

Environmental Impact Statement

Uungula Wind Farm

Appendix T: Telecommunications and Electromagnetic Interference Study (Middleton Group, 2020)

May 2020



CWP RENEWABLES

Uungula Wind Farm

**Telecommunications and Electromagnetic
Interference Study**

DOCUMENT NO: 1974-G-RPT-001

REVISION: 0

Document Control

Table 1: Document approval record

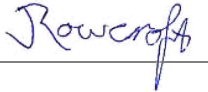
Function	Position	Name	Date	Signature
Prepared by	Senior Renewable Energy Engineer	Jerome Rowcroft	12/02/2020	
Reviewed by	Project Director	Roger Brown	12/02/2020	
Approved by	Project Director	Roger Brown	12/02/2020	

Table 2: Document amendment record

Revision No.	Amendment Description	Author	Initials	Date
A	Initial Draft for Client	Jerome Rowcroft	JR	13/11/2019
B	Final Draft: Amended for client comments and updated layout. Inserted section on micro siting.	Jerome Rowcroft	JR	12/02/2020
0	Issued to client	Jerome Rowcroft	JR	12/02/2020

Contents

1	EXECUTIVE SUMMARY.....	5
2	ABBREVIATIONS / DEFINITIONS	6
3	NORMATIVE REFERENCES	7
4	BACKGROUND	8
5	SCOPE	8
6	INPUTS.....	8
7	ASSUMPTIONS.....	9
8	IMPACT ASSESSMENT.....	10
8.1	POINT TO POINT LINKS.....	10
8.1.1	Fresnel Zones	11
8.1.2	Link 1: Wellington SC, Mt Bogandora – TransGrid Site, Trig Rd.....	13
8.1.3	Link 2: Wellington SC Site, Mt Bodangora – RFS Site, Store Creek	14
8.1.4	Micro siting	16
8.1.5	Summary	18
8.2	METEOROLOGICAL RADAR	18
8.3	MOBILE VOICE-BASED COMMUNICATIONS.....	19
8.4	WIRELESS AND SATELLITE SERVICES	19
8.5	BROADCAST AND DIGITAL RADIO AND TELEVISION	19
9	STAKEHOLDER ENGAGEMENT	20
10	CONCLUSIONS	21
	APPENDIX A STAKEHOLDER CORRESPONDENCE	22
	CONSULTATION EMAIL	22
	TELSTRA RESPONSE	24
	NBNCO RESPONSE	25
	NSW RURAL FIRE SERVICE RESPONSE	27

List of Figures

Figure 1: Uungula Wind Farm turbines and 2 km buffer; ACMA communications sites.	10
Figure 2: Turbine envelope based on 170 m rotor diameter, relative to 2 nd Fresnel Zone extent	12
Figure 3: Plot of topography the length of Link 1's path, LoS, 1 st and 2 nd Fresnel Zones and Turbine location.	13
Figure 4: Wind turbine rotor extent (Turbine 106) plotted against 1 st and 2 nd Fresnel Zones of Link 1.	13
Figure 5: Satellite imagery of the RFS Store Creek Site – at a scale of nominally 1:1500 (A4). There is no evidence of communication equipment in the photograph.	14
Figure 6: ACMA sites in the vicinity of Store Creek. Circled area shows evidence of a communication mast.	15
Figure 7: Plot of topography the length of Link 2's path, LoS, 1 st and 2 nd Fresnel Zones and Turbine 105's location.	16
Figure 8: Wind turbine rotor extent (Turbine 105) plotted against 1 st and 2 nd Fresnel Zones of Link 2.	16
Figure 9: Rotor and micro siting envelopes in the vicinity of point to point microwave links. Second Fresnel zone extents shown.	17
Figure 10: Micro siting allowance for Turbine 105 and Turbine 106.	18
Figure 11: Proximity of the Project to mobile phone base stations.	19
Figure 12: Location of broadcasters relative to the Project.	20
Figure 13: Proximity of turbines to mobile base stations, sent to Telstra, Optus and NBNCo.	22
Figure 14: Proximity of wind turbines to RFS point to point link, as provided to NSW RFS.	23

List of Tables

Table 1: Document approval record.	2
Table 2: Document amendment record.	2
Table 3: Abbreviations.	6
Table 4: Study inputs.	8
Table 5: List of point to point links that pass across the site.	11
Table 6: Maximum radius of 1 st and 2 nd Fresnel Zones of the point to point links that pass across the site.	12
Table 7: Relationship between turbine locations.	13
Table 8: List of stakeholder engagement.	21

1 Executive Summary

CWP Renewables' Uungula Wind Farm is progressing through the statutory approvals process. As part of this, an assessment of telecommunications and Electromagnetic Interference (EMI) is required.

This study has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) for SSD6687 (dated 20/12/2016).

With respect to telecommunications and EMI, the SEARs state:

Telecommunications – identify possible effects on telecommunications systems, assess impacts and mitigation measures including undertaking a detailed assessment to examine the potential impacts as well as analysis and agreement on the implementation of suitable options to avoid potential disruptions to radio communication services, which may include the installation and maintenance of alternative sites.

This report satisfies the SEARs, demonstrating that the Uungula Wind Farm will have no material impact on:

- Existing point to point communication links (UHF and Microwave);
- Meteorological radars;
- Mobile voice-based communications;
- Radio Broadcast (AM, FM and Digital); and
- Television broadcast (Digital).

Two point to point links pass in the vicinity of wind turbines. Detailed assessments of these links demonstrate that, based on the turbine locations provided and the location of the transmitters/receivers provided by ACMA, Uungula Wind Farm will have no material impact on those links.

Consultation with stakeholders has also been undertaken.

2 Abbreviations / Definitions

Table 3: Abbreviations

Abbreviation	Explanation
ACMA	Australian Communications and Media Authority
BOM	Bureau of Meteorology
CWPR	CWP Renewables
DTV	Digital Television
EMI	Electro-Magnetic Interference
GHz	Giga-Hertz – 1 billion Hertz
GIS	Geographic Information System
LoS	Line of Sight
MG	Middleton Group Engineering
MHz	Mega-Hertz – 1 million Hertz
RFS	Rural Fire Service
SEARs	Secretary's Environmental Assessment Requirements (SSD 6687) (20/12/2016)
The Project	Uungula Wind Farm
UHF	Ultra-High Frequency
Wellington SC	Wellington Shire Council

3 Normative References

- [1] D. Bacon, "Fixed-link wind-turbine exclusion zone method," Radiocommunications Agency UK, 2002.
- [2] G. Durgin, "The Practical Behavior of Various Edge-Diffraction Formulas," *IEEE Antennas and Propagation Magazine*, vol. 51, no. 3, pp. 24-35, 2009.
- [3] Commission for Instruments and Methods of Observation, "WMO Guidance Paper on Weather Radar/Wind Turbine Siting," World Meteorological Organisation, Helsinki, 2010.

4 Background

CWP Renewables Pty Ltd (CWPR) are seeking statutory approvals for the proposed 97-turbine Ungula Wind Farm. Ungula Wind Farm is located in the central western ranges of NSW, 15 km east of Wellington, north of Lake Burrendong.

CWPR, on behalf of Ungula Wind Farm Pty Ltd, have requested that Middleton Group Engineering (MG) provide them with a Telecommunications Assessment for the proposed Ungula Wind Farm (the Project). The Project is a State Significant Development (SSD 6687) and Secretary's Environmental Assessment Requirements (SEARs) are available for the project. The scope is required to address the SEARs, specifically, the item related to telecommunications:

Telecommunications – identify possible effect on telecommunications systems, assess impacts and mitigation measures including undertaking a detailed assessment to examine potential impacts as well as analysis and agreement on the implementation of suitable options to avoid potential disruptions to radio communication services which may include the installation and maintenance of alternative sites.

In completing this study, MG have liaised closely with CWPR, working collaboratively to ensure the Project minimises its impacts on telecommunication systems.

5 Scope

This Telecommunications and EMI Study is a desktop study mapping the turbine locations along with telecommunication services and evaluating the impact of the wind turbines on these services.

The study is confined to the analysis of publicly available information and consulting with key stakeholders.

The impact of the Ungula Wind Farm has been assessed with respect to the following telecommunication services:

- Point to point microwave links;
- Meteorological radar;
- Mobile voice-based communications;
- Wireless and satellite internet services;
- Broadcast and digital radio; and
- Broadcast, digital and satellite television.

6 Inputs

This assessment is based on the inputs specified in Table 4.

Table 4: Study inputs.

Input	Source	Format	Date Provided/Accessed
Wind turbine co-ordinates	CWPR: Data Room	Shapefile provided; Co-ordinate system specified.	11/10/2019

Input	Source	Format	Date Provided/Accessed
		Updated layout provided.	25/10/2019
		Updated layout provided.	5/02/2020
Wind turbine dimensions	CWPR: CWPR:	Email Email	14/10/2019 10:54 15/10/2019 14:06
Point to point microwave links, mobile voice-based communication, and internet services	https://web.acma.gov.au/rrl/site_proximity_main_page https://oztowers.com.au/Home/Query (specific for mobile voice-based communication – search for “Yarragal, NSW”)	.kml .kml	11/10/2019 17/10/2019
AM, FM, Digital Radio Broadcasters Digital TV	https://acma.gov.au/Citizen/TV-Radio/Television/Lists-of-broadcasters/list-of-licensed-broadcasting-transmitters	.csv	11/10/2019
Meteorological Radar	http://www.bom.gov.au/australia/radar/info/nsw_info.shtml	Website: Lats & Longs	16/10/2019

7 Assumptions

This study has been developed on the following basis:

- The study is desktop only. No site visit or on-site ground-truthing has been conducted.
- Wind Turbine Co-ordinates provided by CWPR are correct.
- Information, including spatial location of items, antenna heights, emission frequencies and the like, as sourced from ACMA are correct. While MG will check information against satellite imagery, MG has developed the report on the basis that information supplied by/through ACMA is correct.
- Turbines have a tip height of 250 m and a rotor diameter of 170 m.
- Micro siting region is a 100 m radius around the specified wind turbine location.

8 Impact Assessment

8.1 Point to Point Links

Wind turbines have the potential to impact on point to point communication links through three mechanisms [1]:

1. Near field effects;
2. Diffraction; and
3. Scattering or scattering effects.

Near-field effects and scattering effects occur in the vicinity of the transmitter and receiver, typically being impacted by objects with inductive fields up to several hundred metres from the transmitter/receiver – though the precise impact and extent of the impact is difficult to calculate.

Diffraction is where an object modifies a wave, by obstructing its path of travel. Fresnel zones define an envelope of influence, whereby a rotating wind turbine would adversely impact the signal. This occurs the length of the ray line.

Reflection and scattering relate to the interference by an object that reflects the signal from the transmitter to the receiver. This process creates a longer path between the transmitter and receiver, which can cause undesirable temporal modulation. However, where the carrier to interference ratio, that is the ratio of the strength of the intended signal to the interference signal is sufficiently high, the performance will be unaffected. This threshold varies from site to site, but beyond 2 km from a transmitter/receiver, impacts on signal will be negligible.

As can be seen in Figure 1, there are no transmitters/receivers (including point to multipoint) within 2 km of a wind turbine, therefore only point to point links require consideration.

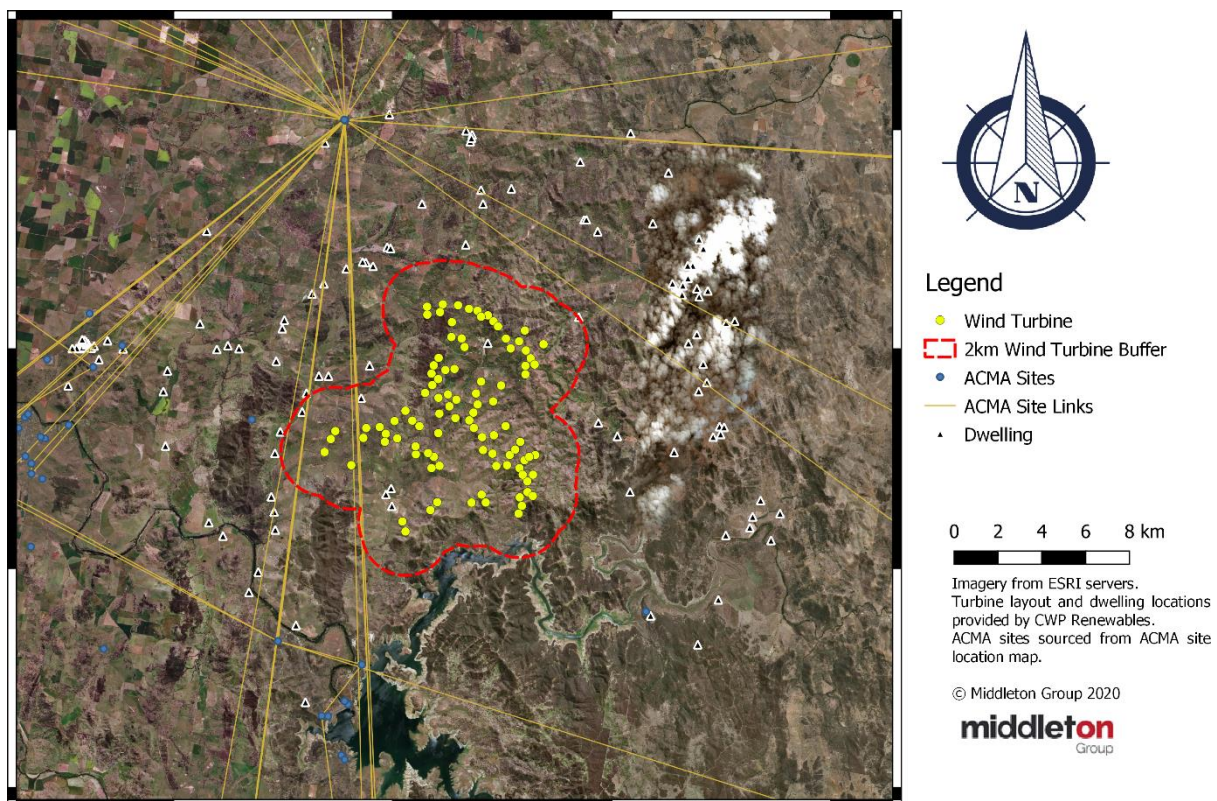


Figure 1: Ungula Wind Farm turbines and 2 km buffer; ACMA communications sites.

Four point to point links pass within 1000 m of wind turbines, therefore further assessment is warranted. These links are listed in Table 5.

Table 5: List of point to point links that pass across the site.

#	BSL/ Licence No	Site 1	Site 2	Length	Frequency (min)	Comment
1	1951530/1	10768: Wellington SC Site; Mt Bodangora	9004466: TransGrid Site Trig Rd; Mullions State Forest	74.0 km	7.5015 GHz	
2	13994/1	34882: RFS Site; Store Creek	10768: Wellington SC, Mt Bodangora	54.1 km	404.18 MHz	Topographic interference – knife-edge propagation
3	1984710/1	10768: Wellington SC, Mt Bodangora	202933: Police Site, Flagstaff Hill	52.2 km	451.425 MHz	
4	36541/1	250307: Country Energy Site; Mt Bodangora	202933: Police Site, Flagstaff Hill	52.3 km	451.3 MHz	

8.1.1 Fresnel Zones

The radius of the n -th Fresnel Zone, F_n , of a point to point link of length D , at a distance d_1 from the transmitter (or receiver) is given by the following equation:

$$F_n = \sqrt{\frac{n\lambda d_1(D - d_1)}{D}}$$

The wavelength of the transmittal signal, λ , is calculated as c/f , where c is the speed of light in air and f is the frequency of the transmittal signal.

Obstacles within the 1st Fresnel Zone will adversely impact the signal, whereas, beyond the 1st Fresnel Zone the impact is reduced. More specifically, for odd values of n the Fresnel Zone is a region of constructive interference; whereas for even values of n the Fresnel Zone is a region of destructive interference [2].

As a conservative measure, it is recommended that wind turbines are kept clear of the 2nd Fresnel Zone. This provides a buffer against uncertainty associated with GIS mapping. However, where this is not possible, further assessment can be undertaken.

The maximum width of the 2nd Fresnel Zones of the four links identified are mapped in Figure 2, with the envelope extent of the turbines shown, based on a rotor diameter of 170 m. Link 2 exhibits knife-edge propagation. That is, there is no LoS between transmitter and receiver, instead, relying on the signal propagating over topography. The high point of the intervening topography effectively becomes the new transmitter/receiver.

In calculating the paths of the links and the relative impact of obstacles, it is important to account for the curvature of the earth and the height of any antennae, as available.

Table 6: Maximum radius of 1st and 2nd Fresnel Zones of the point to point links that pass across the site.

#	BSL/ Licence No	F ₁ Max	F ₂ Max	Length	Frequency (min)	Comment
1	1951530/1	27.2 m	38.4 m	74.0 km	7.5015 GHz	
2	13994/1	98.8 m	139.8 m	54.1 km (52.7 km)	404.18 MHz	Topographic interference – knife-edge propagation; second distance gives effective signal length.
3	1984710/1	93.1 m	131.7 m	52.2 km	451.425 MHz	
4	36541/1	93.1 m	131.7 m	52.3 km	451.3 MHz	

In plan view, without invoking micro siting allowances, the envelope for Turbine 106 overlaps with Link 1's 2nd Fresnel Zone maximum width; Turbine 105 overlaps with Link 2's 2nd Fresnel Zone maximum width.

As such, further analysis is provided for Links 1 and 2. There is enough buffer between turbines and Links 3 and 4 to satisfy the high level 2nd Fresnel Zone criteria.

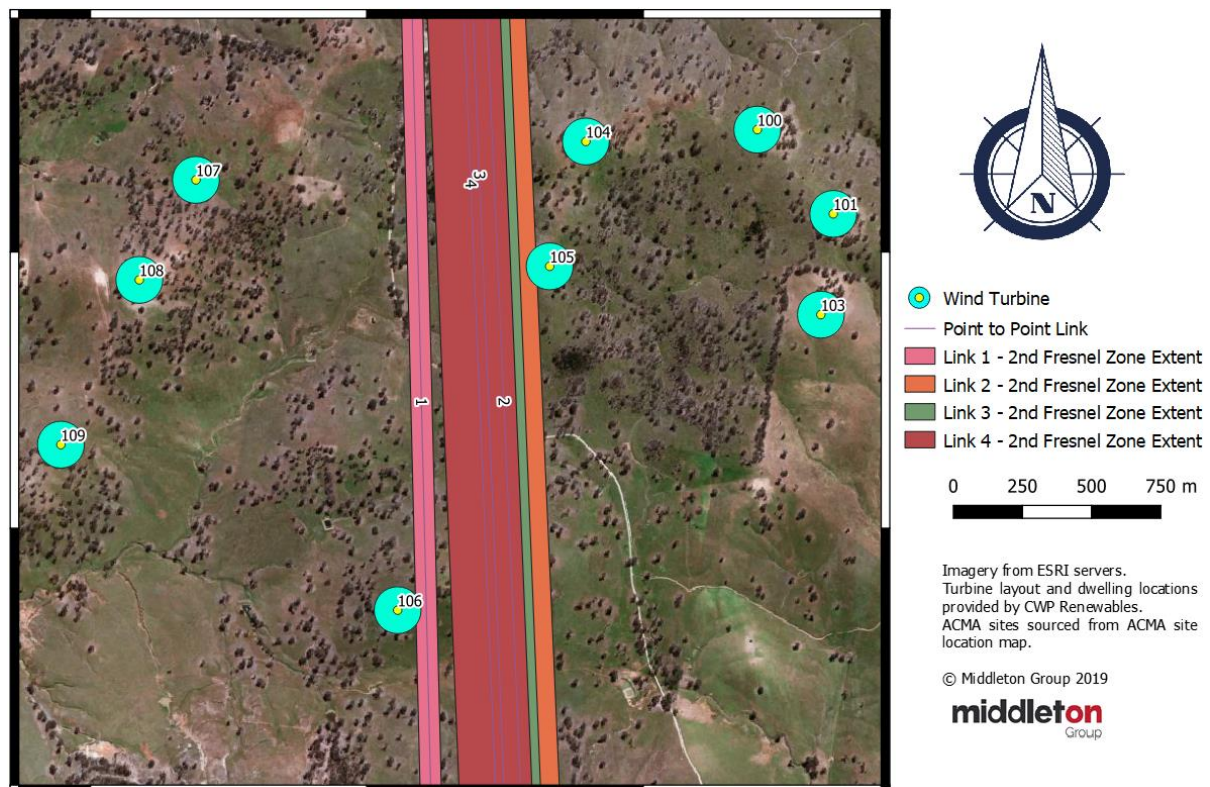


Figure 2: Turbine envelope based on 170 m rotor diameter, relative to 2nd Fresnel Zone extent

Table 7: Relationship between turbine locations

#	Nearest Turbine	Distance to Turbine	Offset from LoS to Turbine	F_1	F_2	F_1 Max	F_2 Max
1	106	15.75 km	104 m	22.3 m	31.5 m	27.2 m	38.4 m
2	105	14.50 km	187 m	88.3 m	124.9 m	98.8 m	139.8 m

8.1.2 Link 1: Wellington SC, Mt Bogandora - TransGrid Site, Trig Rd

Per Figure 2, Turbine 106 overlaps Link 1's 2nd Fresnel Zone envelope. A plot of the topography along the path of Link 1, the corresponding envelope of the turbine and the 1st and 2nd Fresnel Zones, as presented in Figure 3, indicates that there is overlap with the 1st Fresnel Zone. However, further analysis – plotting the slice of the turbine rotor and the lateral and vertical extent of the Fresnel Zones, as shown in Figure 4, indicates that there is no physical overlap between the 170 m wind turbine rotor and the Fresnel Zones.

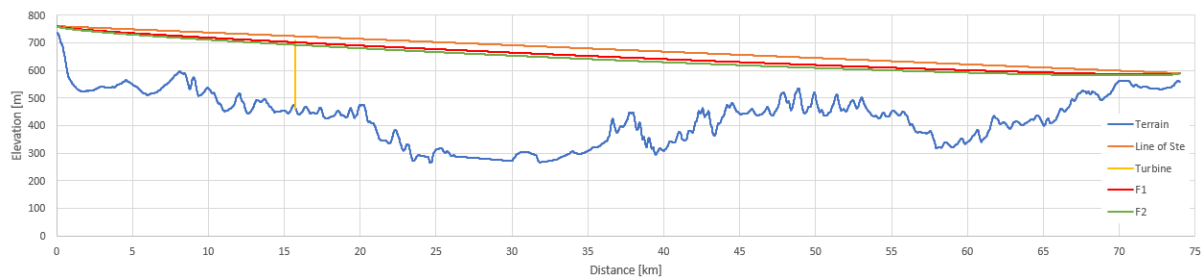


Figure 3: Plot of topography the length of Link 1's path, LoS, 1st and 2nd Fresnel Zones and Turbine location.

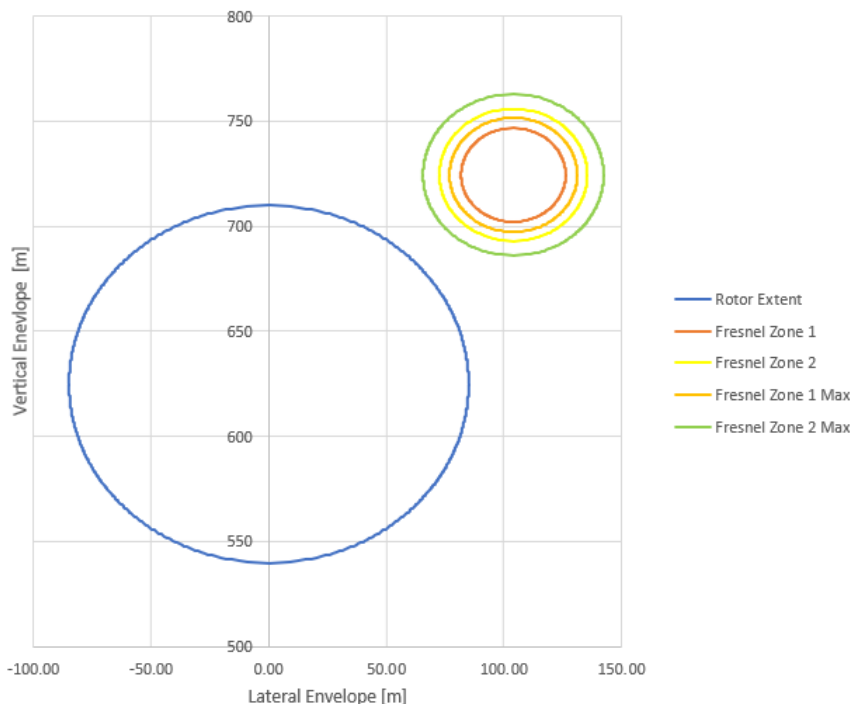


Figure 4: Wind turbine rotor extent (Turbine 106) plotted against 1st and 2nd Fresnel Zones of Link 1.

Based on this analysis, the Project will not impact on Link 1.

8.1.3 Link 2: Wellington SC Site, Mt Bodangora - RFS Site, Store Creek

Link 2 is a 54 km UHF link between Wellington SC's Mt Bodangora Site and the NSW RFS site at Store Creek.

In reviewing the site information, it was noted that satellite imagery (most recent imagery from September 2018 from Google Earth) of the RFS Site at Store Creek did not show any obvious transmitter/receiver at the mapped location, as shown in Figure 5. As shown in Figure 6, another communication site is located 380 m to the north-west of the mapped location (Flagstaff Hill Mount Top). A third communication site, located in a gully 120 m west of the Flagstaff Hill Mount Top site, is named "Commsite STORE CREEK". The mapped location of the Commsite STORE CREEK site is within 120 m of what appears to be a communication tower, based on satellite imagery, while the Flagstaff Hill Mount Top site is 45 m from the communication tower. Should the mapped location be incorrect, and the observed communication tower is the actual site location, this will shift the link to the west, further reducing any impact of Turbine 105 on Link 2. It is noted that, while the licences are current, they were first licenced in January 1990. Nevertheless, RFS has been consulted.



Figure 5: Satellite imagery of the RFS Store Creek Site – at a scale of nominally 1:1500 (A4). There is no evidence of communication equipment in the photograph.

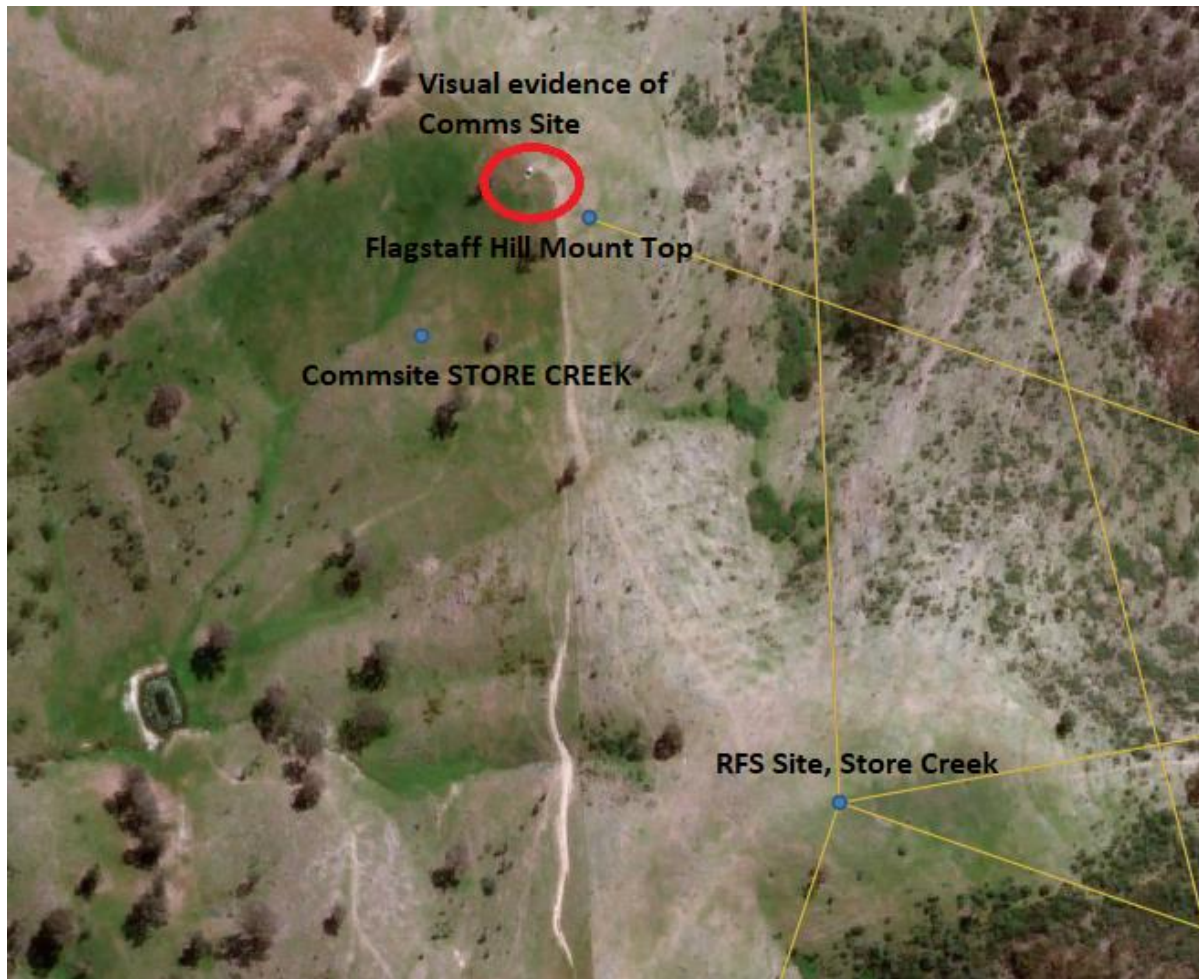


Figure 6: ACMA sites in the vicinity of Store Creek. Circled area shows evidence of a communication mast.

Despite the uncertainty associated with the location of the Store Creek Site, for this analysis, it is assumed that it is as provided in the ACMA database.

The link relies on knife-edge propagation over a peak rather than on LoS, as can be seen in Figure 7. Turbine 105 is laterally offset from the link by 187 m, and the spot height at the turbine location is approximately 40 m above the elevation height below where the link passes, hence, the turbine in Figure 7 appears to be disconnected from the terrain.

It is noted that topography is shown to cut the 1st Fresnel Zone. Generally, for UHF links, obstacles should not obstruct the 1st Fresnel Zone by more than 40%. However, ensuring that rotating machinery such as wind turbines clear the 1st Fresnel Zone, is preferable.

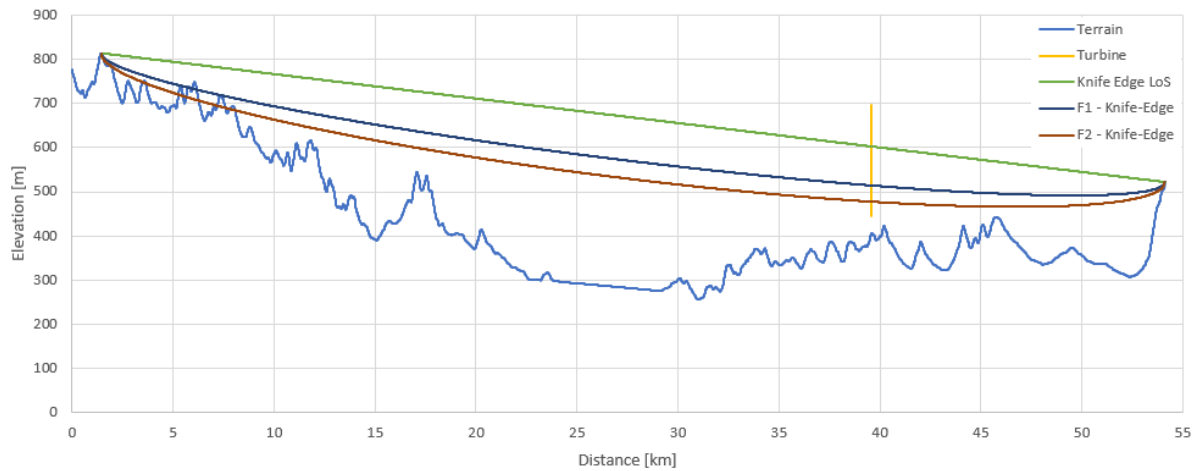


Figure 7: Plot of topography the length of Link 2's path, LoS, 1st and 2nd Fresnel Zones and Turbine 105's location.

Data from Figure 4 and Figure 7 illustrate that the wind turbine envelope encroaches on Link 2. The extent of this encroachment is shown in Figure 8, which demonstrates that the 1st Fresnel Zone is kept completely clear of the wind turbine rotor.

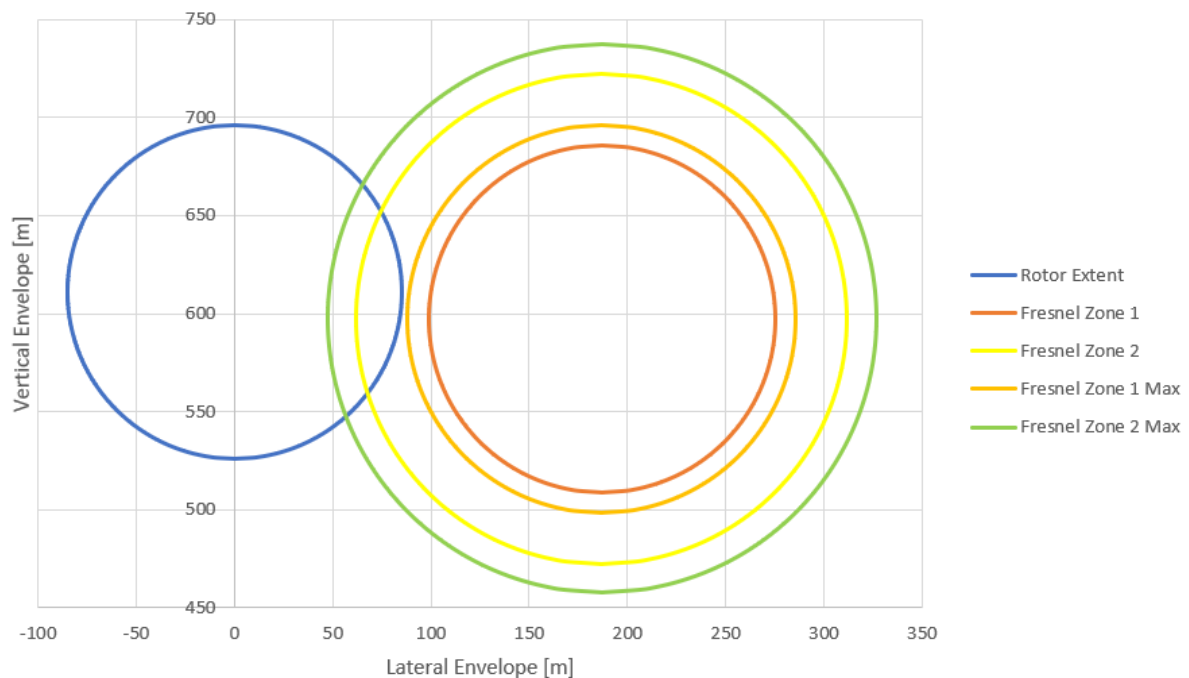


Figure 8: Wind turbine rotor extent (Turbine 105) plotted against 1st and 2nd Fresnel Zones of Link 2.

8.1.4 Micro siting

The ability to microsite wind turbines is an important requirement. Micro siting allowances provide for a 100 m radius around the wind turbine site where the wind turbine can be installed, to best allow for site conditions. These micro siting allowances are often constrained by required buffers from dwellings, vegetation and, in this context, point to point microwave links.

As can be seen in Figure 1 and Figure 2, and as highlighted in the sections above, point to point links only pass in close proximity to Turbines 105 and 106. The remaining turbine micro siting areas will not be constrained by these links.

Figure 9 focusses on the turbines near the previously analysed links. Even with the additional micro siting allowance, only Turbines 105 and 106 require further consideration.

To avoid impact on the links, it is proposed that a constraint on the micro siting areas for these two turbines be applied. The proposed constrained micro siting allowances for Turbines 105 and 106 are shown in Figure 10.

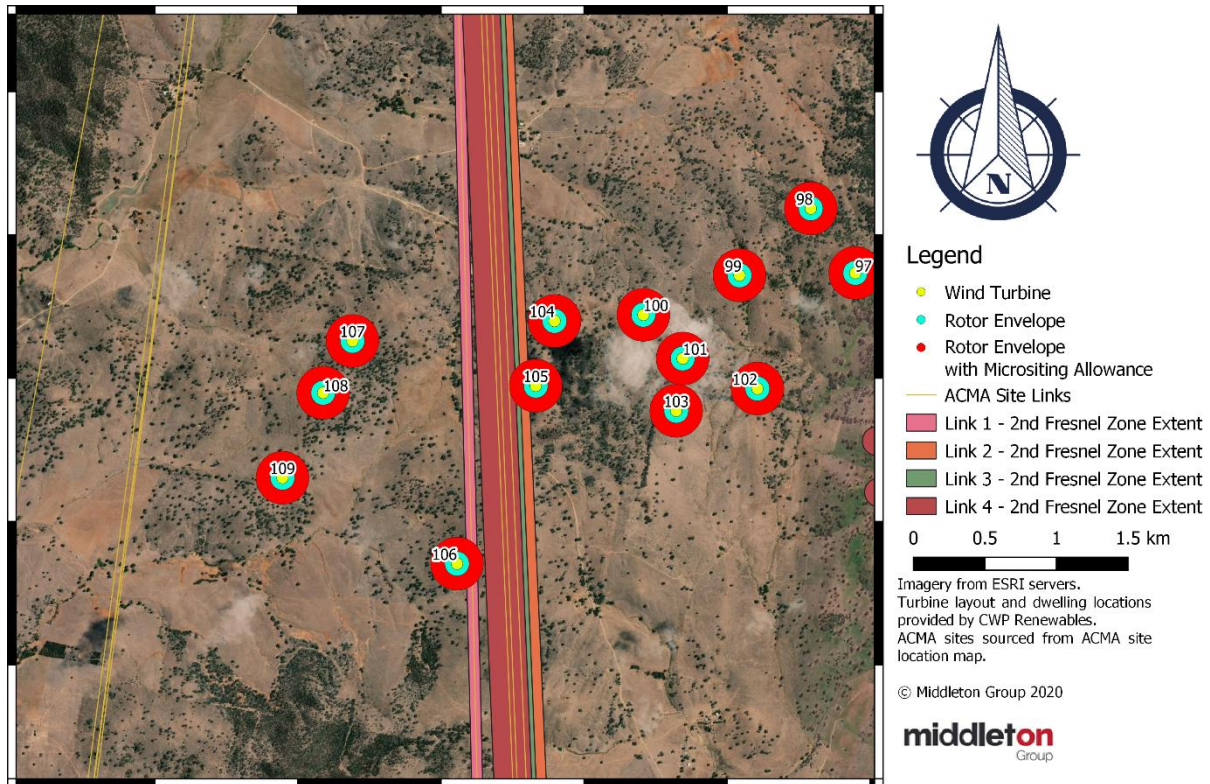


Figure 9: Rotor and micro siting envelopes in the vicinity of point to point microwave links. Second Fresnel zone extents shown.

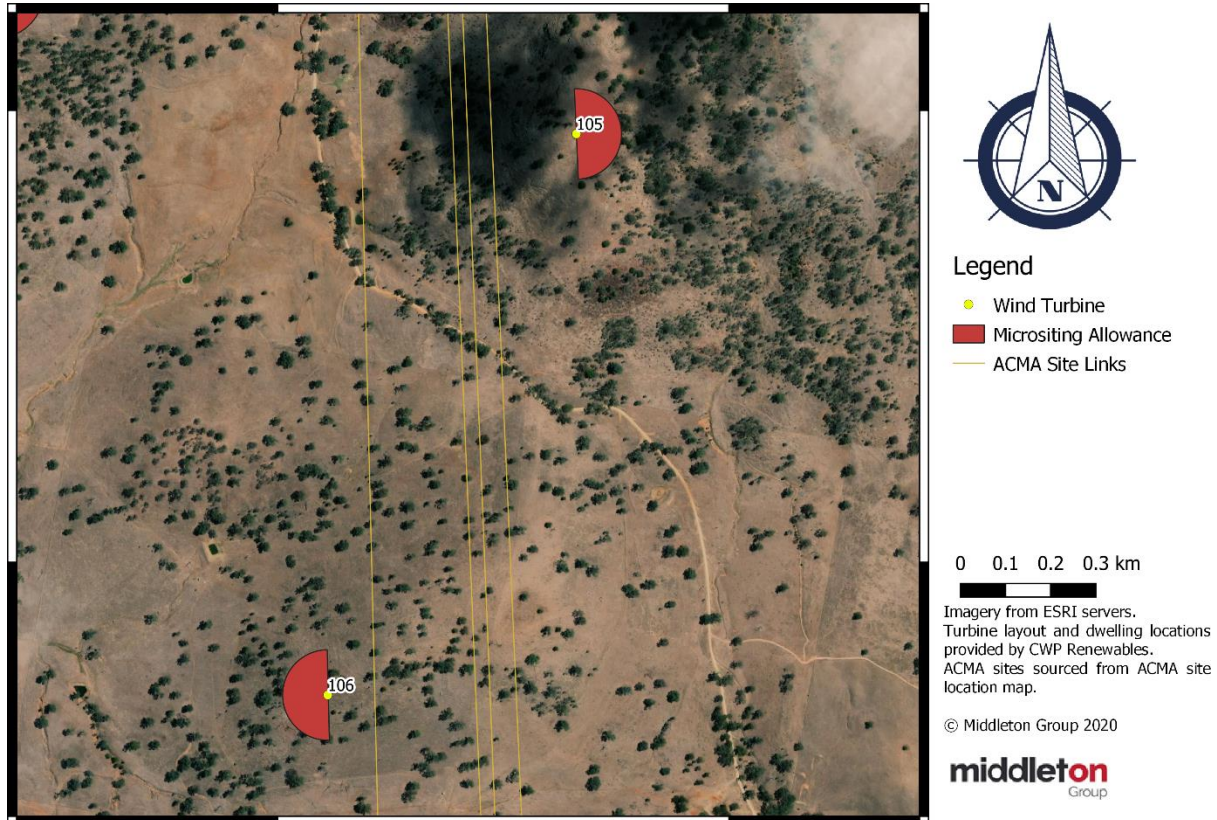


Figure 10: Micro siting allowance for Turbine 105 and Turbine 106.

8.1.5 Summary

Based on the analysis presented, the Project will not impact on point to point links or point to multipoint links. The turbines are not sited in the near-field zones of transmitters/receivers, nor are they sited in reflection or scattering zones. Turbines 105 and 106 are located near the 1st Fresnel Zones of two links; however, neither turbine intersect even the maximum radius of the 1st Fresnel Zone, with Turbine 106 being clear of the maximum extent of Link 1's 2nd Fresnel Zone.

8.2 Meteorological Radar

Meteorological radars detect rain and thunderstorm events, as well as other phenomenon such as flocks of birds, smoke or ash, which cause echoes to be visible. The Bureau of Meteorology's (BOM's) radars typically detect rain between 2.5 km to 3.5 km above the ground within a radius of 200 km. Some wind farms show up on meteorological radars, as static echoes.

Details of specific radars and corresponding coverage maps are available online from <http://www.bom.gov.au/australia/radar/index.shtml>.

The World Meteorological Organisation (WMO) recommend that wind turbines are sited, at a minimum, beyond 5 km from meteorological radars, and preferably beyond 20 km [3].

The nearest turbine in the Project to one of BOM's radars is at a distance of 190 km (Namoi). The next nearest radar is located in Sydney, 220 km away. Based on [3], the Project will have a negligible impact on meteorological radars.

The Project lies SSW of the Namoi radar. In this direction, the performance of the Namoi radar is already impacted by topographic effects. The range of the Sydney radar extends as far west as Mudgee, which is 30 km east of the Project.

Thus, the Project will have negligible impact on Meteorological Radars.

8.3 Mobile Voice-based Communications

The nearest mobile phone base station is located nominally 13 km from the nearest wind turbine, as can be seen in Figure 11. Previous experience suggests that the signal will not be significantly impacted where the towers are located more than 1 km from wind turbines. The mobile phone reception in the vicinity of the wind farm is relatively weak.

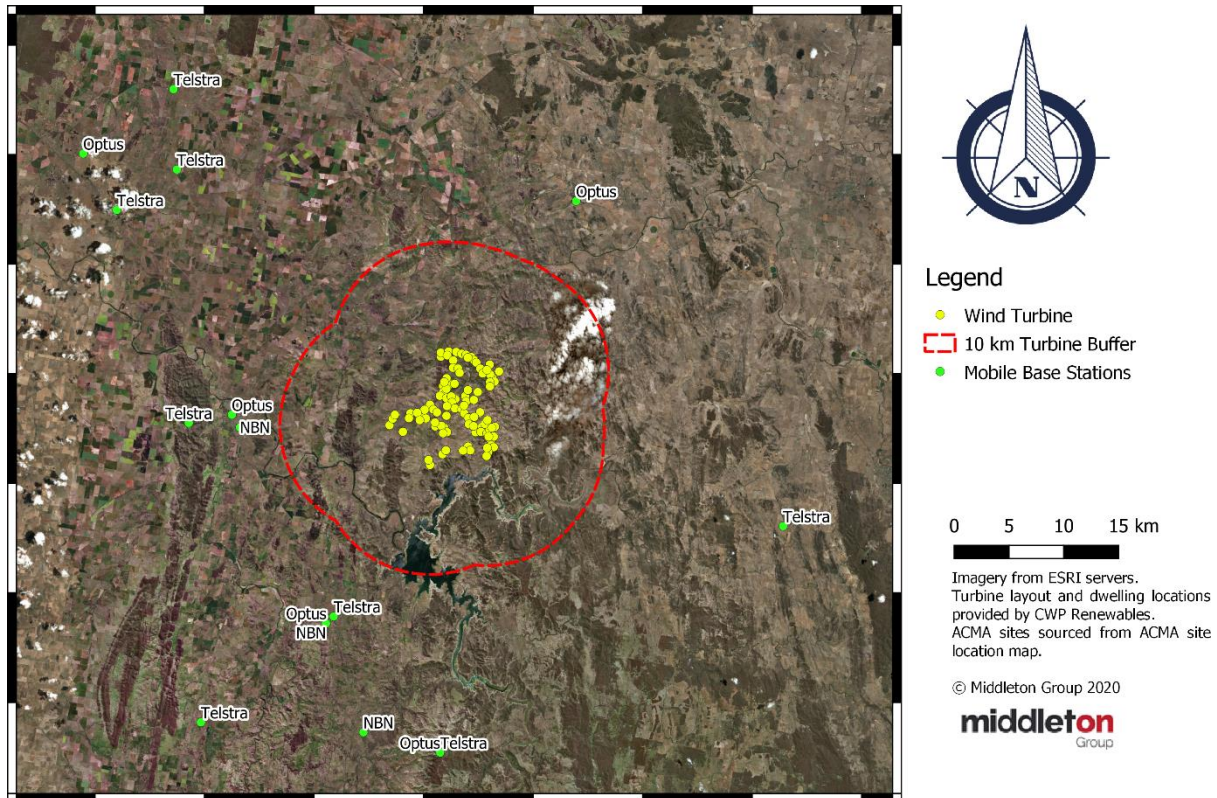


Figure 11: Proximity of the Project to mobile phone base stations.

8.4 Wireless and Satellite Services

Satellite services will only be impacted where receivers are sited in extremely close proximity to turbines, impeding their view of the sky. These satellites typically provide pay-TV, wireless internet and satellite phone coverage, as well as TV coverage where there is no terrestrial service available.

As no turbines are located within 500 m from a dwelling, it is highly unlikely that the Project will impact on satellite services.

8.5 Broadcast and Digital Radio and Television

Amplitude Modulation signals are long wave signals. Operating wind turbines can influence the radiating patterns, with the potential to result in reduced signal quality and strength, as well as causing interference at neighbouring frequencies. A 2 km radius consultation zone exists around AM transmitters. The field of influence from the receiver's perspective is in the order of tens of metres.

Frequency modulated signals tend to be more robust around obstructions such as buildings and wind farms. At the edge of their transmission range, where the signal to noise ratio is already quite low, wind turbines can have an adverse influence on the signal. A 1 km radius consultation zone exists around FM radio transmitters.

Digital signals tend to be more robust than analogue transmitter, though a 2 km radius is generally desirable around transmitters – for both digital radio and Digital Television (DTV). Signals are more robust against ghosting, though wind turbine rotor pass can cause signal frequency variation.

As can be seen in Figure 12 no AM, FM or DTV transmitters are located within 10 km of a turbine. No digital radio transmitters were identified in the vicinity of the site.

If issues are encountered with television reception, this is most readily mitigated by readjusting the receptor, to capture signal from an alternative transmitter.

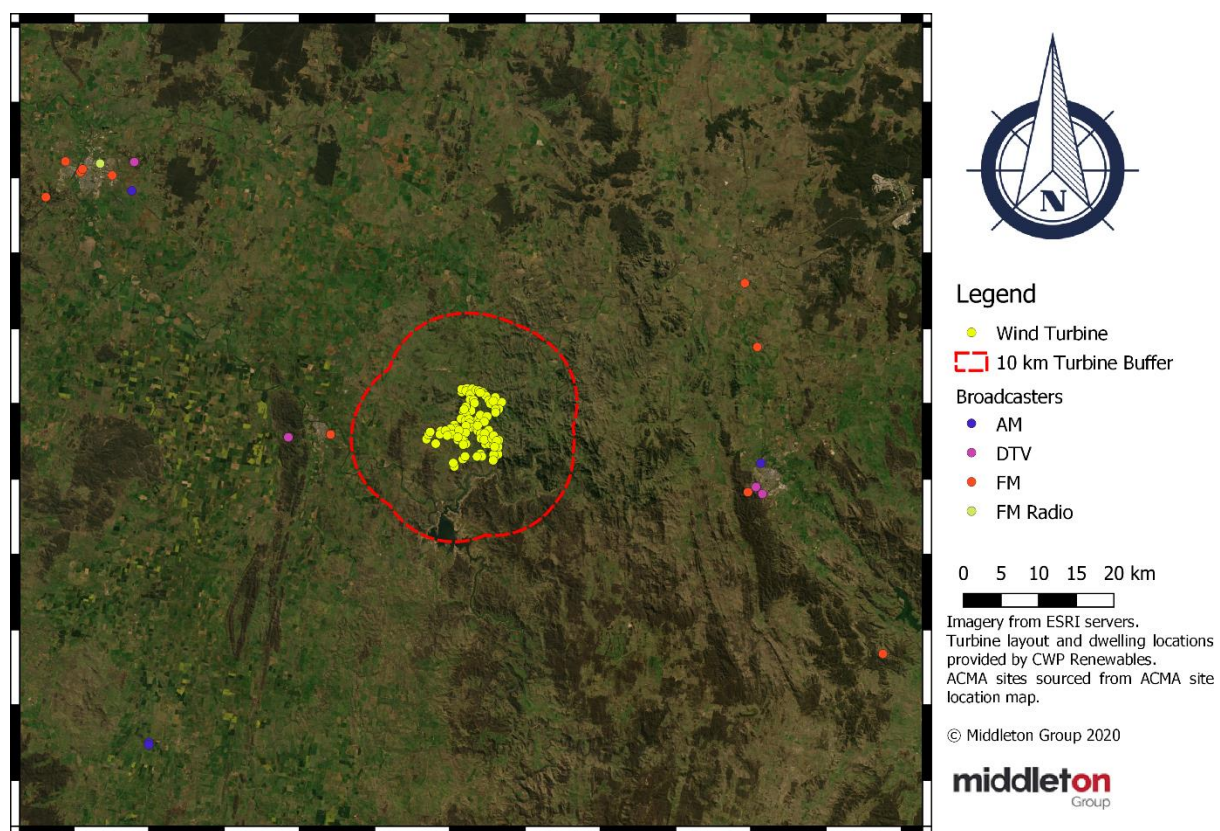


Figure 12: Location of broadcasters relative to the Project.

9 Stakeholder Engagement

On behalf of CWPR, MG have engaged with the stakeholders listed in Table 8. Responses from these stakeholders are provided in Appendix A.

Engagement with Telstra highlighted that there may be issues should SCADA systems and/or substation links rely on wireless technology, and the proponent does not follow ACMA standards. The proponent, however, commits to complying with relevant local and international standards, which implies that the likelihood of any interference with telecommunication systems is very low.

Engagement with stakeholders included provision of the wind farm layout, as at 29th October 2019. The final layout, as provided by the proponent involves the removal of turbines, therefore stakeholders reviewed the more conservative layout, with the updated layout only reducing the impact.

It is noted that the RFS indicated that they would provide further feedback, however, more than three-months have passed since their last correspondence.

Table 8: List of stakeholder engagement.

Stakeholder	Contact Address	Impact	Date	Response
Telstra	Basestation.Enquiries@team.telstra.com	Mobile telemetry	29/10/2019	Finalised
Optus	emeenquiries@optus.com.au	Mobile telemetry	29/10/2019	No Response
NBNCo	Online Portal	Mobile internet	29/10/2019	Acknowledged
Rural Fire Service	webmaster@rfs.nsw.gov.au	UHF Link	29/10/2019	Acknowledged

10 Conclusions

Impacts of the Ungula Wind Farm have been assessed with respect to:

1. Point to point links (microwave and UHF links);
2. Meteorological radar;
3. Mobile voice-based communications;
4. Wireless and satellite services; and
5. Terrestrial radio and television broadcasters.

While some highly localised impacts may be expected in the immediate vicinity of a wind turbine, the Project is highly unlikely to have any material impacts on the services assessed, predominantly due to the proximity from transmitters and receivers.

Two point to point links are near turbines; however, detailed analysis demonstrates that, with a wind turbine rotor diameter of 170 m, these services will not be impacted. The first link, a microwave link in the 7 GHz range, has no blade pass through the maximum 2nd Fresnel Zone envelope; the second link, a UHF link in the 400 MHz range, has no blade pass through the maximum 1st Fresnel Zone envelope.

Care must be taken when micro siting turbines 105 and 106 to ensure that the final as-built locations do not adversely impact the links. A suitable micro siting allowance for these turbines constrained by the proximity to point to point links is shown in Figure 10.

As part of the assessment, MG has engaged with Telstra, Optus, NBNCo and the NSW Rural Fire Service. Correspondence is appended. Telstra has confirmed that there will be no impact on service provided that ACMA requirements are adhered to. Optus has not acknowledged receipt. NBNCo and NSW Rural Fire Service have acknowledged receipt but have not provided comment on the proposal.

Appendix A Stakeholder Correspondence

Consultation Email

Middleton Group initiated consultation with Telstra, Optus, NBNCo and NSW RFS. The following consultation email was sent. Wind turbine co-ordinates were also provided in .csv format. The maps shown in Figure 13 and Figure 14 were included in correspondence, as required.

Dear Sir or Madam

Re: Ungula Wind Farm

CWP Renewables are developing the Ungula Wind Farm in New South Wales.

We are consulting with stakeholders to confirm that our proposal will not have adverse impacts on their operations.

We request that you review the layout of the turbines and confirm that there will be no impact on your operations from an EMI perspective.

Please find attached a map of the development and the co-ordinates of the wind turbines.

Kind regards,

Jerome

Jerome Rowcroft

PhD, BEng (Mech)

Senior Renewable Energy Engineer

middleton
Group

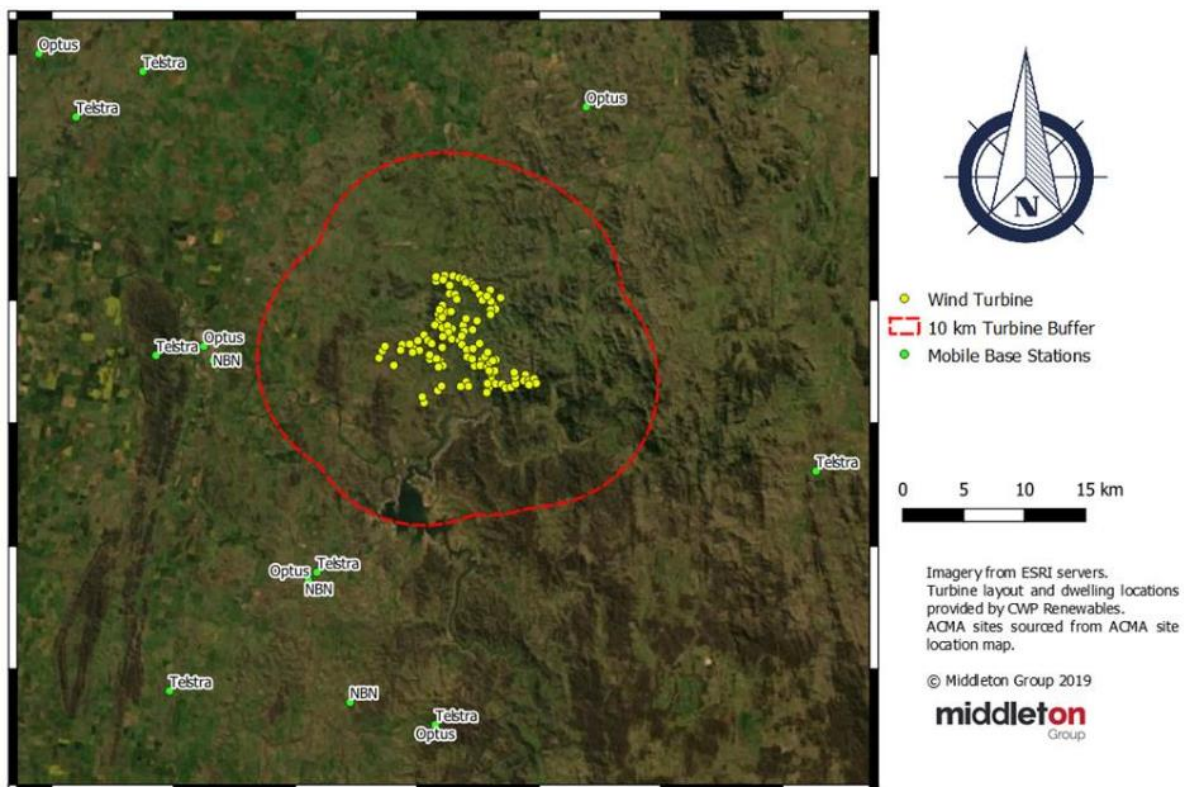


Figure 13: Proximity of turbines to mobile base stations, sent to Telstra, Optus and NBNCo.

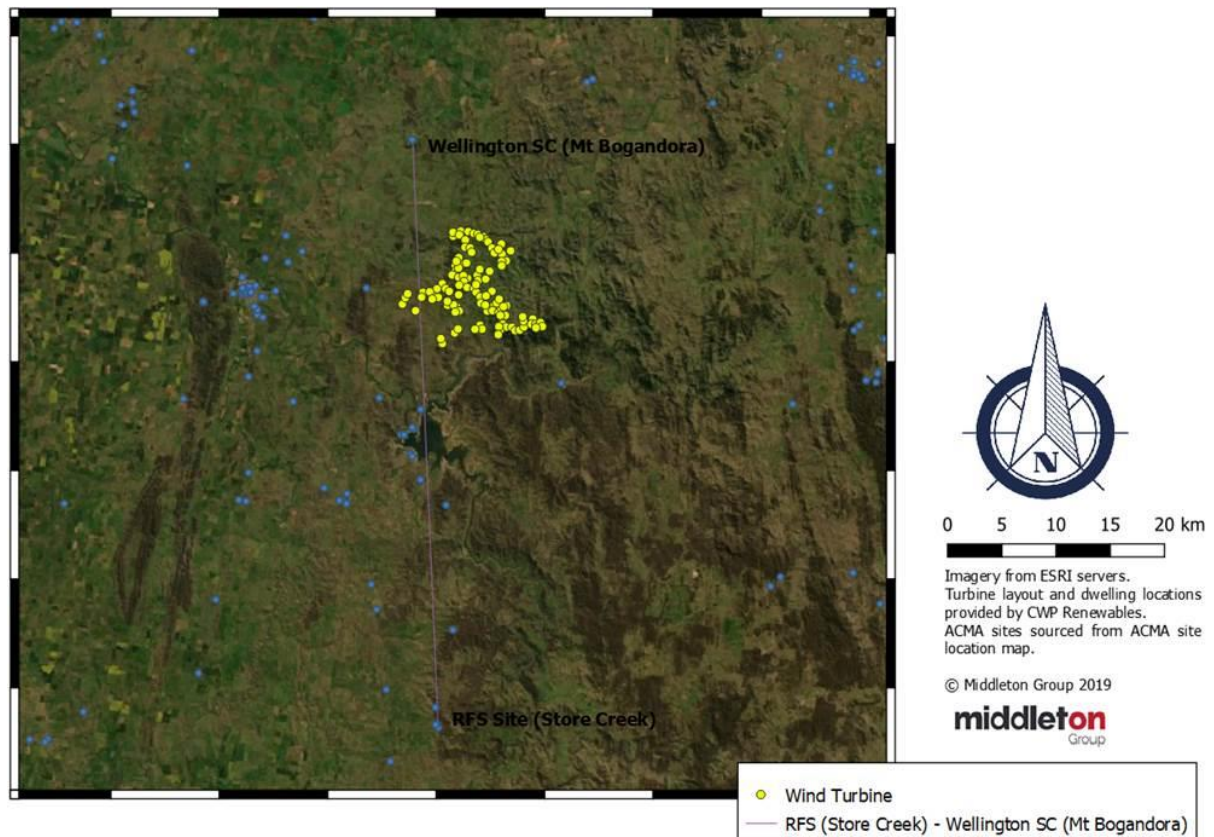


Figure 14: Proximity of wind turbines to RFS point to point link, as provided to NSW RFS.

Telstra Response

From: Bardan, Irwan

Sent: Thursday, 31 October 2019 1:18 PM

To: Jerome Rowcroft

Cc: Dam, Simon; Flower, Matthew; Ungula WF - EMI; ! Basestation Enquiries
<Basestation.Enquiries@team.telstra.com>

Subject: RE: Ungula Wind Farm: Electromagnetic Interference Consultation

Hi Jerome,

I've checked the turbine coordinates against our sites & equipment in the area and I can't see any major impact to our network from the turbines physical location.

From our discussion, I understand that these turbines will be fed by fibre network. However, in circumstances where wireless communication (private network/microwave/point to point link) required for the turbines/substation, can you please advise what is the frequency used?

There might be possibility of interference if the frequency used fall in the same band/close to Telstra's band/network frequency (unlikely if follow regulation set by ACMA).

Thank you.

Best Regards,

Irwan Bardan

Network Specialist – Central

Radio Network Engineering | Wireless Access | N&IE | N&IT

NBNCo Response

From: NoReplyNBN <noreply@nbnco.com.au>
Sent: Tuesday, 29 October 2019 5:30 PM
To: Jerome Rowcroft <jerome.rowcroft@middletongroup.com.au>
Subject: Thank you for contacting nbn (Ref: 11282756)

Dear Jerome Rowcroft,

Thank you, your enquiry has been successfully submitted.

Your reference number is **11282756**.

We will endeavour to respond within five business days.

Your enquiry details

Enquiry type: Enquiry
Address:
Suburb:
Postcode: 3000
State: VIC
Country: Australia

Question/Comment: Dear Sir or Madam Re: Ungula Wind Farm CWP Renewables are developing the Ungula Wind Farm in New South Wales. We are consulting with stakeholders to confirm that our proposal will not have adverse impacts on their operations. We request that you review the layout of the turbines and confirm that there will be no impact on your operations. Please find attached a map of the development and the co-ordinates of the wind turbines. Kind regards, Jerome

Your personal details will be used in accordance with **nbn's** [Privacy policy](#).

Best regards,
nbn

From: info@nbn.com.au <info@nbn.com.au>
Sent: Tuesday, 5 November 2019 11:42 AM
To: Jerome Rowcroft <jerome.rowcroft@middletongroup.com.au>
Subject: Re: New Case Ref: 11282756 Online Enquiry

Hello Jerome,

Thank you for your enquiry to nbn. The reference number for your enquiry is **11282756**.

In reference to your query about impact on infrastructure I must refer you to consult with Dial Before You Dig , I have attached a link to their web page here. <https://www.1100.com.au>

If any assets are required to be relocated as a result of your construction, please contact us again with specific locations and understand there would be associated costs with any relocation requests.

If you require further information, please reply to this email and a consultant will be happy to assist you.

Kind Regards,

Richard

nbn

Email | info@nbn.com.au
Website | www.nbn.com.au
Youtube | www.youtube.com.au/nbnco



Jerome Rowcroft
To: info@nbn.com.au
Cc: [Uungula WF - EMI](#);

Wed 6/11/2019 4:56 PM

Dear Richard

Thank you for your response.

To clarify, the inquiry relates to impact on cellular telephony, point to point and point to multipoint links that NBN Co may manage. Based on information from the ACMA register, NBNCo have sites beyond 10 km from the project.

Based on your response, any outstanding concerns from NBNCo are related to impact on underground infrastructure.

Kind regards,
Jerome

Jerome Rowcroft | Senior Renewable Energy Engineer | **middleton** Group

From: info@nbn.com.au <info@nbn.com.au>

Sent: Sunday, 10 November 2019 12:40 PM

To: Jerome Rowcroft <jerome.rowcroft@middletongroup.com.au>

Subject: Thank you for your enquiry to nbn. The reference number for your enquiry is 11282756.

Hello Jerome,

Thank you for your enquiry to **nbn**. The reference number for your enquiry is **11282756**.

We would mainly be concerned about underground infrastructure impacts as they would have direct impact upon our network. In regards to the cellular impacts, it would be too vast to determine any impacts (eg. frequency disruption) solely based on just the information that you have supplied.

Could you provide Google co-ordinates or an address of this proposed project and additional information of what this project entails (eg, equipment/etc)?

If you require further information, please reply to this email and a consultant will be happy to assist you.

Kind Regards,

Nigel

nbn

Email | info@nbn.com.au

Website | www.nbn.com.au

Youtube | www.youtube.com.au/nbnco



Jerome Rowcroft
To: info@nbn.com.au
Cc: [Uungula WF - EMI](#);

Mon 11/11/2019 9:34 AM



Hi Nigel

Thanks for your response.

The proposal is a wind farm, with turbines located per the attached kml file.

The turbine heights up to 250 m and rotor diameter up to 170 m.

Cheers,
Jerome

Jerome Rowcroft | Senior Renewable Energy Engineer | **middleton** Group

NSW Rural Fire Service Response

Webmaster <webmaster@rfs.nsw.gov.au>
To: Jerome Rowcroft <jerome.rowcroft@middletongroup.com.au>
Wednesday, 30 October 2019 9:21 AM

Hi Jerome

Thank you for your email.

Your enquiry has been forwarded to the relevant department.

Regards
NSW Rural Fire Service

From: RFS Guardian <rfsguardian@id.ngcomms.net>
Sent: Friday, 8 November 2019 10:28 AM
To: Jerome Rowcroft <jerome.rowcroft@middletongroup.com.au>
Subject: NSW RFS Acknowledgement - Uungula Wind Farm Dubbo NSW AUS



NSW RURAL FIRE SERVICE



Attention: Jerome Rowcroft

Application Details: s4.14 - Other - Original

Site Address:
Uungula Wind Farm
Dubbo NSW
AUS

This email is to acknowledge that the NSW RFS received your request for a Bush Fire Safety Authority on 30/10/2019 regarding the above Development Application.

A response will be forwarded following consideration of the information provided.

Should you wish to discuss this matter please contact Matthew Apps on 1300 NSW RFS and quote RFS reference DA20191108000891-Original-1.



Planning and Environment Services

NSW RURAL FIRE SERVICE
Locked Bag 17 Granville NSW 2142

P 1300 NSW RFS **E** records@rfs.nsw.gov.au

www.rfs.nsw.gov.au | www.facebook.com/nswrfs | www.twitter.com/nswrfs

PREPARE. ACT. SURVIVE.