute lowest safe altitude, instrument approach procedures at aerodromes, navigational aids, communications facilities or surveillance facilities. The Airservices Australia contact for assessment is Mr Joe Doherty on (02) 6268 5101;

- Contact Mr Phil Hurst of the Aerial Agriculture Association of Australia on (02) 6241 2100 to advise him of the proposal and to seek comment on the potential hazards to aerial application and related operations in the area; and

- Contact operators of any non-certified or non-registered aerodromes, i.e. privately owned landing areas, also termed aeroplane landing areas (ALA), which may be located in the vicinity of the proposed wind turbines and temporary or permanent wind monitoring masts erected prior to the construction of the wind farm . Please consult with the owner and users of the ALAs to ascertain if they consider the wind turbines or wind monitoring masts to be a hazard to their operations. If the wind turbines are considered to be a hazard to their operations you may have a duty of care to provide obstacle lighting or adopt other risk mitigating measures as necessary.

- Contact Royal Flying Doctor Service (RFDS) to advise of the proposal and obtain comment on any impact it may have on RFDS operating at aerodromes located near the tall structures.

Aircraft are permitted to fly as low as 500 ft. (152 m), and certain operations are permitted to fly below this height. Wind turbines with a maximum blade tip height of 150 m or more above ground level could be a hazard to aircraft traversing the area. It is recommended that you take this into consideration when assessing your duty of care in deciding whether or not the wind farm should be obstacle lit or otherwise marked.

Use of obstacle marking to provide better conspicuity to pilots for day operations is not considered essential as the wind turbines are conspicuous by their size.

Work done overseas, particularly by the UK Civil Aviation Authority (CAA) recognises turbulence from wind turbines as having the potential to impact negatively on aviation. It is recognised that aircraft wake vortices can be hazardous to other aircraft, and that wind turbines produce wakes of similar, but not identical, characteristics to aircraft. Although there are independent bodies of knowledge for both of the above, currently, there is no known method of linking the two. Published research shows turbulence effects are still noticeable at 16 rotor diameters downstream of the wind turbine. Verification and validation processes are still ongoing. Whilst being a consideration for all aircraft (particularly in critical stages of flight), turbulence is of particular concern to those aircraft involved in very light sport aviation such as gliding, parachuting, hang-gliding, paragliding or microlight operations.

If the proponent should choose to provide obstacle lighting to indicate the presence of the wind turbines or wind monitoring masts at night or during periods of low visibility, to ensure consistency and avoid any confusion to pilots, the obstacle lighting installation should conform with CASA Manual Of Standards (MOS) Part 139, Chapter 9. The MOS is available on our Web Site, http://casa.gov.au/wcmswr/_assets/main/rules/1998casr/139/139mfull.pdf

If the proposal is approved details of the wind turbines and wind monitoring masts should be reported for inclusion in the national database of tall structures maintained by the Royal Australian Air Force (RAAF). Information on reporting of tall structures may be found in advisory circular issued by CASA, "AC 139-08(0) *Reporting of Tall Structures*" http://www.casa.gov.au/wcmswr/_assets/main/rules/1998casr/139/139c08.pdf

If the proposal is approved, and before construction commences, a temporary Notice to Airmen (NOTAM) will need be issued to cover the construction period of the wind farm. Please advise the Airservices Australia Aeronautical Information Service (AIS) at docs.amend@airservicesaustralia.com of the turbine location and height AHD data of the wind turbines so that pilots can be warned of the construction activity. A permanent NOTAM will need to be issued on completion of the Wind farm at which point you will be required to provide final location and height AHD details of the wind turbines.

Any requirements placed on developers by planning authorities, insurers, or financiers, are beyond CASA's control.

The Department of Infrastructure and Transport currently chairs two groups that have associated roles in this topic area:

1. The National Airspace Safeguarding Advisory Group (NASAG); and
2. The Airports Protection Taskforce (APT).

The NASAG has produced draft guidelines for State building and planning authorities. The APT is reviewing current legislative arrangements that are in place which protect airports and aerodrome operations.

Airways and Aerodromes Branch
February 2013

REHBEIN Airport Consulting

APPENDIX D

DEPARTMENT OF DEFENCE RESPONSE

Australian Government
Department of Defence
Defence Support and Reform Group

EP_ID_ELP/2013/OUT/AF13952745

Mr Mike Ward
Rehbein Airport Consulting
PO Box 112
FORTITUDE VALLEY QLD 4006

Dear Mr Ward

BANGO WIND FARM NSW

Thank you for advising the Department of Defence (Defence) of the proposed Bango wind farm to be situated in the area between Boorowa and Rye Park NSW. The proposal is for 122 wind turbines located in three main clusters. The wind turbines will have a maximum blade tip height of 192m Above Ground Level (AGL).

Defence has assessed the proposal for any possible impact on its operations including the safety of military aircraft, the affect on Defence communications and the operation of Airfield Surveillance radars.

Defence acknowledges that the draft Aviation Impact Statement prepared by your company has recommended obstacle lighting of the wind turbines in accordance with the National Airports Safeguarding Framework Guideline D. Defence supports the implementation of any measures that increase aviation safety and requests that the colour used for the wind turbines ensure that they are conspicuous to aircraft during daylight hours.

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. The 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:

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 wind turbines will meet the above definition of tall structure. RAAF AIS has requested that the proponent supply them with location and height details once final design positions are known and before construction commences. After construction is complete, Defence requests that the proponent provides 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.

Defence has no objection to the proposal subject to the conditions stated above. Should you wish to discuss the content of this submission further please contact Mr Gary Lee on email LPSI.directorate@defence.gov.au or telephone (02) 6266 8187.

Yours sincerely

Ms Simone Murray
Director External Land Planning
Department of Defence
PO Box 7925
CANBERRA ACT 2610

20 May 2013

For Information:
Regional Director DSRG Southern NSW

APPENDIX E

AIRSERVICES AUSTRALIA RESPONSE

Mike Ward

From: Neidert, Jessica <Jessica.Neidert@AirservicesAustralia.com>
Sent: Monday, 13 May 2013 11:09 AM
To: Mike Ward
Subject: NSW-WF-043 P2 - Bango Wind Farm, NSW

Hi Mike

I refer to your request for the assessment of Bango Wind Farm, NSW.

With respect to procedures promulgated by Airservices in accordance with ICAO-PANS OPS and Document 9905, at a maximum height of 944m/3098ft AHD, the turbines will not affect any LSALT or any sector or circling altitude, nor any instrument approach or departure procedure at any aerodrome.

This Wind Farm to a maximum height of 944 m AHD will not adversely impact the performance of Airservices Precision/Non-Precision Nav Aids, HF/VHF Comms, A-SMGCS, Radar, PRM, ADS-B, WAM or Satellite/Links.

Can you please advise the likely date that the proposed Wind Farm will be installed?

Kind regards

Jessica Neidert
Airport Development Assistant
Corporate and Industry Affairs
jessica.neidert@airservicesaustralia.com
~~~~~~
Airservices Australia
Ph +61 2 6268 4725
Fax +61 2 6268 5683
www.airservicesaustralia.com
~~~~~~

REHBEIN Airport Consulting

APPENDIX F

AAAA RESPONSE

Mike Ward

From: Phil Hurst <phil@aerialag.com.au>
Sent: Wednesday, 10 April 2013 6:08 PM
To: Mike Ward
Subject: RE: Bango Wind Farm - Draft Aviation Impact Statement

Hi

AAAA is opposed to all windfarm developments – including related infrastructure such as wind monitoring towers – in agricultural areas. They represent a direct threat to aviation safety and a direct economic impact on our industry and the farmers we service.

AAAA does not have the resources to provide detailed responses to windfarm development proposals.

The windfarm issue is covered in some detail in our policy on windfarms that you can find at www.aerialag.com.au – under resources / policies.

From that policy you will see we are opposed to all wind towers in agricultural areas and their associated infrastructure. In particular, we have identified wind monitoring towers as a safety threat to legitimate low level aviation. I also refer you to my evidence to the Senate Windfarm inquiry and the death of an agricultural pilot in the US from hitting an unmarked, un-notified tower.

http://www.aph.gov.au/hansard/senate/commttee/S13670.pdf

In terms of windfarm and related infrastructure safety, AAAA fully supports the whole of government approach encapsulated in the NASAG National Guidelines and particularly Guideline D that relates to windfarms and wind monitoring towers. You can find more information on the NASAG approach at http://www.infrastructure.gov.au/aviation/environmental/airport_safeguarding/nasf/

Phil Hurst
CEO - Aerial Agricultural Association of Australia

Ph: 02 6241 2100
Fax: 02 6241 2555
Mob: 0427 622 430
Web: www.aerialag.com.au

Professionalism = aerial agriculture
FACT: Air ag pilots have a commercial pilots licence, hold a chemical distribution licence and undertake ongoing training throughout their careers

---

From: Mike Ward [mailto:Mike.W@lar.net.au]
Sent: Wednesday, 10 April 2013 3:56 PM
To: admin@aerialag.com.au
Subject: Bango Wind Farm - Draft Aviation Impact Statement

Hi Phil,

Please find attached a copy of the draft aviation impact statement for the proposed Bango Wind Farm near Rye Park, NSW for AAAA review and comment.

To assist with your review please find attached wind turbine information in the following additional formats:

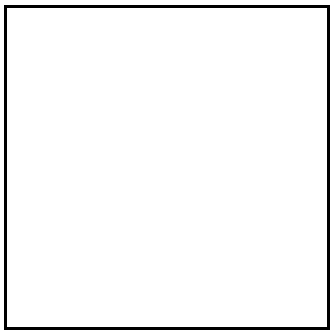
- MGA94 Zone 55 coordinates for each turbine in excel .xlsx format; and
- Google Earth (.kmz).

Can you please confirm receipt of this email and advise when we may expect comments back?

Please do not hesitate to contact me if you have any questions.

Regards,

Mike Ward
Senior Aviation Consultant
REHBEIN AIRPORT CONSULTING
Level 3, CBD House, 120 Wickham Street
(PO Box 112) Fortitude Valley QLD 4006
Phone: (07) 3250 9000
Fax: (07) 3250 9001
Email: Mike.W@lar.net.au
Web: www.lar.net.au



Aerial Agricultural Association of Australia

Windfarm Policy

March 2011

Introduction

Windfarms and their pre-construction wind monitoring towers are a direct threat to aviation safety – and especially aerial application. They also pose an economic threat to the industry where the costs of windfarm development—including those of compensation for loss of income—are externalized onto other sectors such as aerial application.

AAAA has developed this policy so as to inform regulators, asset developers and operators alike of the need for action on their part to fulfill their duty of care to Australia's aerial applicators.

AAAA Windfarm Policy

As a result of the overwhelming safety and economic impact of windfarms and supporting infrastructure on the sector, AAAA **opposes all windfarm developments** in areas of agricultural production or elevated bushfire risk.

In other areas, AAAA is also opposed to windfarm developments unless the developer is able to clearly demonstrate they have:

1. consulted honestly and in detail with local aerial application operators
2. sought and received an independent aerial application expert opinion on the safety and economic impacts of the proposed development
3. clearly and fairly identified that there will be no short or long term impact on the aerial application industry from either safety or economic perspectives and
4. if there is an identified impact on local aerial application operators, provided a legally binding agreement for compensation over a fair period of years for loss of income to the aerial operators affected.
5. Adequately marked any wind infrastructure and advised pilots of its presence .

AAAA believes that the above processes should also apply for all windfarms that have already been approved or erected, especially the establishment of long-term (for the life of the windfarm or until it is removed, whichever is the longest) binding compensation arrangements for affected aerial application companies.

While it is not AAAA policy to provide specific comment on particular development proposals due to resource limitations, AAAA notes that windfarms can have far-reaching footprints that can remove significant amounts of land from treatment for a considerable distance from the windfarm boundary.

Operational implications of each development will vary enormously depending on the site, the positioning of the turbines, orientation of affected paddocks relative to the turbines, the type of aerial application taking place, the aircraft used, the pilot's experience, the meteorological conditions, the site elevation, the position of any airstrip relative to the turbines and a range of other variables.

However, it is clearly unacceptable that one industry can impose significant safety threats on another, longer established industry with impunity.

AAAA believes that:

- All wind monitoring towers—including guy wires—must be clearly marked to assist pilots to see them
- All wind turbines, wind monitoring towers and associated infrastructure must be required to be removed when no longer in use. A mandatory bond should be levied on all developments to ensure the site can be remediated.

Recommendations to Government

Moratorium & National Policy
AAAA recommends to all Governments the establishment of a moratorium on windfarm developments until a national COAG policy on windfarms is established that requires the following to be considered before approval:

- Competing land uses for the particular site.
- Priority for existing long-term land-uses.
- Economic and safety impacts on contracting industries such as aerial application, including the broader implications for thresholds of sustainability for contractors.
- Independent life cycle analysis of windfarms and their overall environmental impact.
- Impact on aviation safety.
- Impact on bushfire preparedness and aerial firefighting.
- Impact on visual pollution / amenity/ tourism.
- Other sources of sustainable energy.

Transparency
AAAA recommends that any 'special' or 'fast-track' planning processes established for windfarm developments be removed. All windfarm developments should be subject to the full planning processes and community consultation in each State and Territory, including appeal of decisions.

Governments should require public disclosure on a register of payments to landholders made before approval of the windfarm. This will allow other landholders and contractors to be aware of developments.

Aviation Safety
AAAA recommends that government provide better information to all windfarm developers on their responsibilities for aviation safety, including raising the duty of care requirements established under *Sheather v Country Energy* (NSW Court of Appeals) for owners of assets that pose a known threat to aviation activities to provide for suitable marking and other safety initiatives.

The Commonwealth should establish a head of power to consider and regulate windfarm developments to protect aviation safety. This should include mandatory marking and notification of wind infrastructure and the power to veto proposed developments where they interfere with aviation safety.

CASA should set a much lower than previously used height trigger for notification of tall structure developments - down to 50 feet in an area of known aerial application activity—or by using a risk assessment based approach.

CASA should work with Airservices Australia and any other relevant agencies to ensure that completed windfarms are included on suitable aviation mapping including WAC charts and topographic maps.

CASA should develop a national tall structures web database that is accessible in real time by all low-level aviation pilots and which captures all wind-monitoring towers as well as completed windfarms. The database should also capture other tall structures such as radio masts etc.

Background

CASA does not have a clear head of power or a pathway for windfarm developers to ensure the risks their developments are posing are appropriately managed so as to protect legitimate activities of low-level aviation operators.

In particular, previous CASA efforts to address this issue by requiring marking and lighting of certain towers above a certain height and within a certain distance of an airport misses the main risk to aviation and this is the wind monitoring towers as they are frequently lower than the height trigger, but still a threat to legitimate low-level aviation.

Wind monitoring towers are very tall in relation to aerial application operations, are erected within very short timeframes, are extremely difficult for any pilot to identify from the aircraft and are often not notified to aviation users because of the lack of a Government-mandated notification system and the desire of the developers to keep their positions a secret because of commercial issues.

There are two quite distinct issues arising from windfarms that affect aerial application:

- safety of the aircraft and pilot and
- economic impact on aerial applicators.

Safety Impacts

AAAA's view is that the case of *Sheather v Country Energy* (NSW Court of Appeals) clearly established that anyone with infrastructure posing a threat to aviation must consider the risks that infrastructure poses to aviation safety and respond appropriately through marking or other measures to safeguard aviation operations.

This precedent is of critical relevance to windfarm developers although not apparently widely known to them or acted upon.

Economic Impacts

Safety is not the only consideration that is imposing additional risk and consequences on the aerial application industry.

The placement of wind farms in areas of highly productive agricultural land is leading to reductions in treatment areas of aerial application companies with no compensation for this externalization of costs by wind farm developers.

For example, placement of a wind farm may affect flight lines and application height or even whether the application can be conducted at all - leading directly to either an increase in cost or a reduction in income - and sometimes both - for aerial application operators.

As windfarm developments increase in number and scale of footprints, the threshold of non-viability of aerial application in an area may be reached where it is simply not economic to base an aircraft there. In a highly seasonal industry such as aerial application, operations may already be close to this threshold and windfarm footprints may compromise the availability of a critical service.

The need to manage spray applications to ensure they are safe may mean that pest outbreaks such as locusts may not be able to be effectively controlled. Windfarms may create significant gaps in large scale treatment plans—leading to a breakdown of an overall campaign against locusts, cereal rust, noxious weeds or other pests with massive economic implications for farmers and the economy.

In particular, AAAA is concerned that not enough consideration is being given through the State planning approval processes to the impacts of windfarms on productive agricultural land and the aerial application industry, remembering that it may not only be the land footprint where the windfarm is sited, but also land surrounding that for some kilometers where aircraft may have to maneuver to conduct aerial application.

At the very least, windfarm developers should be required to pay compensation to aerial applicators where it can be reasonably established that there will be an economic impact imposed on the aerial application company by the wind farm developer.

Operational Impacts

The following potential impacts on aerial application should be considered by all windfarm developers:

- positioning of wind farms may affect local aerial application operations, depending on the particular site.
- impacts could vary from affecting flight lines to treatment height and accuracy, maneuvering areas and possibly take-off and landing splays if an airfield is nearby (see for example, CASA CAAP 92-1 for agricultural airstrips – www.casa.gov.au – search for CAAP 92-1.)
- it may not be the land or farm that the wind farm is to be situated on that will be affected. Neigbouring farms, especially any with borders close to the windfarm site, may suffer significant impacts by imposed limits on the manouvering areas of aerial application aircraft.
- a key impact may not be the turbines themselves, but the positioning of any powerline that would lead from the windfarm substation back to the grid, or any other above ground powerline that would be put in to support the development. Any sections of above ground cable should be adequately marked.
- economic impacts could include increased costs due to longer flight times required to manouver heavily laden aircraft around wind towers, a loss of accuracy due to being required to fly higher for safety reasons, an increase in liability due to the reduction in accuracy, or the complete loss of application jobs due to the landholder not wanting the area covered by windfarms to be treated.

AAAA Activities to date

AAAA has done a lot of work to make it easier to mark guy wires and powerlines – including on wind monitoring towers – through amendment of the national standard on marking of wires so as to use a marker developed by Country Energy (NSW) with the cooperation of AAAA.

There is now little practical reason why wind towers and especially wind monitoring towers should not to be clearly marked.

In addition, AAAA has attempted to provide relevant information to developers through the Wind Energy Association, but this process/ advice is voluntary and consequently will not provide coverage of all developers.

AAAA also passes on information to members that has been provided to it by wind farm developers on the physical location of wind monitoring towers. However, only a few developers provide this information and again there is little doubt that many towers are going up unmarked and unknown until hopefully spotted by pilots during pre-application inspections.

More comprehensive safeguards must include a mandatory national system of communication of the position of all wind monitoring towers and the inclusion of this on a national database accessible by low level pilots.

This is a very real issue for topdressing and firebombing operations - as wind monitoring increases, so does the threat to legal aviation activities.

AAAA Windfarm Notification Process

AAAA tries to assist aviation safety by advising those of our members on our email lists of the position of wind monitoring towers and also wind turbines when they are under construction and finally constructed, if advised by windfarm developers.

Windfarm developers are encouraged to provide these details (in lats and longs by email to AAAA) so that AAAA can pass them on to those members.

AAAA provides this facility on the basis of it being information of a general nature only and the understanding that the information, for a range of reasons (including email failure, not all members being covered by email, or non-use by members, or operational shortcomings) will not provide any guarantees of aviation safety.

AERIAL AGRICULTURAL ASSOCIATION OF AUSTRALIA

FURTHER INFORMATION

If you would like more information on the vital and responsible role the aerial application industry plays:

www.aerialag.com.au

Or contact us on:
02 6241 2100 ph.

phil@aerialag.com.au

AAAA
PO BOX 353
Mitchell ACT 2911

REHBEIN Airport Consulting

APPENDIX G

RFDS RESPONSE

Mike Ward

From: Justin Marr <Justin.Marr@rfdsse.org.au>
Sent: Friday, 3 May 2013 8:43 AM
To: Mike Ward
Cc: David Charlton
Subject: RE: Bango Wind Farm - Draft Aviation Impact Statement

Hi Mike

David has asked me to respond on the behalf of the RFDS SE.

I have had a look, along with a pilot representative and based on what you have provided we can't see any problems with your proposal.

If you need to discuss further, please don't hesitate to call me.

Kind regards

Justin Marr
Quality and Safety Manager
RFDS South Eastern Section
Cnr 11th Street & Ross Smith Ave
Mascot NSW 2020

T 02 8374 2425
F
M 0400 964 594
E Justin.Marr@rfdsse.org.au
> www.flyingdoctor.org.au

>Providing the finest care to the furthest corners of Australia for 85 years. Visit us at www.flyingdoctor.org.au

From: David Charlton
Sent: Monday, 29 April 2013 8:38 PM
To: Justin Marr
Subject: Fwd: Bango Wind Farm - Draft Aviation Impact Statement

G'day mate,

Can you take a look at this?

djc..

Sent from my iPad

Begin forwarded message:

> **From: "Mike Ward" <Mike.W@lar.net.au>**
> **To: "David Charlton" <David.Charlton@rfdsse.org.au>**
> **Subject: FW: Bango Wind Farm - Draft Aviation Impact Statement**

Hi David,

Are you able to provide the comments of the RFDS on the proposed Bango and Uungula Wind Farms by COB Wednesday?

I will be issuing my final reports to my client this week.

Regards,

Mike Ward
Senior Aviation Consultant
REHBEIN AIRPORT CONSULTING
Level 3, CBD House, 120 Wickham Street
(PO Box 112) Fortitude Valley QLD 4006
Phone: (07) 3250 9000
Fax: (07) 3250 9001
Email: Mike.W@lar.net.au<mailto:Mike.W@lar.net.au>
Web: www.lar.net.au<http://www.lar.net.au/>

[http://www.lar.net.au/assets/img/email-30year-logo.jpg]

From: Mike Ward
Sent: Wednesday, 10 April 2013 3:53 PM
To: 'david.charlton@rfdsse.org.au'
Subject: Bango Wind Farm - Draft Aviation Impact Statement

Hi David

As discussed, please find attached a copy of the draft aviation impact statement for the proposed Bango Wind Farm near Rye Park, NSW for RFDS review and comment.

To assist with your review please find attached wind turbine information in the following additional formats:

- **MGA94 Zone 55 coordinates for each turbine in excel .xlsx format; and**
- **Google Earth (.kmz).**

Could you advise when we may expect comments back?

Please do not hesitate to contact me if you have any questions.

Regards,

Mike Ward
Senior Aviation Consultant
REHBEIN AIRPORT CONSULTING
Level 3, CBD House, 120 Wickham Street
(PO Box 112) Fortitude Valley QLD 4006
Phone: (07) 3250 9000
Fax: (07) 3250 9001
Email: Mike.W@lar.net.au<mailto:Mike.W@lar.net.au>
Web: www.lar.net.au<http://www.lar.net.au/>

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David Charlton
General Manager - Operations

REHBEIN Airport Consulting

APPENDIX H

SYDNEY VNC CHART EXTRACT

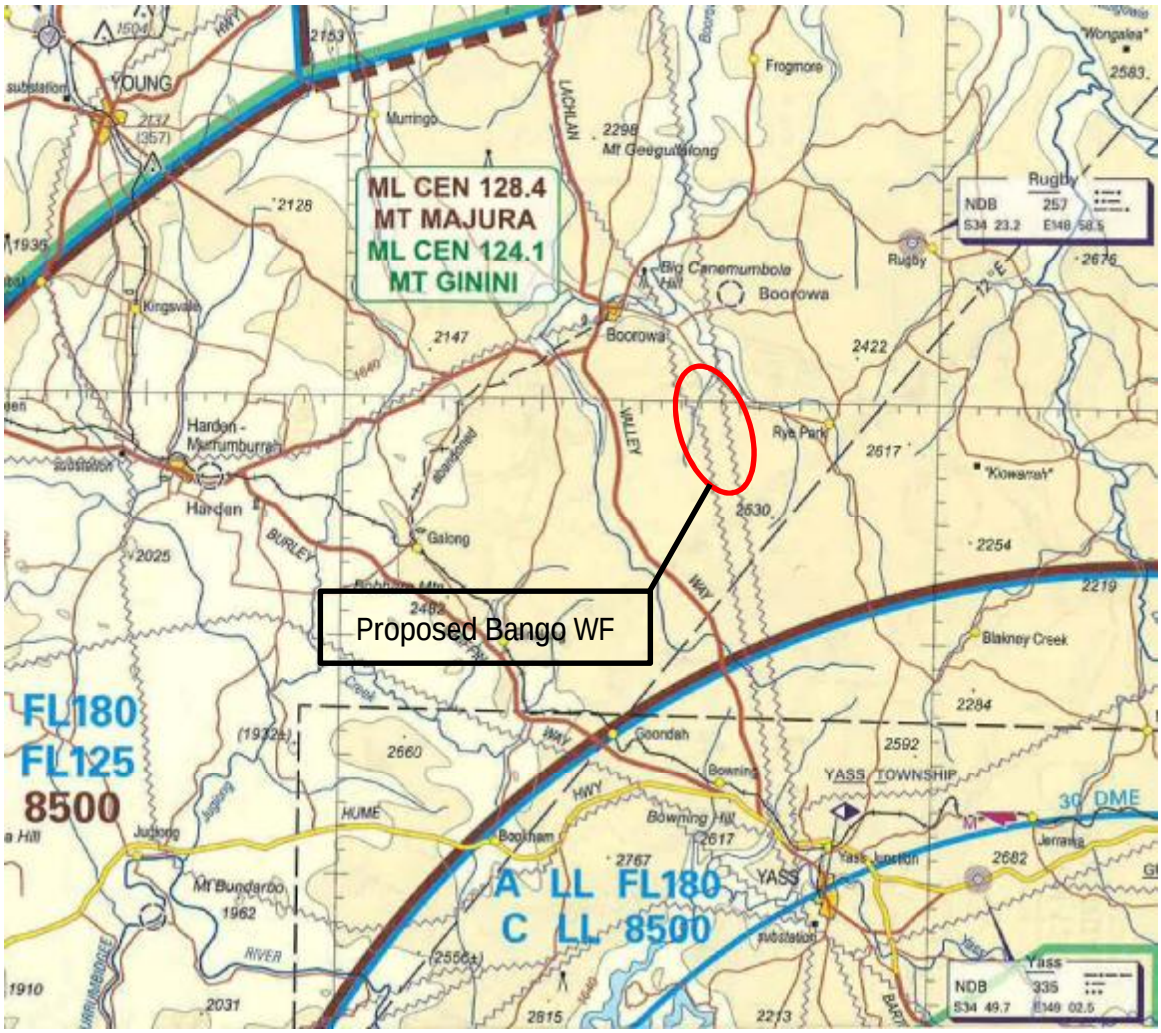

Figure 1 – Sydney VNC Chart Extract (Effective 30 May 2013)