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Telecommunications impacts of the proposed Silverton Wind Farm

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Telecommunication impacts

This section was researched and prepared by Anthony Micallef BE (Electrical), EPURON Pty Ltd.

Executive summary

The objective of this chapter is to investigate the potential impacts of the Silverton wind farm on existing telecommunications services in the vicinity of the proposal and to propose appropriate mitigation strategies for any impacts identified.

Telecommunication services, including television, radio, mobile phone services and other radio communication services occur in proximity to population centres and often utilise the ridgelines that provide optimum locations for wind turbines. As with any large structure, wind turbines have the potential to cause interference with such electromagnetic signals.

In general VHF and UHF frequency band radio signals, and digital voice based technologies such as GSM and CDMA mobile, are essentially unaffected by wind turbines. This includes land mobile repeaters, radio, the audio component of analogue television and mobile phones.[1]

Following a review of the radio communication services near the wind farm site, the nature of potential interference and consultation with the service providers, it is considered that the wind farm would have minimal effect on telecommunications services. Mitigation strategies are proposed to ensure any impacts can be managed and mitigated.

Glossary of technical terms

VHF	Very High Frequency
UHF	Ultra High Frequency
EMI	Electromagnetic Interference
VHF Channels	TV Channels 0 to 12 (45 - 230 MHz)
UHF Channels	TV Channels 28 - 46 (526 - 820 MHz)
Band 111	VHF TV Channels 5A - 12
Fresnel Clearance	Clearance to obstructions from the ray line on a radio path, which does not produce any additional loss above free space loss
FM	Frequency Modulation
MF	Medium Frequency
LF	Low Frequency
GSM	Global Systems Mobiles
CDMA	Code Division Multiple Access Cellular Mobile System
ITU	International Telecommunications Union
ABA	Australian Broadcasting Authority
ACMA	Australian Communications & Media Authority
CB Radio	Citizens Band Radio

[1] http://www.dungog.nsw.gov.au/files/2142/File/GreenpowerEMIAnalysisIssue.pdf

Existing environment

Electromagnetic Interference (EMI) has the potential to cause degradation or total loss of signal strength and may cause poor TV reception and/or "ghosting" effects. EMI may also result in a reduction in the coverage of mobile phone, radio and aircraft navigation communications in certain instances. There are three principal mechanisms by which wind turbines may cause EMI: reflection or scattering, diffraction and near field effects.[2]

Reflection or scattering

When a signal sent between a transmitter and receiver becomes obstructed by an object located within the path of a signal, reflection and/or scattering may occur. If the rotating blade of a wind turbine receives a primary transmitted signal, a scattered time delayed (or out of phase) signal may be produced and transmitted to the receiver. The out of phase signal will be distorted in relation to the primary signal, causing EMI.[3]

Diffraction

In some instances when an object is located in the path of a signal wave front, the object can both reflect and absorb the signal. This phenomenon is commonly referred to as diffraction.[4]

Near field effects

Wind turbines may cause interference to radio signals due to the electromagnetic fields emitted by the generator and the switching components within the turbine nacelle. This is referred to as a near field effect.[5]

Due to advances in technology and compliance with the Electromagnetic Emission Standard, EN 61000-6-4 (AS/NZ 4251.2:1999) *Emission standard for industrial environments*, the wind turbines proposed for the project will not cause active EMI due to near field effects.

The level of EMI produced by a wind turbine due to reflection or scattering, diffraction and near field effects is dependant on a number of factors, including placement of the wind turbine in relation to the signal path/s; the signal frequency; the characteristics / composition of the wind turbines rotor blades; the receiver characteristics; and the propagation characteristics of the radio wave in the local atmospheric conditions.[6]

While the site proposed for the development of the wind farm is a remote area, communications links and broadcast networks are present in the surrounding region.

As with any large structure, there may be circumstances where wind turbines cause disruption to the electromagnetic signals used in a variety of commonly used radar, navigation and telecommunications services. The following approach was adopted to identify the impact of the proposal on telecommunications:

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[2] D. F. Bacon, A Proposed Method for Establishing an Exclusion Zone around a Terrestrial Fixed Link outside of which a Wind Turbine will cause Negligible Degradation of the Radio Link, Radiocommunications Agency UK Report Ver 1.1, 28 Oct 2002

[3] URS Woodlawn Wind Farm Environmental Impact Statement 2004
[4] *Ibid.*
[5] *Ibid.*
[6] *Ibid.*

- Identify license holders within a 25km radius of the proposed wind farm site and point-to-point links in the vicinity of the site, using information provided on the ACMA RADCOM database;
- Provide written notification of the proposal to and seek comments from each license holder identified via the ACMA RADCOM database within a 25km radius of the site;
- Record and review all responses received to identify any issues raised by license holders;
- Discuss issues raised with relevant license holder with the aim to resolve or identify mitigation options;
- Carry out an assessment of the "Fresnel zone" associated with each fixed point-to-point communications link crossing the site;
- Determine appropriate exclusion zones for proposed turbine layout based on "Fresnel zone" calculations and advice from license holders;
- Confirm that all turbines (including blades) are located outside the exclusion zone;
- Determine appropriate additional mitigation measures which may be required.

Impact assessment

The possible impact of the proposed wind farm on the four most common communications services has been investigated separately. These services are television/radio broadcast services, mobile phone services, radio communication services and aircraft navigation services.

Any impact would be confined to the *operational phase* of the wind farm. Various measures are available to help mitigate potential impacts and are discussed below.

Television and radio broadcast services

Summary of existing services and facilities

The ACMA RADCOM database lists the following broadcasters for television, under postcode 2880, which includes the Silverton area.

Television broadcasting: Broken Hill TV1: ABC, BKN, SBS and SCN. Remote Central and Eastern Australia TV1: ABC, IMP, SBS. Remote Central and Eastern Australia TV2: QQQ.

Radio broadcasting: Broken Hill RA1: 2ABCFM, 2BH, 2DRY, 2HIL, 2JJJ, 2NB. Central Zone RA2: 8KIN, Remote Commercial Radio Service Central Zone RA1: 8SAT. Remote commercial Radio Service North East Zone RA1: 4BRZ, 4RBL.

Rocky Hill, Broken Hill (-31 57 10, 141 26 20) licence number 1158320 is the nearest TV transmission source for the locality of the proposed wind farm. It is located approximately 28km SE of the proposed wind farm site.

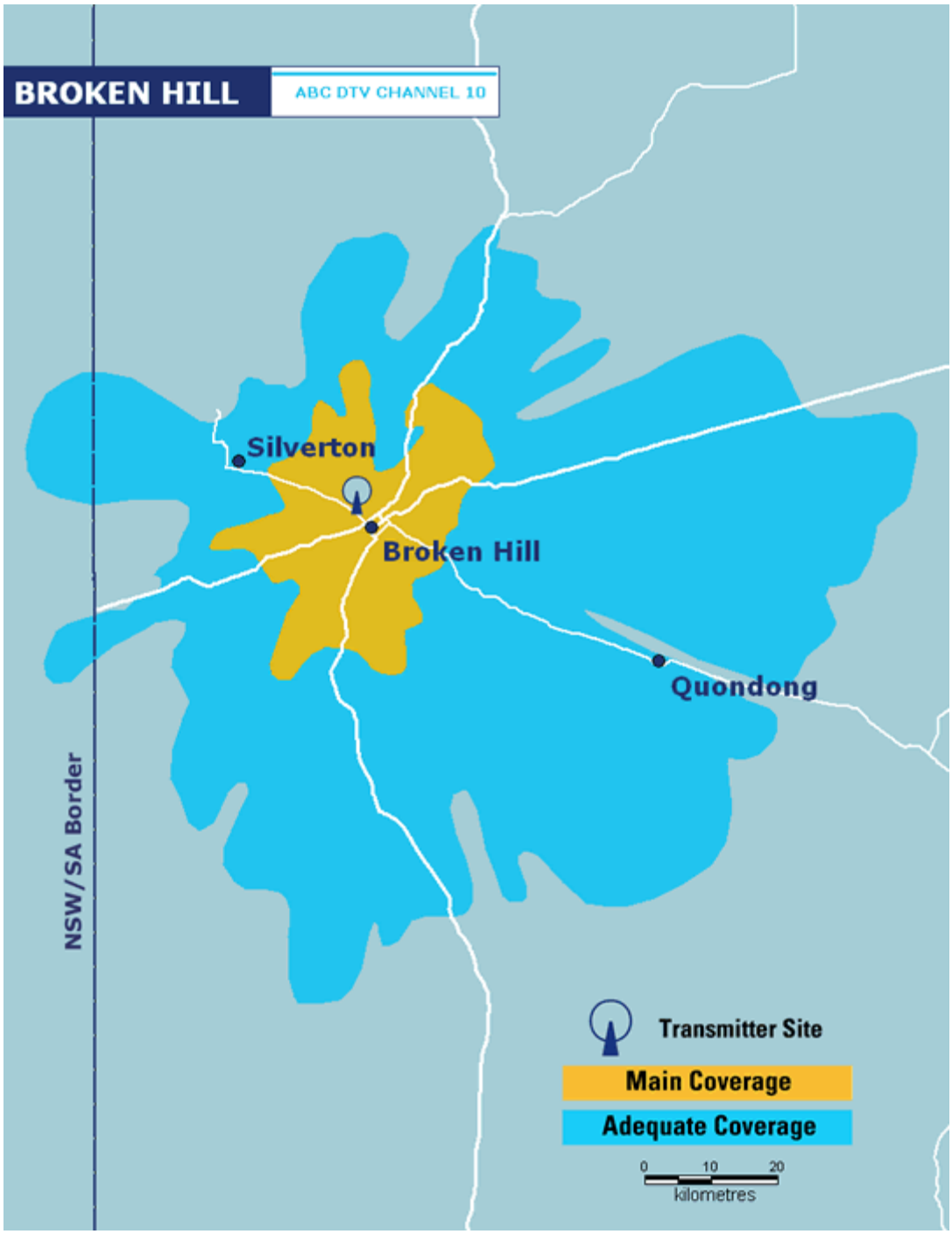
Analog television channel details[7]

Broadcaster	Channel	Band	Frequency (MHz)
ABC	2	VHF	64.25
SBS	44	UHF	639.224
Central GTS BKN	7	VHF	182.25
SCN	9A	VHF	203.25

Digital television channel details

Broadcaster	Channel	Band	Frequency (MHz)
ABC	10	VHF	212.625
SBS	12	VHF	226.5
Central GTS BKN	9	VHF	198.5
SCN	9A	VHF	203.25

[7] http://internet.aca.gov.au/webwr/_assets/main/lib100059/tv_7.pdf



ABC Digital TV CH10 reception map[8]

[8] http://www2b.abc.net.au/reception/frequencyfinder/asp/largemap.asp?transmissionid=8926&presdir=

ABC TV CH2 reception map[9]

[9] http://www2b.abc.net.au/reception/frequencyfinder/asp/largemap.asp?transmissionid=736&presdir=

Interference and impact analysis

Television Interference (TVI) is dependent on a range of factors including environmental factors (topography, direct signal strength, transmitter type, and receiver type) and wind farm design factors (turbine elevation, rotor size and orientation, speed of rotation, blade material and pitch). TVI caused by the operation of wind turbines is characterised by video distortion, while the audio component of the signal is not affected.[10] Due to the variability of local conditions and the characteristics of antennae used in particular installations, there is a degree of uncertainty regarding predicted levels of interference.

The level of TVI can be influenced by a number of factors including:

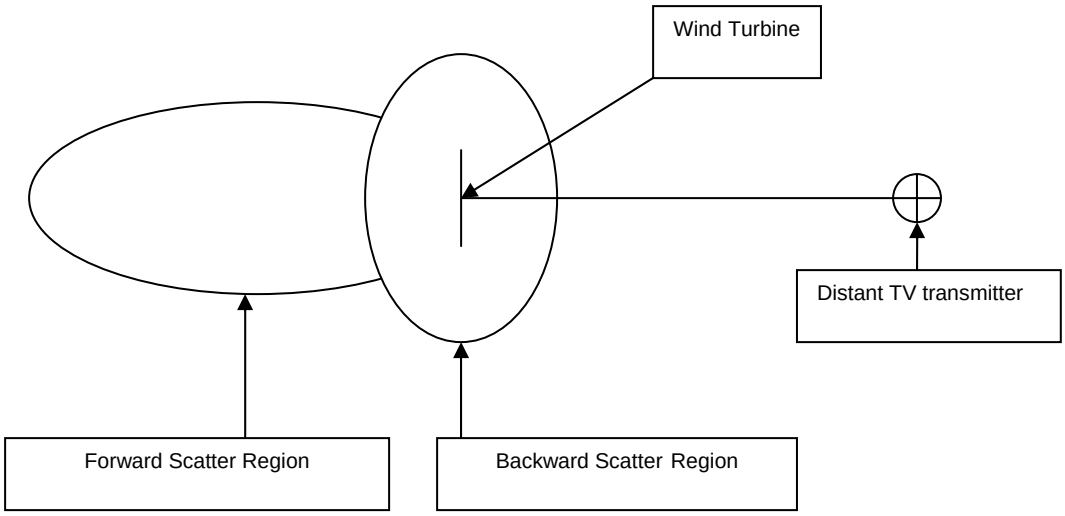
- Where the receiver is located, relative to the TV transmitter and the wind farm;
- The frequency of the transmitted TV signal;
- Whether there are any other tall structures in the vicinity of the receiver;
- The direction of the rotor blades and blade material;
- The nature and quality of the receiving aerial eg designs, height, directionality, power.

In general, the potential for interference at receiver locations can increase with distance of the receiver from the transmitter, as signal strength decreases with increasing distance from the source. As such, a wind farm in an area of already poor signal strength may potentially have a greater impact on reception than the same wind farm in an area of relatively strong signal strength. In addition, reception in the vicinity of the wind farm can vary with the degree of topographic obstruction of the signal.

A wind turbine has the potential to scatter analogue television waves both forward and back. Forward scatter will only occur if a wind turbine is located approximately between the dwelling and the broadcast site. The forward scatter region is as shown in the figure below, and generally does not extend further than 5 km for the worst combination of factors. Interference may extend beyond 5 km if the dwellings are screened from the broadcast tower, but do have line-of-sight to the wind turbines. The effect of the forward scatter is to potentially cause the brightness of the television picture to vary with the rotation of each blade. Modern television sets usually incorporate Automatic Gain Compensators (AGC) which act to lessen or eliminate variations in picture gain or brightness. [11]

[10] David E Spera, Wind Turbine Technology, Chapter 9 ASME Press 1994

[11] http://www.dungog.nsw.gov.au/files/2142/File/GreenpowerEMIAnalysisIssue.pdf



Schematic diagram of potential analogue television signal interference zones around a wind turbine[12]

The zone of potential interference for a wind farm is the resultant total of the effects from the individual turbines. The International Telecommunications Union Recommendation ITU-R BT.805 states that impacts beyond 5 kilometres are unlikely.

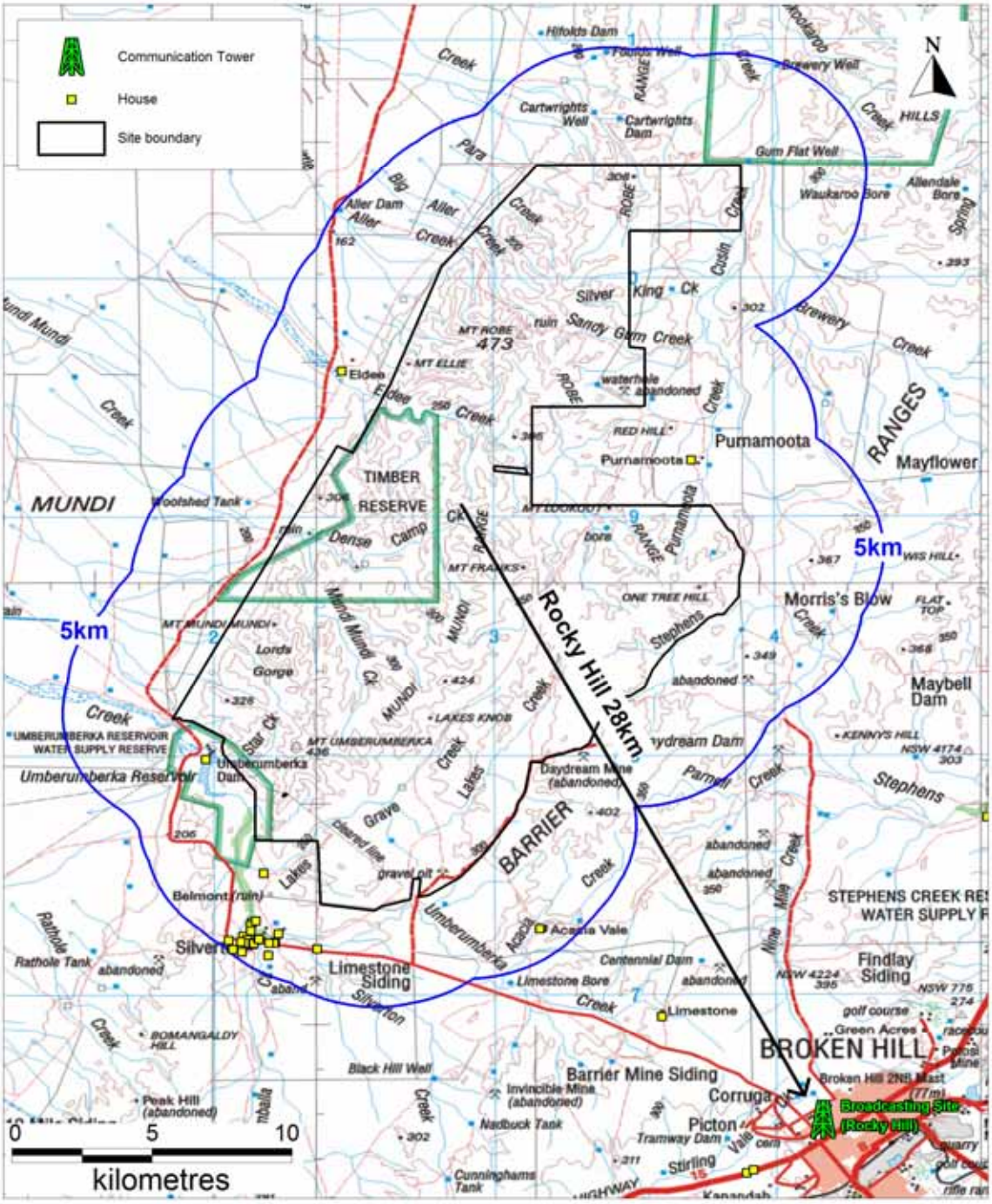
It also indicates that interference may extend beyond 5km where the receiver location is shielded from the direct signal, but in direct line-of-sight to the turbine. The form of interference, if experienced, will depend on the relative positions of the wind farm, the transmitting station and the receiver.

Television interference can take the form of either a “ghost” image that pulsates horizontally at the “blade pass” frequency or a fluctuation in picture brightness, also at the “blade pass” frequency.[13]

There are approximately 26 houses within a 5km radius of the proposed wind farm. The location of the wind farm with respect to Rocky Hill, Broken Hill communications tower can also be seen in the following map.

[12] Reproduced from the Connell Wagner PPI Gunning Wind Farm Environmental Impact Statement - Chapter 11.

[13] Connell Wagner Delta Electricity Gunning Environmental Impact Statement 2004



House and Rocky Hill television tower locations

It is difficult to assess the likely impact on specific house locations and once the wind farm is operational it is possible that television reception could be affected at some of these locations unless some form of mitigation is introduced. As previously stated, the International Telecommunications Union Recommendation ITU-R BT.805 states that impacts beyond 5kms are unlikely. The majority of houses are located approximately 5km from the wind farm and so impacts are unlikely.

Broadcast Australia (BA) was consulted in relation to the wind farm proposal. BA builds and operates broadcast sites for the transmission of services for SBS and ABC Television and Radio. BA operates two broadcast sites in Broken Hill:

- Broken Hill MF #2014 on Racecourse Road – service is ABC Local Radio (AM);
- Rocky Hill #2095 on Wyman Street – services are ABC Classic FM, NewsRadio, Triple J, Radio National, ABC Television (digital and analogue), SBS (analogue) Television, plus some commercial services.

Both sites are approximately 15 kilometres away from the proposed wind farm site.

BA undertook an analysis of the proposal and commented that ghosting effects would be unlikely due to the proposed location of the wind farm. Comments from BA Engineering are included in the correspondence section of this report.

Mitigation measures

In the design of the project, the proponent will carry out the following mitigation measures to help minimise TVI:

- Use of primarily non-metallic turbine blades;
- Use wherever practical of equipment complying with the Electromagnetic Emission Standard, AS/NZS 4251.2:1999;

Once the wind farm is operational, the proponent will offer to undertake a monitoring program of houses within 5km of the wind farm to determine any loss in television signal strength, if requested by the owners. In the event that TVI is experienced by existing receivers in the vicinity of the wind farm, the source and nature of the interference will be investigated by the proponent.

Should investigations determine that the cause of the interference can be reasonably attributable to the wind farm; the proponent will put in place mitigation measures at each of the affected receivers in consultation and agreement with the landowners.

Specific mitigation measures may include:

- Modification to, or replacement of receiving antenna;
- Provision of a land line between the effected receiver and an antenna located in an area of favourable reception;
- Improvement of the existing antenna system;
- Installation of a digital set top box or,
- In the event that interference cannot be overcome by other means, negotiating an arrangement for the installation and maintenance of a satellite receiving antenna at the proponent's cost.

Satellite pay television

Some houses in the area may have satellite pay TV service antenna installations. Unless a particular subscriber's antenna reception direction and elevation is aligned with a turbine, no impacts on TV reception are likely.

Radio broadcasting

The level of radio broadcast interference experienced can be influenced by a variety of variables including:

- Abnormal weather conditions;
- Multi-path distortion (reception of a signal directly from a transmitter and also a reflected signal from hills, structures etc.);
- Overloading (occurs when an FM receiver receives too strong a signal);
- Electrical interference from household appliances etc;

Existing FM sound broadcasting

The ACMA RADCOM database lists the following broadcasters for radio, under postcode 2880, which includes the Silverton area.

Radio broadcasting: Broken Hill RA1: 2ABCFM, 2BH, 2DRY, 2HIL, 2JJJ, 2NB. Central Zone RA2: 8KIN, Remote Commercial Radio Service Central Zone RA1: 8SAT. Remote commercial Radio Service North East Zone RA1: 4BRZ, 4RBL.[14]

MF sound broadcasting

Wind farm effects on MF radio are highly unlikely and therefore the stations serving the area have not been listed.

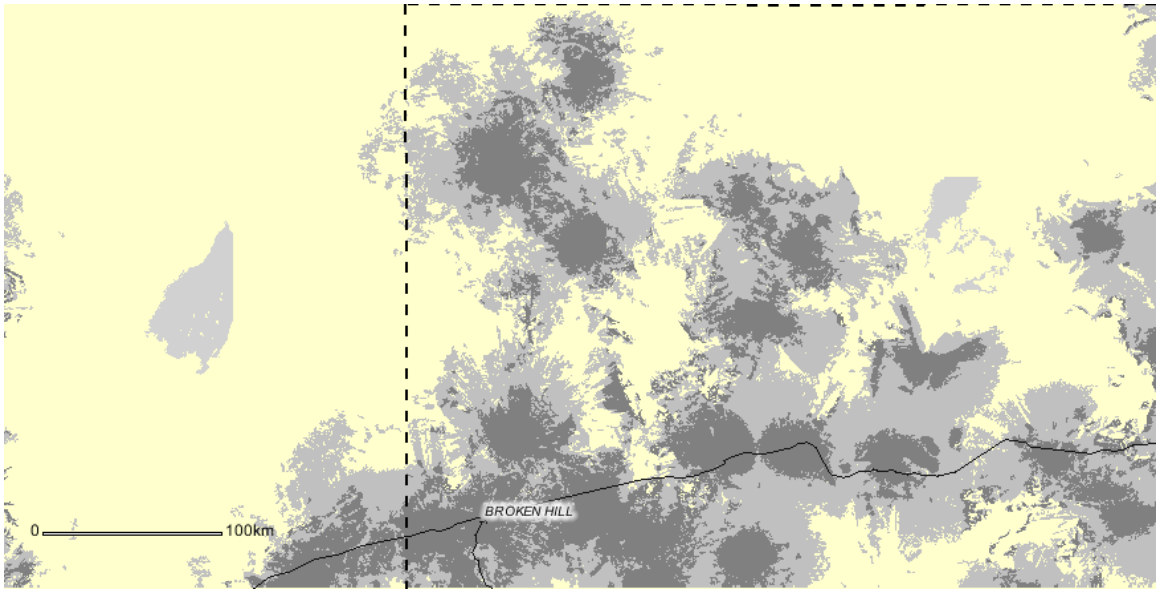
Mobile phone services

Existing services and facilities

This section covers CDMA, GSM, 3G and Next G mobile phone services (high frequency communications links used for mobile transmission networks are discussed in the next section: Radio Communication Services).

Figures below show the existing local mobile phone coverage from the three providers at the time of writing. (Source: company websites).

[14] As per ACMA website search for postcode 2880 http://www.acma.gov.au/postcode/results_initial.asp



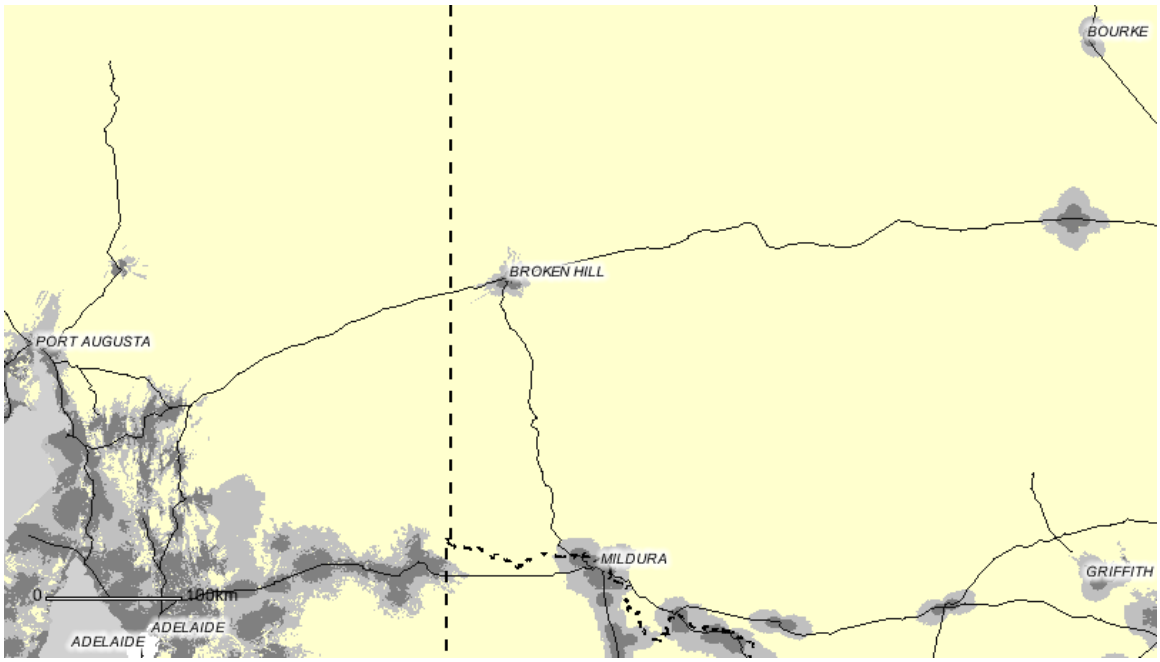
Voice, picture, video, TV and broadband

Voice, picture, video, TV and broadband with an external antenna

Telstra Mobile Satellite

Telstra Shops

Telstra Next G Coverage



3G and GSM

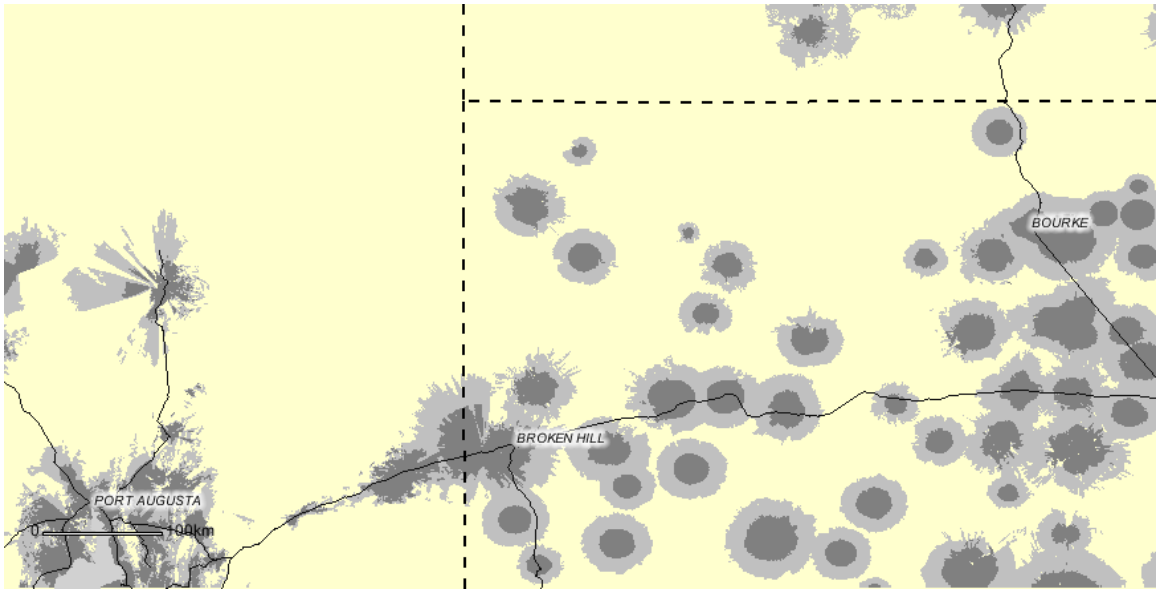
GSM handheld

GSM handheld in a car kit fitted with an external antenna

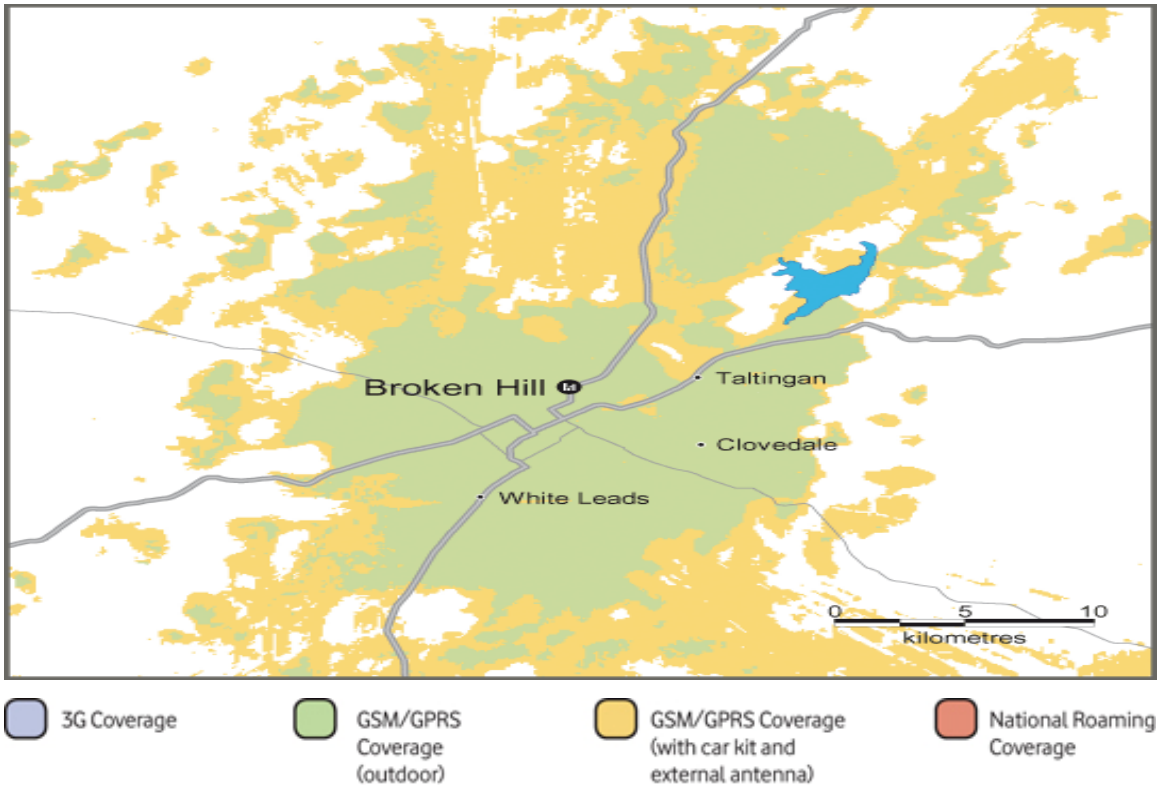
Telstra Mobile Satellite

Telstra Shops

Telstra 3G and GSM Coverage

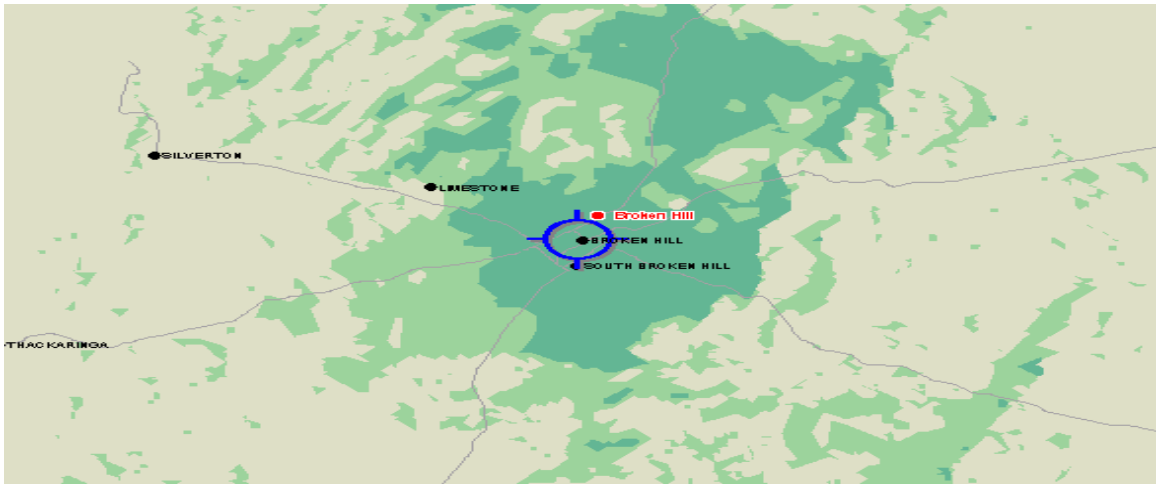


Telstra CDMA Coverage



Vodafone 3G & GSM Coverage

Optus GSM Coverage



3G Coverage

LEGEND

- Optus Wireless Connect on Street
- Future 3G Coverage
- GSM/GPRS On Street
- GSM/GPRS Car Kit
- Future GSM/GPRS Coverage
- Wifi Hotspot

Optus 3G Coverage

Interference and impact analysis

A mobile phone network consists of a system of adjoining zones called 'cells', which vary in size with a radius of 2-10 km. Each cell has its own base station that sends and receives radio signals throughout its specified zone. Mobile phone antennas need to be mounted clear of surrounding obstructions such as buildings to reduce 'dead spots' and allow the base station to effectively cover its intended cells. [15]

No GSM/CDMA mobile services are registered at sites in the close vicinity of the wind farm. Telstra plans to shut down its CDMA services in April, 2008.

Mitigation measures

No additional mitigation measures are required.

Radio communication services

Existing services and facilities

The ACMA issues radio communications licenses in accordance with Part 3.5 of the Commonwealth *Radiocommunications Act 1992*. The ACMA issues licenses to use specific segments of the radio broadcasting frequency spectrum for different purposes and maintains a register (the ACMA RADCOM Database) of all the licenses issued.

The register allows the ACMA to create a 'density' classification of areas across Australia as high, medium or low depending on the number of licenses in operation in a particular area.

According to the ACMA RADCOM Database, the area in the vicinity of the proposed wind farm is classified as a "Remote Density Area". Very few license holders operate radio communications services and/or mobile communication systems within a 25km radius of the proposed wind farm.

The proponent contacted the organisations identified as operating radio communication licences, including fixed link communications, within 25km of the wind farm wind monitoring mast (-31 47 57.31827, 141 14 56.83686). Each was asked to provide independent comments / advice on the possibility of the wind farm development interfering with their communications links.

Radio communication license holders within 25km of wind farm.

ACMA Licence Holder	ACMA Site ID No.
Country Energy	39514, 500777
NSW Rural Fire Service	34929

Interference and impact analysis

A fixed link radio transmission is a point-to-point transmission path typically between two elevated topographical features. The transmission path may become compromised if a wind farm is located within the direct line-of-sight or what is known as the Fresnel zone around the line-of-sight between the sending and receiving antennae.

[15] URS Woodlawn Wind Farm Environmental Impact Statement 2004,

The potential impact zone will vary with the distance between the transmitter and receiver, frequency of transmission and the location of any particular point along its path. Communications are only likely to be affected if a wind farm is in the line-of-sight between two sending and receiving antennae or within a zone of the line-of-sight of these antennae.

Where the potential exists for interference to line-of-sight links, an obstruction analysis can be undertaken to ensure that no part of a wind turbine assembly will enter the Fresnel zone of the microwave link. The maximum extent of the Fresnel zone occurs at the midpoint along the path of the microwave link.

Country Energy responded on 22nd January 2008 and advised that they do not envisage any interference or disruption to their communications services as a result of the proposal.[16]

At the time of writing, one point-to-point communications link was identified as crossing the site boundary.

This was listed on the ACMA data base as, "Rural Fires North Barrier Trig Point 95 km N of Broken Hill", Site ID 34929 transmitting to "NSW State Emergency Service Site Ambulance Site THACKARINGA".

Further investigation by the Rural Fire Service determined that "there is a current UHF link licence (No. 1208677) which was applied for in anticipation of establishing a radio link over this path; however this path was never installed"

"Enquiries with the local District indicate that it is unlikely that this path would ever be developed. In fact, at this point in time, the calculated performance of a radio link across this path would be too poor to consider its installation"[17]

Other radio communication

Two way mobile

No significant impact from the wind farm on base coverage beyond normal mobile operational performance is predicted in view of the geographic separation between the base antennas and the turbine structures. Of course a mobile unit communicating with a base station when the mobile is located within metres of the wind turbine structures (or indeed near any large building, silo, tower etc) may experience some very local performance change, however moving a short distance would restore performance to normal.

CB radio

CB radios are not individually licensed, the equipment being subject to class licensing only. Therefore no records of location or operators of CB radios exist, and the channels are shared without any right of protection from interference. No impact from the wind farm is predicted except perhaps for very local effects to portable or mobile units in the immediate vicinity of the turbines which could be avoided by a small location change of the unit.[18]

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[16] Refer to correspondence section for email from Mr David Morton of Country Energy.

[17] Letter from Mr Bruce McDonald Manager Operational Communications Rural Fire Service

[18] *Ibid.*

Mitigation measures

As a result of the exclusion zones established in planning the wind farm, no significant impacts will occur to existing point-to-point links and therefore no mitigation will be required.

In the event that any issues with additional license links are identified as a result of the wind farm, whether prior to or post construction, the proponent will consult with the operator and undertake appropriate remedial measures, which may include:

- Modifications to or relocation of the existing antennae;
- Installation of a directional antennae; and/or
- Installation of an amplifier to boost the signal.

Aircraft navigation systems

Existing services and facilities

Broken Hill Certified Aerodrome is the closest major aerodrome to the wind farm site. CASA advised that the Obstacle Limitation Surfaces[19] reach a distance of 15km from the field. The aerodrome is approximately 6km south of Broken Hill CBD and 22km S/E of the wind farm site. There are also a number of private airstrips which are located approximately 15km from the proposed wind farm site.

Interference and impact analysis

The proponent notified the Civil Aviation Safety Authority (CASA) of the proposal on 10th October 2007 and received a response on 22nd October 2007. CASA performed an impact analysis and advised that the Silverton proposal appeared to be well beyond the Obstacle Limitation Surfaces for the Broken Hill Aerodrome and so should not be an issue.

On the advice of CASA, the proponent also notified Broken Hill City Council (the aerodrome operator) on 23rd October 2007, a response from Broken Hill City Council dated 21st January 2008, confirmed the wind farm to be clear of the Obstruction Limitation Surfaces for the Broken Hill Airport.

Airservices Australia was notified on 16th January, 2008 in relation to the proposal. Airservices Australia carried out a preliminary high level assessment of the proposal and at the time, EPURON was advised that there were no radar or satellite links in the vicinity of the wind farm and that there is not expected to be a navigational aid issue as the majority of services are located at Broken Hill which is a sufficient distance from the wind farm.[20]

A response by email was received from Mr Joe Doherty of Airservices Australia on 4th April 2008 which indicated that:

"the wind farm development will affect several procedures at Broken Hill Airport. The Lower Safe Altitude (LSALT) route W428 west of Broken Hill Airport will need to rise

[19] The Obstacle Limitation Surfaces (OLS) are conceptual (imaginary) surfaces associated with a runway, which identify the lower limits of the aerodrome airspace above which objects become obstacles to aircraft operations and must be reported to CASA.

[20] As per discussion with Mr Joe Doherty of Airservices Australia 190108

from 2600 to 2900 and the 25MSA must rise from 2700 to 3100 – and consequent changes to all starting altitudes for the instrument procedures to the airport.

These changes are within acceptable limits and can be managed safely by Airservices provided we receive prior notification of the commencement of construction for publication by NOTAM (Notice to Airmen).

Parts of the associated transmission lines, in the vicinity of the airport, connecting the wind farm to Broken Hill and on to Red Cliffs (Vic) may also require assessment when details of the location and elevations are available.

The wind farm will not impact on Precision/Non-Precision Nav Aids, HF/VHF Comms, Cables, ASMGCS, Radar or Satellite/Links."

The Department of Defence was notified in writing on 21st January 2008 in relation to the proposal.[21] A response from Mr John Kerwan of the Department of Defence dated 11th March 2008 was sent to Mr Neville Osbourne, Manager, Water and Energy of the Department of Planning with a copy to EPURON.

The letter stated that the Department of Defence had finalised an assessment with regard to the possible impact of the Silverton wind farm on military aircraft operations, radio communications and the operation of navigational aids and radars.

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

The RAAF AIS has requested that the proponent supply location and height details once the final position of the wind turbines have been determined and before construction commences. After the construction is complete, the Department of Defence requests that the proponent provide RAAF AIS with "as constructed" details for the wind turbines, wind monitoring masts and electricity transmission lines if applicable.

Subject to the conditions stated in the letter (Consultation with CASA in relation to Obstacle Marking and Lighting and provision of location and height details to RAAF AIS) the Department of Defence has no objection to the proposed wind farm.

Mitigation measures

No mitigation measures are required.

Conclusion

Interference to MF and FM sound broadcasting is not expected.

One point-to-point microwave link was identified on the ACMA database as crossing the wind farm site; however further investigation by the NSW Rural Fire Service showed that the link was never installed and was unlikely to be installed in the foreseeable future.

[21] Email sent to Mr Gary Lees, Department of Defence, Canberra

Mobile phone and other radio communication services in the area are not expected to be impacted by the wind farm or its operation.

VHF TV reception at dwellings within about 1km of the wind farm turbines and with antennas having turbines located with +/- 25 degrees angle of their reception direction may have some probability of noticeable “ghosting” at times. For UHF TV time variant “ghosting” may be evident out to about 2 km for turbines, located +/- 20 degrees from the reception direction.

Digital TV is not susceptible to visible “ghosting” degradation. Any impact of reflections from the turbines would be a minor reduction of coverage at the limit of the service area.

For any confirmed wind farm interference problems where TV antenna system improvements are unsuccessful, the use of the digital TV services in the area may be the best solution, requiring the provision of a digital set top converter.

Local and overseas experience indicates that electrical interference from wind farm generators and controls is not a problem with reputable world class wind turbine manufacturers and therefore no electrical noise measurements are warranted.

Correspondence

Australian Government
Department of Defence
Defence Support Group

2004/1044160/2
LPSI/OUT/22/2008

Mr Neville Osborne
Manager, Water and Energy
Department of Planning
GPO Box 39
SYDNEY NSW 2001

Dear Mr Osborne

PROPOSED SILVERTON WIND FARM NSW

1. The Department of Defence lodged an interim response to your request for comments in a letter dated 11 January 2008 (LPSI/OUT/2/2008). A copy of the letter is attached at Annex A. In addition to the proposed development outlined in Paragraph 1 of Annex A, it is noted that a 65m high wind monitoring mast has been established on the site with three additional wind monitoring masts to be installed in the future. Also, Epuron Pty Ltd has subsequently advised that the total number of wind turbines may now be up to 600 in number.

2. Defence has finalised the assessment with regard to the possible impact of the wind farm on military aircraft operations, radio communications and the operation of navigation aids and radars. The Department advises the proposed development will be outside any areas affected by the Defence (Areas Control) Regulations (DACR). The DACR control the height of objects (both man-made structures and vegetation) and the purpose for which they may be used within approximately 15km radius of Defence airfields. In addition, the proposal has been assessed as unlikely to affect existing Defence communications within the region.

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

4. It should be noted that tall structures present a hazard to flight safety for low level flying operations. Consequently, there is an ongoing need to obtain and maintain accurate information about tall structures so that risks associated with inadvertent collision by low flying aircraft can be reduced. RAAF 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.

5. The proposed wind turbines, wind monitoring masts and possibly the electricity transmission lines will meet the above definition of tall structure. RAAF AIS has requested that the proponent supply them with location and height details once the final position of the wind turbines have been determined and before construction commences. After construction is complete, the Department of Defence requests that the proponent provide RAAF AIS with "as constructed" details for the wind turbines, wind monitoring masts and electricity transmission lines if applicable. 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.

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

Aeronautical Data Officer
RAAF AIS (VBM-M2)
Victoria Barracks
St Kilda Road
Southbank Vic 3006

Tel: (03) 9282 6400 Fax: (03) 9282 6695

Email: ais.charting@defence.gov.au

7. The Department of Defence has no objection to the proposed wind farm subject to the conditions stated at paragraphs 3 and 5. Please direct any questions to Mr Gary Lee on telephone (02) 6266 8187.

Yours sincerely

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

// March 2008

Annex:
A. Defence Letter LPSI/OUT/2/2008 dated 11 January 2008

cc. Regional Manager DS-SA
Mr Anthony Micallef, Epuron Pty Ltd
Mr Tim Browne, NGH Environmental

Annex A to
LPSI/OUT/22/2008
dated 11/3/08.

Australian Government

Department of Defence
Defence Support Group

2004/1044160/2
LPSI/OUT/2/2008

Mr Neville Osborne
Manager, Water and Energy
Department of Planning
GPO Box 39
SYDNEY NSW 2001

Dear Mr Osborne

PROPOSED SILVERTON WIND FARM NSW

1. I refer to your email dated 4 January 2008 advising of a proposal to construct and operate a wind farm and associated infrastructure on a site approximately 25km north-west of Broken Hill. The wind farm will consist of up to 500 wind turbines with an above ground level (AGL) height of up to 158m. The project also requires the construction of transmission lines connecting the wind farm to Broken Hill and connecting Broken Hill to Red Cliffs in Victoria.

2. As advised, Defence cannot finalise a detailed assessment by 25 January 2008. Therefore, as agreed, Defence herewith provides an outline of the assessment which will be undertaken by the Department. Once this assessment has been completed, the results will be forwarded to the Department of Planning for consideration.

3. Wind farms have the potential to affect the safety and operation of Department of Defence activities including military aircraft operations, radio communications and the operation of navigation aids and radars.

4. Being tall structures, wind turbines can be hazardous objects to aviation, especially for low level flying operations. Defence will assess the impact of the wind farm on military aircraft operations.

5. The operation of Line-of-sight Communications, such as VHF and UHF communications and Microwave Links can be affected by the location of a wind farm. Defence will determine if any Defence communications will be affected.

6. A wind farm located in proximity to a radar has the potential to affect its operation, thereby having an impact on the safety of flying operations. Defence will determine if there is a radar within proximity to the wind farm site.

7. Please direct any further questions to Mr Gary Lee on telephone (02) 6266 8187.

Yours sincerely

Natasha Davies
A/Director Land Planning & Spatial Information
BP3-1-A046
Department of Defence
CANBERRA ACT 2600

11 January 2008

cc. Regional Manager SA

Australian Government
Civil Aviation Safety Authority

Our file ref :- 07/5882

Mr Anthony Micallef
Project Manager
EPURON Pty Ltd
Suite 104, 349 Pacific Hwy
NORTH SYDNEY
NSW 2060

Dear Anthony

RE: Mundi Mundi Range (Silverton NSW) - Wind Farm Proposal

I refer to you correspondence dated 10 /10/07 in which you advised of a development proposal for establishing a wind turbine farm on the Mundi Mundi Range in the vicinity of Silverton NSW.

In my email response of 11/10/07, I referred you to a Civil Aviation Safety Authority Advisory Publication AC-139-18(0) – Obstacle Marking and Lighting of Wind Farms.

That publication is comprehensive in providing the CASA requirements in respect to wind farm developments, and it is recommended they be considered from the outset when determining sighting.

Broken Hill Certified Aerodrome is the nearest Aerodrome and the Obstacle Limitation Surfaces (OLS's) reach to a horizontal distance of 15000 metres from the edge of the field. The Silverton proposal appears to be well beyond that distance; however it would be prudent to clear this with Broken Hill City Council, the aerodrome operator.

If this is the case and given your advice during our initial discussion that the proposal calls for structures greater than 110m in height Above Ground Level, it will then be necessary to provide sufficient details to this office for a CASA determination.

A plan showing contours and providing turbine locations with geographic coordinates and ground level spot heights will be required. Generally the scale of plan is from 1:15,000 to 1: 30,000.

I also note within the development brief, Buronga and Red Cliffs are strategic sites in respect to the grid connection. Mildura and Wentworth aerodromes are in the vicinity of these areas and consequently it will be necessary to observe the OLS clearance requirements for both these aerodromes.

4 KEL BARCLAY AVENUE ADELAIDE AIRPORT PO BOX 126 PBC EXPORT PARK SOUTH AUSTRALIA 5950
TELEPHONE: (08) 84222930 FACSIMILE: (08) 84222915
Email: vas.saris@casa.gov.au

Aerodrome contacts are;

Mildura
Mr Bill Chapman
Aerodrome Manager
Mildura Rural City Council
PO Box 105
MILDURA
VIC 3502
Tel: 03 50215745

Wentworth
Bill Turner
Aerodrome Manager
Shire of Wentworth
PO Box 81
WENTWORTH
NSW 2648
Tel: 03 50275041

A proponent establishing structures to a permissible height does imply that CASA approves structures, and it does not preclude any proponent from complying with any State or Local Government Development Plans in the sighting or erection of structures.

Aerodromes that are neither Certified or Registered Aerodromes under the jurisdiction of the Civil Aviation Safety Regulations are known as Aeroplane Landing Areas (ALA's); for additional information and details, please refer to; http://www.casa.gov.au/download/CAAPs/ops/92_1.pdf

For structures in the vicinity of Aircraft Landing Areas, proponents will need to negotiate with the landowners to determine the impact that wind turbines may have on private operations, including medical evacuations. Councils, community groups or individual owners normally administer ALA's; they determine the controls and operational restrictions to accommodate proposals.

Should you have any queries in relation to the above, please do not hesitate to contact me on 08 84222930 or email to vas.saris@casa.gov.au .

Yours faithfully

Vas Saris
District Aerodrome Inspector
Adelaide
22/10/2007

Broken Hill City Council

... a safe, vibrant, prosperous and culturally rich City achieved through community leadership and sustainable management.

Please address all communications to:
The General Manager,
240 Blende Street,
P.O. Box 448,
BROKEN HILL N.S.W. 2880
Telephone: (08) 8080 2222
Fax: (08) 8088 1702
ABN: 84 873 116 132
Email: council@brokenhill.nsw.gov.au
Website: www.brokenhill.nsw.gov.au

Quote No 44840 - I3/1
PD:KOB
Telephone / Personal Enquiries
Ask For Mr. Paul Delisio

January 21, 2008

Mr. Anthony Micallef
Project Manager
Level 11, 75 Miller Street
NORTH SYDNEY NSW 2060

Dear Mr. Micallef,

PROPOSED WIND FARM

Further to your letter of October 2007, please be advised that the Obstacle Limitation Surfaces (OLS's) for the Broken Hill Airport extends out for a distance of 15km from the Broken Hill Airport.

Our understanding is that the proposed wind farm will be located outside of this distance and hence would be clear of the OLS for the Broken Hill Airport. Please advise Council should our understanding that the wind farm will be located further than 15 kilometres from the Broken Hill Airport be incorrect.

Yours faithfully,

PAUL DELISIO
GROUP MANAGER-INFRASTRUCTURE

www.brokenhill.nsw.gov.au

From: Doherty, Joe [mailto:Joseph.Doherty@AirservicesAustralia.com]
Sent: Friday, 4 April 2008 3:39 PM
To: Anthony Micallef
Cc: Quigley, Kent; Rogers, Carly; Neville.Osborne@planning.nsw.gov.au
Subject: Silverton Wind Farm and Transmission Lines

Anthony

I refer to your request for Airservices assessment of the proposed Wind Farm about 25km north-west of Broken Hill at Silverton.

The wind farm development will affect several procedures at Broken Hill Airport. The Lower Safe Altitude (LSALT) route W428 west of Broken Hill Airport will need to rise from 2600 to 2900 and the 25MSA must rise from 2700 to 3100 – and consequent changes to All starting altitudes for the instrument procedures to the airport.

These changes are within acceptable limits and can be managed safely by Airservices provided we receive prior notification of the commencement of construction for publication by NOTAM (Notice to Airmen).

Parts of the associated transmission lines, in the vicinity of the airport, connecting the wind farm to Broken Hill and on to Red Cliffs (Vic) may also require assessment when details of the location and elevations are available.

The wind farm will not impact on Precision/Non-Precision Nav Aids, HF/VHF Comms, Cables, ASMGCS, Radar or Satellite/Links.

Regards

Joe

JOE DOHERTY

Senior Advisor

Airport Relations

joseph.doherty@airservicesaustralia.com

Ph +61 2 6268 5101

Fax +61 2 6268 5688

www.airservicesaustralia.com

-----Original Message-----
From: david.morton@countryenergy.com.au [mailto:david.morton@countryenergy.com.au]
Sent: Tuesday, 22 January 2008 12:30 PM
To: Anthony Micallef
Subject: Fw: Silverton wind farm proposal - Country Energy radio link

Anthony,
We don't envisage any interferance or disruption to our services.

Kind Regards

Dave Morton
IS Infrastructure Design Manager
Responsible for design and development of IS Infrastructure systems Country Energy
Phone: 0265898441
Mobile: 0419401314

Email: david.morton@countryenergy.com.au
Forwarded by David Morton/People/Country Energy on 22/01/2008 12:28 PM -----
Steve Allan/People/Country Energy To David Morton/People/Country 22/01/2008 08:53 Energy@CountryEnergy
AM cc Matthew Coman/People/Country Energy@CountryEnergy, Mark Howard/People/Country
Energy@CountryEnergy Subject
Re: Fw: Silverton wind farm proposal - Country Energy radio link(Document link: David Morton)

Dave,

I am confident this will not have any impact on our services.

_____
Steve Allan
Radio Networks Specialist
Country Energy
Phone: (02) 6883 4590
Mobile:0428 636 334
FAX: (02) 6883 4433
Email: steve.allan@countryenergy.com.au
_____

David Morton/People/Country Energy To Steve Allan/People/Country 21/01/2008 11:01Energy@CountryEnergy
AM cc Matthew Coman/People/Country Energy@COUNTRYENERGY Subject Fw: Silverton wind farm proposal
Country Energy radio link

Steve,
Would you be able to review and let me know if there are any concerns?

Kind Regards

Dave Morton
IS Infrastructure Design Manager
Responsible for design and development of IS Infrastructure systems Country Energy
Phone: 0265898441
Mobile: 0419401314
Email: david.morton@countryenergy.com.au
----- Forwarded by David Morton/People/Country Energy on 21/01/2008 11:00 AM -----

"Anthony Micallef" <A.Micallef@epuron.com.au> To <david.morton@countryenergy.com.au>
cc
16/01/2008 04:09 PM Subject FW: Silverton wind farm proposal - Country Energy radio link

Dear David,

I sent the letter below to Mark, but have had no response and I'm not sure if he is the correct person to look at this. I found the name on the ACMA website. Would appreciate if you could forward this request to the correct person within Country Energy for assessment. Thanks.

Kind regards,

Anthony,

[IMAGE]

ANTHONY MICALLEF, Project Manager
EPURON PTY LTD (ABN 70 104 503 380)
Level 11, 75 Miller St
NORTHSYDNEY, NSW 2060

Office: (02) 8456 7407 Int'l: +61 (2) 8456 7407
Mob: 0434 395 618 Int'l: +61 (434) 395 618
Fax: (02) 9922 6645 Int'l: +61 (2) 9922 6645
www.epuron.com.au

From: Anthony Micallef
Sent: Tuesday, 15 January 2008 5:44 PM
To: 'mark.howard@countryenergy.com.au'
Cc: Donna Bolton
Subject: Silverton wind farm proposal - Country Energy radio link

Dear Mark,

Please find attached a letter, map and proposed wind turbine co-ordinates in relation to the Silverton wind farm proposal. We have identified that Country Energy operates radio links within 25km of our proposed wind farm site and would appreciate your feedback / comments in relation to this.

Please feel free to contact me on the numbers below should you need any further information. I look forward to your earliest response, and would appreciate if you could send me a short response by email acknowledging receipt.

Thanks in advance.

Kind regards,

Anthony,

[IMAGE]

ANTHONY MICALLEF, Project Manager
EPURON PTY LTD (ABN 70 104 503 380)
Level 11, 75 Miller St
NORTHSYDNEY, NSW 2060

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www.epuron.com.au

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From: Cremer Rachel [mailto:Rachel.Cremer@BroadcastAustralia.com.au]
Sent: Thursday, 24 January 2008 4:46 PM
To: Anthony Micallef

Cc: Freer Peter
Subject: RE: Silverton wind farm proposal - Broadcast Australia

Hi Anthony

Thanks for your letter and email dated 16 January 2008 regarding the proposed Silverton Wind Farm.

As you are aware, Broadcast Australia (BA) builds and operates broadcast sites for the transmission of services for SBS and ABC Television and Radio. BA operates two broadcast sites in Broken Hill:

- Broken Hill MF #2014 on Racecourse Road – service is ABC Local Radio (AM);
- Rocky Hill #2095 on Wyman Street – services are ABC Classic FM, NewsRadio, Triple J, Radio National, ABC Television (digital and analogue), SBS (analogue) Television, plus some commercial services.

Both sites are approximately 15 kilometres away from the proposed wind farm site.

Wind farms have been known to cause interference (ghosting), particularly to analogue television reception, caused by the turbine blades reflecting the signal in the reception area.

BA has undertaken a brief analysis of the proposal and, while we are not able to guarantee that some parties may experience some ghosting effects, this seems unlikely due to the proposed location of the wind farm. Comments from BA Engineering as follows:

> Broken Hill has the largest concentration of viewers followed by the small town of Silverton. In my brief analysis I have only considered these audiences so I cannot rule out the possibility of an isolated farm having analogue TV reception problems. However, it is unlikely and as far as I'm aware there are very few (less than 5 homesteads according to the topographic map) which are outside these two main centres.
>
> Silverton receive antennas will be orientated on a bearing of 110deg towards Rocky Hill (see attached map). Reflections from the wind farm would be coming in to those Rx on a bearing of 35deg (on the side) so that should not be a problem.
>
> A significant proportion of the audience in Broken Hill (particularly South and West) will be pointing their receive antennas towards NW which is where the wind farm is. However the difference between the distances travelled by direct and reflected signals would range from 30km up to 80km. In brief, these distances ensure that the required protection ratio is achieved such that any possible reflections should be beyond the limit of perceptibility.
>
> Another pleasing aspect is that Broken Hill already has ABC digital TV which is designed to deal with multipath reflections.

While we don't anticipate any impact upon our services, we do recommend that Epuron engage an engineering consultancy firm to undertake a detailed study as part of your Environmental Impact Study investigations.

Thanks for notifying us of this proposal and please keep us informed of progress. Please contact me if you need any further information in relation to the above.

Regards
Rachel

Rachel Cremer
Property Co-ordinator
Broadcast Australia Pty Ltd
t: 02 6256 8020
f: 02 6256 8041
e: rachel.cremer@broadcastaustralia.com.au
w: www.broadcastaustralia.com.au