

Appendix

E

E.10 | Telecommunications Impact Assessment



Dinawan Wind Farm

Telecommunication Impact Assessment



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A	01.03.24	Initial Draft for Client Review	Ebony Apps	Eric Bendtsen Ramez Barakat	Timothy Cervenjak
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Executive Summary

Middleton Group Engineering (MGE) has been engaged by EMM Consulting to undertake a Telecommunication Impact Assessment (TIA) desktop study for the Dinawan Wind Farm (the project) within the Murrumbidgee and Edward River local government areas (LGAs) in New South Wales (NSW).

This study assesses the impact of the project on the following telecommunication services:

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

The ACMA database for point-to-point links within a 150 km radius of the site has been surveyed. Six (6) ACMA links and zero (0) ACMA sites were identified within 2 km of the WTG locations. From a plan view of the site, twelve (12) WTG fell within the Fresnel zone of a link. However, after 3D analysis, no significant interference is expected to any link.

Based on MGE's assessment, it is expected that the project has been designed, located and sited to avoid, or minimise and mitigate electromagnetic interference to the pre-existing television, radar and radio transmission and reception.

Correspondence with stakeholders regarding the impact on their services has been initiated and communications have been collated. No impact is anticipated by any of the responding stakeholders, any recommendations from the stakeholders have been summarised in their respective sections.

Two responses have not been received and follow up emails have been sent to the respective stakeholder.

Contents

1	Abbreviations / Definitions	1
2	Background	2
3	Scope	2
4	Inputs	3
5	Analysis	3
5.1	Qualifications	3
5.2	Site Overview	4
5.3	Point-to-Point Links	5
5.3.1	Near-field effects	7
5.3.2	Reflection/scattering effects	7
5.3.3	Diffraction effects	8
5.4	Meteorological Radar	27
5.5	Mobile Voice-Based Communications	29
5.5.1	Mobile Coverage – Nearby Towers	29
5.5.2	Mobile Coverage – General	30
5.6	Wireless and Satellite Services	32
5.7	Trigonometrical Stations and GPS	33
5.7.1	Survey Marks	33
5.7.2	Navigation Satellite System (GNSS) Station	35
5.8	Broadcast, Digital Radio and Television	36
6	Stakeholder Engagement	37
7	Conclusion	38
Appendix A	References	39
Appendix B	Stakeholder Correspondence	40
B.1	NSW Rural Fire Service	40
B.2	NSW Electricity Networks operations Pty Limited	43
B.3	Essential Energy	44
B.4	Bureau of Meteorology (BoM)	46
B.5	Geoscience Australia	49
B.6	Telstra correspondence	52
B.7	Optus correspondence	55

Tables

Table 1: Abbreviations	1
Table 2: Study Inputs – Project Infrastructure	3
Table 3: Study Inputs - Stakeholder Infrastructure	3
Table 4: Point-to-point link details.	6
Table 5: Fresnel zone and exclusion zone for the point-to-point links.	8
Table 6: WTG distance to link 1.	9
Table 7: WTG distance to link 2.	13
Table 8: WTG distance to link 3.	17
Table 9: WTG distance to link 2.	19
Table 10: WTG distance to link 5.	22
Table 11: Meteorological Radar Information	28
Table 12: Proximity of Nearby Survey Marks and proposed WTGs.	34
Table 13: List of stakeholder engagement.	37

Figures

Figure 1: Wind turbine layout overlaid with telecommunication services.	
Figure 2: Aerial view of Link 2 passing through the WTG layout.	9
Figure 3: Side view of the path of link 1 and location of WTG 59_WEST	10
Figure 4: Cross sectional view of link 1 and WTG 59_WEST	10
Figure 5: Side view of the path of link 1 and location of WTG 121_WEST	11
Figure 6: Cross sectional view of link 1 and WTG 121_WEST	11
Figure 7: Side view of the path of link 1 and location of WTG 148_WEST	12
Figure 8: Cross sectional view of link 1 and WTG 148_WEST	12
Figure 9: Link 2 passing through the project area.	13
Figure 10: Side view of the path of link 2 and location of WTG 4_EAST	14
Figure 11: Cross sectional view of link 2 and WTG 4_EAST	14
Figure 12: Side view of the path of link 2 and location of WTG 6_EAST	15
Figure 13: Cross sectional view of link 2 and WTG 6_EAST	15
Figure 14: Side view of the path of link 2 and location of WTG 9_EAST	16
Figure 15: Cross sectional view of link 2 and WTG 9_EAST	16
Figure 16: Aerial view of Link 3 passing through the WTG layout.	17

Figure 17: Side view of the path of link 3 and location of WTG 22_EAST	18
Figure 18: Cross sectional view of link 3 and WTG 22_EAST	18
Figure 19: Aerial view of Link 2 passing through the WTG layout.	19
Figure 20: Side view of the path of link 4 and location of WTG 115_EAST	20
Figure 21: Cross sectional view of link 4 and WTG 115_EAST	20
Figure 22: Side view of the path of link 4 and location of WTG 117_EAST	21
Figure 23: Cross sectional view of link 4 and WTG 117_EAST	21
Figure 24: Aerial view of Link 5 passing through the WTG layout.	22
Figure 25: Side view of the path of link 5 and location of WTG 106_EAST	23
Figure 26: Cross sectional view of link 5 and WTG 106_EAST	23
Figure 27: Side view of the path of link 5 and location of WTG 112_EAST	24
Figure 28: Cross sectional view of link 5 and WTG 112_EAST	24
Figure 29: Side view of the path of link 5 and location of WTG 124_EAST	25
Figure 30: Cross sectional view of link 5 and WTG 124_EAST	25
Figure 31: Link 6 east of the eastern wind area.	26
Figure 32: Meteorological Radars Map.	27
Figure 33: Proximity of the project to mobile phone base stations.	29
Figure 34: Optus network coverage map of Dinawan Wind Farm.	31
Figure 35: Telstra network coverage map of Dinawan Wind Farm.	31
Figure 36: Dinawan Wind Farm and nearby dwellings	32
Figure 37: Survey marks within the vicinity of the project.	33
Figure 38: GNSS Station Locations relative to WTG Layout.	35
Figure 39: Location of Broadcast Transmitters Relative to the project.	36

1 Abbreviations / Definitions

Table 1: Abbreviations

Abbreviation	Explanation
ACMA	Australian Communications and Media Authority
AM	Amplitude Modulation
BSL	Broadband Service Locator
BOM	Bureau of Meteorology
C/I	Carrier-to-interference ratio
D_a	Diameter of antenna physical aperture (m)
D_{nf}	Near-field clearance distance
DTV	Digital Television
EDM	Electronic Distance Measurement
f	Frequency (GHz)
FM	Frequency Modulated
F_n	<i>n</i> th Fresnel Zone; also, F ₁ , F ₂ , etc.
G	Maximum (boresight) antenna gain (dBi)
GHz	Giga-Hertz – 1 billion Hertz
GIS	Geographic Information System
GNSS	Global Navigation Satellite System Networks
ICNIRP	International Commission on Non-Ionizing Radiation Protection
LoS	Line of Sight
MGE	Middleton Group Engineering
MHz	Mega-Hertz – 1 million Hertz
PO3	Performance Outcome 3
RPM	Revolutions per minute
the Project	Dinawan Wind Farm
TIA	Telecommunications Impact Assessment
UHF	Ultra-High Frequency
WMO	World Meteorological Organization
WTG	Wind Turbine Generator
η	Antenna efficiency

2 Background

Spark Renewables Pty Limited (Spark Renewables) proposes to develop the Dinawan Wind Farm (the project). The project includes the installation, operation, maintenance and decommissioning of up to approximately 200 wind turbine generators (WTGs) and associated infrastructure. The project will have a generation capacity of up to approximately 1,200 megawatts (MW) (AC), equivalent to the needs of 600,000 NSW households per year. It will assist in meeting NSW and Australian Government emissions reduction targets and will abate approximately 3.2 million tonnes of greenhouse gases (GHG) annually. The project is State significant development (SSD) pursuant to schedule 1 of State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP).

The project is on the traditional lands of the Wiradjuri people and several smaller nations of the Murrumbidgee plains, about halfway between the towns of Coleambally and Jerilderie and lies within the Murrumbidgee and Edward River local government areas (LGAs) in New South Wales (NSW).

This Telecommunications Impact Assessment (TIA) forms part of the environmental impact statement (EIS) for the project.

3 Scope

This TIA is a desktop study mapping the WTG locations along with telecommunication services and evaluating the impact of the WTGs on these services.

The study has been undertaken to address the telecommunications element of the NSW Planning Secretary's Environmental Assessment Requirements (SEARs) for the Project, specifically to:

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.

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

The project's potential impacts on the following services have been assessed:

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

4 Inputs

This assessment is based on stakeholder infrastructure specified in Table 2.

Table 2: Study Inputs – Project Infrastructure

Project Detail	Value
Wind turbine coordinates	Final wind turbine layout received from EMM Consulting (05.02.24).
Wind turbine dimensions	Tip Height: 280 m Hub Height: 180 m Turbine Blade Diameter: 200 m

Table 3: Study Inputs - Stakeholder Infrastructure

Input	Source	Date Provided/Accessed
Dwellings coordinates	Spark Renewables	05.02.24
Point-to -point microwave links, mobile voice-based communication, and internet services	ACMA Site Location Map RFNSA Website	18.09.23
AM, FM, Digital Radio, Digital TV broadcasters	List of transmitters with a licence to broadcast	18.09.23
Meteorological Radar	NSW Radar Information	30.06.23
Survey Marks	NSW SCIMS Online	30.06.23
Trigonometrical Station and GPS	GNSS Network Map	18.09.23

5 Analysis

5.1 Qualifications

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.

Information, including the spatial location of items, antenna heights, emission frequencies and the like, as sourced from ACMA are correct. While MGE checked information against satellite imagery, MGE has developed the report on the basis that information supplied by/through ACMA is correct, except where a stakeholder provides updated specifications.

5.2 Site Overview

A snapshot of the site and nearby telecommunication services is shown in Figure 2 below.



Figure 1: Wind turbine layout overlaid with telecommunication services

5.3 Point-to-Point Links

WTGs have the potential to impact on point-to-point communication links through three mechanisms [1].

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

As seen in the site overview, there are 6 communication links found within the two (2) km boundary of the proposed WTGs. Detailed information for these links is outlined in Table 4. In depth analysis of the links will be presented in the following subsections.

In addition, the site overview shows that there are no communication sites registered with ACMA within two (2) km of the proposed WTGs. Discussion of near-field and reflection/scattering effects is presented in section 5.3.1 and section 5.3.2 respectively, with diffraction effects assessed in section 5.3.3.

Table 4: Point-to-point link details.

Point-to-Point link number	BSL / Licence No	Site 1	Site 2	Length (km)	Frequency (MHz)	Owner
1	1207619/1	Murrumbidgee Shire Council 76.6m Guyed Mast Argoon, off Kidman Way COLEAMBALLY Site ID:402871	Essential Energy 35m Lattice Tower 75 Warwillah Rd WANGANELLA Site ID:35605	101.0	404.28	NSW Rural Fire Service
2	21536/2	Transgrid Site near Clifford Downs Homestead COLEAMBALLY Site ID: 35102	Transgrid 80m Guyed Mast off Conargo Rd HARTWOOD Site ID: 9932	72.5	42.63	NSW Electricity Networks Operations Pty Limited
3	1213555/1	Murrumbidgee Shire Council 76.6m Guyed Mast Argoon, off Kidman Way COLEAMBALLY Site ID: 402871	Conargo Shire Tower CONARGO Site ID: 36960	84.9	404.28	NSW Rural Fire Service
4	40874/1	Translator Site ARGOON Site ID: 35602	Coonong St JERILDERIE Site ID:35601	55.5	450.65	Essential Energy
	1105687/1				450.70	
5	1902304/1	NSWRFS and Murrumbidgee Shire Council 30m Monopole Gala Vale, Cnr Cadell Rd & Mclennons Bore Rd JERILDERIE Site ID:9007842	Conargo Shire Tower CONARGO Site ID: 36960	63.7	451.33	NSW Rural Fire Service
6	1968232/1	NSWRFS and Murrumbidgee Shire Council 30m Monopole Gala Vale, Cnr Cadell Rd & Mclennons Bore Rd JERILDERIE Site ID:9007842	Jerilderie Shire Council 50m Lattice Tower 3 Coonong Street JERILDERIE Site ID: 9019510	39.5	404.58	NSW Rural Fire Service
	1968233/1				404.58	
	9948039/1				404.12	

Multiple licences can be assigned to one link; however, this assessment uses the licence with the lowest frequency when calculating Fresnel zones, as they create the largest disturbance. The values used for this study are summarised in Table 5.

5.3.1 Near-field effects

Near-field 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 is difficult to calculate.

As per Bacon [1] the near-field clearance distance, D_{nf} (m) can be calculated as follows:

For a dish or horn type of antenna:

$$D_{nf} = 10 \times \eta \times D_a^2 \times f$$

For any other type of antenna:

$$D_{nf} = 0.1 \times 10^{0.1G} / f$$

Where:

η = antenna efficiency

D_a = diameter of antenna physical aperture (m)

f = frequency (GHz)

G = maximum (boresight) antenna gain (dBi)

No proposed WTGs have been placed within or close to the ACMA (Australian Communications and Media Authority) towers that could result in near-field effects.

5.3.2 Reflection/scattering effects

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. Generally, impacts on signal will be negligible beyond 2 km from a transmitter/receiver.

There are no transmitters/receivers within 2 km of a proposed WTG.

5.3.3 Diffraction effects

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

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].

In calculating the paths of the links and the relative impact of obstacles, it is important to account for the curvature of the earth, as low frequency links bend across the earth's surface, and the height of any antennae, as available.

Some sources recommend a clearance threshold of 60% of the 1st Fresnel Zone Radius - in particular for ground clearance and the like [1]; this advice typically relates to 400 MHz links. However, a more conservative approach for wind turbines is required for GHz (higher frequency) links – that is, maintaining a clearance of the full 1st Fresnel Zone, or, as recommended by Bacon [1], clearance of the full 2nd Fresnel Zone. In particular, for sub-GHz links, the impact of a wind turbine on the link will be a function of the carrier to interference ratio, C/I. In some instances, the presence of a wind turbine penetrating the 1st Fresnel Zone will have no material impact on the link; in other instances, the presence of the wind turbine may have an impact, and mitigation strategies may be required.

The maximum radii of the 1st and 2nd Fresnel Zones for the communication links that traverse the project area are summarised in Table 5.

Table 5: Fresnel zone and exclusion zone for the point-to-point links.

Point to Point Link number	BSL/ Licence No	Frequency (MHz)	F ₁ Max (m)	F ₂ Max (m)
1	1207619/1	404.28	136.82	193.49
2	21536/2	42.63	356.96	504.82
3	1213555/1	404.28	125.44	177.40
4	40874/1	450.65	96.06	135.85
5	1902304/1	451.33	102.83	145.43
6	9948039/1	404.12	85.58	121.02

5.3.3.1 Link 1

The NSW Rural Fire Service manages license 1207619/1 which connects Site 1 (Murrumbidgee Shire Council 76.6m Guyed Mast Argoon, off Kidman Way ID: 402871) to Site 2 (Essential Energy 35m Lattice Tower 75 Warwillah Rd ID: 35605). The lowest frequency signal, 404.28 MHz, has been applied in this analysis.

Figure 2 shows the aerial view of Link 1 passing through the proposed WTGs in the western wind area. Table 6 details the effect of the link on the surrounding turbines.

Table 6: WTG distance to link 1.

Turbine Number	Is the link's Fresnel zone affected? (Y/N)	Distance from maximum 2nd Fresnel zone to rotor extent
WTG 20_WEST	N	44 m
WTG 59_WEST	Y	-
WTG 121_WEST	Y	-
WTG 129_WEST	N	40 m
WTG 148_WEST	Y	-

This is a conservative analysis, using the maximum 1st and 2nd Fresnel Zones of the link. The radius of the link's Fresnel zone changes in size across the course of the link, reaching a maximum size at the mid-point of the link. The actual Fresnel zone size of Link 2 in the vicinity of WTG 59_WEST, WTG 121_WEST, and WTG 148_WEST may be smaller than what is represented in Figure 2. As three WTGs contact the link's Fresnel zone, further 3D analysis must be conducted to determine if the WTG locations are likely to cause telecommunication interference with Link 1. This is investigated in the section below.

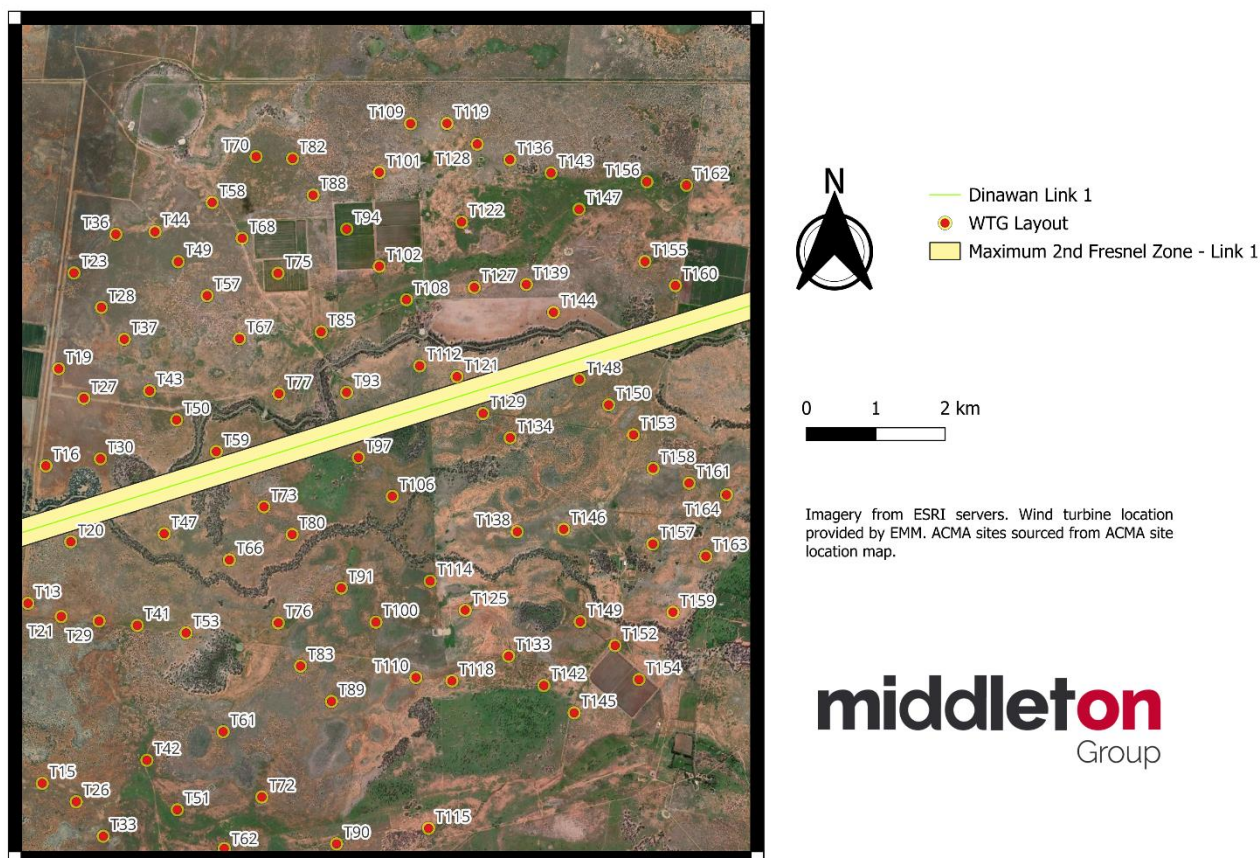


Figure 2: Aerial view of Link 2 passing through the WTG layout.

WTG 59_WEST

The figures below show WTG 59_WEST’s potential interference with Link 1. Figure 4 shows WTG 59_WEST’s rotor does not intersect with the 2nd Fresnel zone of the link. Thus, WTG 59 is not expected to cause interference to the link. Middleton Group has reached out to the affected to stakeholder(s) to review the study results with them. The stakeholder has responded no impact is expected on their telecommunication services. Please refer to Section 6 Stakeholder Engagement for more details.

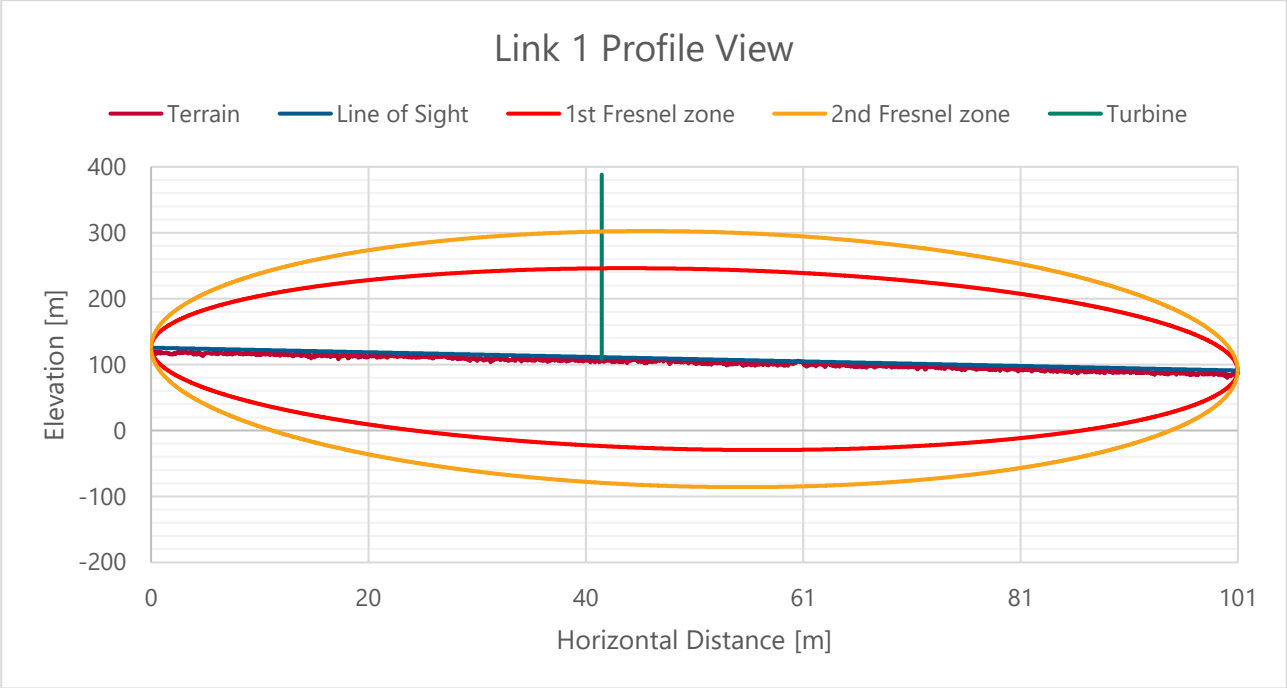


Figure 3: Side view of the path of link 1 and location of WTG 59_WEST

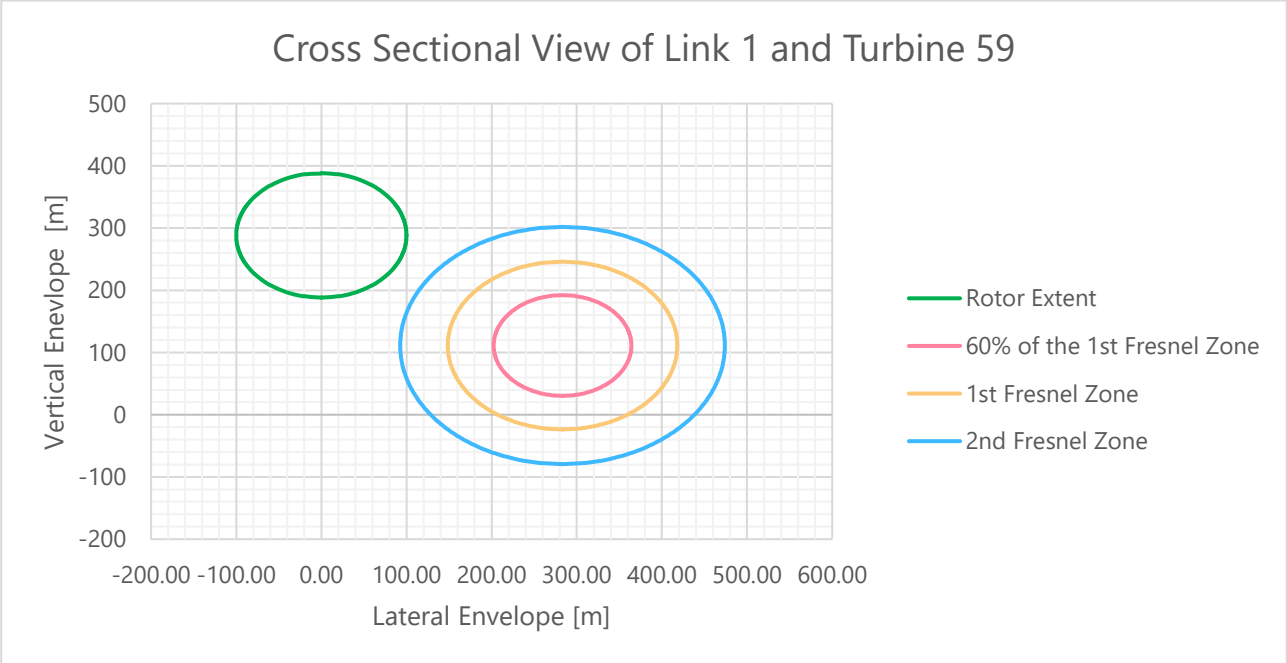


Figure 4: Cross sectional view of link 1 and WTG 59_WEST

WTG 121_WEST

The figures below show WTG 121_WEST's potential interference with Link 1. Figure 6 shows WTG 121_WEST's rotor does not intersect with the 2nd Fresnel zone of the link. Thus, the WTG is not expected to cause interference to the link. Middleton Group has reached out to the affected stakeholder(s) to review the study results with them. The stakeholder has responded no impact is expected on their telecommunication services. Please refer to Section 6 Stakeholder Engagement for more details.

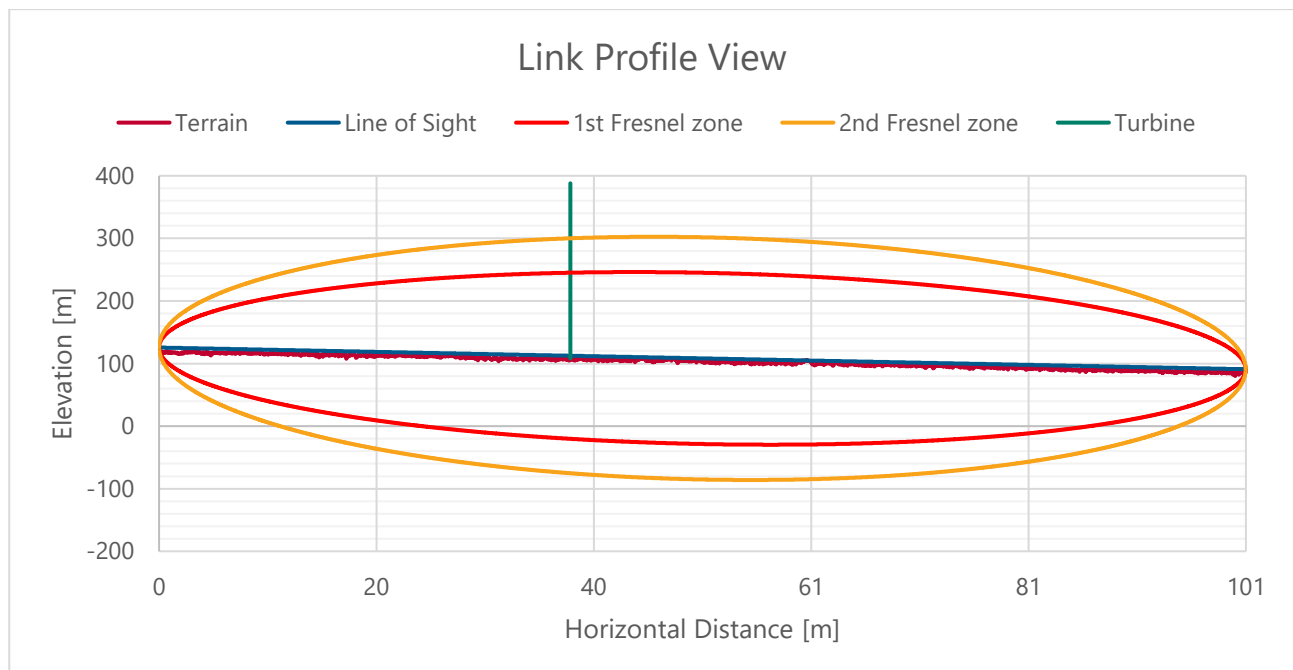


Figure 5: Side view of the path of link 1 and location of WTG 121_WEST

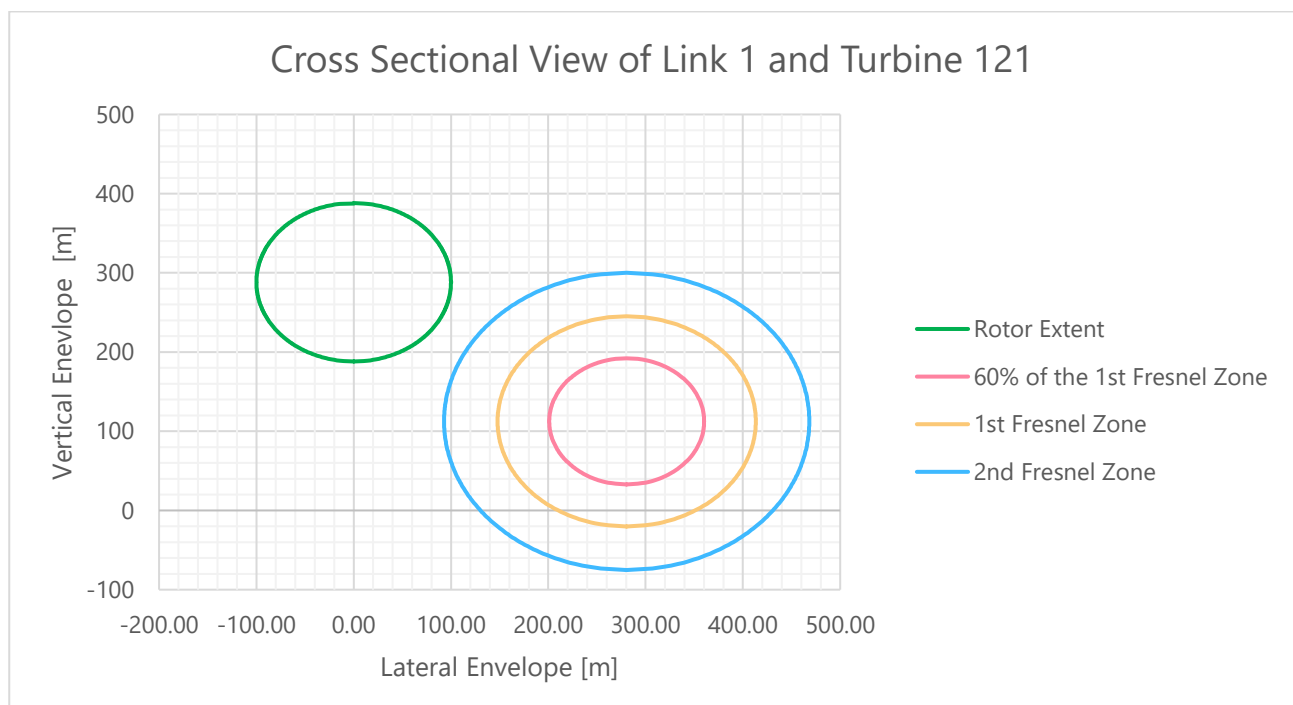


Figure 6: Cross sectional view of link 1 and WTG 121_WEST

WTG 148_WEST

The figures below show WTG 148_WEST's potential interference with Link 1. Figure 8 shows WTG 148_WEST's rotor does not intersect with the 2nd Fresnel zone of the link. Thus, the WTG is not expected to cause interference to the link. Middleton Group has reached out to the affected stakeholder(s) to review the study results with them. The stakeholder has responded no impact is expected on their telecommunication services. Please refer to Section 6 Stakeholder Engagement for more details.

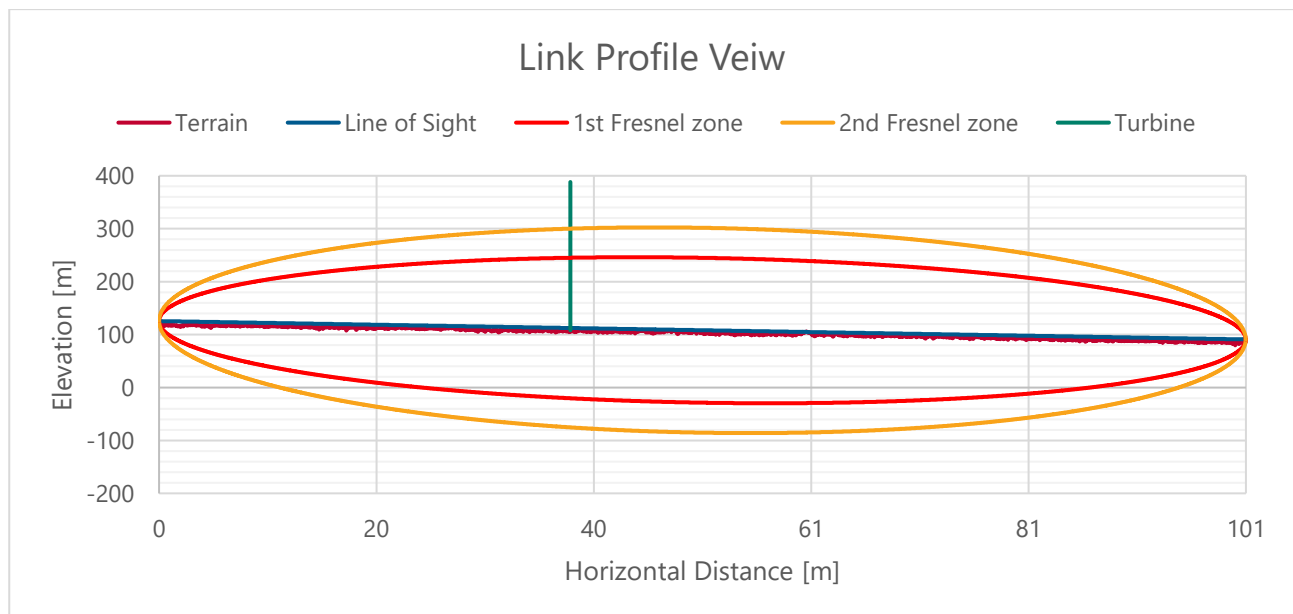


Figure 7: Side view of the path of link 1 and location of WTG 148_WEST

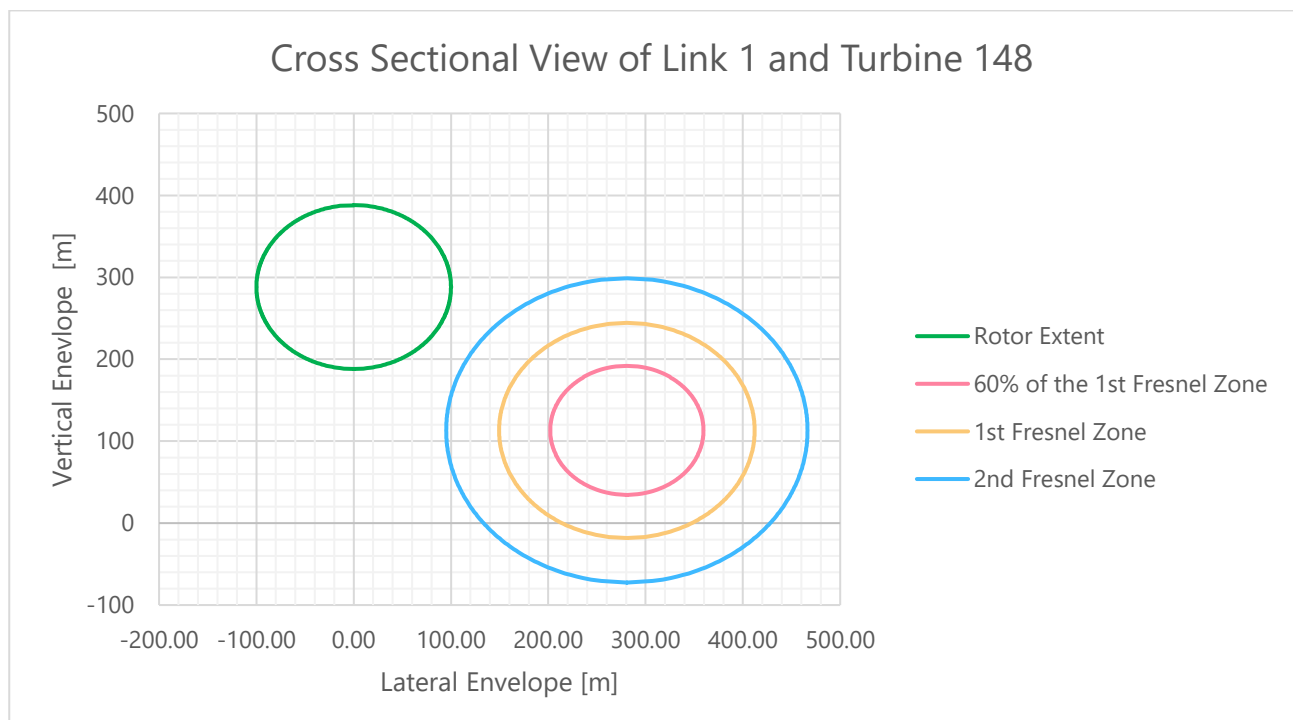


Figure 8: Cross sectional view of link 1 and WTG 148_WEST

5.3.3.2 Link 2

The NSW Electricity Networks Operations Pty Limited manages license 21536/2 which connects Site 1 (Transgrid Site near Clifford Downs Homestead COLEAMBALLY Site ID: 35102) to Site 2 (Transgrid 80m Guyed Mast off Conargo Rd HARTWOOD Site ID: 9932). The lowest frequency signal, 42.63 MHz, has been applied in this analysis.

Figure 9, shows the aerial view of Link 2 passing through the proposed WTGs in the eastern wind area. Table 7 details the effect of the link on the surrounding turbines.

Table 7: WTG distance to link 2.

Turbine Number	Is the link's Fresnel zone affected? (Y/N)	Distance from maximum 2nd Fresnel zone to rotor extent
WTG 2_EAST	N	447 m
WTG 4_EAST	Y	-
WTG 6_EAST	Y	-
WTG 9_EAST	Y	-
WTG 13_EAST	N	205 m

This is a conservative analysis, using the maximum 1st and 2nd Fresnel Zones of the link. The radius of the link's Fresnel zone changes in size across the course of the link, reaching a maximum size at the mid-point of the link. The actual Fresnel zone size of Link 2 in the vicinity of WTG 4_EAST, WTG 6_EAST, and WTG 9_EAST may be smaller than what is represented in Figure 2. As three turbines contact the link's Fresnel zone, further 3D analysis must be conducted to determine if the WTG locations are likely to cause telecommunication interference with Link 2. This is investigated in the section below.

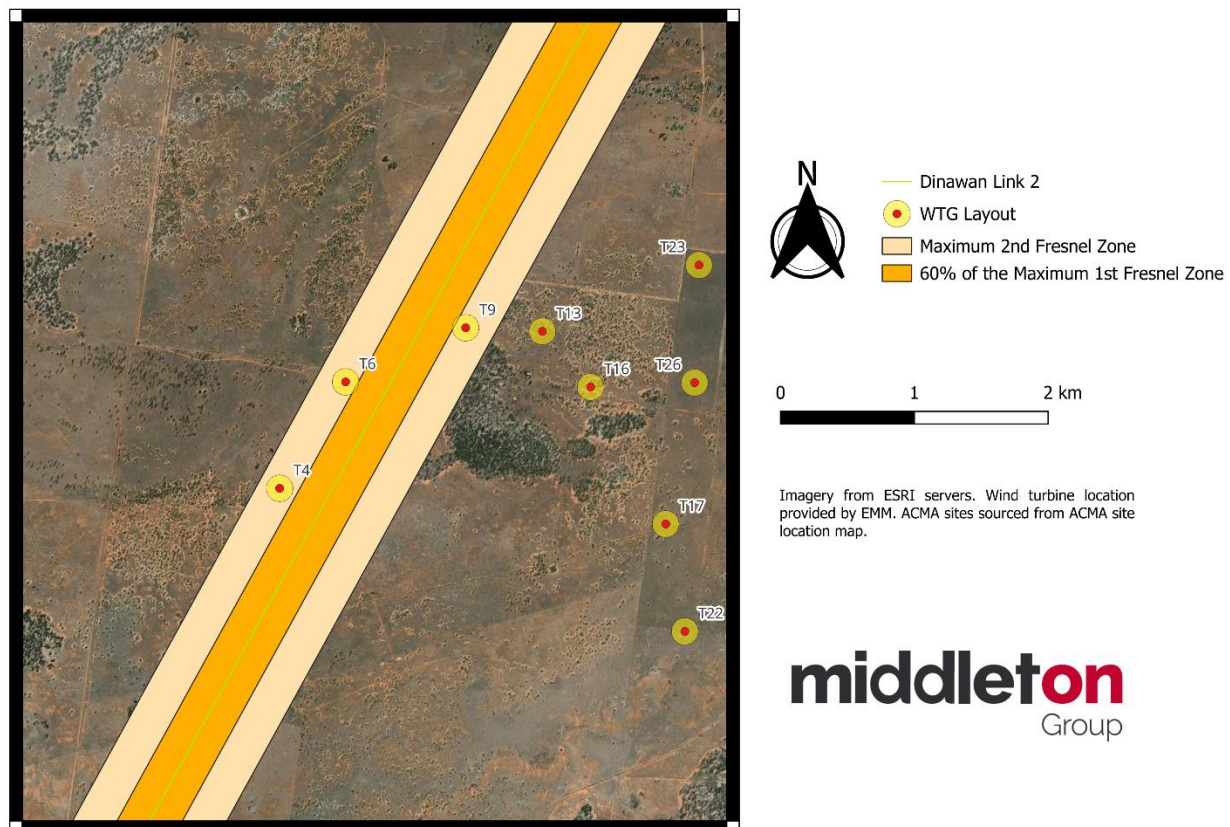


Figure 9: Link 2 passing through the project area.

WTG 4_EAST

The figures below show WTG 4_EAST's potential interference with Link 2. As shown, WTG 4_EAST's rotor extends within a small portion of the 1st Fresnel zone of the link. Figure 11 shows WTG 4_EAST's rotor does not extend beyond 60% of the 1st Fresnel zone of the link. While the WTG encroaches on the 1st Fresnel zone, it is not expected to impact the performance of the link. Middleton Group has reached out to the affected stakeholder(s) to review the study results with them. No response has been received on the impact of the WTG to this telecommunication service.

Please refer to Section 6 Stakeholder Engagement for more details.

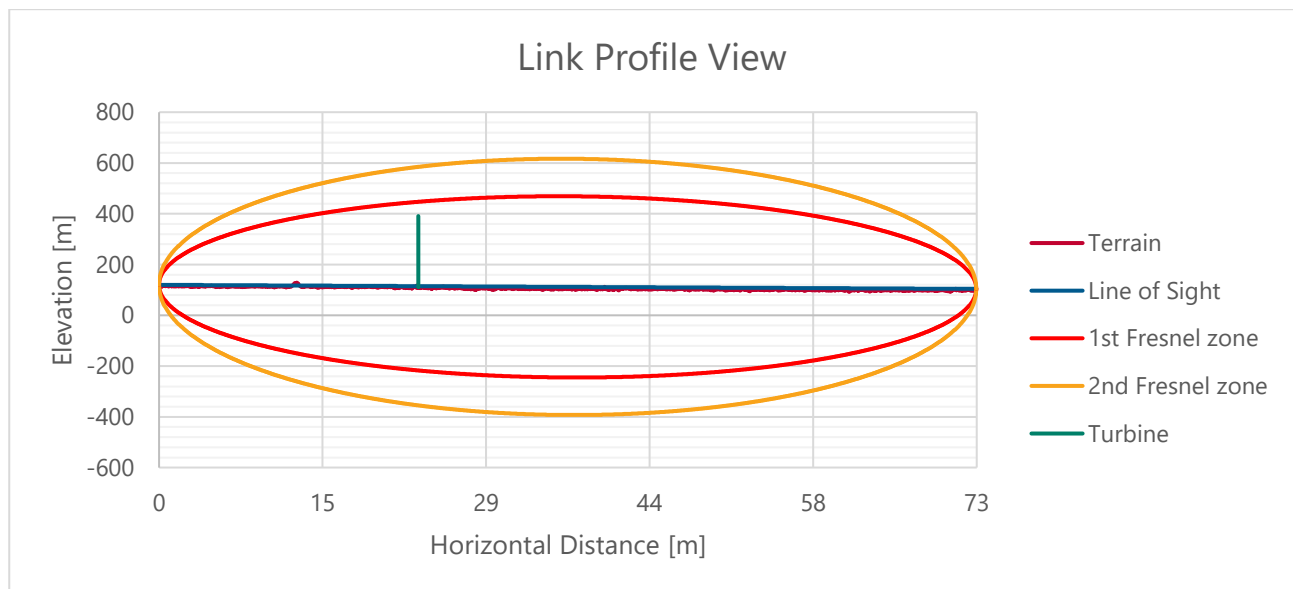


Figure 10: Side view of the path of link 2 and location of WTG 4_EAST

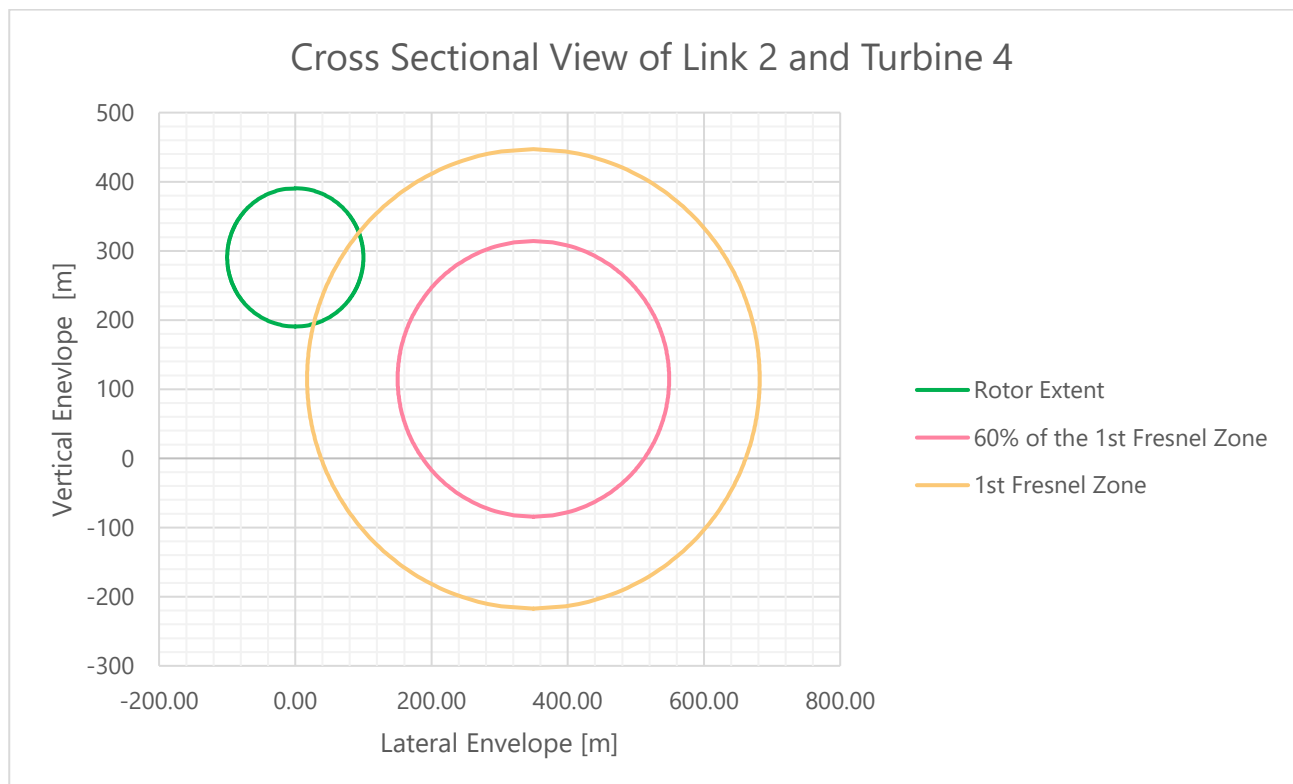


Figure 11: Cross sectional view of link 2 and WTG 4_EAST

WTG 6_EAST

The figures below show WTG 6_EAST's potential interference with Link 2. As shown, WTG 6_EAST's rotor extends within a small portion of the 1st Fresnel zone of the link. Figure 13 shows WTG 6_EAST's rotor does not extend beyond 60% of the 1st Fresnel zone of the link. While the WTG encroaches on the 1st Fresnel zone, it is not expected to impact the performance of the link. Middleton Group has reached out to the affected stakeholder(s) to review the study results with them. No response has been received on the impact of the WTG to this telecommunication service. Please refer to Section 6 Stakeholder Engagement for more details.

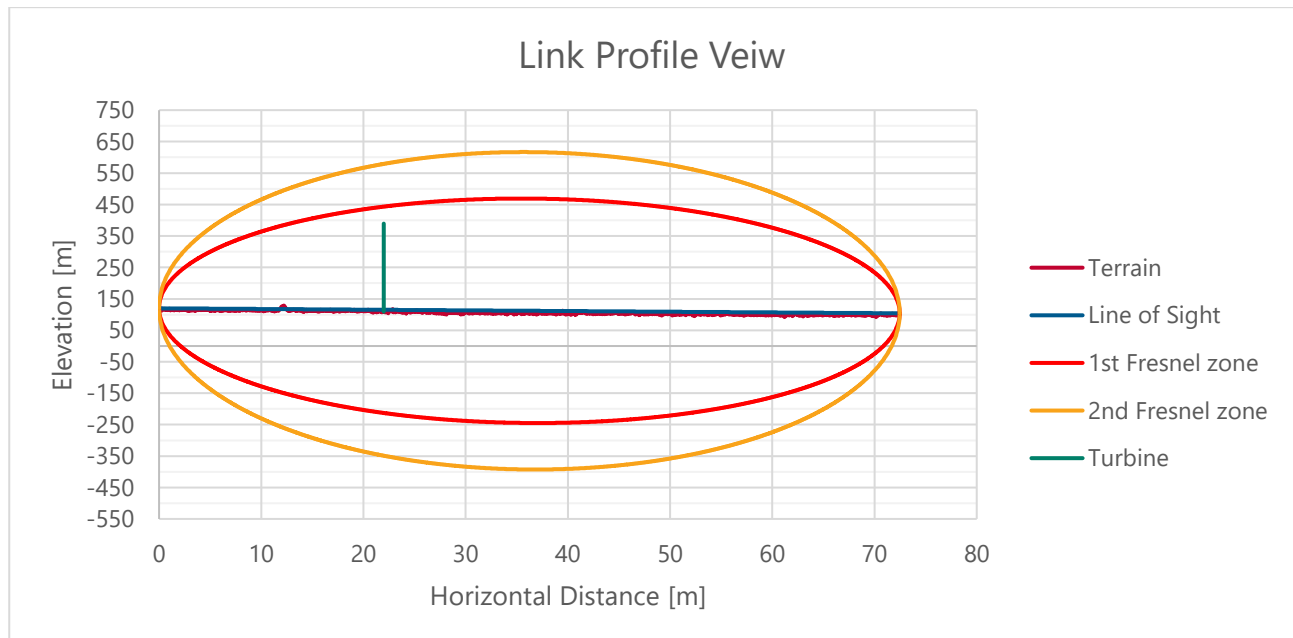


Figure 12: Side view of the path of link 2 and location of WTG 6_EAST

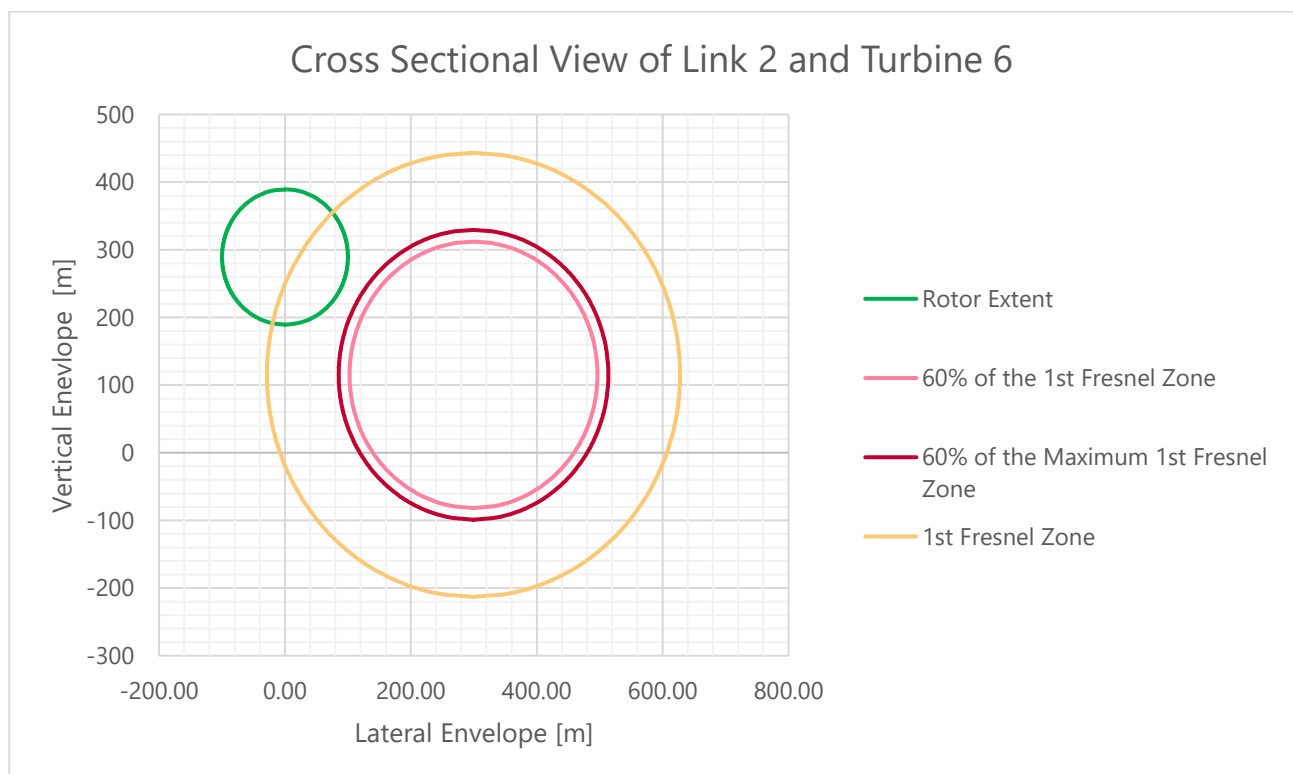


Figure 13: Cross sectional view of link 2 and WTG 6_EAST

WTG 9_EAST

The figures below show WTG 9_EAST's potential interference with Link 2. As shown, WTG 9_EAST's rotor extends within a small portion of the 1st Fresnel zone of the link. Figure 15 shows WTG 9_EAST's rotor does not extend beyond 60% of the 1st Fresnel zone of the link. While the WTG encroaches on the 1st Fresnel zone, it is not expected to impact the performance of the link. Middleton Group has reached out to the affected stakeholder(s) to review the study results with them. No response has been received on the impact of the WTG to this telecommunication service. Please refer to Section 6 Stakeholder Engagement for more details.

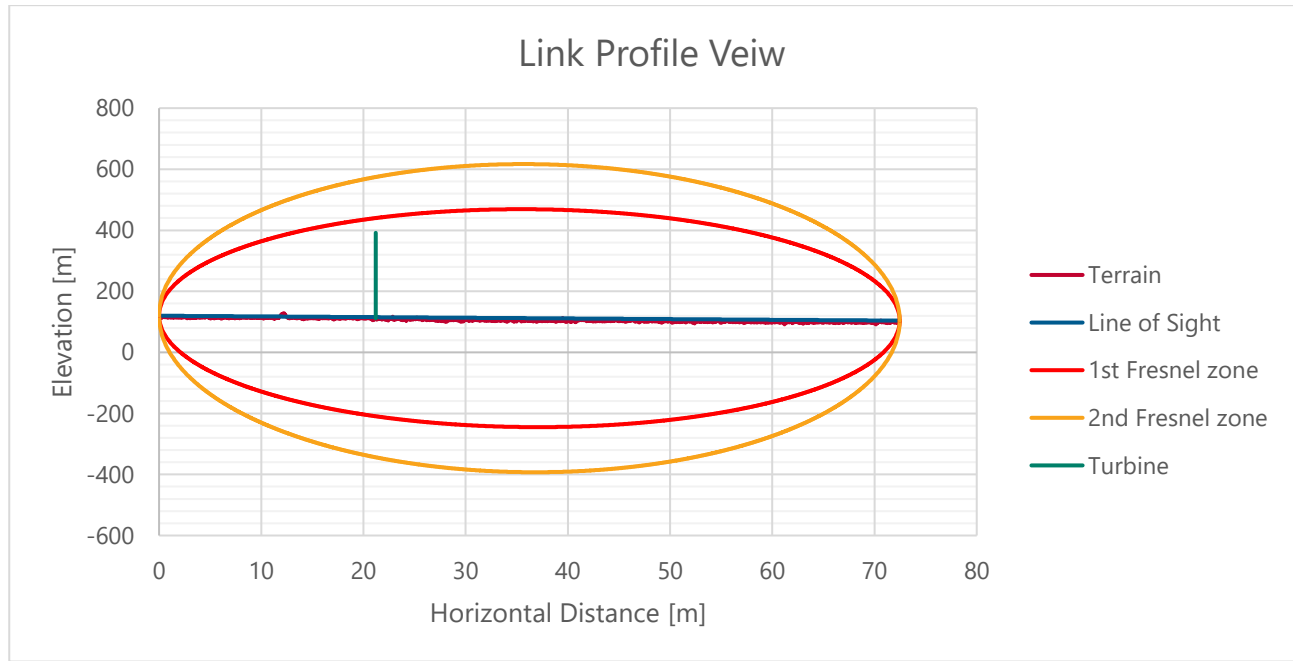


Figure 14: Side view of the path of link 2 and location of WTG 9_EAST

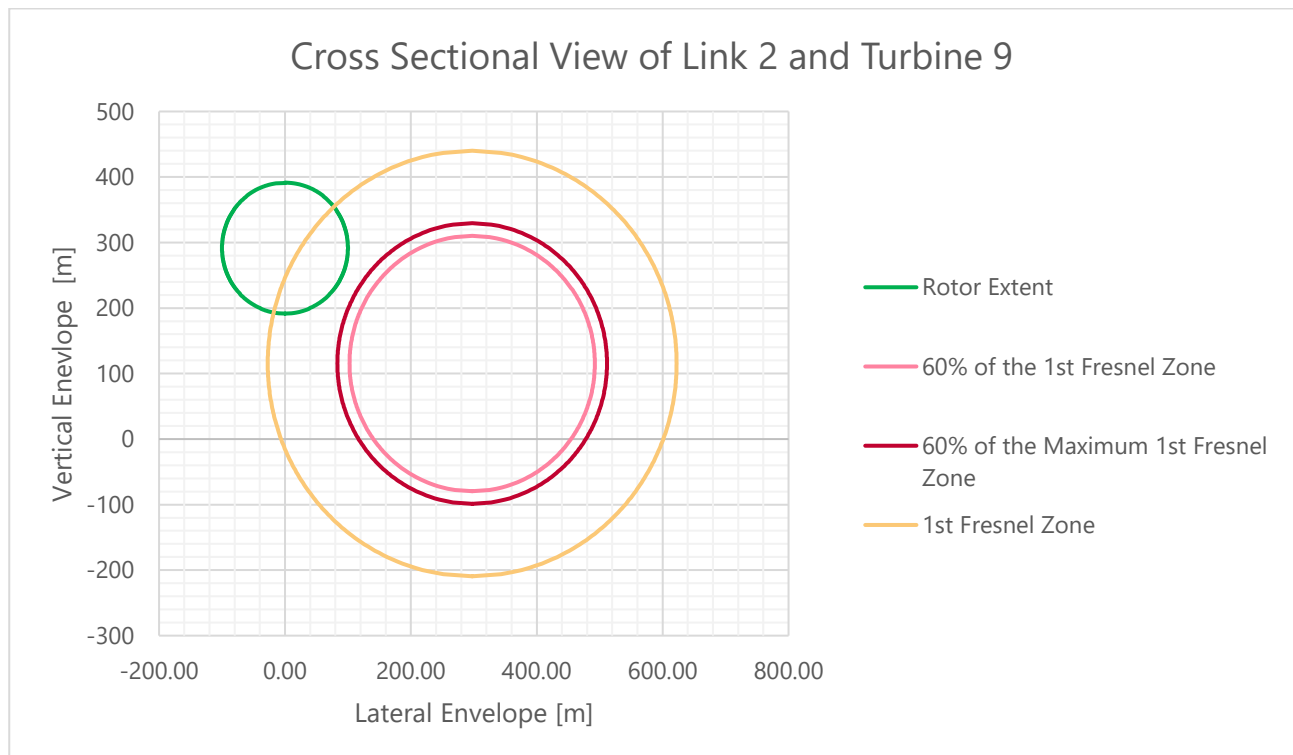


Figure 15: Cross sectional view of link 2 and WTG 9_EAST

5.3.3.3 Link 3

The NSW Rural Fire Service manages license 1213555/1 which connects Site 1 (Murrumbidgee Shire Council 76.6m Guyed Mast Argoon, off Kidman Way COLEAMBALLY Site ID: 402871) to Site 2 (Conargo Shire Tower CONARGO Site ID: 36960). The lowest frequency signal, 404.275 MHz, has been applied in this analysis.

Figure 16, shows the aerial view of Link 3 passing through the proposed WTGs in the eastern wind area. Table 8 details the effect of the link on the surrounding turbines.

Table 8: WTG distance to link 3.

Turbine Number	Is the link's Fresnel zone affected? (Y/N)	Distance from maximum 2nd Fresnel zone to rotor extent
WTG 17_EAST	N	159 m
WTG 22_EAST	Y	-
WTG 31_EAST	N	8 m
WTG 37_EAST	N	216 m

This is a conservative analysis, using the maximum 1st and 2nd Fresnel Zones of the link. The radius of the link's Fresnel zone changes in size across the course of the link, reaching a maximum size at the mid-point of the link. The actual Fresnel zone size of Link 3 in the vicinity of WTG 22_EAST may be smaller than what is represented in Figure 2. As one turbine contacts the link's Fresnel zone, further 3D analysis must be conducted to determine if the WTG's location is likely to cause telecommunication interference with Link 3. This is investigated in the section below.



Figure 16: Aerial view of Link 3 passing through the WTG layout.

WTG 22_EAST

The figures below show WTG 22_EAST's potential interference with Link 3. Figure 18 shows WTG 22_EAST's rotor does not intersect with the 2nd Fresnel zone of the link. Thus, the WTG is not expected to cause interference to the link. Middleton Group has reached out to the affected stakeholder(s) to review the study results with them. The stakeholder has responded no impact is expected on their telecommunication services. Please refer to Section 6 Stakeholder Engagement for more details.

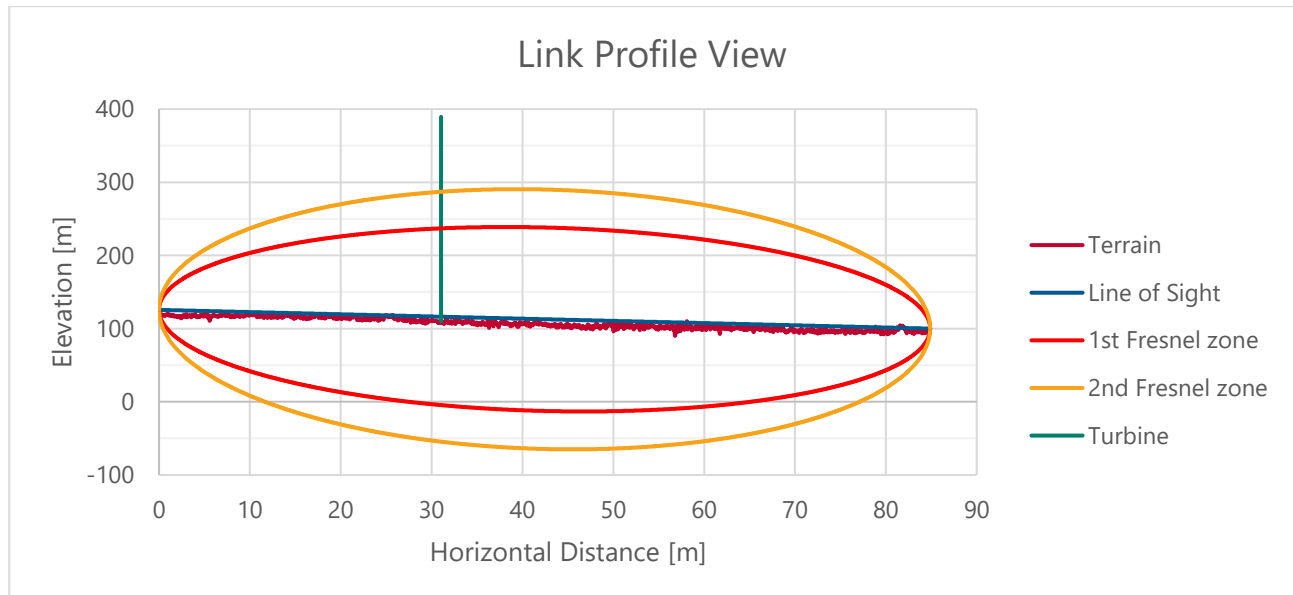


Figure 17: Side view of the path of link 3 and location of WTG 22_EAST

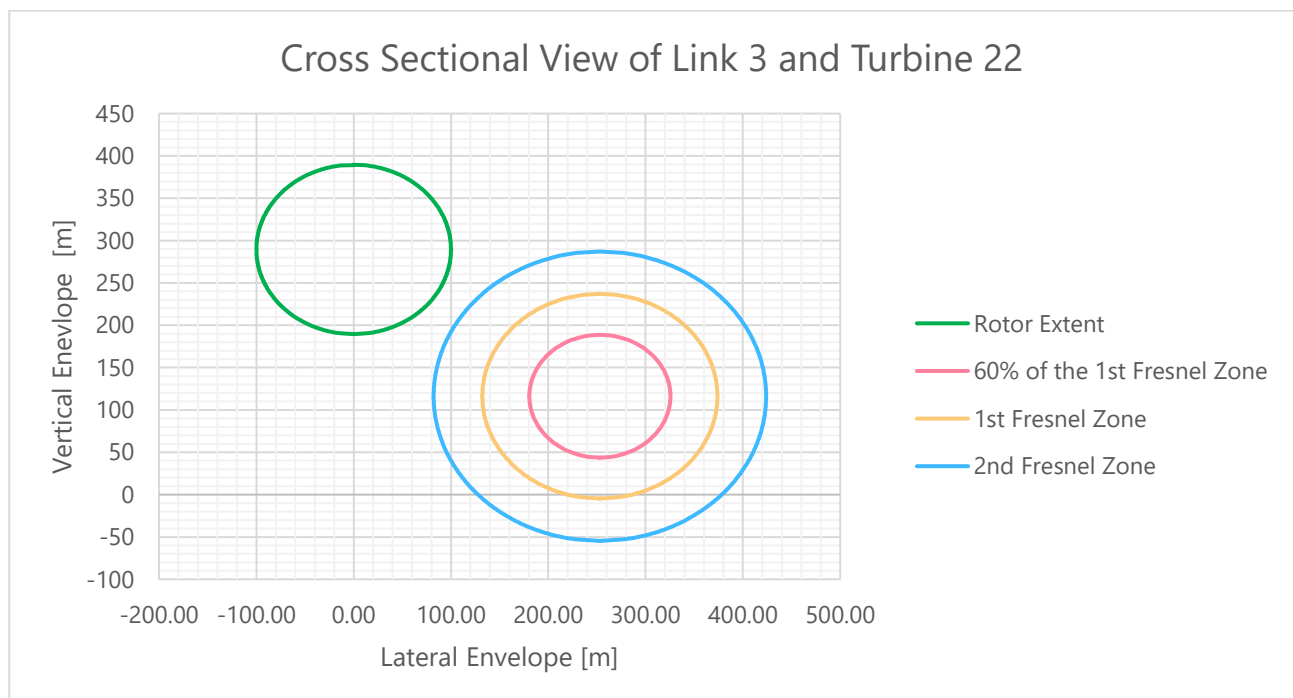


Figure 18: Cross sectional view of link 3 and WTG 22_EAST

5.3.3.4 Link 4

Essential Energy manages license 40874/1 and 1105687/1 which connects Site 1 (Translator Site ARGOON Site ID: 35602) to Site 2 (Coonong St JERILDERIE Site ID:35601). The lowest frequency signal, 450.65 MHz, has been applied in this analysis.

Figure 19, shows the aerial view of Link 4 passing through the proposed WTGs in the eastern wind area. Table 6 details the effect of the link on the surrounding turbines.

Table 9: WTG distance to link 2.

Turbine Number	Is the link's Fresnel zone affected? (Y/N)	Distance from maximum 2nd Fresnel zone to rotor extent
WTG 113_EAST	N	91 m
WTG 114_EAST	N	136 m
WTG 115_EAST	Y	-
WTG 116_EAST	N	22 m
WTG 117_EAST	Y	-

This is a conservative analysis, using the maximum 1st and 2nd Fresnel Zones of the link. The radius of the link's Fresnel zone changes in size across the course of the link, reaching a maximum size at the mid-point of the link. The actual Fresnel zone size of Link 4 in the vicinity of WTG 115_EAST and WTG 117_EAST may be smaller than what is represented in Figure 19. As two turbines contact the link's Fresnel zone, further 3D analysis must be conducted to determine if the WTG locations are likely to cause telecommunication interference with Link 4. This is investigated in the section below.



Figure 19: Aerial view of Link 2 passing through the WTG layout.

WTG 115_EAST

The figures below show WTG 115_EAST's potential interference with Link 4. Figure 21 shows WTG 115_EAST's rotor does not intersect with the 2nd Fresnel zone of the link. Thus, the WTG is not expected to cause interference to the link. Middleton Group has reached out to the affected stakeholder(s) to review the study results with them. The stakeholder has responded no impact is expected on their telecommunication services. Please refer to Section 6 Stakeholder Engagement for more details.

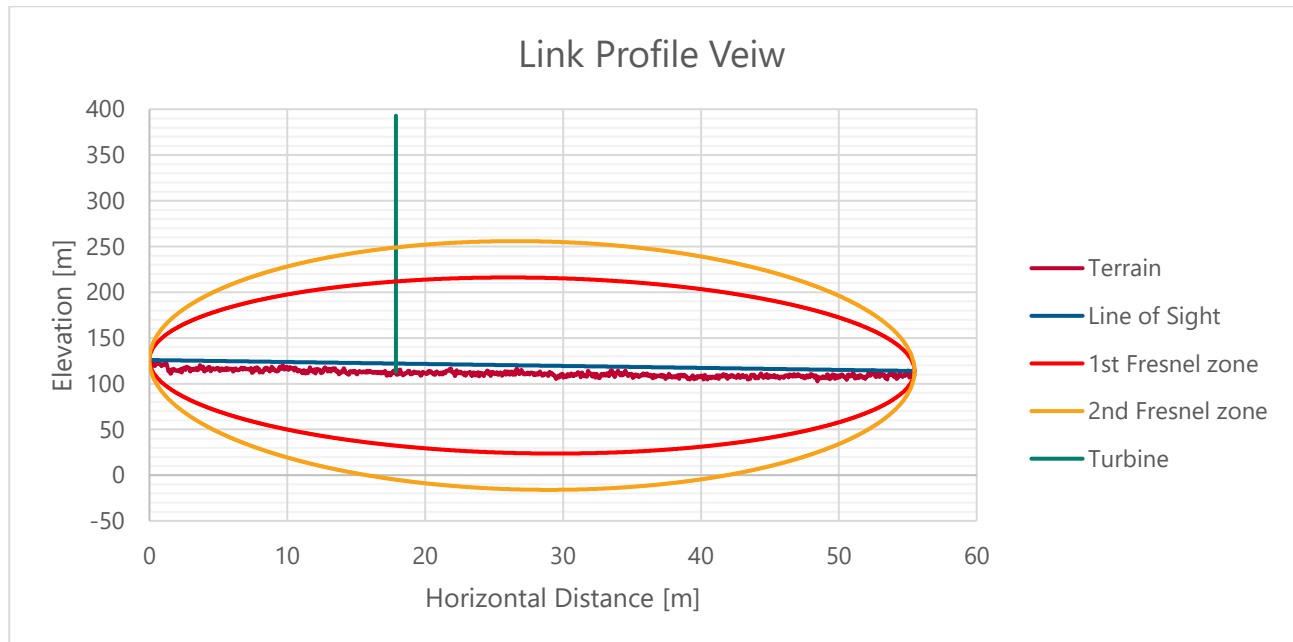


Figure 20: Side view of the path of link 4 and location of WTG 115_EAST

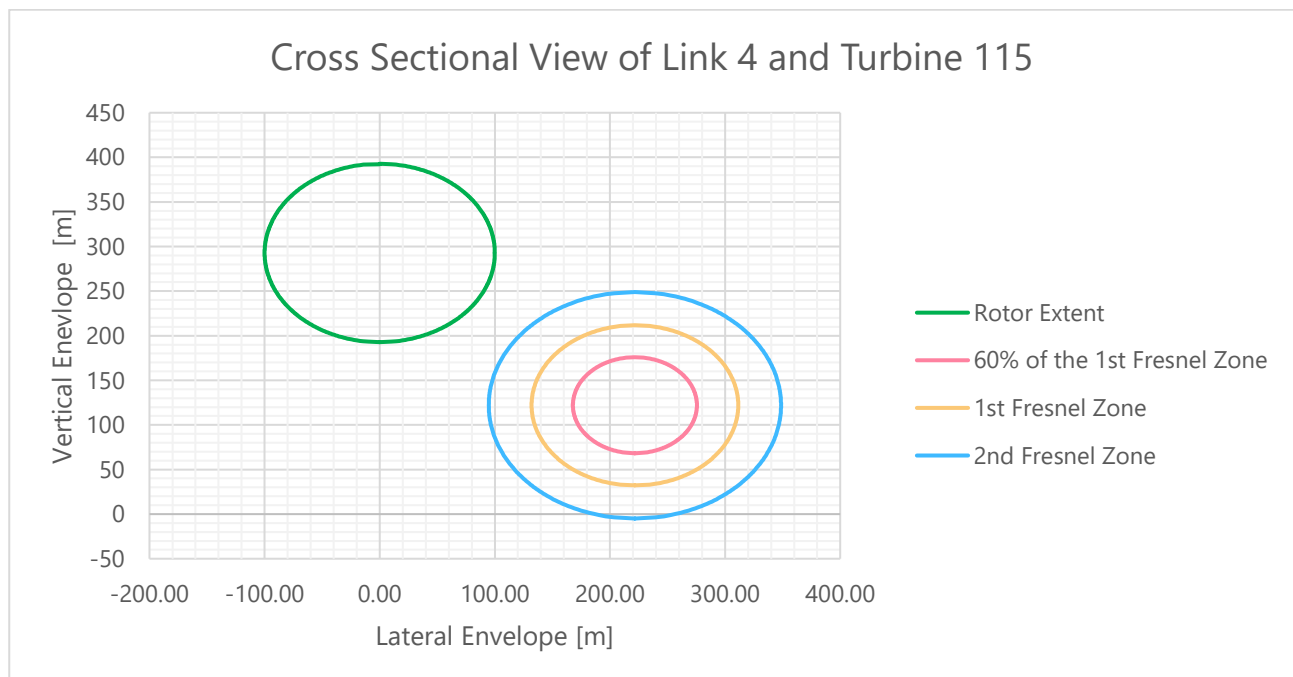


Figure 21: Cross sectional view of link 4 and WTG 115_EAST

WTG 117_EAST

The figures below show WTG 117_EAST's potential interference with Link 4. Figure 23 shows WTG 117_EAST's rotor does not intersect with the 2nd Fresnel zone of the link. Thus, the WTG is not expected to cause interference to the link. Middleton Group has reached out to the affected stakeholder(s) to review the study results with them. The stakeholder has responded no impact is expected on their telecommunication services. Please refer to Section 6 Stakeholder Engagement for more details.

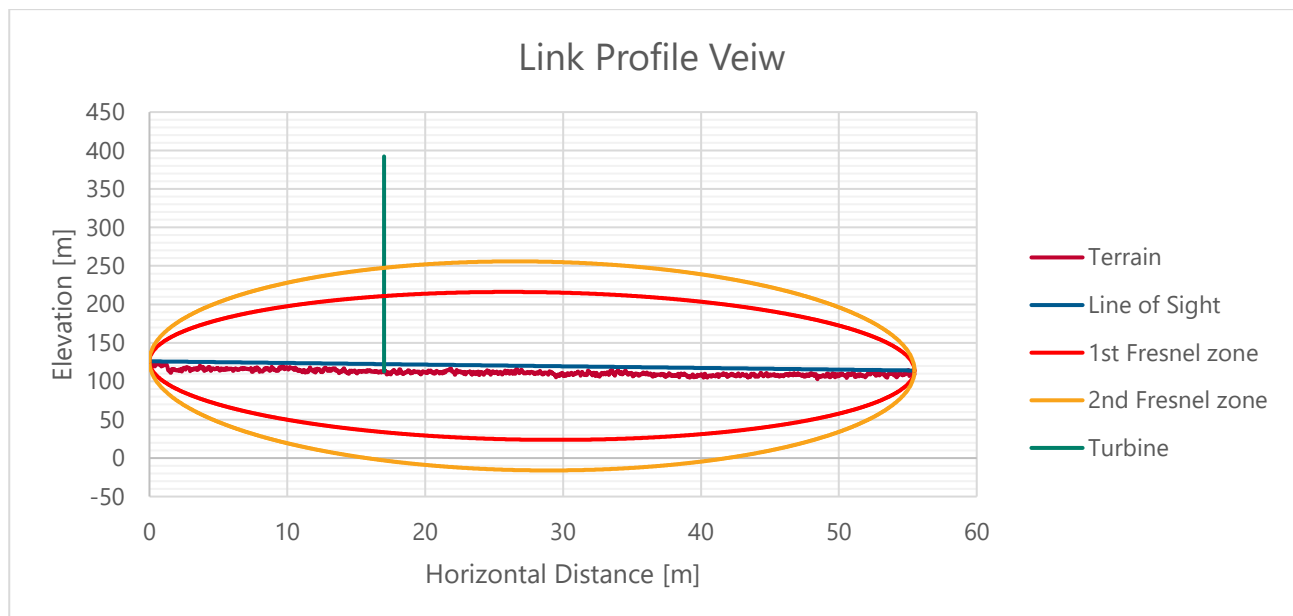


Figure 22: Side view of the path of link 4 and location of WTG 117_EAST

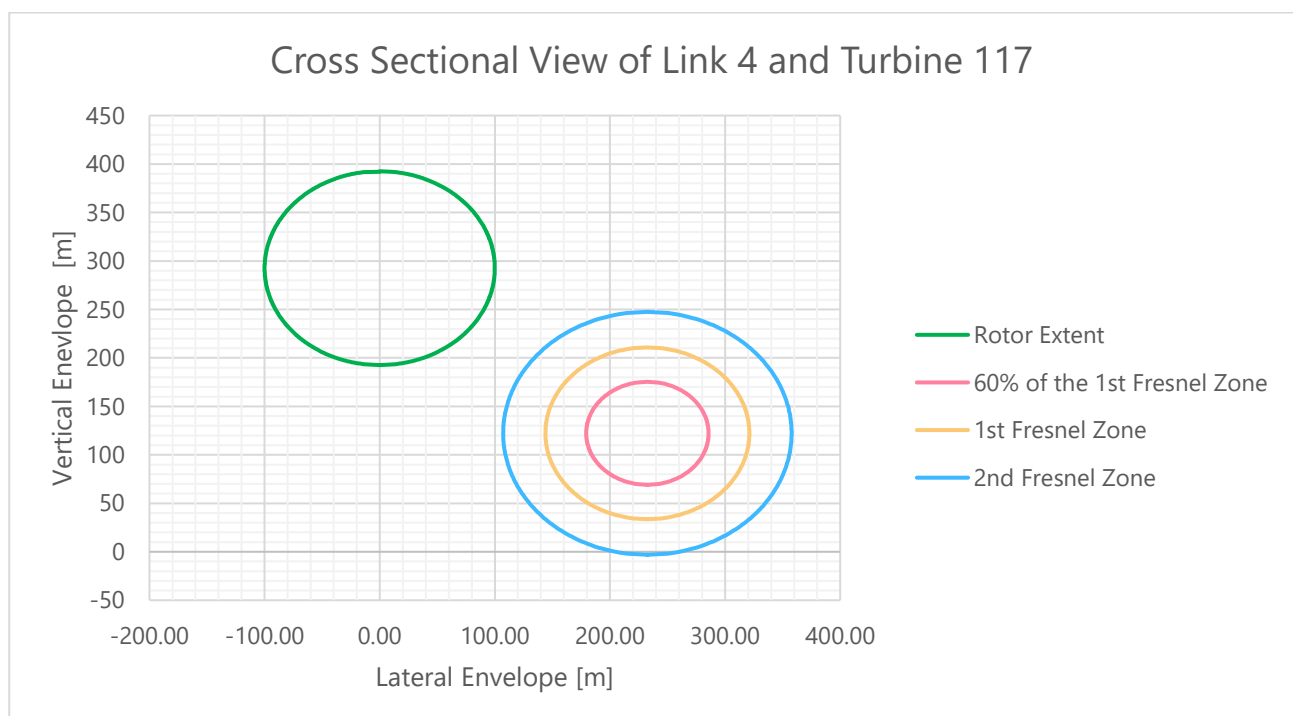


Figure 23: Cross sectional view of link 4 and WTG 117_EAST

5.3.3.5 Link 5

The NSW Rural Fire Service manages license 1902304/1 which connects Site 1 (NSWRFS and Murrumbidgee Shire Council 30m Monopole Gala Vale, Cnr Cadell Rd & McLennons Bore Rd JERILDERIE Site ID: 9007842) to Site 2 (Conargo Shire Tower CONARGO Site ID: 36960). The lowest frequency signal, 451.325 MHz, has been applied in this analysis.

Figure 24, shows the arial view of Link 5 passing through the proposed WTGs in the eastern wind area. Table 6 details the effect of the link on the surrounding turbines.

Table 10: WTG distance to link 5.

Turbine Number	Is the link's Fresnel zone affected? (Y/N)	Distance from maximum 2nd Fresnel zone to rotor extent
WTG 74_EAST	N	79 m
WTG 106_EAST	Y	-
WTG 112_EAST	Y	-
WTG 122_EAST	N	42 m
WTG 124_EAST	Y	-

This is a conservative analysis, using the maximum 1st and 2nd Fresnel Zones of the link. The radius of the link's Fresnel zone changes in size across the course of the link, reaching a maximum size at the mid-point of the link. The actual Fresnel zone size of Link 5 in the vicinity of WTG 106_EAST, WTG 112_EAST, and WTG 124_EAST may be smaller than what is represented in Figure 24. As three turbines contact the link's Fresnel zone, further 3D analysis must be conducted to determine if the WTG locations are likely to cause telecommunication interference with Link 5. This is investigated in the section below.



Figure 24: Aerial view of Link 5 passing through the WTG layout.

WTG 106_EAST

The figures below show WTG 106_EAST's potential interference with Link 5. Figure 26 shows WTG 106_EAST's rotor does not intersect with the 2nd Fresnel zone of the link. Thus, the WTG is not expected to cause interference to the link. Middleton Group has reached out to the affected stakeholder(s) to review the study results with them. The stakeholder has responded no impact is expected on their telecommunication services. Please refer to Section 6 Stakeholder Engagement for more details.

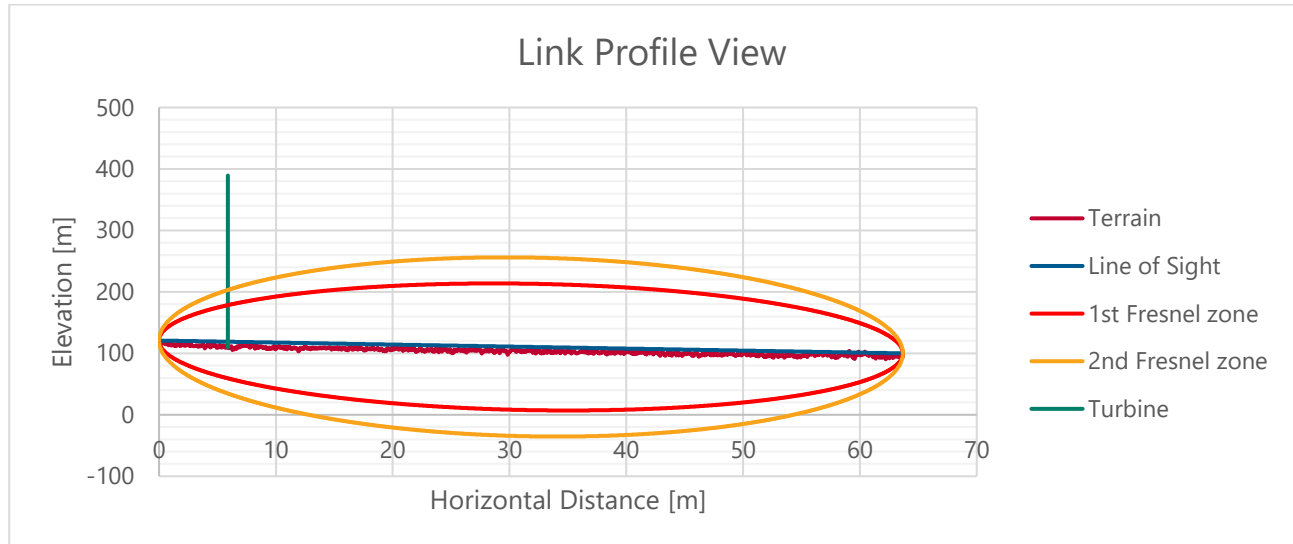


Figure 25: Side view of the path of link 5 and location of WTG 106_EAST

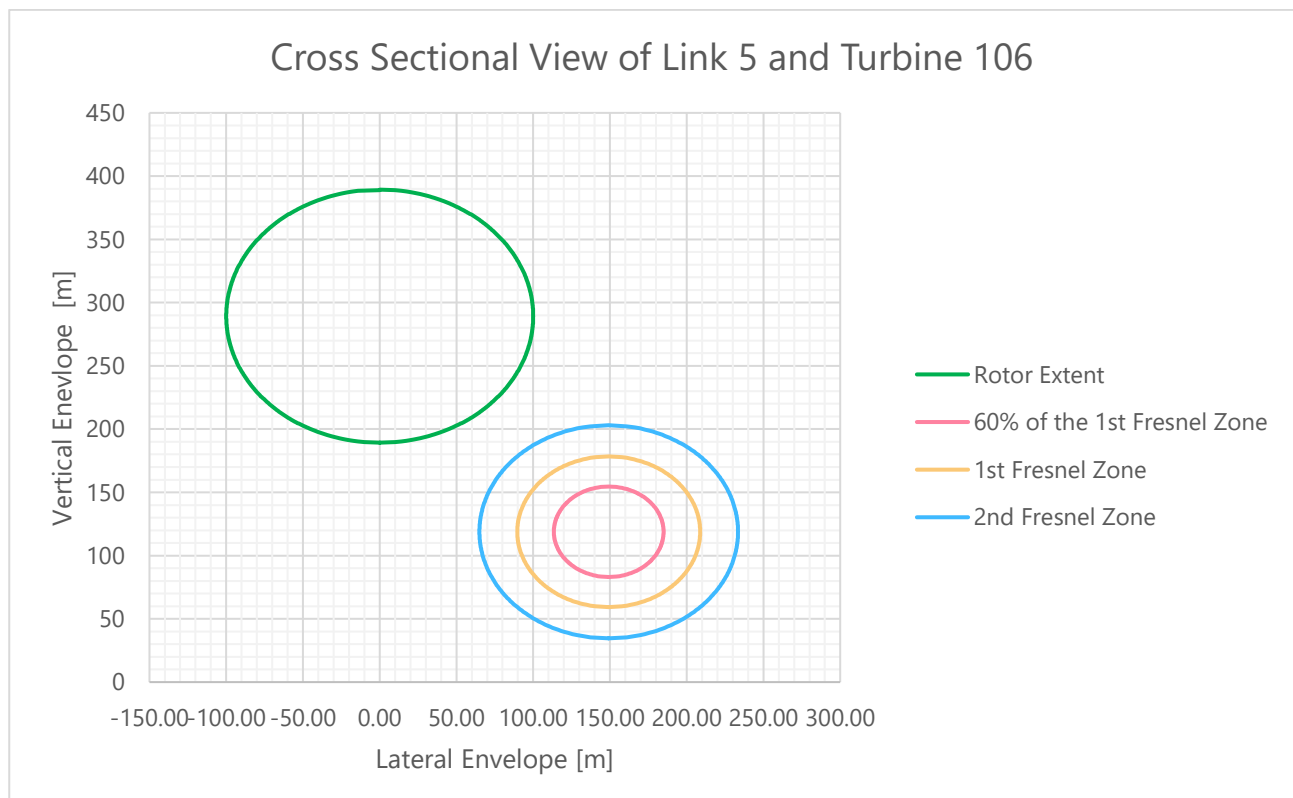


Figure 26: Cross sectional view of link 5 and WTG 106_EAST

WTG 112_EAST

The figures below show WTG 112_EAST's potential interference with Link 5. Figure 28 shows WTG 112_EAST's rotor does not intersect with the 2nd Fresnel zone of the link. Thus, the WTG is not expected to cause interference to the link. Middleton Group has reached out to the affected stakeholder(s) to review the study results with them. The stakeholder has responded no impact is expected on their telecommunication services. Please refer to Section 6 Stakeholder Engagement for more details.

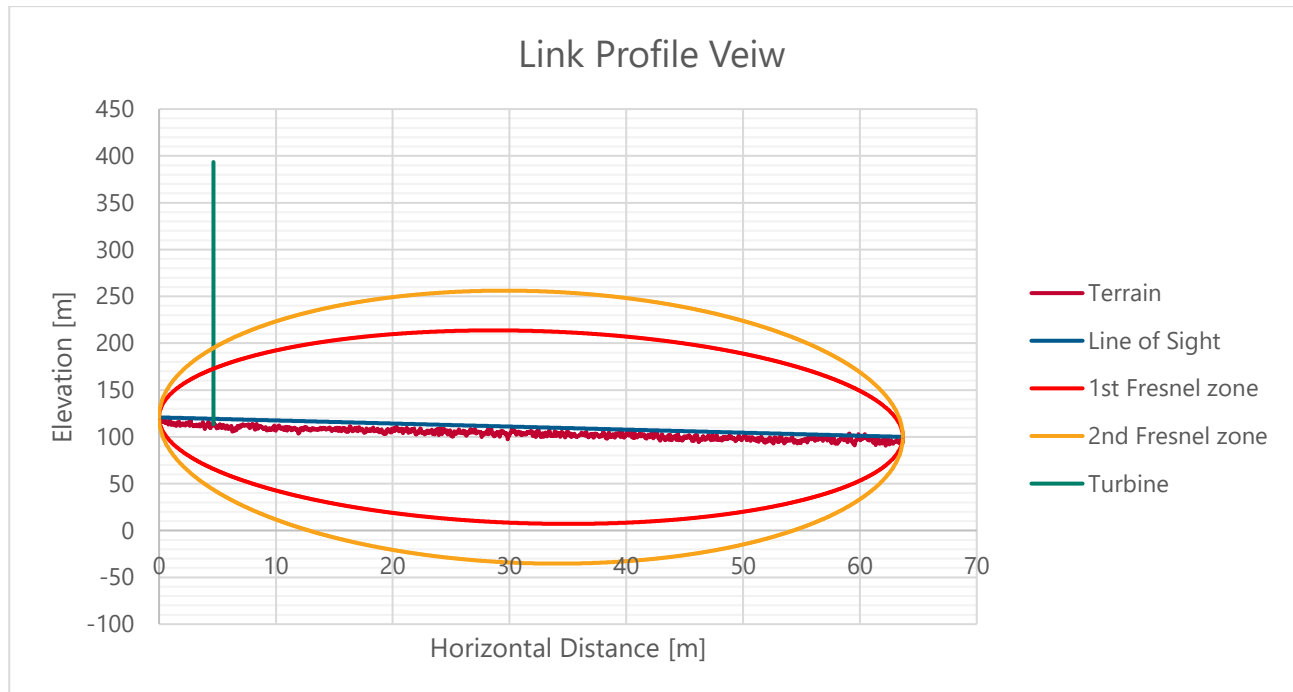


Figure 27: Side view of the path of link 5 and location of WTG 112_EAST

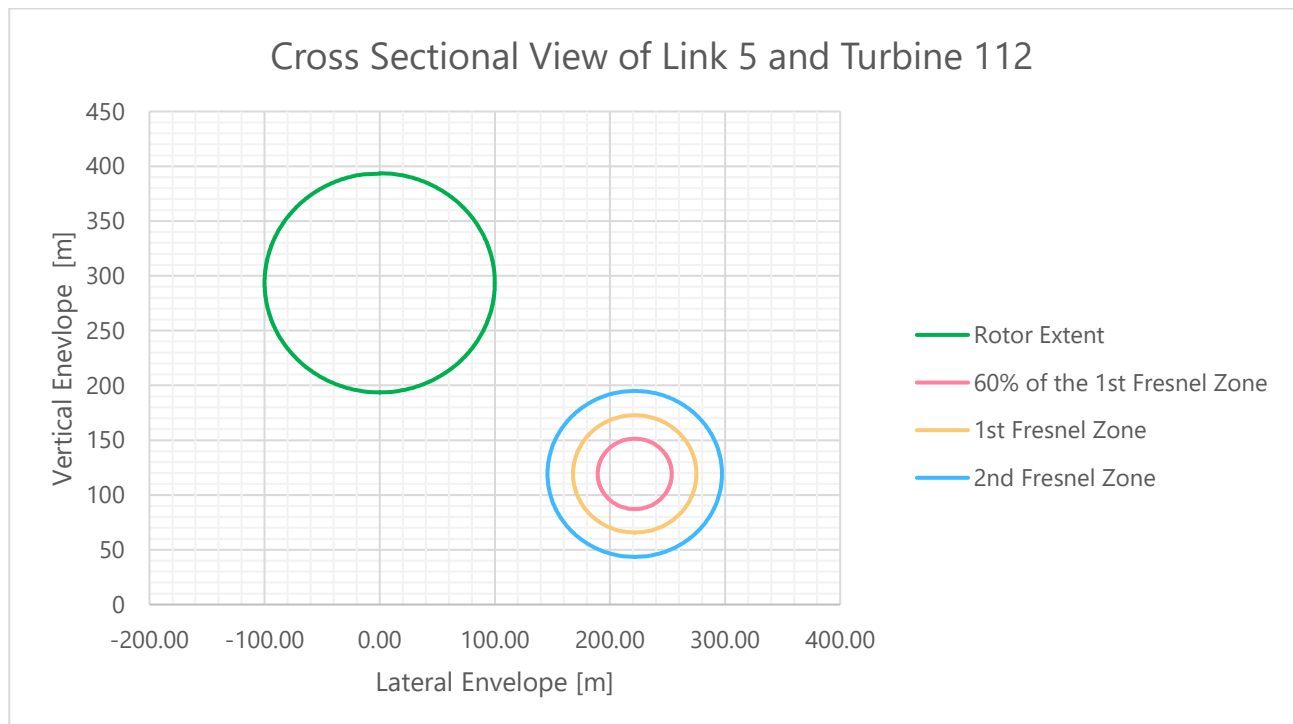


Figure 28: Cross sectional view of link 5 and WTG 112_EAST

WTG 124_EAST

The figures below show WTG 124_EAST's potential interference with Link 5. Figure 26 shows WTG 124_EAST's rotor does not intersect with the 2nd Fresnel zone of the link. Thus, the WTG is not expected to cause interference to the link. Middleton Group has reached out to the affected stakeholder(s) to review the study results with them. The stakeholder has responded no impact is expected on their telecommunication services. Please refer to Section 6 Stakeholder Engagement for more details.

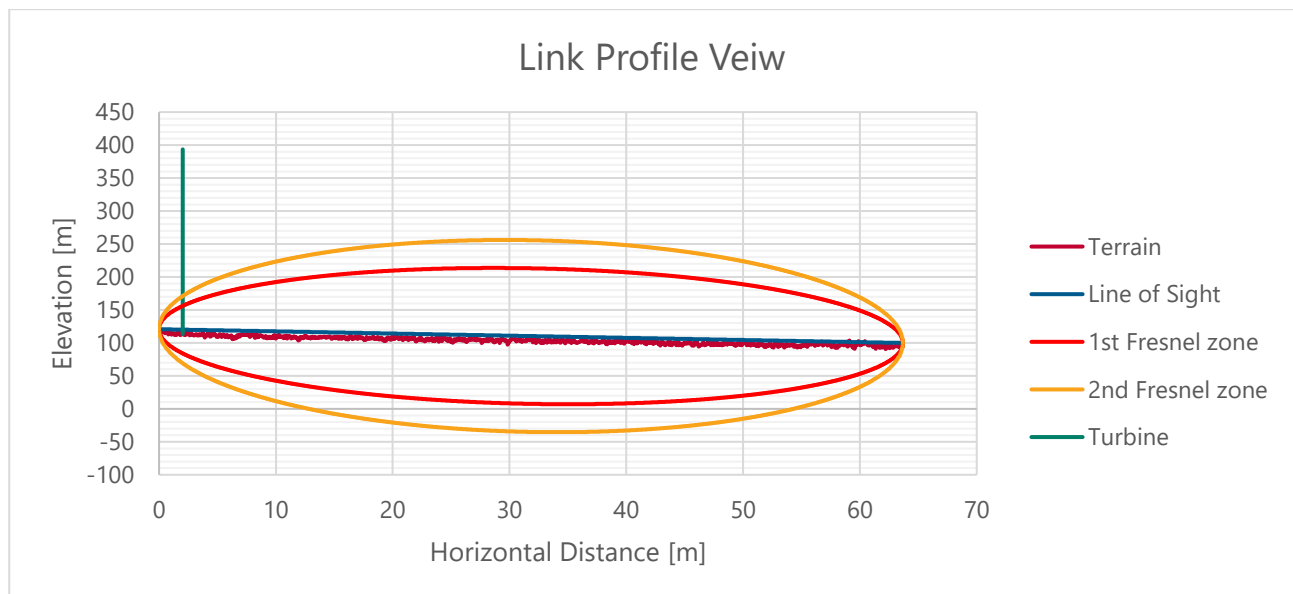


Figure 29: Side view of the path of link 5 and location of WTG 124_EAST

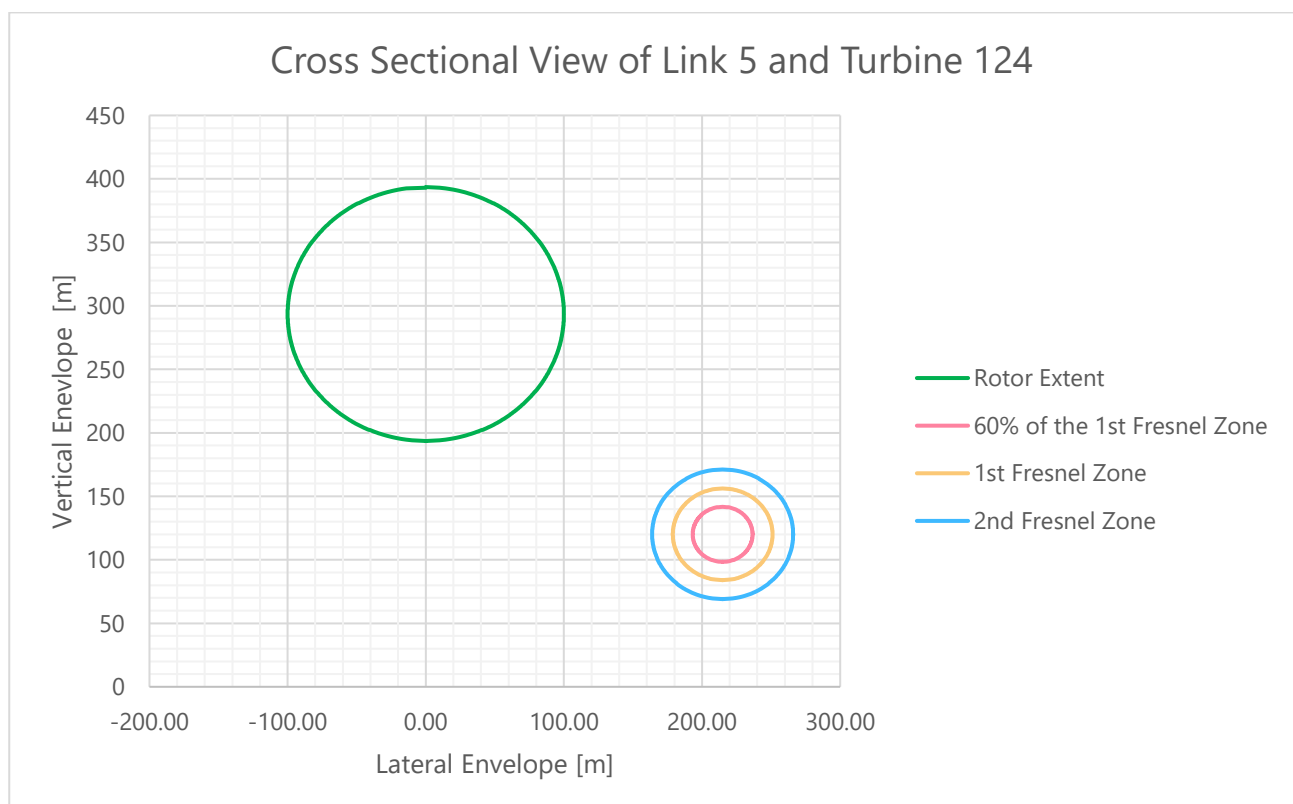


Figure 30: Cross sectional view of link 5 and WTG 124_EAST

5.3.3.6 Link 6

Telstra manages license 9948039/1 which connects Site 1 (NSWRFS and Murrumbidgee Shire Council 30m Monopole Gala Vale, Cnr Cadell Rd & Mclennons Bore Rd JERILDERIE Site ID:9007842) to Site 2 (Jerilderie Shire Council 50m Lattice Tower 3 Coonong Street Site ID: 9019510). The lowest frequency signal, 404.11875 MHz, has been applied in this analysis. Figure 31, below, shows Link 6 east of the eastern wind area. No turbine contacts the link's Fresnel zones. The closest turbine, WTG 126_EAST, is 975 m from the maximum 2nd Fresnel Zone. The proposed WTG locations are not expected to cause telecommunication interference with Link 6.

Middleton Group has reached out to the affected stakeholder to review the study results with them. No response has been received on the impact of the WTG to this telecommunication service.

Please refer to Section 6 Stakeholder Engagement for more details.



Figure 31: Link 6 east of the eastern wind area.

5.4 Meteorological Radar

Meteorological radars detect rain and thunderstorm events, as well as other phenomena 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 250 km, and in some instances, beyond. Some wind farms are visible to meteorological radars, registering 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) recommends that wind turbines are sited, at a minimum, beyond 5 km from meteorological radars, and preferably beyond 20 km [3]. The Operational Programme for the Exchange of Weather Radar Information (OPERA) and the radar programme of European Meteorological Services Network (EUMETNET) state that no wind turbine should be deployed within a 5 km radius of C-band radars and a 10 km radius of S-band radars. An impact study should be submitted if the wind turbines are sited within a 20 km radius of C-band radars and a 30 km radius of S-band radars [4].

Figure 32 demonstrates the location of the Meteorological Radars in relation to the project. The details of the closest three (3) weather radars are outlined in Table 11.

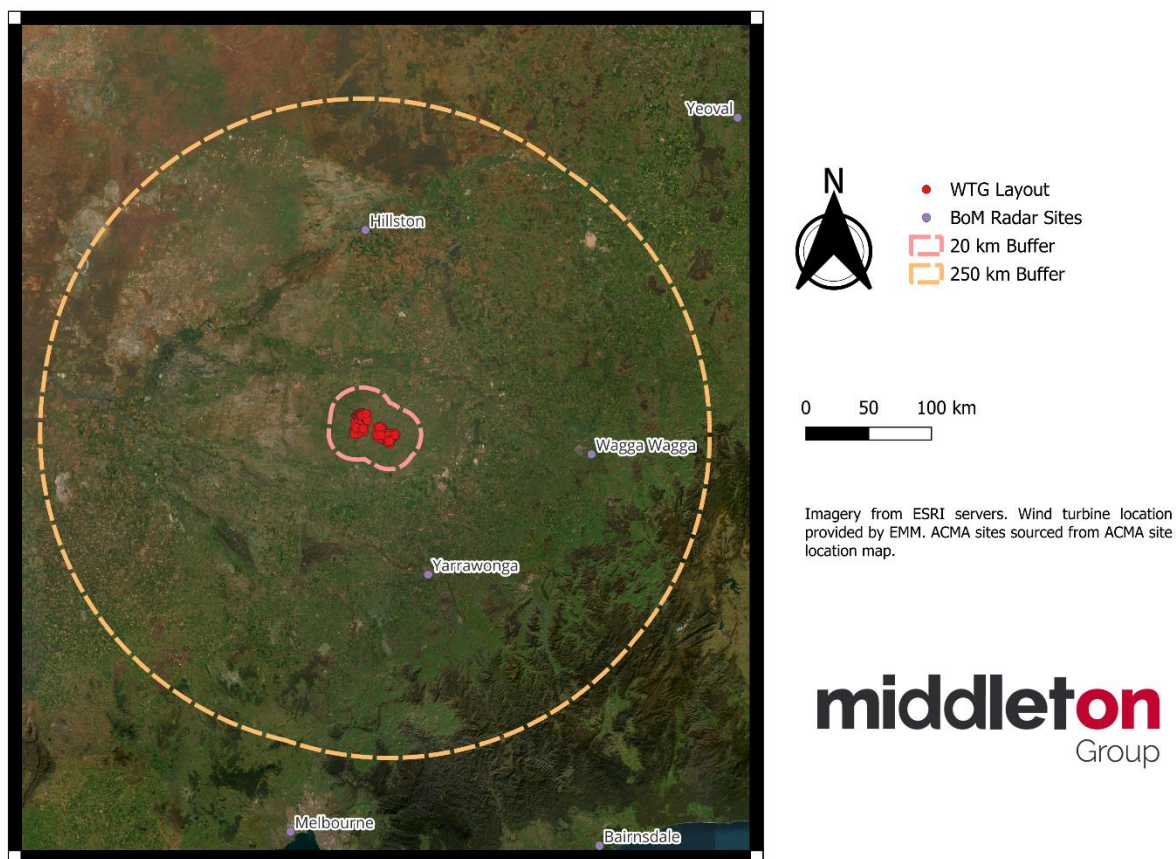


Figure 32: Meteorological Radars Map.

Table 11: Meteorological Radar Information

Weather Radar Name	Coordinate	Radar type	Distance to Dinawan Wind Farm
Yarrawonga	36.03° S, 146.03° E	WSR 81C C-Band	108.5 km
Hillston	33.55° S, 145.52° E	Meteor 735CDP	145.5 km
Wagga Wagga	35.17° S, 147.47° E	WF 100 C Band	156.8 km

The project complies with WMO standards based on setbacks from the various meteorological radars in the region. Further, there is excellent coverage from the three radars within 250 km of the project, giving good visibility of weather events in that region. As such, the presence of the project is unlikely to cause adverse performance of the radars during extreme weather events.

In response to stakeholder engagement initiated by MG, the Bureau of Meteorology requested that Spark Renewables:

- Informs the Bureau of any changes in the wind farm, including varying the layout of the farm, changing the location of a turbine more than 100 meters, or altering turbine height,
- Informs the Bureau at least 2 weeks before any planned shut-down of the wind farm (for maintenance or any other reason) so that the Bureau may calibrate its weather radar system,
- Collaborates with the Bureau in the event of severe weather conditions to assist in matters of community safety.

Detailed correspondence can be found in Appendix B.4.

5.5 Mobile Voice-Based Communications

5.5.1 Mobile Coverage – Nearby Towers

There are no mobile phone base stations located within a 2 km buffer of the project's WTGs as shown in Figure 33. Typically, the signal will not be significantly impacted where the towers are located more than 1 km from wind turbines. Therefore, it is unlikely that the project will cause any significant impact on the operation of mobile phone base stations.



Figure 33: Proximity of the project to mobile phone base stations.

5.5.2 Mobile Coverage – General

The mobile network coverage maps of Optus and Telstra within the region are shown in Figure 34 and Figure 35 respectively. It is noted that there are some mobile network services provided by Telstra and Optus in the project area.

In the immediate vicinity of the wind turbines, some reduction in signal may occur. However, this can be mitigated by relocating the mobile phone receiver in the order of tens of metres. Beyond the project area, there will not be any significant impact on the signal as a result of project infrastructure.

Consultation and engagement with Telstra and Optus with respect to the impact on their services has been collated. While MG are still waiting on further response from Telstra, Optus has advised there will be interference issues with Optus equipment.

It's acknowledged that during construction, the use of the mobile network by the project's construction workforce may impact network availability for neighbouring landowners. While telecommunications upgrades are not proposed as part of the project, Spark Renewables will work with Murrumbidgee Council, EnergyCo and the broader community to identify any opportunities for project infrastructure or the community benefit fund to help address these local issues.

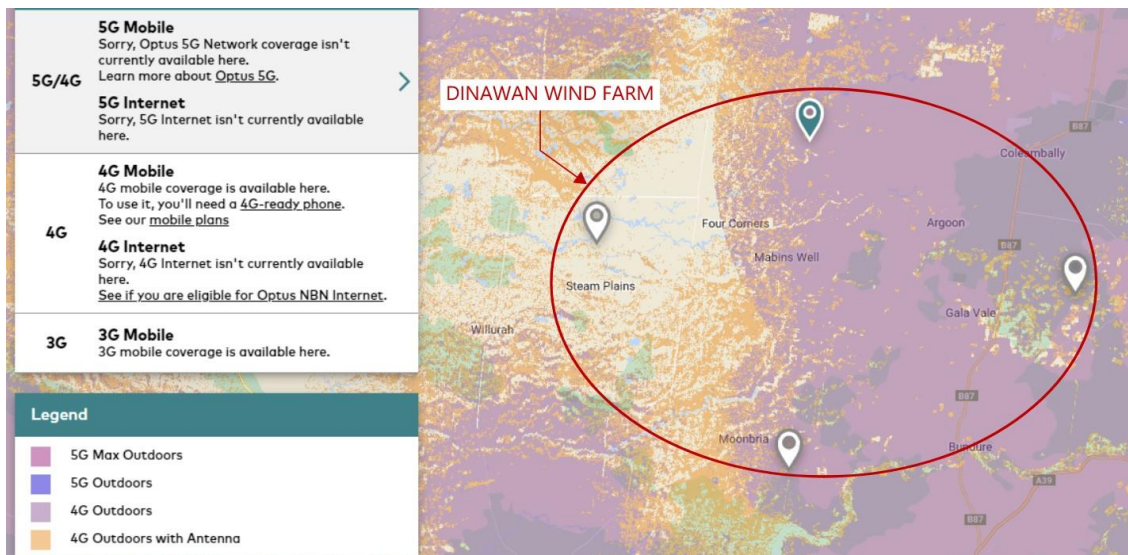


Figure 34: Optus network coverage map of Dinawan Wind Farm.



Figure 35: Telstra network coverage map of Dinawan Wind Farm.

5.6 Wireless and Satellite Services

Satellite services will only be impacted where receivers are sited in 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 shown in Figure 36, there are two (2) associated dwellings within two (2) kilometres of the closest WTG. The project is likely to cause degradation to signal quality from satellite services to these dwellings. No non-associated dwellings are within two (2) kilometres of the proposed WTG layout.

Should impacts to wireless or satellite services at associated dwellings occur, Spark Renewables will work with the landholders to identify a suitable alternative.

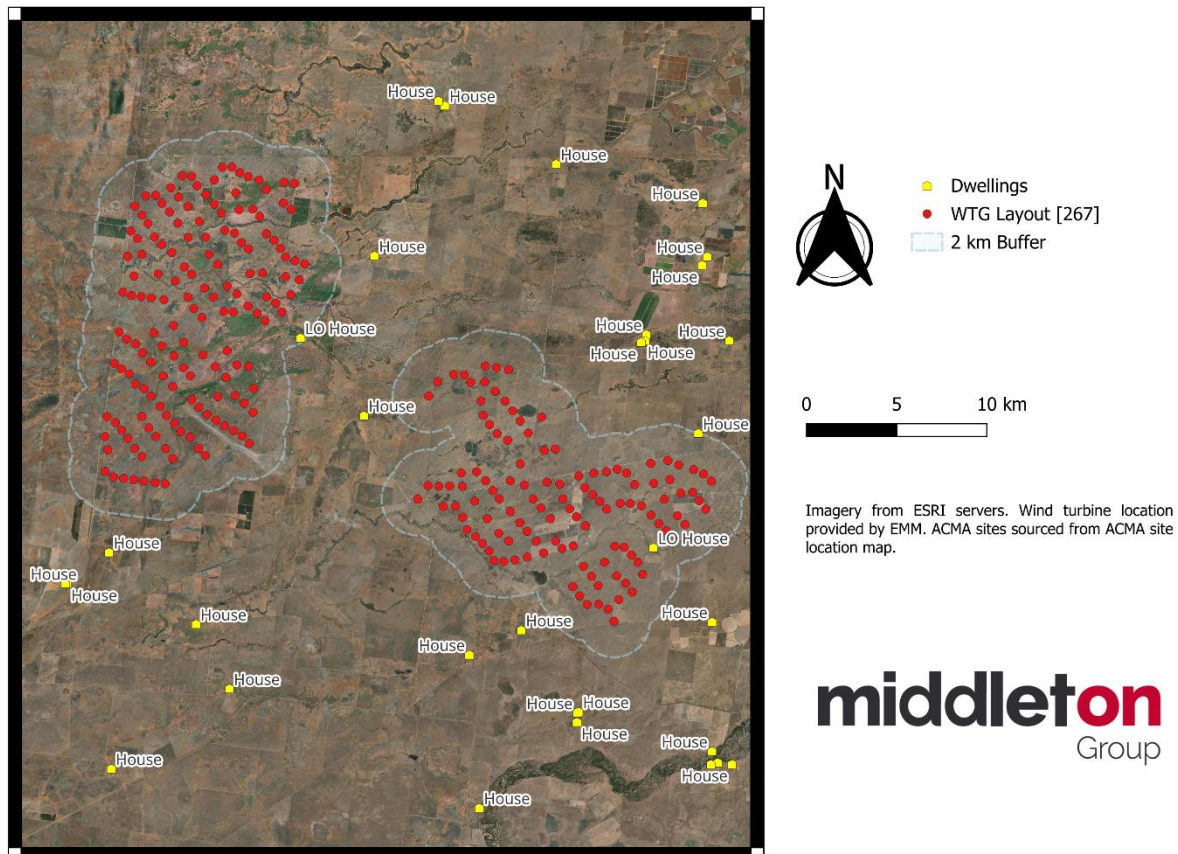


Figure 36: Dinawan Wind Farm and nearby dwellings

5.7 Trigonometrical Stations and GPS

Trigonometrical stations and survey marks are observation marks used for surveying or distance measuring purposes. GPS antennas and Electronic Distance Measuring (EDM) devices may be installed at some Trigonometrical stations.

The performance of the EDM devices depends on the type of wavelength bands used. The current EDM devices operate by using three different wavelength bands: microwave systems, infrared systems, and light wave systems. Microwave systems have a measurement range of up to 150 km and are not limited to line of sight or visibility. The infrared systems and light wave systems can measure a range 3 – 5 km, but accuracy may be limited by the line of sight or visibility [5]. If a line-of-sight blockage occurs, moving laterally one to two metres will typically alleviate the line-of-sight blockage. In addition, the presence of turbines will typically assist with sight navigation, providing fixed reference points.

5.7.1 Survey Marks



Figure 37: Survey marks within the vicinity of the project.

A review of the location of all active survey marks has been completed, and the findings are summarised below:

- There are no proposed WTGs that share the same location as a survey mark. The relative location of survey mark PM 51064, CP 80279194 and CP 79288168 will not be impacted by project construction (See Table 12 for detail).
- There are eight (8) survey marks within a two-kilometre buffer of a proposed WTG (See Figure 37).

- The closest distance between survey marks to the nearest WTG is as shown in Table 12. If the Project was likely to impact a survey mark, site works will need to be designed to avoid the survey marks, or, alternatively, seek assistance from a registered surveyor to move or remove the survey marks.

Table 12: Proximity of Nearby Survey Marks and proposed WTGs.

Survey Mark ID	WTG ID	Distance (m)
PM 51064	WTG 7_EAST	445.25
PM 68247	WTG 6_EAST	1,872.14
PM 68264	WTG 1_EAST	1,970.63
TS 5327	WTG 137_WEST	1,537.51
CP 79279146	WTG 4_WEST	685.03
CP 79288168	WTG 10_WEST	233.73
CP 80279194	WTG 7_EAST	468.81
CP 80289223	WTG 59_EAST	1,361.60

The construction of the project may physically impact these survey marks. If this is likely to occur the project Proponent should consult with the New South Wales Government via the following website: <https://www.spatial.nsw.gov.au/surveying>. As stated above, assistance from a registered surveyor may be required.

5.7.2 Navigation Satellite System (GNSS) Station

Global Navigation Satellite System (GNSS) networks are operated and maintained across the Australian region and the South Pacific. This includes the Australian Regional GNSS Network (ARGN), the South Pacific Regional GNSS Network (SPRGN) and the AuScope Network. GNSS networks provide the geodetic framework for the spatial data infrastructure in Australia and its territories. Data from the GNSS Network also contributes to the International GNSS Service (IGS).

Based on the GNSS network map provided by Geoscience Australia [6], the potential impact of the project on GNSS stations has been analysed. Figure 38 demonstrates that there are no GNSS stations within approximately 20 km of a proposed WTG. The closest GNSS stations, COLE and JERI are 26 km and 30 km away from the nearest wind turbines, respectively.

Geoscience Australia has confirmed that they do not foresee any impact to their service from Dinawan Wind Farm. For the full stakeholder consultation see Appendix B.5.



Figure 38: GNSS Station Locations relative to WTG Layout.

5.8 Broadcast, Digital Radio and Television

Amplitude Modulation (AM) 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 (FM) 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 signals. A 2 km radius is generally desirable around transmitters – for both digital radio and Digital Television (DTV). Digital signals are more robust against ghosting, though wind turbine rotor pass can cause signal frequency variation.

As can be seen in Figure 39, no broadcast, radio, and television services transmitters are located within 2 km of a proposed WTG.



Figure 39: Location of Broadcast Transmitters Relative to the project.

6 Stakeholder Engagement

Consultation with stakeholders was initiated by MGE. A list of key stakeholders is presented in Table 13. All stakeholders with pending responses were sent follow up emails. These emails have been recorded along with stakeholder responses are provided in Appendix B.

A summary of the engagement is listed below:

Table 13: List of stakeholder engagement.

Stakeholder	Impact	Responses
NSW Rural Fire Service	ACMA links (1,3,5, and 6)	No impact.
NSW Electricity Networks Operations Pty Limited	ACMA links (2)	No further response provided.
Essential Energy	ACMA links (4)	No impact.
Bureau of Meteorology	Meteorological radar operations	No impact.
Geoscience Australia	Survey Marks, GNSS Towers and Trigonometrical infrastructure	No impact.
Telstra	Mobile service operation	No further response provided.
Optus	Mobile service operation	No impact.

7 Conclusion

The potential impact of the project on telecommunications infrastructure has been assessed in this report. Based on this assessment, the project will have no material impact on:

- Wireless and satellite internet services;
- Broadcast and digital radio;
- Broadcast, digital and satellite television;
- Trigonometry stations; and
- GPS.

Initial analysis conducted by MGE has found T4_EAST, T6_EAST, and T9_EAST impinge the 1st Fresnel zone of link 2, owned by NSW Electricity Networks Operations Pty Limited. The stakeholder has not provided a final response. However, after a 3D assessment looking at the link elevation and profile, no significant interference is expected. Further correspondence is recommended between the stakeholder and the Proponent to confirm acceptance of the WTG's placements.

MGE have assessed the Dinawan Wind Farm WTG layout and found that all other links are not expected to be impacted.

There are up to two (2) associated dwellings within two (2) kilometres of a proposed WTG. The project may cause degradation to signal quality from satellite services to these dwellings. Should impacts to wireless or satellite services at associated dwellings occur, Spark Renewables will work with the landholders to identify a suitable alternative.

Stakeholder correspondences have been collated regarding potential impacts on their services. Two stakeholders, NSW Electricity Networks Operations Pty Limited and Telstra have not provided final responses. All other stakeholders have confirmed that there is no anticipated impact on their services from the Dinawan Wind Farm.

Spark Renewables and EMM will continue to engage and consult with key stakeholders to ensure that the project does not have material impacts on the point-to-point links within proximity of the proposed WTGs.

Appendix A 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] O. Il, "Impact of Wind Turbines on Weather Radars," 2006.
- [5] Satheesh Gopi, R. Sathikumar, N. Madhu, "8.3 EDM Instrument Characteristics," in *Advanced Surveying: Total Station, Gis and Remote Sensing*, Pearson, 2006.
- [6] G. Australia, "GNSS Network Map," Geoscience Australia, [Online]. Available: <https://gnss.ga.gov.au/network>. [Accessed 25 05 2021].

Appendix B Stakeholder Correspondence

B.1 NSW Rural Fire Service

From: Haydn Follett <Haydn.Follett@rfs.nsw.gov.au>
Sent: Friday, April 12, 2024 9:20 AM
To: Joanne Laundess <Joanne.Laundess@rfs.nsw.gov.au>
Cc: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Subject: RE: Dinawan Wind Farm - RFS ACMA Link Consultation

Hi Jo.

Link licences in question are no longer used by RFS. there is no impact to the NSW RFS network from the Dinawan Wind Farm.

Regards



Haydn Follett | ICT Field Operations Officer | ICT Field Engineering & Communications

NSW RURAL FIRE SERVICE
Unit 2, 63 Cranbrook Road, Batemans Bay 2536 | PO Box 35, Batemans Bay 2536

P 02 4472 0600 **F** 02 4472 0690 **M** 0428 280 066 **E** haydn.follett@rfs.nsw.gov.au

ICT Help Desk **P** 02 8741 5123 **E** Communication.systems@rfs.nsw.gov.au
www.rfs.nsw.gov.au | www.facebook.com/nswrfs | www.twitter.com/nswrfs

PREPARE. ACT. SURVIVE.

From: Joanne Laundess <Joanne.Laundess@rfs.nsw.gov.au>
Sent: Friday, April 12, 2024 8:09 AM
To: Haydn Follett <Haydn.Follett@rfs.nsw.gov.au>
Cc: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Subject: FW: Dinawan Wind Farm - RFS ACMA Link Consultation
Importance: High

Good morning Haydn,

Are you able to provide any updates please?

Thanks

Jo

From: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Sent: Friday, April 12, 2024 8:01 AM
To: Ebony Apps <Ebony.apps@middletongroup.com.au>; Webmaster <webmaster@rfs.nsw.gov.au>
Cc: Joanne Laundess <Joanne.Laundess@rfs.nsw.gov.au>
Subject: RE: Dinawan Wind Farm - RFS ACMA Link Consultation
Importance: High

Hi,

Can we please get an update on the below request as soon as possible.

Thank you

Ramez Barakat

Electrical Engineer

M: +61 488 088 605 | **E:** ramez.barakat@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000 **W:** www.middletongroup.com.au

From: Ebony Apps <Ebony.apps@middletongroup.com.au>
Sent: Friday, March 1, 2024 2:37 PM
To: Webmaster <webmaster@rfs.nsw.gov.au>
Cc: Ramez Barakat <ramez.barakat@middletongroup.com.au>; Joanne Laundess <Joanne.Laundess@rfs.nsw.gov.au>
Subject: Dinawan Wind Farm - RFS ACMA Link Consultation

To whom it may concern,

We are conducting early-stage consultation for the Dinawan Wind Farm in New South Wales, focusing on Telecommunications Impact. An environmental impact statement is being prepared by EMM Consulting Pty Ltd (EMM) and Middleton Group, and the applicant for the wind farm is Spark Renewables Pty Limited (Spark Renewables).

The proposed wind farm would be located about halfway between the towns of Coleambally and Jerilderie and lies within the Murrumbidgee and Edwards River local government areas (LGAs) in New South Wales (NSW). The project consists of up to approximately 250 wind turbines, within a hybrid wind and solar farm and battery energy storage system (BESS).

We note that your organisation has 4 licensed communication links passing through the proposed project boundary, license number 1207619/1 (Link 1), 1213555/1 (Link 3), 1902304/1 (Link 5), 1968232/1, 1968233/1, and 9948039/1 (Link 6).

Our 2D analysis, using the lowest frequency signal, showed the following WTG turbine generators extending within the link's maximum second Fresnel zone:

Link Number	Turbine Number
1	WTG 59
	WTG 121
	WTG 148
3	WTG 22
5	WTG 106
	WTG 112
	WTG 124

From our 3D analysis, all turbines are unlikely to cause interference with the link, as the links pass below each the WTGs rotor extent. As such our assessment finds that the turbines should not reduce the performance of the wireless link, as per typical industry standards. Please see the attachments for this demonstration.

We append the wind turbine co-ordinates for turbines in .csv and .kml format. Note that the rotor diameter of the turbines will be up to 200 metres, with a tip height of 280 metres.

If you have any concerns relating to the development and any potential impacts on your communication links, please get in contact by return email or by calling us on the phone number listed below prior to 22/03/2024.

Kind Regards,

Ebony Apps | **middleton** Group

M: +61 424 777 971 | **E:** ebony.apps@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000



B.2 NSW Electricity Networks operations Pty Limited

Ramez Barakat

From: Ramez Barakat
Sent: Wednesday, 29 May 2024 1:45 PM
To: TransGrid Community
Cc: Connection Email; Ebony Apps; Kasun Fernando
Subject: RE: Dinawan Wind Farm - Transgrid ACMA Link Consultation

Hi Cathryn,

Thank you and I would like to note again the urgency of the matter as our client is looking to lodge the EIS statement this week.

If TransGrid cannot provide a response by this week kindly let me know in advance so I can communicate it through.

Kind regards

Ramez Barakat

Electrical Engineer

M: +61 481 088 605 | **E:** ramez.barakat@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000 **W:** www.middletongroup.com.au

From: TransGrid Community <community@transgrid.com.au>
Sent: Wednesday, May 29, 2024 11:41 AM
To: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Cc: Connection Email <Connections@transgrid.com.au>; Ebony Apps <Ebony.apps@middletongroup.com.au>; Kasun Fernando <Kasun.Fernando@transgrid.com.au>
Subject: Dinawan Wind Farm - Transgrid ACMA Link Consultation

Hi Ramez,

Thank you for your email of 28 May.

I will follow up with the relevant Business Unit on this matter.

Kind regards

Cathryn Riddiford

Community Engagement Officer - Operations | Community and Policy

Transgrid | 14 Copland St, Wagga Wagga NSW 2650
T: 1800 222 537
E: community@transgrid.com.au **W:** www.transgrid.com.au



We acknowledge the Aboriginal and Torres Islander people as the Traditional Custodians of the land which we provide our services. We pay our respects to their Elders, past and present.



Data Classification: Official

From: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Sent: Tuesday, May 28, 2024 3:46 PM
To: Ebony Apps <Ebony.apps@middletongroup.com.au>; TransGrid Community <community@transgrid.com.au>
Cc: Connection Email <Connections@transgrid.com.au>; Kasun Fernando <Kasun.Fernando@transgrid.com.au>
Subject: RE: Dinawan Wind Farm - Transgrid ACMA Link Consultation
Importance: High

Hi Cathryn,

Can we get a response to the below by Thursday if possible? Our client is pushing to submit the EIS ASAP.

Thank you for understanding.

Ramez

Ramez Barakat

Electrical Engineer

M: +61 481 088 605 | **E:** ramez.barakat@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000 **W:** www.middletongroup.com.au

Data Classification: Official

From: Ebony Apps <Ebony.apps@middletongroup.com.au>
Sent: Tuesday, April 30, 2024 9:28 AM
To: TransGrid Community <community@transgrid.com.au>
Cc: Connection Email <Connections@transgrid.com.au>; Kasun Fernando <Kasun.Fernando@transgrid.com.au>; Ramez Barakat <ramez.barakat@middletongroup.com.au>
Subject: RE: Dinawan Wind Farm - Transgrid ACMA Link Consultation

Hi Cathryn,

Please see the attached file inclusive of both the email and its attachments.

Feel free to contact me if there are any further issues.

Warm Regards,

Ebony Apps | **middleton** Group

M: +61 424 777 971 | **E:** ebony.apps@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000



From: TransGrid Community <community@transgrid.com.au>
Sent: Monday, April 29, 2024 3:08 PM
To: Ebony Apps <ebony.apps@middletongroup.com.au>
Cc: Connection Email <Connections@transgrid.com.au>; Kasun Fernando <Kasun.Fernando@transgrid.com.au>; Ramez Barakat <ramez.barakat@middletongroup.com.au>
Subject: Dinawan Wind Farm - Transgrid ACMA Link Consultation
Importance: High

Hi Ebony,

I refer to your email of 2.40pm Friday 1 March 2024 copied below.

Can you please re-send this email inclusive of the attachment 'wind turbine co-ordinates for turbines in .csv and .kml format'.

Thanks in advance.

Kind regards

Cathryn Riddiford
Community Engagement Officer - Operations | Community and Policy

Transgrid | 14 Copland St, Wagga Wagga NSW 2650
T: 1800 222 537
E: community@transgrid.com.au **W:** www.transgrid.com.au



We acknowledge the Aboriginal and Torres Islander people as the Traditional Custodians of the land which we provide our services. We pay our respects to their Elders, past and present.



Data Classification: Official

From: Ebony Apps <Ebony.apps@middletongroup.com.au>
Sent: Friday, March 1, 2024 2:40 PM
To: community@Transgrid.com.au
Cc: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Subject: Dinawan Wind Farm - Transgrid ACMA Link Consultation

To whom it may concern,

We are conducting early-stage consultation for the Dinawan Wind Farm in New South Wales, focusing on Telecommunications Impact. An environmental impact statement is being prepared by EMM Consulting Pty Ltd (EMM) and Middleton Group, and the applicant for the wind farm is Spark Renewables Pty Limited (Spark Renewables).

The proposed wind farm would be located about halfway between the towns of Coleambally and Jerilderie and lies within the Murrumbidgee and Edwards River local government areas (LGAs) in New South Wales (NSW). The project consists of up to approximately 250 wind turbines, within a hybrid wind and solar farm and battery energy storage system (BESS).

We note that your organisation has one licensed communication link (link 2) with passing through the proposed project boundary, license number 21536/2.

We conducted 3D analysis on the link, using the lower frequency signal and found three turbines, WTG 4, WTG 6 and WTG 9 make contact with the link's first Fresnel zone. From our assessment, the turbines should not significantly reduce the performance of the wireless link, as per typical industry standards. Please see the attached PDF for this demonstration.

We append the **wind turbine co-ordinates for turbines in .csv and .kml format**. Note that the rotor diameter of the turbines will be up to 200 metres, with a tip height of 280 metres.

If you have any concerns relating to the development and any potential impacts on your communication links, please get in contact by return email or by calling us on the phone number listed below prior to 22/03/2024.

Kind Regards,

Ebony Apps | **middleton** Group

M: +61 424 777 971 | **E:** ebony.apps@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000



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B.3 Essential Energy

From: Craig Salisbury <craig.salisbury@essentialenergy.com.au>

Sent: Wednesday, March 6, 2024 7:49 AM

To: Ebony Apps <Ebony.apps@middletongroup.com.au>

Cc: Public Safety <public.safety@essentialenergy.com.au>; Ramez Barakat
<ramez.barakat@middletongroup.com.au>

Subject: RE: Dinawan Wind Farm - ACMA Link Consultation

Hi Ebony

Many thanks for the notification and Essential Energy are confident that the Windfarm construction will have no bearing on the link mentioned.

Kind Regards

Craig Salisbury

Operational Technology Manager

Telecommunications

T:07 5506 3803 | M: 0428 286 940 craig.salisbury@essentialenergy.com.au

PO Box 5730 Port Macquarie NSW 2444 | essentialenergy.com.au

General enquiries: 13 23 91 | Supply interruptions (24hr): 13 20 80



From: Ebony Apps <Ebony.apps@middletongroup.com.au>
Sent: Friday, March 1, 2024 2:26 PM
To: Craig Salisbury <craig.salisbury@essentialenergy.com.au>
Cc: Public Safety <public.safety@essentialenergy.com.au>; Ramez Barakat
<ramez.barakat@middletongroup.com.au>
Subject: Dinawan Wind Farm - ACMA Link Consultation

WARNING: Do not click links or open attachments unless you recognise the source of the email and know the contents are safe.

To whom it may concern,

We are conducting early-stage consultation for the Dinawan Wind Farm in New South Wales, focusing on Telecommunications Impact. An environmental impact statement is being prepared by EMM Consulting Pty Ltd (EMM) and Middleton Group, and the applicant for the wind farm is Spark Renewables Pty Limited (Spark Renewables).

The proposed wind farm would be located about halfway between the towns of Coleambally and Jerilderie and lies within the Murrumbidgee and Edwards River local government areas (LGAs) in New South Wales (NSW). The project consists of up to approximately 250 wind turbines, within a hybrid wind and solar farm and battery energy storage system (BESS).

We note that your organisation has one communication link with two assigned licensed frequency passing through the proposed project boundary, license numbers 40874/1 and 1105687/1.

We conducted 2D analysis on the link, using the lower frequency signal, 450.65 MHz, and found two turbines, WTG 115 and WTG 117 fall within the maximum second Fresnel zone. However, upon further 3D analysis it was found that the link passed below both WTGs rotor extent. See the attached for our analysis.

From our assessment, the turbines should not reduce the performance of the wireless link, as per typical industry standards. Please see the attached images for this demonstration.

We append the wind turbine co-ordinates for turbines in .csv and .kml format. Note that the rotor diameter of the turbines will be up to 200 metres, with a tip height of 280 metres.

If you have any concerns relating to the development and any potential impacts on your communication link, please get in contact by return email or by calling us on the phone number listed below prior to 22/03/2024.

Kind Regards,

Ebony Apps | middleton Group

M: +61 424 777 971 | **E:** ebony.apps@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000



B.4 Bureau of Meteorology (BoM)

From: Muhammad Afzal <Muhammad.Afzal@bom.gov.au>

Sent: Tuesday, March 19, 2024 2:11 PM

To: Mohammad Zomorodi <Mohammad.Zomorodi@bom.gov.au>; Ebony Apps <Ebony.apps@middletongroup.com.au>

Cc: Ramez Barakat <ramez.barakat@middletongroup.com.au>; windfarmenquiries <windfarmenquiries@bom.gov.au>; Energy <energy@bom.gov.au>; Adrian Cresswell <Adrian.Cresswell@bom.gov.au>

Subject: RE: Dinawan Wind Farm - Bureau of Meteorology Consultation [SEC=OFFICIAL]

Hi Ebony,

The Bureau of Meteorology's assessment of the proposed Dinawan wind farm in NSW is now complete, which indicates manageable impact to our neighboring assets, under normal propagation conditions.

The Bureau requests that the owner/operator of the Dinawan wind farm to:

- informs the Bureau of any changes in the wind farm, including varying the layout of the farm, changing the location of a turbine more than 100 meters, or altering turbine height,
- informs the Bureau at least 2 weeks before any planned shut-down of the wind farm (for maintenance or any other reason) so that the Bureau may calibrate its weather radar system,
- collaborates with the Bureau in the event of severe weather conditions to assist in matters of community safety.

Please kindly acknowledge the receipt of this E-mail and direct any further correspondence to energy@bom.gov.au & windfarmenquiries@bom.gov.au, including Dinawan wind farm in the subject line, and let us know if you have any queries.

Kind regards,

Muhammad Usman Afzal (Ph.D)

Spectrum Engineer

Observing Systems & Operations, Data and Digital Group

Level 15, 300 Elizabeth Street, Surry Hills, NSW

muhammad.afzal@bom.gov.au | www.bom.gov.au



From: Mohammad Zomorodi <Mohammad.Zomorodi@bom.gov.au>
Sent: Monday, March 4, 2024 11:03 AM
To: Ebony Apps <Ebony.apps@middletongroup.com.au>
Cc: Ramez Barakat <ramez.barakat@middletongroup.com.au>; windfarmenquiries <windfarmenquiries@bom.gov.au>; Energy <energy@bom.gov.au>; Adrian Cresswell <Adrian.Cresswell@bom.gov.au>
Subject: RE: Dinawan Wind Farm - Bureau of Meteorology Consultation [SEC=OFFICIAL]

Hi Ebony,

Thanks for contacting the Bureau regarding Dinawan WF in NSW.

We initiate the process for analysis of the proposed wind farm on the Bureau's radiocommunication assets and will update you on the result hopefully soon.

Given that different teams within the Bureau who are involved in the preparation of response for windfarms are busy with other works, so we might not be able to update you by 22nd March 2024.

Regards

Mohammad

Dr. Mohammad Zomorodi

Radio Frequency Spectrum Manager

Data & Digital, Operational Technology & Engineering

M: 0415 524 457 | T: 03 9669 4413

Level 7, 700 Collins St, Docklands, VIC 3008

Mohammad.Zomorodi@bom.gov.au | www.bom.gov.au



From: Ebony Apps <Ebony.apps@middletongroup.com.au>
Sent: Friday, March 1, 2024 11:50 AM
To: windfarmenquiries <windfarmenquiries@bom.gov.au>
Cc: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Subject: Dinawan Wind Farm - Bureau of Meteorology Consultation

To whom it may concern,

We are conducting early-stage consultation for the Dinawan Wind Farm in New South Wales, focusing on Telecommunications Impact. An environmental impact statement is being prepared by EMM Consulting Pty Ltd (EMM) and Middleton Group, and the applicant for the wind farm is Spark Renewables Pty Limited (Spark Renewables).

The proposed wind farm would be located about halfway between the towns of Coleambally and Jerilderie and lies within the Murrumbidgee and Edwards River local government areas (LGAs) in New South Wales (NSW). The project consists of up to approximately 250 wind turbines, within a hybrid wind and solar farm and battery energy storage system (BESS).

As a result of our assessment, there are 3 sites have been identified that fall within 250 kilometres of the Dinawan Wind Farm buffer as per below:

Weather Radar Name	Coordinate	Radar type	Distance to the Project Area
Yarrawonga	36.03° S, 146.03° E	WSR 81C C-Band	108.5 km
Hillston	33.55° S, 145.52° E	Meteor 735CDP	145.5 km
Wagga Wagga	35.17° S, 147.47° E	WF 100 C Band	156.8 km

We append the wind turbine co-ordinates for turbines in .csv and .kml format. Note that the rotor diameter of the turbines will be up to 200 metres, with a tip height of 280 metres.

If you have any concerns relating to the development and any potential impacts on your services, please get in contact by return email or by calling us on the phone number listed below prior to 22/03/2024.

Kind Regards,

Ebony Apps | middleton Group

M: +61 424 777 971 | **E:** ebony.apps@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000



B.5 Geoscience Australia

From: Ryan Ruddick <Ryan.Ruddick@ga.gov.au>

Sent: Tuesday, March 5, 2024 9:17 AM

To: Ebony Apps <Ebony.apps@middletongroup.com.au>

Cc: Client Services <ClientServices@ga.gov.au>; Ramez Barakat <ramez.barakat@middletongroup.com.au>

Subject: RE: Dinawan Wind Farm - GNSS Consultation [SEC=OFFICIAL]

Hi Ebony,

Geoscience Australia do not foresee any interference to our GNSS infrastructure as a result of the proposed Dinawan Wind Farm in NSW.

Kind regards,

Ryan Ruddick (He/Him) | Director

GNSS Infrastructure and Informatics Section | Positioning Australia

Space Division

t +61 2 6249 9426 t +61 429 771 069 ga.gov.au



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Geoscience Australia acknowledges the traditional owners and custodians of Country throughout Australia and acknowledges their continuing connection to land, waters and community. We pay our respects to the people, the cultures and the elders past and present.

From: Client Services <ClientServices@ga.gov.au>
Sent: Friday, March 1, 2024 12:05 PM
To: Ryan Ruddick <Ryan.Ruddick@ga.gov.au>
Subject: FW: Dinawan Wind Farm - GNSS Consultation [SEC=OFFICIAL]

Hi Ryan,

Can you please assist with the following enquiry. If you could copy Client Services into your response we'd appreciate it.

Regards

Darren

Darren King | Client and Visitor Services Officer

Discovery and Engagement Section
Office of the Chief Scientist

t +61 2 6249 9775 ga.gov.au

Mon, Tues: Work From Home | Wed, Thurs and Fri: In the Office 8.00am – 4.00pm



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Geoscience Australia acknowledges the traditional owners and custodians of Country throughout Australia and acknowledges their continuing connection to land, waters and community. We pay our respects to the people, the cultures and the elders past and present.

From: Ebony Apps <Ebony.apps@middletongroup.com.au>
Sent: Friday, March 1, 2024 11:45 AM
To: Client Services <ClientServices@ga.gov.au>
Cc: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Subject: Dinawan Wind Farm - GNSS Consultation

To whom it may concern,

We are conducting early-stage consultation for the Dinawan Wind Farm in New South Wales, focusing on Telecommunications Impact. An environmental impact statement is being prepared by EMM Consulting Pty Ltd (EMM) and Middleton Group, and the applicant for the wind farm is Spark Renewables Pty Limited (Spark Renewables). Our consultation particularly relates to potential impact on survey marks and GNSS stations.

The proposed wind farm would be located about halfway between the towns of Coleambally and Jerilderie and lies within the Murrumbidgee and Edwards River local government areas (LGAs) in New South Wales (NSW). The project consists of up to approximately 250 wind turbines.

We append the wind turbine co-ordinates for turbines in .csv and .kml format. Note that the rotor diameter of the turbines will be up to 200 metres, with a tip height of 280 metres.

We note that all installations on the wind farm will comply with the Radiocommunications Act (1992) and associated notices.

If you have any concerns relating to the development and any potential impacts on your services, please get in contact by return email or by calling us on the phone number listed below prior to 22/03/2024.

Kind Regards,

Ebony Apps | **middleton** Group

M: +61 424 777 971 | **E:** ebony.apps@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000



B.6 Telstra correspondence

From: ! Windfarm Assessment Requests <WindfarmAssessmentRequests@team.telstra.com>

Sent: Tuesday, April 16, 2024 6:04 PM

To: Ramez Barakat <ramez.barakat@middletongroup.com.au>

Cc: Ebony Apps <Ebony.apps@middletongroup.com.au>

Subject: RE: Dinawan Wind Farm - Telstra Consultation

Hi Ramez,

Apologies for the delay.

I am waiting on some analysis from our engineering team.

I will get back to you with a response as soon as I can.

Regards,

David Jonas

Senior Chapter Lead

Fixed Access Planning WA, SA & NT

Connectivity Engineering

Global Networks & Technology



Flow to Work – CAN Reliability Team

P	08	6224	6268
M	0438	934	894
E		David.Jonas@team.telstra.com	
W	www.telstra.com		

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General

Document name: Dinawan Wind Farm
Document no: 23064-E-RPT-0001
Revision no: 0

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From: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Sent: Friday, April 12, 2024 6:00 AM
To: Ebony Apps <Ebony.apps@middletongroup.com.au>; ! Windfarm Assessment Requests <windfarmassessmentrequests@team.telstra.com>
Subject: RE: Dinawan Wind Farm - Telstra Consultation
Importance: High

Hi,

Can we please get an update on the below request as soon as possible.

Thank you

Ramez Barakat

Electrical Engineer

M: +61 488 088 605 | **E:** ramez.barakat@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000 **W:** www.middletongroup.com.au

From: Ebony Apps <Ebony.apps@middletongroup.com.au>
Sent: Friday, March 1, 2024 11:44 AM
To: ! Windfarm Assessment Requests <windfarmassessmentrequests@team.telstra.com>
Cc: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Subject: Dinawan Wind Farm - Telstra Consultation

To whom it may concern,

We are conducting early-stage consultation for the Dinawan Wind Farm in New South Wales, focusing on Telecommunications Impact. An environmental impact statement is being prepared by EMM Consulting Pty Ltd (EMM) and Middleton Group, and the applicant for the wind farm is Spark Renewables Pty Limited (Spark Renewables).

The proposed wind farm would be located about halfway between the towns of Coleambally and Jerilderie and lies within the Murrumbidgee and Edwards River local government areas (LGAs) in New South Wales (NSW). The project consists of up to approximately 250 wind turbines, within a hybrid wind and solar farm and battery energy storage system (BESS).

We append the wind turbine co-ordinates for turbines in .csv and .kml format. Note that the rotor diameter of the turbines will be up to 200 metres, with a tip height of 280 metres.

We note that all installations on the wind farm will comply with the Radiocommunications Act (1992) and associated notices.

If Telstra have any concerns relating to the development and any potential impacts on their mobile services, please get in contact by return email or by calling us on the phone number listed below prior to 22/03/2024.

Kind Regards,

Ebony Apps | middleton Group

M: +61 424 777 971 | **E:** ebony.apps@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000



B.7 Optus correspondence

From: EME Enquiries <emeenquiries@optus.com.au>
Sent: Thursday, March 7, 2024 10:22 AM
To: Ebony Apps <Ebony.apps@middletongroup.com.au>
Cc: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Subject: RE: Dinawan Wind Farm - Optus Consultation

Hi Ebony,

Thanks for your email. Our technical team has reviewed this proposal and advised not interference issues with Optus equipment.

Kind regards,

Yadira Narvaez

Community Manager | Mobile Deployment | Networks | Optus

M: 0411286005

727 Collins Street, Melbourne 3000, Australia

Yadira.Narvaez@optus.com.au



OPTUS

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Optus acknowledges the Traditional Owners and Custodians of the lands on which we live, work, and serve. We celebrate the oldest living culture and its unbroken history of storytelling and communication. We pay our respect to Elders – past, present, and future – and we strive together to embrace an optimistic outlook for our future in harmony, across all of Australia and for all of its people

This email may be confidential. If you received it accidentally, please do not send it to anyone else, delete it and let the sender know straight away.

Document name: Dinawan Wind Farm
Document no: 23064-E-RPT-0001
Revision no: 0

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From: Ebony Apps <Ebony.apps@middletongroup.com.au>
Sent: Friday, March 1, 2024 11:45 AM
To: EME Enquiries <emeenquiries@optus.com.au>
Cc: Ramez Barakat <ramez.barakat@middletongroup.com.au>
Subject: Dinawan Wind Farm - Optus Consultation

To whom it may concern,

We are conducting early-stage consultation for the Dinawan Wind Farm in New South Wales, focusing on Telecommunications Impact. An environmental impact statement is being prepared by EMM Consulting Pty Ltd (EMM) and Middleton Group, and the applicant for the wind farm is Spark Renewables Pty Limited (Spark Renewables).

The proposed wind farm would be located about halfway between the towns of Coleambally and Jerilderie and lies within the Murrumbidgee and Edwards River local government areas (LGAs) in New South Wales (NSW). The project consists of up to approximately 250 wind turbines, within a hybrid wind and solar farm and battery energy storage system (BESS).

We append the wind turbine co-ordinates for turbines in .csv and .kml format. Note that the rotor diameter of the turbines will be up to 200 metres, with a tip height of 280 metres.

We note that all installations on the wind farm will comply with the Radiocommunications Act (1992) and associated notices.

If Optus have any concerns relating to the development and any potential impacts on their mobile services, please get in contact by return email or by calling us on the phone number listed below prior to 22/03/2024.

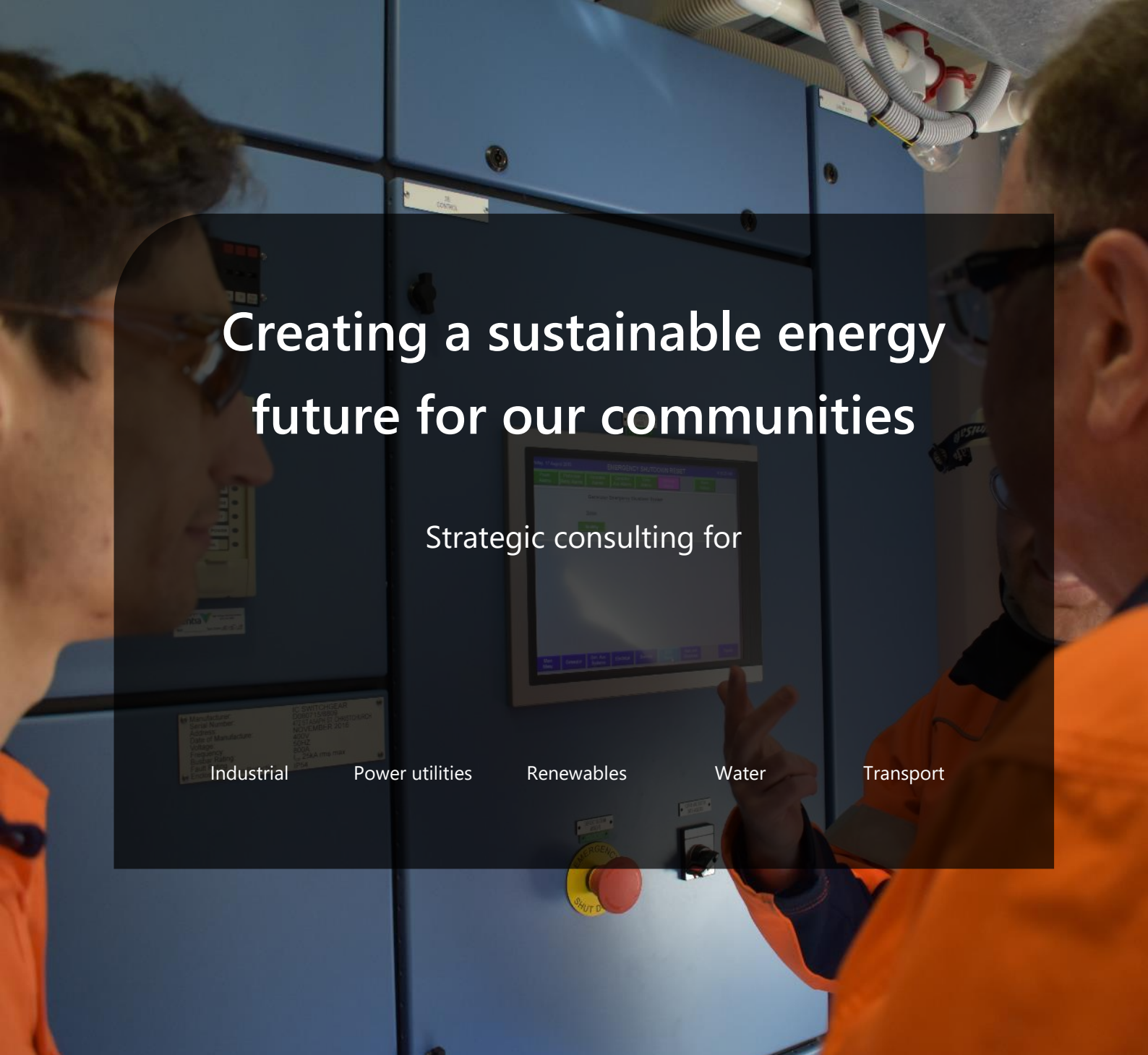
Kind Regards,

Ebony Apps | **middleton** Group

M: +61 424 777 971 | **E:** ebony.apps@middletongroup.com.au

Level 4, 59 Goulburn St, Haymarket NSW 2000





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Power utilities

Renewables

Water

Transport

Melbourne

Suite 3 L10, 350 Collins Street
Melbourne VIC 3000

Sydney

Tower 2 Darling Park L20
201 Sussex Street, Sydney NSW 2000