

22 January 2008

61859

WestWind Pty Ltd
505 Warrenheip Rd
Buninyong VIC 3357

Attention: Mr Grant Flynn

Dear Grant

ASSESSMENT OF POTENTIAL WIND FARM INTERFERENCE TO RADIOCOMMUNICATIONS SERVICES

1. INTRODUCTION

WestWind Energy Pty Ltd (WestWind) is an Australian based company established to develop, build and operate wind farms. WestWind have recently started development work on their second project – the Lal Lal Wind Farm near Ballarat in Victoria.

GQ-AAS was commissioned by WestWind to examine the radiocommunications services in the region surrounding the proposed wind farm, and assess the potential for interference to these services from wind turbines.

GQ-AAS developed a methodology and presented calculations based on Reference 1 and Reference 2, in order to determine recommended exclusion zones around fixed link services. These recommendations were incorporated by WestWind into the Proposed Layout for the Lal Lal Wind Farm.

This document provides the following:

1. Brief outline of interference mechanisms.
2. Summary of conclusions on the calculation of the recommended exclusion zone around each fixed link.
3. Summary of each fixed link identified as crossing the wind farm area, and the recommended exclusion zone for each link.
4. Conclusions on the potential for the proposed wind farm to interfere with the identified radiocommunications services (with reference to the Proposed Layout of the wind farms).
5. Implications of moving the wind turbine YSWT03 from the location in the Proposed Layout, to a new location approximately 100 m east.

2. WIND TURBINES AND INTERFERENCE

Wind turbines can cause interference to point to point links and point to multipoint services by three interference mechanisms:

1. Near field effects: When an obstruction exists within the 'near field' zone of a transmitting or a receiving antenna, signal degradation can occur which is complex to predict.

2. Diffraction: When an electromagnetic wave encounters an obstruction, some energy is diffracted around the obstruction, causing an additional loss above free space loss for the radio path due to some of the energy of the wave being diffracted away from the direct path between the transmitter and the receiver.
3. Reflection/Scattering: When an electromagnetic wave encounters an obstruction, some energy is re-radiated (reflected or scattered) in other directions. The amount and direction of re-radiated energy depends on the properties of the obstruction.

3. RECOMMENDED EXCLUSION ZONE

GQ-AAS has previously assessed the interference mechanisms with respect to wind turbines, following the methodology outlined in Reference 1. Calculations and conclusions are presented in Reference 3. From this work, GQ-AAS concludes the following, for fixed link services:

1. If there is more than 57% of the first Fresnel zone clear of knife edge obstructions, wanted signal loss due to diffraction is not significant.
2. Near field effects are restricted to locations very close to the transmitters.
3. The interference due to reflections is only significant close to each end of the radio link (within 1 km).

GQ-AAS recommends a diffraction exclusion zone based on clearance of the first Fresnel zone by the whole wind turbine (tower and blades) to overcome potential degradation of the link due to diffraction.

The diffraction exclusion zone is calculated as double the distance from the bore sight line of the radio path to the centre line of the wind turbine. This equals the maximum first Fresnel zone radius of the fixed link service + the length of the turbine blade, as shown in the figure below.

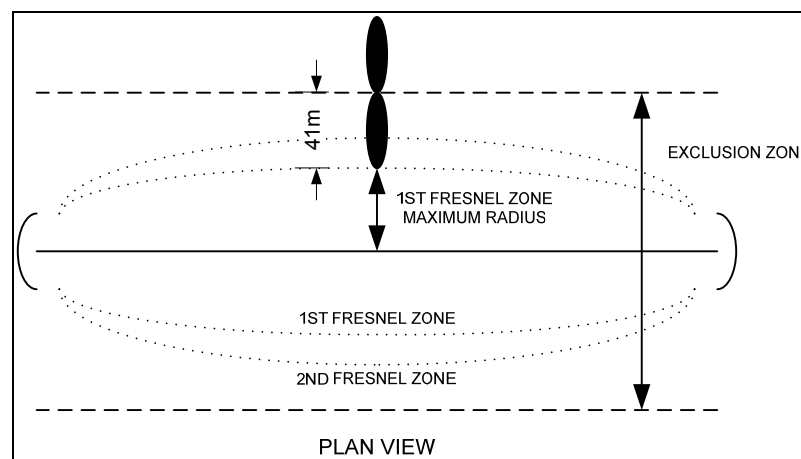


Figure 3.1 – Exclusion zone width.

4. FIXED LINK ANALYSIS

4.1 Initial Analysis

From the Australian Communications and Media Authority (ACMA) Register of Radio communications Licences (RRL) (Reference 4), GQ-AAS identified the following 14 fixed links that cross the proposed wind farm area.

Path ID	From (ACMA Site ID)	To (ACMA Site ID)	Frequency (MHz)	Path Length (km)
1	Mt Buninyong (11716)	Blue Mountain (41712)	852.3875 928.3875	41.2
2	Mt Blackwood (11707)	Mt Helen (101173)	7821.825 8133.145	41.55
3	ODonnell Hill (300281)	Mt Buninyong (11717)	18685 19695	17.91
4	Mt Buninyong (11717)	Mt Macedon (11740)	856.5 932.5	65.67
5	Murradoc Hill (40824)	Mt Warrenheip (150365)	7690.5 7529.5	86.34
6	Mt Warrenheip (11724)	Mt Anakie (11693)	5945.2 6197.24	44.01
7	Mt Buninyong (11717)	Mt Blackwood (11707)	1438.5 1499	39.94
8	Ballan (46299)	Mt Buninyong (11716)	852.2375 928.2375	27.06
9	Mt Warrenheip (11727)	Bamganie (303695)	18655 19665	33.33
10	Meredith (131936)	Mt Buninyong (11717)	10572 10637	22.5
11	Ballarat (301006)	Mount Egerton (9001493)	404.45 413.9	17.67
12	CFA Site Moorabool Rd West (302624)	Mt Buninyong (11716)	450.9 460.4	23.48
13	CFA Site Fiskville (45962)	Sidbury Ave Ballarat (46209)	460.15 450.65	37.59
14	Ceres Lookout (11689)	Mt Warrenheip (11727)	8103.495 7792.175	72.81

Table 4.1 – Identified fixed links.

The recommended exclusion zone for each link (as calculated in Reference 3) is summarised below.

Path ID	1 st Fresnel Zone Maximum Radius	Recommended Exclusion Zone Width
1	60 m	Not required, adequate path clearance
2	20 m	122 m
3	8 m	Not required, adequate path clearance.
4	76 m	Not required, adequate path clearance.
5	29 m	Not required, adequate path clearance.
6	24 m	Not required, adequate path clearance.
7	46 m	Not required, adequate path clearance.
8	49 m	180 m, between 15 km and 18 km along the link path from the Fisken St Fire Station site.

Path ID	1 st Fresnel Zone Maximum Radius	Recommended Exclusion Zone Width
9	12 m	106 m
10	13 m	108 m
11	57 m	196 m
12	62 m	206 m, between 10 km and 11 km along the link path from the Mt Buninyong site.
13	79 m	240 m
14	26 m	Not required, link passes outside Yendon Section.

Table 4.2 – Summary of recommended exclusion zones.

4.2 WestWind Proposed Layout

These recommended exclusion zones have been incorporated into the Proposed Layout by WestWind. All wind turbines (24 in the Elaine zone, 40 in the Yendon zone) are situated outside the recommended exclusion zones and thus GQ-AAS concludes they will have an insignificant impact on the identified fixed links.

5. TURBINE YSWT03

WestWind have identified one turbine (YSWT03) that would ideally be situated approximately 100 m east of the location in the Proposed Layout.

The new position will place the turbine in the centre of the exclusion zone for Path 12, which appears to rely on knife edge diffraction over the terrain obstruction 18 km from the Mt Buninyong end of the link (refer to following Figure).

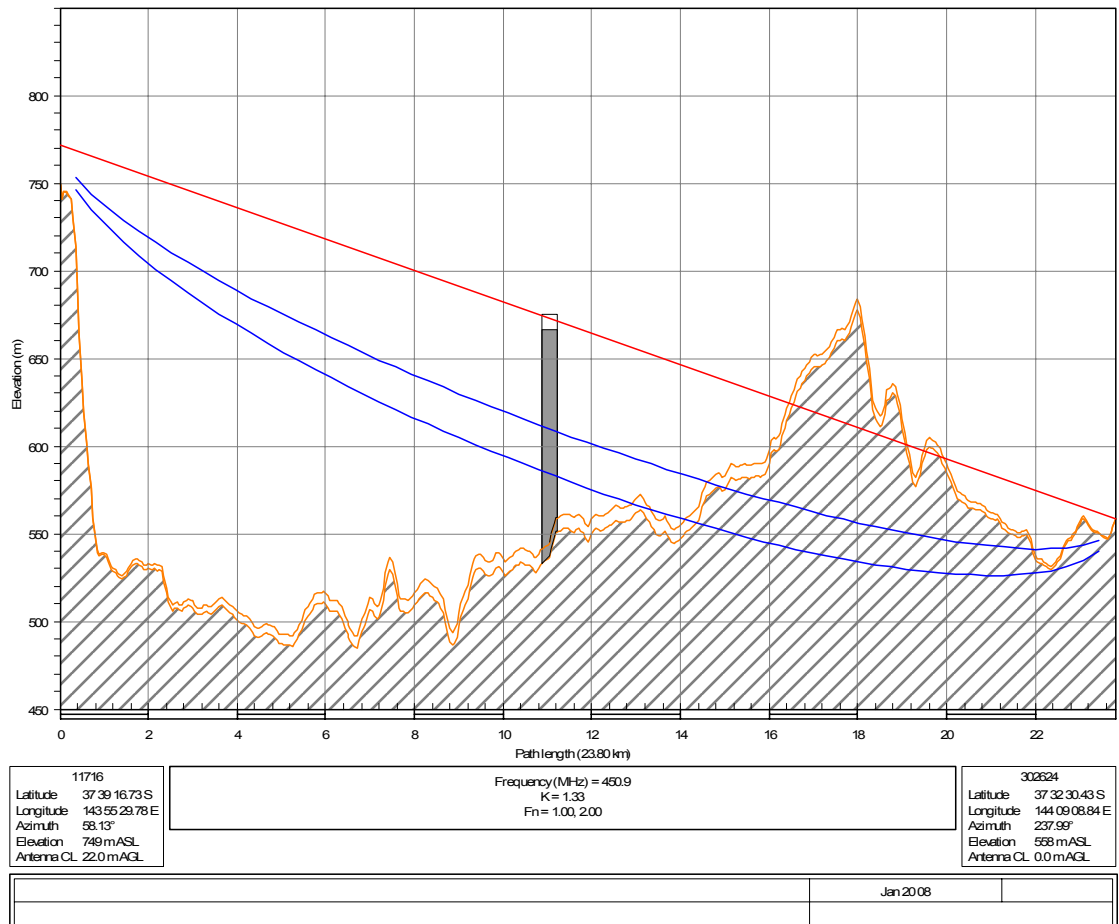


Figure 5.1 – Path profile for Path 12, with turbine YSWT03 100 m east of the proposed location.

The Fresnel zone of interest is along the path from the Mt Buninyong site to the knife edge obstruction. This section of the path is shown in the following Figure. The first Fresnel zone of this path is smaller, as the path length is shorter. The two Fresnel zones shown in the Figure are 60% and 100% of the first Fresnel zone.

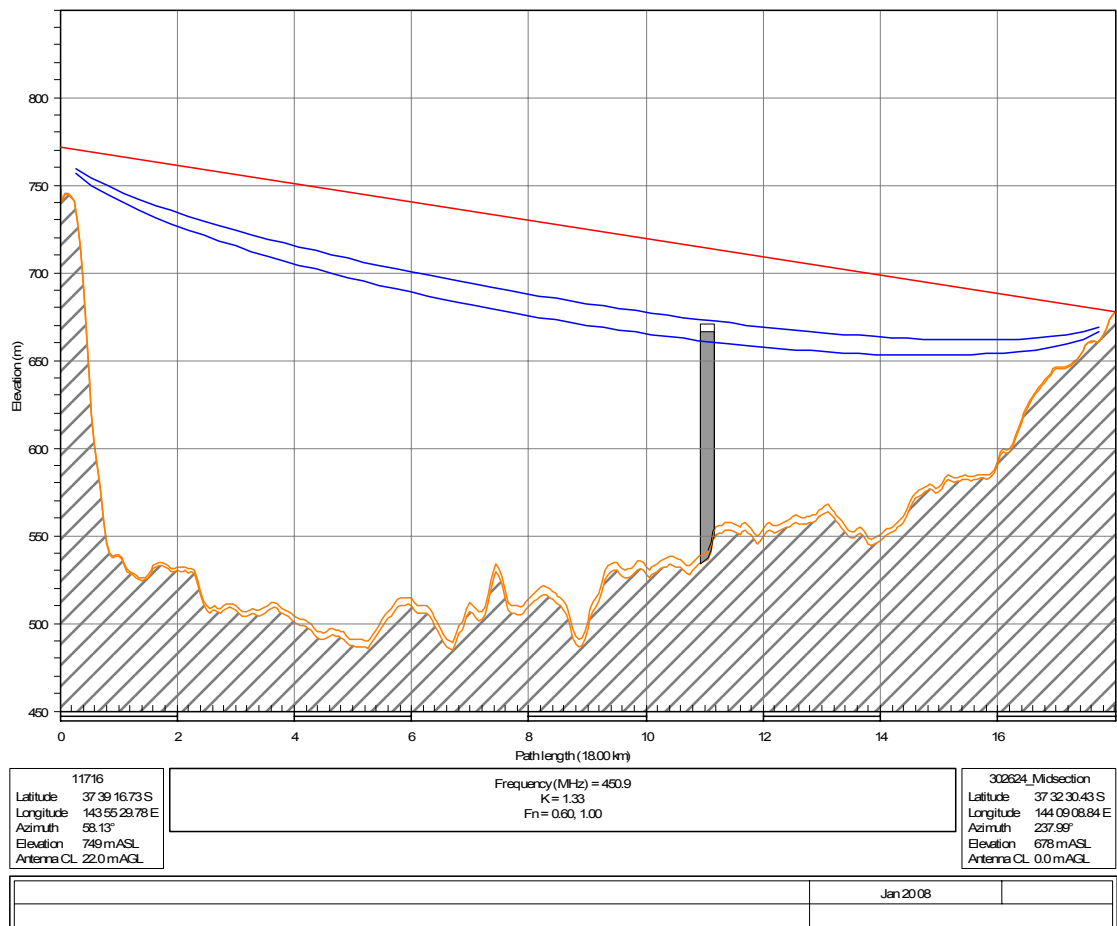


Figure 5.2 – Path profile for the midsection of Path 12. Turbine YSWT03 is 100m east of the proposed location.

The new location means turbine YSWT03 intrudes into part of the first Fresnel zone of the diffracted path, though it does not intrude into 60% of the first Fresnel zone area. As noted above this is the critical part of the first Fresnel zone.

However it should be noted that the new location is at the base of a 15 m rise in terrain, and if the new turbine location was actually at the top of this rise then the obstruction would move into the critical part of the Fresnel zone, increasing the likelihood of signal loss due to diffraction.

6. CONCLUSIONS

GQ-AAS concludes the following:

1. All wind turbines at the locations in the Proposed Layout will have an insignificant effect on the performance of the identified fixed links.
2. Moving turbine YSWT03 100 m to the east will place the turbine on the path for link 12 between Mt Buninyong and the CFA site at Moorabool Road West. This is an obstructed path that appears to rely on diffraction at a point 18 km from the Mt Buninyong end of the link. The path between the diffraction point and the Moorabool Road West site will have some intrusion of the turbine into the first Fresnel zone.

No reduction in signal level is predicted if the area defined by 60% of the first Fresnel zone for this path is clear of the wind turbine.


7. REFERENCES

The following reference documents were used to conduct this work:

1. "Fixed-link wind-turbine exclusion zone method", D. F. Bacon, Version 1.1, 2002.
2. ITU-R Recommendation P.526-10 "Propagation by Diffraction"
3. "Response to Country Fire Authority Concerns", Gibson Quai – AAS letter, 18 October 2007.
4. ACMA Register of Radiocommunications Licences
http://web.acma.gov.au/pls/radcom/register_search.main_page

Yours sincerely

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