



WEST ARTHUR WIND FARM

EMI Assessment

West Arthur Energy Pty Ltd

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Customer: West Arthur Energy Pty Ltd
Level 7, 140 St Georges Terrace
Perth WA 6000
Customer contact: Ben Kraft
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DNV Australia Pty Limited
Level 12, 350 Queen Street
Melbourne Vic 3000
Australia
Tel: +61 3 8615 1515
ABN: 14 154 635 319

Objective: West Arthur Wind Farm EMI Assessment

Prepared by:

Verified by:

Approved by:

E Tomlinson
Engineer
Technical Planning
Energy Analytics & Measurements (ANZ)

N Brammer
Senior Engineer, Team Lead
Technical Planning
Energy Analytics & Measurements (ANZ)

G Slack
Senior Principal Engineer
Energy Systems (ANZ)

T Thydal
Engineer
Technical Planning
Energy Analytics & Measurements (ANZ)

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EXECUTIVE SUMMARY

DNV has been commissioned by West Arthur Energy Pty Ltd (“the Customer”) to independently assess potential electromagnetic interference (EMI) impacts associated with the development and operation of the proposed West Arthur Wind Farm (“the Project”) in southwest Western Australia. The results of the EMI assessment are described in this document.

Background and methodology

DNV has assessed the potential EMI impacts for the Project in accordance with the Draft National Wind Farm Development Guidelines [1]. The methodology used in this study has been informed by these guidelines and various standard industry practices.

A Project layout consisting of up to 92 wind turbines with a rotor diameter of up to 184 m, upper tip height of up to 253 m, and lower tip height of 59 m has been considered. These dimensions represent the maximum and minimum overall tip heights and maximum rotor diameter under consideration for the Project.

There are 29 identified dwellings within 5 km of the Project, 16 of which are host dwellings.

Outcomes of the assessment

The results of the EMI assessment are summarised in the table at the end of this section.

There is potential for the Project to interfere with point-to-area communications, including public mobile phone services and emergency services communications, hosted on three radiocommunication towers located within 2 km of the proposed turbine locations. Consultation with the relevant service operators - Western Australia Police (WA Police), St John Ambulance Western Australia, the Department of Fire and Emergency Services of WA and Telstra Limited is ongoing. Consultation with the Shire of West Arthur is planned to be undertaken at a later stage.

Through consultation, WA Police have raised concerns about the potential for interference to their point-to-point links crossing the Project site. To address the potential for interference to these services, DNV recommends that a quantitative assessment of the expected impacts of reflection and scattering and near-field effects is undertaken, as requested by WA Police. If the assessment shows that the performance of these services is likely to be adversely affected, mitigation measures would need to be determined through further investigation and consultation with WA Police but may include upgrading the equipment for the affected links, re-routing links via an existing or new tower, or replacing links with alternative communication technologies. Alternatively, turbines 89, 92, 93 and 94 could be relocated to be a minimum distance of 250 m from the point-to-point links and towers as requested by WA Police.

Based on a preliminary turbine layout, Electricity Networks Corporation (Western Power) advised of a planned point-to-point link that crosses the southeastern portion of the Project, south of T73 and T74, and advised that moving turbines further south in the Project may increase the potential for interference to the planned link path. In the current turbine layout T73 has been moved southwest compared to the preliminary turbine layout. However, based on the figures shown in Western Power’s previous response it is not expected that this adjustment will impact the proposed link path. The current turbine layout has been shared with Western Power for their review and feedback.

Turbines at the Project may interfere with other point-to-area style services such as mobile phone signals, radio broadcasting, and terrestrial television broadcasting, particularly in areas with poor or marginal signal coverage. Dwellings within approximately 5-10 km of the Project that are currently receiving weak signals from the Bunbury and Wagin television broadcast transmitters may experience interference to those services. However, coverage

maps indicate that most dwellings within the potential interference zones are unlikely to receive signals from these transmitters. If interference to these services is experienced, a range of options are available to rectify difficulties.

Interference to signals from a geostationary satellite (NSS 9) that transmits programs intended for Australian audiences is possible at two nearby dwellings. DNV recommends that the Customer engages with the occupants of these dwellings prior to construction of the Project to determine whether the residents are currently receiving or intending to receive signals from the NSS 9 satellite, and to establish an understanding of how any impacts to those services may be mitigated.

Since it is not possible to determine the potential EMI impacts on point-to-multipoint links, emergency services, wireless internet services, and meteorological radar without obtaining further information from the relevant operators, DNV has consulted with organisations operating services that may be affected by the Project. The Bureau of Meteorology (the Bureau) has advised that impacts to their radar are expected to be manageable. Consultation is ongoing with the Department of Fire and Emergency Services of WA (DFES) to clarify their response. The response received from WA Police is described above. Of the responses received from the other operators consulted as part of this assessment, no concerns have been raised.

Potential EMI impacts on other services considered in this assessment, including fixed point-to-point links, trigonometrical stations and survey marks, low earth orbit satellites and CB radio, are not expected or are considered to be minor.

DNV notes that the Project is located in an area of high wind farm development activity, with other proposed wind farms located nearby. The potential cumulative impacts of the Project in conjunction with the nearby wind farms have not been considered in detail in this assessment. However, for services where impact from the Project itself is considered either unlikely or non-existent, it is generally expected that cumulative impacts will be minimal or non-existent.

Summary of EMI assessment results for the proposed Project

Licence or service type	Results of DNV assessment	Stakeholder feedback (to date)	Expected impact	Potential mitigation options
Radio-communication towers	3 towers within 2 km of proposed turbine locations, operated by: Western Australia Police (WA Police) St John Ambulance Western Australia Shire of West Arthur Department of Fire and Emergency Services of WA (DFES) Telstra Limited	WA Police: concerns raised regarding point-to-point links and further assessment of impacts and mitigation options has been requested. DFES: consultation is ongoing. Shire of West Arthur: consultation is planned Other operators: No response received	Point-to-point links: see findings for point-to-point links Point-to-area style communications: see findings for emergency services and mobile phone networks	Point-to-point links: see mitigation for point-to-point links Point-to-area style communication: see mitigation for emergency services and mobile phone networks
Fixed point-to-point links	5 links crossing Project boundary, operated by: Optus Mobile Pty Limited Telstra Limited WA Police Optus Mobile Pty Limited links: no turbines in diffraction zones, 3 turbines in potential reflection/scattering zones, no turbines in potential near-field zones Telstra Limited link: no turbines in diffraction zones, no turbines in potential reflection/scattering zones, no turbines in potential near-field zones WA Police links: no turbines in diffraction zones, 3 and 7 turbines in respective potential reflection/scattering zones, no turbines in potential near-field zones	Optus Mobile Pty Ltd: No concerns raised Telstra Limited: No response received WA Police: No concerns raised regarding diffraction effects. Concerns raised regarding potential reflection and scattering and near-field effects. Further quantitative assessment of impacts and mitigation options requested. Alternatively, 250 m clearance distance advised. Electricity Networks Corporation (Western Power): Advised of a proposed link path crossing the southeastern portion of the Project and recommended that T73 and T74 are not moved further south in order to avoid interference once the link is active.	Telstra Limited link: none Western Power: low likelihood of interference however further consultation regarding the current turbine layout is ongoing Other links: low likelihood of interference through reflection or scattering of signals	Optus Mobile Pty Ltd and Western Power: If required - reroute affected links, install additional towers, replace affected links with alternative technologies Telstra Limited: none required WA Police: mitigation measures are to be determined through consultation with the operator but may include relocating turbines outside of the recommended interference zone
Fixed point-to-multipoint links	144 assignments within 75 km of Project boundary No base stations within 20 km of Project boundary	Western Power: interference is not expected. Water Corporation: no response received	Western Power: Unlikely to cause interference Water Corporation: Potential for interference if link paths cross the Project near turbines	If required – reroute affected links, install additional towers, replace affected links with alternative technologies

Summary of EMI assessment results for the proposed Project (continued)

Licence or service type	Results of DNV assessment	Stakeholder feedback (to date)	Expected impact	Potential mitigation options
Other licence types	Point-to-area style communications: see findings for emergency services, mobile phone networks, radio broadcasting, and television broadcasting	-	-	-
Emergency services	Point-to-point links: 2 Western Australia Police links crossing boundary (see above) Point-to-area style communications: potential for interference for sites within 2 km of proposed turbines	WA Police: concerns raised regarding point-to-area services and further assessment of impacts and mitigation options for point-to-point links has been requested. DFES: consultation is ongoing. Other operators: no response received	Point-to-point links: low likelihood of interference Services from towers within 2 km of turbines: potential for interference Other point-to-area style communications: unlikely to cause interference	Point-to-point links: see mitigation for point-to-point links Point-to-area style communications: if required – increase signal strength from affected tower or alternative towers, install signal repeater, install additional tower
Meteorological radar	Nearest radar: 131 km from Project	Impacts are expected to be manageable	Impacts are expected to be manageable	None required
Trigonometrical stations	Trigonometrical stations and survey marks: unlikely to be affected	No concerns raised	Unlikely to cause interference	None required
Citizen's band radio	Unlikely to be affected	Consultation not considered necessary	Unlikely to cause interference	None required
Mobile phone networks	Telstra services: 1 tower within 2 km of turbines, variable coverage within and surrounding the Project Other services: unlikely to be affected in areas with good coverage, may experience interference in areas with marginal coverage	Optus: No concerns raised Telstra: No response received Consultation is recommended with Vodafone/TPG	Telstra services from towers within 2 km of turbines: potential for interference Other services, including Telstra services from other towers: low likelihood of interference	If required – increase signal strength from affected tower or alternative towers, install additional tower
Wireless internet	Wireless broadband service providers: mobile phone networks, NBN Co NBN: available as a satellite service only	Optus: No concerns raised Telstra: No response received Consultation is recommended with Vodafone/TPG and NBN	Wireless broadband services: see findings for mobile phone networks NBN: none	Wireless broadband services: see mitigation for mobile phone networks NBN: none required

**Summary of EMI assessment results for the proposed Project
(continued)**

Licence or service type	Results of DNV assessment	Stakeholder feedback (to date)	Expected impact	Potential mitigation options
Satellite television and internet	Geostationary satellites: signals from satellites providing services intended for Australian audiences intercepted at two dwellings; signals from satellites providing services intended for international audiences unlikely to be affected Low Earth orbit (LEO) satellites: unlikely to be affected	Geostationary satellites: consultation with operators not considered necessary; DNV recommends engaging with residents or owners of potentially affected dwellings LEO satellites: consultation not considered necessary	Geostationary satellites: potential for interference to satellite signals intended for Australian audiences LEO satellites: none	Geostationary satellites: if required – redirect satellite dish to alternative satellite, install larger or higher-quality satellite dish, change location or height of satellite dish LEO satellites: none required
Radio broadcasting	AM and FM signals: may experience interference in close proximity to turbines Digital radio signals: Project is outside the intended coverage area	Consultation not considered necessary	AM and FM signals: low likelihood of interference Digital radio signals: none	AM and FM signals: if required – install higher-quality antenna at affected location Digital radio signals: none required
Television broadcasting	May experience interference in areas with poor or marginal reception Bunbury transmitter: dwellings in the potential interference zone are unlikely to be receiving signals from this transmitter 17 dwellings (10 host dwellings) in potential interference zone Wagin transmitter dwellings in the potential interference zone are unlikely to be receiving signals from this transmitter 15 dwellings (13 host dwellings) in potential interference zone	Consultation recommended but not undertaken	Low likelihood of interference, as dwellings may not be currently receiving a signal	If required – re-align antenna at affected dwelling to existing tower, re-direct antenna to alternative tower, install more directional or higher gain antenna, change location of antenna, install cable or satellite television, install relay transmitter

1 INTRODUCTION

West Arthur Energy Pty Ltd (“the Customer”) has commissioned DNV to independently assess the potential electromagnetic interference (EMI) related impacts associated with the proposed West Arthur Wind Farm (“the Project”) in southwest Western Australia. The results of this work are reported here. This document has been prepared in accordance with DNV proposal OPP-00433442-AUMEL-P-01 Issue C, dated 15 December 2025, and is subject to the terms and conditions in that agreement.

In accordance with the National Wind Farm Development Guidelines – Draft (“the Draft National Guidelines”) prepared by the Environment Protection and Heritage Council (EPHC) in July 2010 [1], this assessment investigates the potential EMI impact of the Project on:

- fixed point-to-point links
- fixed point-to-multipoint links
- radiocommunication assets belonging to emergency services
- meteorological radars
- trigonometrical stations
- Citizen’s band (CB) radio
- mobile phone networks
- wireless internet
- satellite television and internet
- broadcast radio and television.

“Radiocommunications” is used as a broad term in this report to encompass all services that rely on microwave or radio frequency electromagnetic waves to transfer information, including those listed above.

2 DESCRIPTION OF THE SITE AND PROJECT

2.1 The site

The Project site is located approximately 90 km east of Bunbury, with Collie being the closest major town approximately 45 km west of the Project. The land at the site is rural and predominantly used for cropping and grazing.

2.2 The Project

2.2.1 Proposed wind farm layout

The Project is proposed to consist of up to 92 wind turbines [2]. A map of the site with the proposed turbine layout is shown in Figure 1, and the coordinates of the proposed turbine locations are presented in Table 7.

2.2.2 Dwelling locations

The locations of dwellings in the vicinity of the Project have been provided by the Customer [3, 4, 5]. There are 29 dwellings located within 5 km of the Project boundary, 16 of which are host dwellings. The coordinates of these dwellings are presented in Table 8, and the dwellings and Project boundary considered in this assessment are shown in Figure 1.

For the purposes of this assessment, DNV has evaluated the potential for EMI-related impacts at identified dwellings within 5 km of the Project boundary. The locations of identified dwellings more than 5 km from the Project boundary have also been shown, where available, but impacts at these dwellings have not been considered in detail.

DNV has not carried out a detailed and comprehensive survey of building locations in the area and is relying on information provided by the Customer. For the purposes of this assessment, DNV has assumed that all considered dwellings are inhabited.

3 REGULATORY REQUIREMENTS

The development of wind farms in Western Australia is governed by the Western Australian Planning Commission's Position Statement on renewable energy facilities ("the WA Position Statement"), published in March 2020 [6]. However, the WA Position Statement does not address the potential for wind farms to cause EMI-related impacts on nearby radiocommunication services.

The EPHC, in conjunction with Local Governments and the Planning Ministers' Council released a draft version of the National Wind Farm Development Guidelines in July 2010 ("the Draft National Guidelines") [1]. The Draft National Guidelines cover a range of issues across the different stages of wind farm development.

In relation to EMI, the Draft National Guidelines provide advice and methodologies to identify likely affected parties, assess EMI impacts, consult with affected parties and develop mitigation steps to address the likely EMI impacts.

Since the WA Position Statement does not provide any guidance on the assessment of EMI-related impacts, DNV considers that the recommendations of the Draft National Guidelines are relevant to the assessment of EMI impacts for wind farms in Western Australia. Therefore, the Draft National Guidelines have been used to inform the methodology adopted for this assessment.

4 EMI CAUSED BY THE PHYSICAL PRESENCE OF WIND TURBINES

4.1 Assessment approach

If not properly designed, wind farms have the potential to interfere with radiocommunication services. Two services that are most likely to be affected are television broadcast signals and fixed point-to-point signals. Terrestrial broadcast signals are commonly used to transmit domestic television, while point-to-point links are used for line-of-sight connections for data, voice, and video. The interference mechanisms are different for each of these and, hence, there are different ways to avoid interference.

The Customer has asked DNV to complete this assessment based upon a layout provided for the Project consisting of up to 92 wind turbines, as outlined in Table 7.

For the purpose of the EMI assessment, a hypothetical turbine with a rotor diameter of up to 184 m, an upper tip height of up to 253 m, and a lower tip height of 59 m has been considered. These dimensions represent the maximum tip height and rotor diameter under consideration for the Project. The results generated based on this turbine configuration will be conservative for all turbine configurations with dimensions that remain inside the turbine envelope by satisfying all of the following criteria:

- a rotor diameter of up to 184 m or less
- an upper tip height of up to 253 m or less
- a lower tip height of 59 m or more.

The Draft National Guidelines recommend that a radial distance of 50 km to 60 km from the centre of a wind farm would normally capture all of the potentially affected services in the area. However, the methodology for assessing the potential radiocommunications interference used in this assessment is to locate all of the radiocommunication towers within approximately 75 km of the proposed Project, and then assess the radiocommunication licences attached to these towers. This reduces the likelihood that radiocommunication links crossing the Project are inadvertently excluded from the assessment.

To conduct the EMI assessment, information regarding radiocommunications licences in the vicinity of the Project was obtained from a copy of the Australian Communications and Media Authority (ACMA) Register of Radiocommunications Licences (RRL) database dated 31 July 2026 [7].

Other services with the potential to experience interference from the Project have also been identified, and the potential for interference to those services assessed. These services include meteorological radars, trigonometrical stations, CB radio and mobile phone networks, wireless internet, broadcast radio, satellite television and internet, and broadcast television.

The Draft National Guidelines recommend that consultation with the relevant operator be undertaken if a turbine is located within 2 km of a radiocommunication site, within the second Fresnel zone of a point-to-point link, or within 250 nautical miles of an aeronautical or meteorological radar site. DNV has consulted with select organisations operating services in the vicinity of the Project, to disseminate basic information on the Project and request feedback from the organisations regarding the Project. The organisations that have been contacted and all responses received to date are summarised in Table 17. Consultation with these operators has been undertaken in two stages:

1. Consultation based on a previous turbine layout consisting of 96 turbines ("the preliminary turbine layout") with a rotor diameter of 184 m and an upper tip height of 253 m.
2. Additional consultation based on a revised turbine layout consisting of 92 turbines ("the current turbine layout") with a rotor diameter of 184 m and an upper tip height of 253 m.

The radiocommunication licences and services with potential to experience interference from the proposed Project are considered in the following sections. Each section contains a brief overview of the relevant technology, followed by an assessment of the identified licences and services in the area around the Project and the expected potential for interference. Details of any potential mitigation options are also included where appropriate.

DNV notes that the Project is located in an area of high wind farm development activity, with other proposed wind farms located nearby. The potential cumulative impacts of the Project in conjunction with the nearby wind farms have not been considered in detail in this assessment. However, for services where impact from the Project itself is considered either unlikely or non-existent, it is generally expected that cumulative impacts will be minimal or non-existent.

4.2 Radiocommunication towers

Wind turbines located close to radiocommunication sites have the potential to cause interference through near-field effects or reflection or scattering of the signals. According to the Draft National Guidelines [1], the near-field zone for a transmission tower can vary from several metres to approximately 720 m depending on the service type. The Draft National Guidelines therefore recommend that any radiocommunication site within 1 km of a proposed turbine location be considered as having the potential to be impacted by near-field effects. The potential for a turbine to cause reflection or scattering of signals also depends on a number of factors, including the service type, the required signal-to-noise ratio for the service, and the distances between the user, transmission tower, and turbine. Since there is no single criterion for potential impact on radiocommunication services due to near-field effects and reflection or scattering, the Draft National Guidelines recommend consulting with the service operator if any turbine is to be located within 2 km of a radiocommunication site.

4.2.1 Locations of radiocommunication towers and potential for interference

From the ACMA RRL database, there are 513 radiocommunication towers within a nominal 75 km of the Project boundary. The locations of these radiocommunication towers relative to the Project are shown in Figure 2.

There are 3 radiocommunication towers located within 2 km of the proposed turbine locations. These towers and the consultation zones recommended by the Draft National Guidelines [1] are shown in Figure 3 based on information obtained from the ACMA RRL database and extracted from aerial or satellite imagery. Each consultation zone includes the rotor radius for turbines with a 184 m rotor diameter, and an additional buffer to account for potential inaccuracies in the tower locations. Where appropriate, the size of the uncertainty buffer in each case has been informed by the deviations between the tower locations given in the ACMA RRL database and the apparent locations determined from aerial or satellite imagery.

Details of the licences associated with these radiocommunication towers are given in Table 1. These licences and services include point-to-point links and point-to-area style communications, comprising land mobile licences used for private mobile telephony (mobile radio) and spectrum licences used for commercial public mobile phone networks.

Table 1 Details of radiocommunication towers located within 2 km of turbines at the proposed Project

Site ID	Operator	Licence/service types	Distance to nearest turbine [m]
29013	Western Australia Police (WA Police)	Point-to-point links Point-to-area (land mobile)	302
	St John Ambulance Western Australia (St John Ambulance WA)	Point-to-area (land mobile)	
	Shire of West Arthur	Point-to-area (land mobile)	
	Department of Fire and Emergency Services of WA (DFES)	Point-to-area (land mobile)	
10017620	Telstra Limited (Telstra)	Point-to-point links Point-to-area (spectrum)	968
132125	WA Police	Point-to-point links Point-to-area (spectrum)	1762
	Telstra	Point-to-area (spectrum)	

The potential for the Project to interfere with point-to-point links through reflection or scattering of signals or near-field effects is discussed further in Section 4.3. For the point-to-point links associated with the radiocommunication towers shown in Table 1, DNV has established potential reflection/scattering and near-field interference zones as described in Sections 4.3.1.2 and 4.3.1.3. Based on these interference zones, it is not expected that the Project will cause interference to the point-to-point links through near-field effects. However, there may be potential for the Project to cause interference to the point-to-point links through reflection or scattering of the signals.

Point-to-area style radiocommunications such as mobile radio and paging systems are typically designed to operate in a range of environments and are generally not affected by the presence of wind turbines any more than other effects such as terrain, vegetation, and other forms of signal obstruction. However, interference caused by reflection or scattering of signals or near-field effects can be a problem if the turbines are located close to the transmission tower. Reference [8] provides general guidance regarding the potential for interference with mobile radio systems, and suggests that a clearance of 500 m from the tower is sufficient to avoid significant impacts due to reflection or scattering of signals. Other references recommend that turbines be kept outside of clearance zones ranging from a distance of 200 m to 1200 m from the tower for these types of services [9]. Previous advice received from mobile phone network operators in Australia has suggested that clearances of between 500 m and 1000 m from their towers may be required to avoid the potential for impacts to mobile phone signals.

Given the proximity of the proposed wind turbine locations to the towers shown in Table 1, there is a potential for the Project to interfere with the associated point-to-area style communications through reflection or scattering of the signals. Near-field zones for these types of systems are typically only a few metres in radius, and so it is considered unlikely that the Project will cause interference to the services associated with these towers through near-field effects.

4.2.2 Stakeholder consultation

DNV has contacted WA Police, St John Ambulance WA, DFES, and Telstra to determine the likelihood that the proposed Project will cause interference to their services through near-field effects or reflection or scattering of signals. Consultation with the Shire of West Arthur is planned to be undertaken at a later stage.

As summarised in Table 17, a response has been received from WA Police based on the preliminary turbine layout. The response raised concerns regarding the potential for interference to point-to-point links operated by

WA Police from site ID 29013, through reflection, scattering, and near-field effects. This response is detailed in Section 4.3.2.

The DFES have advised that their services from Site ID 29013 do not currently experience any interference and that if any degradation were to be experienced it would impact the local fire service operations. DFES also advised that they do not have enough information to comment on potential electromagnetic emissions from the turbines and the potential for EMI from such emissions. Despite the large numbers of wind turbines currently installed, DNV is not aware of any cases where EMI impacts have been caused by electromagnetic emissions from wind farms. Given that wind turbines are typically constructed in accordance with standards that are recognised electromagnetic compatibility regulations in Australia, and the nature of turbine design means that any emissions are likely to be counteracted or shielded, it is considered unlikely that electromagnetic emissions from the Project will have an adverse effect on radiocommunications services in the surrounding area. Further consultation with the DFES regarding point-to-area services within the Project boundary is ongoing to understand the potential for interference to those services.

No responses have been received from the remaining operators.

4.2.3 Mitigation options

Potential mitigation options for impacts to the point-to-point links operated by WA Police and Telstra are discussed in Section 4.3.3.

Mitigation measures to avoid potential for impacts to the point-to-area style communications operated by WA Police, St John Ambulance WA, DFES, Telstra and the Shire of West Arthur from the towers at site ID 29013, 10017620 and 132125 would need to be determined in consultation with operators, but may include relocating turbines, increasing the signal strength from the affected tower or alternative towers, or installing additional towers in the vicinity of the Project.

4.3 Fixed licences of point-to-point type

Point-to-point links are often used for line-of-sight connections for data, voice, and video. Such links often exist on mobile phone and television broadcast towers. The frequency of common microwave signals varies from approximately 1 GHz to 30 GHz.

Wind turbines can potentially cause interference to point-to-point microwave links and, in some cases, point-to-point ultra high frequency (UHF) links through three mechanisms: diffraction of the signal, reflection or scattering of the signal, and near-field effects. It is generally possible to design around these issues as the link paths and potential interference zones for these signals can be determined.

4.3.1 Locations of point-to-point links and potential for interference

DNV has analysed the registered licences for each radiocommunication tower according to the ACMA RRL database to determine the transmission paths of the licenced links. For this analysis, DNV has used a wider and more conservative frequency range of 0 GHz to 50 GHz.

Each individual link identified in this assessment was given a unique identifier or “Assignment ID” so that it could be readily distinguished. This Assignment ID was taken as either the Device Registration ID (for spectrum licences associated with the use of certain frequency band within a particular geographic area) or the EFL ID (for apparatus licences associated with the use of a particular device).

The links paths associated with the analysed towers are shown in Figure 4. It can be seen that not all of the identified transmission towers have a fixed licence of point-to-point type transmission vector. Some towers have

no active licences associated with them, and some towers are used solely for point-to-area style transmissions, such as some emergency services towers.

There are five point-to-point links recorded in the ACMA RRL database that pass over the proposed Project boundary, operated by WA Police, Optus Mobile Pty Limited (Optus) and Telstra. The details of the links are provided in Table 9, and the link paths are shown in greater detail in Figure 5 based on information obtained from the ACMA RRL database and extracted from aerial or satellite imagery. To simplify reporting, each link has been assigned a unique identifier (e.g. Link #1) so that it can be easily distinguished.

The potential interference mechanisms and interference zones established by DNV for these links are described in Sections 4.3.1.1, 4.3.1.2, and 4.3.1.3, and summarised in Section 4.3.1.4.

4.3.1.1 Interference caused by diffraction

The potential for interference to a fixed point-to-point link through diffraction or obstruction of the signal can usually be avoided by keeping clear of an exclusion zone of circular cross-section around the link path from the transmitter to the receiver [1, 10, 11], typically defined in terms of the Fresnel zones for the link. The n th Fresnel zone is comprised of all points for which, if the signal travelled in a straight line from the transmitter to the point and then to the receiver, the additional length compared to the straight transmitter-receiver path equals $\frac{n - \lambda}{2}$, where λ = wavelength.

The radius of the n th Fresnel zone varies along the length of the signal, and is given by:

$$R_{Fn} = \sqrt{\frac{n\lambda d_1 d_2}{D}}$$

where d_1 is the distance from the transmitter

d_2 is the distance from the receiver

D is the distance from the transmitter to receiver, such that $d_1 + d_2 = D$

To avoid interference to point-to-point links caused by signal diffraction, wind turbines, including the blades, should be kept outside of an exclusion zone based on either the second Fresnel zone as recommended in [10], or potentially 60% of the first Fresnel zone for links below 1,000 MHz with a clear line of sight as suggested in [8]. For each of the links crossing the proposed Project boundary, DNV has established a diffraction exclusion zone based on the second Fresnel zone for that link.

It is common practice to have multiple Assignment IDs for the same physical link to cover practicalities such as licensing for sending or receiving signals. Accordingly, the second Fresnel zone for each link has been calculated based on the Assignment ID with the lowest frequency.

The potential diffraction exclusion zones in the horizontal plane are shown in Figure 5. Each exclusion zone includes the rotor radius for turbines with a 184 m rotor diameter, and an additional buffer to account for potential inaccuracies in the tower locations. Where appropriate, the size of the uncertainty buffer in each case has been informed by the deviations between the tower locations given in the ACMA RRL database and the apparent locations determined from aerial or satellite imagery.

The results of this analysis are summarised in Table 2.

As shown in Figure 5, there are no turbines located within the diffraction exclusion zone for the point-to-point links passing over proposed Project site. Therefore, it is not expected that the Project will cause interference to the point-to-point links through diffraction of the signals.

4.3.1.2 Interference caused by reflection or scattering

Interference due to reflection or scattering of a fixed point-to-point link can occur when the signal produced by the transmitting antenna is reflected, scattered, or re-radiated by an intervening object into the corresponding receiver antenna. If the reflected or scattered signal is sufficiently strong that the ratio of the direct signal to the indirect signal is lower than the required carrier-to-interference (C/I) ratio, or protection ratio, for the link, the link performance can be degraded. The extent to which an object such as a wind turbine will reflect or scatter electromagnetic waves is characterised by its radar cross section (RCS) [10].

Reference [10] describes a methodology for calculating the C/I ratio that might be expected at a receiver in the presence of a reflected or scattered signal from a wind turbine at a specified location. By evaluating the C/I ratio for incremental changes in the distances between the transmitter, receiver, and wind turbine, and comparing this to the required C/I ratio, a potential interference zone can be defined.

For each of the identified links with a transmission tower near the proposed turbine locations, DNV has established a reflection/scattering interference zone based on the antenna gains and length of the link, the worst-case RCS for the turbine calculated according to the equation proposed in [12], and an assumed minimum C/I ratio of 20 dB [12]. The radiation patterns for the antennas were approximated using the reference radiation patterns given in the International Telecommunication Union (ITU) Recommendation F.699-8 [13].

The potential reflection/scattering interference zones are shown in Figure 5. Each interference zone includes the rotor radius for turbines with a 184 m rotor diameter, and an additional buffer to account for potential inaccuracies in the tower locations. Where appropriate, the size of the uncertainty buffer in each case has been informed by the deviations between the tower locations given in the ACMA RRL database and the apparent locations determined from aerial or satellite imagery. For comparison, Figure 5 also shows the 2 km radius consultation zones for reflection or scattering effects as recommended by the Draft National Guidelines, centred on the transmission towers for the point-to-point links crossing the Project boundary.

The results of this analysis are summarised in Table 2.

There are three turbines located within the potential reflection/scattering interference zone for the point-to-point links operated by Optus. There are three and seven turbines located within the reflection/scattering interference zones for the two point-to-point links operated by WA Police.

Nevertheless, DNV notes that the reflection/scattering interference zones shown in Figure 5 are approximations only and may be overly conservative [1]. This is especially true for high frequency links where increased antenna directionality (or gain) and narrower scatter regions can make the signal less susceptible to interference caused by reflection or scattering [8]. The turbine RCS and C/I ratios used to establish the interference zones were based on recommendations developed on behalf of the United Kingdom telecommunications regulator Ofcom [12], and may not be appropriate for point-to-point links operating in Australia. Uncertainties are also associated with the assumptions used to derive the Ofcom recommendations, and the use of ITU reference radiation patterns rather than the actual radiation patterns for the transmitting and receiving antennas. To account for these uncertainties, DNV recommends contacting the operators of the point-to-point links crossing the proposed Project boundary, as described in Section 4.3.2, to seek their feedback on the potential for the Project to cause interference to those links through reflection or scattering of the signals.

4.3.1.3 Interference caused by near-field effects

The potential for interference to fixed point-to-point links caused by near-field effects can generally be avoided by keeping clear of the near-field zone for the transmitting or receiving antenna. Within the near-field zone, local inductive and capacitive effects are significant and it is difficult to predict the potential impacts of other objects on the transmitted or received signal. Although the near-field distance typically varies with direction relative to the link

path, for most practical purposes the near-field zone can be approximated as a sphere centred on the transmitting or receiving antenna.

Reference [10] presents an equation for estimating the radius of the near-field zone for a point-to-point link from the properties of the transmitting or receiving antenna.

For each of the identified links with a transmission tower located near the proposed turbine locations, DNV has established a near-field interference zone based on the operating frequency and antenna gain for that link.

The potential near-field interference zones are shown in Figure 5. Each interference zone includes the rotor radius for turbines with a 184 m rotor diameter, and an additional buffer to account for potential inaccuracies in the tower locations. Where appropriate, the size of the uncertainty buffer in each case has been informed by the deviations between the tower locations given in the ACMA RRL database and the apparent locations determined from aerial or satellite imagery.

The results of this analysis are summarised in Table 2.

There are no turbines located within the near-field interference zones for any of the point-to-point links passing over the proposed Project boundary. Therefore, it is not expected that the Project will cause interference to the point-to-point links through near-field effects.

4.3.1.4 Summary of point-to-point interference effects

Table 2 summarises the turbines located within the calculated diffraction, reflection/scattering, and near-field interference zones for each of the point-to-point links crossing the Project boundary.

Table 2 Details of turbines located within the interference zones established by DNV for point-to-point links crossing the proposed Project boundary

Link no.	Operator	Turbines within potential interference zone			
		Diffraction Horizontal plane	Diffraction Vertical plane	Reflection/ scattering	Near-field
1	Optus	None	None	T79, T82 and T88	None
2	Optus	None	None	T79, T82 and T88	None
3	Telstra	None	None	None	None
4	WA Police	None	None	T93, T94 and T95	None
5	WA Police	None	None	T49, T75, T84, T89, T92, T93, T97	None

4.3.2 Stakeholder consultation

DNV has contacted the operators of the point-to-point links crossing the proposed Project boundary to determine the likelihood that the proposed Project will cause interference to their operations and services through diffraction, reflection or scattering, or near-field effects.

As summarised in Table 17, Optus have not raised any concerns regarding their point-to-point links.

Based on the preliminary turbine layout, WA Police have raised concerns about potential interference to their point-to-point links caused by near-field and reflection and scattering effects, but noted that diffraction effects are not expected to be an issue. Specifically, WA Police raised concerns regarding turbines 89, 92, 93 and 94 and requested that further quantitative assessment of the expected impacts and an investigation of mitigation

measures be undertaken. WA Police advised that, in general, a separation distance of 250 m between their point-to-point links and turbines would provide reasonable confidence that minimal interference will be experienced.

No response has been received from Telstra to date.

Through consultation in relation to their point-to-multipoint licences and based on the preliminary turbine layout, Western Power advised of a planned point-to-point link that crosses the southeastern portion of the Project, south of T73 and T74. Western Power advised that moving turbines further south in the Project may increase the potential for interference to the planned link path. In the current turbine layout T73 has been moved southwest compared to the preliminary turbine layout. However, based on the figures shown in Western Power's previous response, it is not expected that this adjustment will impact the proposed link path. The current turbine layout has been shared with Western Power for their review, but no response has been received to date.

4.3.3 Mitigation options

To address the potential for interference to the WA Police point-to-point links crossing the Project, DNV recommends that a quantitative assessment of the expected impacts of reflection and scattering and near-field effects is undertaken, as requested by WA Police. If the assessment shows that the link performance is likely to be adversely affected, mitigation measures would need to be determined through further investigation and consultation with WA Police but may include upgrading the equipment for the affected links, re-routing links via an existing or new tower, or replacing links with alternative communication technologies. Alternatively, turbines 89, 92, 93 and 94 could be relocated to be a minimum distance of 250 m from the point-to-point links and towers as requested by WA Police.

In the event that interference to the other point-to-point links is experienced after the Project is operational, mitigation options may include upgrading the equipment for the affected links, re-routing links via an existing or new tower, or replacing links with alternative communication technologies.

4.4 Fixed licences of point-to-multipoint type

Fixed licences of the point-to-multipoint type are a variation of the point-to-point type. The difference between them is administrative. A point-to-point licence permits communication between two static sites, where the locations of the sites are detailed in the ACMA RRL database. A point-to-multipoint licence allows communication between one or more static sites and multiple points or between the points, and is usually licensed for a defined operational area.

Administratively, the ACMA RRL database details the location of the static station for a fixed licence of the point-to-multipoint type but does not include the remote stations that communicate with the static station. Hence, the paths of the transmission vectors are not readily identifiable.

4.4.1 Locations of point-to-multipoint licences and potential for interference

From the ACMA RRL database, DNV has identified 144 point-to-multipoint Assignment IDs within approximately 75 km of the proposed Project boundary. These licences are shown in Figure 6. The details of the licence holders as given in the ACMA RRL database are provided in Table 10.

There are no point-to-multipoint base stations within 20 km of the Project boundary. However, there are several point-to-multipoint base stations located more than 20 km from the Project.

Wind turbines can cause interference to point-to-multipoint links through the same mechanisms as described for point-to-point links in Section 4.3.1. As such, there may be potential for interference to point-to-multipoint links if those links cross the Project near the turbines. Based on the distances between the point-to-multipoint base stations and the Project, DNV considers it unlikely that any links will be crossing the Project boundary. However,

as it is not possible to know the link paths in a point-to-multipoint network without obtaining further information about the locations of each station in the network, consultation with the relevant operators is needed to determine the potential for interference.

4.4.2 Stakeholder consultation

DNV has contacted the operators of potentially affected base stations identified within approximately 60 km of the Project, to determine the likelihood that the proposed Project will cause interference to their operations and services. As detailed in Table 17, responses have been received from the Bureau of Meteorology and Western Power and no concerns have been raised regarding impacts to point-to-multipoint services.

4.4.3 Mitigation options

In the event that interference to point-to-multipoint links is experienced after the Project is operational, mitigation options may include re-routing the affected links via an existing or new tower, installing additional towers, or replacing the links with alternative communications technologies.

4.5 Other licence types

Besides fixed point-to-point and point-to-multipoint licences, other licence types recorded in the ACMA RRL database include spectrum licences that permit a range of radiocommunications in a specific geographic area and frequency band, private mobile radio and public telecommunications service (PTS) licences, television and radio broadcasting licences, amateur apparatus licences, and aeronautical licences for ground to aircraft communications.

4.5.1 Locations of other licences and potential for interference

DNV has identified a number of other licences in the ACMA RRL database within 75 km of the proposed Project boundary. The locations of these licences and number of associated Assignment IDs for each licence type are shown in Figure 7 and Table 11.

Most of the licences identified can be broadly described as base to mobile station or point-to-area style communications, including commercial and private mobile telephony and radio and television broadcasting. These licence types are generally not affected by the presence of wind turbines any more than other effects such as terrain, vegetation, and other forms of signal obstruction.

The potential for interference to emergency services signals and commercial mobile telephony signals is discussed further in Sections 4.6 and 4.11 respectively, while the potential for interference to radio and television broadcasting services is considered in Sections 4.14 and 4.15.

A number of aeronautical licences, and radiodetermination licences which may be used for aircraft navigation, have been identified. DNV expects that potential impacts to these services will be considered as part of an aviation impact study.

4.6 Emergency services

Licence types operated by emergency services such as state ambulance, police, fire, and rescue services typically comprise fixed point-to-point link and mobile radio communications.

4.6.1 Locations of emergency services licences and potential for interference

DNV has reviewed the ACMA RRL database to identify emergency services with licences for radiocommunication assets operating in the vicinity of the Project. The groups identified are listed in Table 12 along with their contact

details. The nearest licence is associated with a tower located within the site boundary, approximately 302 m from the nearest turbine.

The potential for the turbines at the Project to interfere with emergency services point-to-point links crossing the proposed Project site is discussed in Section 4.3.

All other licences operated by emergency services in the vicinity of the Project are mobile telephony licences used for mobile radio and paging systems. As discussed in Section 4.5, mobile telephony systems are generally not affected by the presence of wind turbines any more than other forms of signal obstruction. Reference [8] provides general guidance regarding the potential for interference with mobile radio systems, and suggests that a clearance of 500 m from the tower is sufficient to avoid significant impacts to these systems. Other references recommend that turbines be kept outside of clearance zones ranging from a distance of 200 m to 1200 m from the tower for point-to-area style services [9].

The potential for interference to mobile telephony services operated by WA Police, St John Ambulance WA and DFES from towers within 2 km of the proposed turbine locations is discussed in Section 4.2.1.

Given the distance of the other emergency services mobile telephony licences from the Project, DNV considers it unlikely that the Project will cause interference to other mobile radio and paging systems operated by emergency services.

4.6.2 Stakeholder consultation

DNV has contacted the operators of emergency services point-to-area style communications operated from towers within 2 km of the proposed turbine locations and the operators of emergency services point-to-point links crossing the Project boundary, to seek feedback regarding the potential for the Project to interfere with their operations and services. The responses received from those operators are discussed in Sections 4.2.2 and 4.3.2 respectively.

DNV has also contacted the operators of other potentially affected emergency services licences identified within approximately 60 km of the Project, to seek feedback on any potential impact that the Project could have on their operations and services. No other responses have been received to date.

4.6.3 Mitigation options

Potential mitigation options for impacts to emergency services point-to-point links crossing the Project boundary are discussed in Section 4.3.3.

Potential mitigation options for impacts to the mobile telephony services operated by WA Police, St John Ambulance WA and DFES from towers within 2 km of the proposed turbine locations are discussed in Section 4.2.3.

As noted above, interference with mobile telephony services operated by other emergency services is considered unlikely. If localised interference to mobile radio or paging system signals is experienced, this can often be mitigated by the user moving a short distance to a new or higher location to receive a clearer signal or by using an external antenna to improve the signal reception. Other mitigation options may include increasing the signal strength from the affected tower or alternative towers, or installing a signal repeater or additional tower on the opposite side of the Project.

4.7 Aircraft navigation systems and radar

DNV expects that a separate aviation impact study will be undertaken to assess the impact of the Project on nearby aviation navigation systems and radar.

4.8 Meteorological radar

The Bureau of Meteorology (“the Bureau”) operates a network of weather radars across Australia consisting of high-resolution Doppler radars and standard weather watch or weather surveillance radars. Operation of the Bureau’s part-time wind finding radar installations ceased in August 2019 [14].

Standard weather watch radars emit pulsed microwave radiation and use reflections or “echoes” of that radiation from water particles in the atmosphere to detect rain and storm activity. Doppler radar installations operate in the same way but are also able to measure the speed of the moving water particles, and therefore can provide information about wind speed and direction [15, 16].

While the uninhibited operation of meteorological radars may not be as critical as aviation radar, there are implications for public safety if severe weather is not predicted or if its approach is masked due to EMI. Because radar installations monitor the current weather situation over a wide area, the information they provide can be used to indicate the possibility and approach of severe storms, tropical cyclones, and flooding events. Wind profile measurements are also used to ensure the safe and economical operation of aircraft and provide an important source of data for the Bureau’s general weather forecasting system.

The optimal coverage area for a weather radar generally extends approximately 200 km from the radar installation at a height of around 3000 m [17, 18], and approximately 100 km at a height of 1000 m [18]. Therefore, wind farms can theoretically impact on weather radar operations when located within several hundred kilometres of an installation. However, due to the curvature of the earth and intervening terrain, the range at or near ground level is generally less.

The World Meteorological Organisation (WMO) currently states that wind turbines should not be located within 5 km of a meteorological radar site, due to the high potential for complete or partial blockage of the radar signal and subsequent loss of weather data [19, 20]. For wind farms located between 5 km and 20 km of a radar, the WMO recommends consultation and analysis to assess the likelihood of turbines causing reflection or scattering of the radar signals or interfering with Doppler velocity measurements. At distances of between 20 km and 45 km, the presence of a wind farm may produce radar echoes or signal clutter that can cause loss of data or be mistaken for rain. Significant impacts are generally not expected for wind farms located more than 45 km from a meteorological radar, since in most cases the turbine will be below the radar scan line of sight. However, the WMO notes that these guidelines are only applicable to typical radar installations in flat terrain and may need to be modified for higher-powered radars or specific situations.

According to the Draft National Guidelines, operators of weather radars within 250 nautical miles (463 km) of the proposed Project should be consulted [1].

4.8.1 Locations of meteorological radars and potential for interference

DNV has identified that the Bureau operates seven weather radars within 250 nautical miles of the proposed Project, with the closest radar located approximately 131 km northwest of the Project at Hopeland. The locations of these radars are shown in Figure 8 and the details of each radar are given in Table 13.

Although the distance between the Project and the nearest Bureau radar is considerably greater than the distances at which the WMO suggests impact may occur, consultation with the Bureau is still required to comply with the Draft National Guidelines and to confirm whether any potential for interference exists.

4.8.2 Stakeholder consultation

DNV has contacted the Bureau regarding the Project to seek feedback on whether interference to their operations and services is likely. Based on an internal assessment of the preliminary turbine layout, the Bureau has advised that the impact of the Project on their operations and services is expected to be manageable under normal

weather conditions. However, the Bureau has noted that a new assessment will be required if any of the proposed Project details, such as the turbine layout or turbine dimensions, are changed. The current turbine layout has been provided to the Bureau for review and no response has been received to date.

4.8.3 Mitigation options

In the event that the Project is expected to obscure signals from meteorological radars, and hence interfere with weather monitoring and predictions for the region, mitigation options would need to be determined through consultation with the Bureau.

According to the WMO, there are currently no automated signal processing techniques available that can be used to effectively filter radar data to remove interference caused by wind farms [20]. However, if analysis indicates there is a potential for the wind farm to cause reflection or scattering of radar signals, the WMO suggests it may be possible to reduce the potential impact through the relocation of individual turbines prior to construction. In situations where the expected interference is limited to signal clutter, the radar operator may also be able to mask these effects in the data or train the users to take the locations of the wind farms into account.

4.9 Trigonometrical stations

A trigonometrical station, also known as a trig point or a trig beacon, is an observation mark used for surveying or distance measuring purposes.

Some trig points may host surveying equipment such as Global Positioning System (GPS) antennas and electronic distance measuring (EDM) devices. EDM devices measure the distance from the trig point to the target object by means of a beam of known velocity which is reflected back to the unit from the target object. Most EDM devices require the target object to be highly reflective and, accordingly, a reflective prism is placed on the target object being surveyed.

The effective range of EDM devices depends on the wavelength bands used. Light wave and infrared systems have an effective range of 3 km to 5 km, and could be intercepted or obstructed by the presence of turbines. However, the potential for impact is considered low as it is likely to be possible to relocate the target to obtain an unobstructed view of the trig point. Microwave systems can measure distances up to 150 km, but such systems are not limited by the line of sight or affected by visibility [21].

Global navigation satellite system (GNSS) technology is also commonly used for surveying and distance measurements, as it enables users to accurately determine their geographic location using positioning and timing information received from satellite signals. Geoscience Australia currently operates several GNSS networks across Australia, including the Australian Regional GNSS Network (ARGN) and the AuScope GNSS network [22]. The ARGN is comprised of 20 permanent GNSS Continuously Operating Reference Stations (CORS) which provide the geodetic framework for the spatial data infrastructure in Australia and its territories. Eight stations from the ARGN form the Australian Fiducial Network (AFN) [23], through which the Geocentric Datum of Australia (GDA) is defined. The ARGN also provides information for the measurement of geological processes and contributes data to the International GNSS Service. Additional geospatial information aimed at enhancing the accuracy and resolution of the National Geospatial Reference System is provided by the AuScope GNSS network of around 100 CORS strategically distributed across the country, and several private and state-based GNSS CORS networks. GNSS stations are typically equipped with EDM devices and GPS receivers, and transmit data to Geoscience Australia or the relevant state authority via phone lines, internet, or satellite communications.

4.9.1 Locations of trigonometrical stations and potential for interference

According to Geoscience Australia [24], there are 12 trig points within 20 km of the Project boundary. Two trig points (Fisher and R 229 T) are located inside the Project boundary approximately 300 m and 469 m south of the

nearest proposed turbine location. The details of these trig points are provided in Table 14 and their locations are illustrated in Figure 9.

There are also 27 permanent survey marks within 2 km of the Project boundary [25] as shown in Figure 10. The closest survey mark is located 292 m west of the nearest turbine.

DNV has reviewed the primary geodetic network of Australia [26] and observed that the Project is located within a first-order triangulation region in the east of the Project and a third-order triangulation region in the west of the Project. First-order triangulation depends on trigonometrical stations of known positions, baselines and heights, with the highest degree of accuracy. Points determined from first-order triangulation are then used for the second-order triangulation network and so forth, with the degree of accuracy decreasing for subsequent networks.

The closest GNSS station is located approximately 56 km east of the Project, at Wagin [27]. Due to the significant distance between the Project and the GNSS station, it is considered unlikely that the Project will cause interference to the GNSS network.

4.9.2 Stakeholder consultation

Although it is unlikely that the trig points in close proximity to the Project host EDM devices or other equipment that may be subject to EMI, DNV has contacted Geoscience Australia to inform them of the Project, and seek feedback regarding whether interference to their systems is possible. As summarised in Table 17, based on the preliminary turbine layout, no concerns have been raised by Geoscience Australia. Further consultation with Geoscience Australia is not considered necessary.

4.10 Citizen's band radio

Citizen's band radio, also known as CB radio, is a class-licensed two-way, short distance communication service that can be used by any person in Australia for private or work purposes. It is commonly used in rural areas for emergency communications, road safety information, communication between recreational travellers, and general conversation. The class licence implies that all users of the CB radio operate within the same frequency range on a shared basis and no individual licence is required.

The CB radio service can be used for voice communication activities, telemetry, and telecommand applications. The radio service operates on two frequency bands, namely the high frequency (HF) band between 26.965 MHz and 27.405 MHz and the ultra-high frequency (UHF) band between 476.425 MHz and 477.400 MHz.

The HF CB radio service was legalised in Australia in the 1970s as a temporary move to switch to UHF CB over the following five years, and transmits signals in either AM (amplitude modulation) or SSB (single side band) transmission mode. The actual range over which the signal is transmitted depends on the antenna used, the terrain, and the interference levels. Over the last decade, the use of the HF CB radio service has declined and has been replaced by UHF CB radio service.

The UHF CB radio service is unique in Australia and uses the FM (frequency modulation) transmission mode. It provides clear communication over 5–20 km and is less susceptible to power line noise. However, the UHF CB radio service requires a clear line-of-sight for a strong signal and is easily hindered by hilly terrain and forested areas. Even in the absence of physical obstructions, UHF CB radio signals generally cannot travel beyond the effective radio horizon, which depends on elevation, antenna height, weather, and atmospheric conditions. If located on a hilltop, CB radio signals can be transmitted over at least 50 km. However, under normal conditions on flat ground, signal range is typically limited to around 5 km. CB repeater stations are often set up on hilltops by community groups and commercial organisations to transmit signals from one channel to another.

No individual or organisation owns or has the right to use a channel exclusively. However, out of the 40 channels available, some of them will be allocated to emergency, telemetry, or repeater inputs.

4.10.1 Locations of CB radio devices and potential for interference

Since users of CB radio services do not require a licence, there is no record of users of the service and their locations and the channels are shared among the users and the repeater stations without a right of protection from interference. Given the limitations of UHF radio signals, CB radio services are typically only intended for local or short-range communications. CB radio signals passing through the Project are likely to be intercepted by existing obstructions such as terrain and vegetation, and there is little evidence in the literature to suggest that wind turbines pose a particular risk of interference to these systems. Therefore, the impact of the Project on CB radio services is expected to be minimal.

4.10.2 Mitigation options

If interference to CB radio signals is experienced by a user, simple steps such as moving a short distance to a new or higher location until the signal strength improves may help to mitigate the impact. CB radio users can also increase their signal range and improve reception by switching their equipment to a higher power setting, using a longer antenna, or increasing the antenna mounting height.

4.11 Mobile phone networks

Mobile phone networks typically operate at frequencies of either between 700 MHz and 900 MHz, or between 1800 MHz and 2600 MHz, however some new services may operate at up to 3500 MHz. At such frequencies, signals may be affected by physical obstructions such as buildings and wind turbines. However, mobile phone networks are designed to operate in such conditions and in most cases, if there is sufficient mobile network coverage and signal strength, the presence of wind turbines is unlikely to cause any interference.

In rural areas, the mobile network coverage may be more susceptible to physical obstructions due to the large distance between the phone towers and the mobile phone user. In that case, it is theoretically possible that wind turbines could cause some interference to the signal. However, there is little evidence in the literature of wind turbines interfering with mobile phone signals, and DNV notes that previous advice received from mobile phone network operators in Australia has generally indicated that they do not expect wind farm developments to interfere with their services provided that appropriate clearances from the mobile phone towers are maintained.

4.11.1 Availability of mobile phone services and potential for interference

DNV has reviewed the locations of mobile phone towers in the vicinity of the proposed Project. The locations of these towers are shown in Figure 11. The nearest mobile phone tower is located approximately 95 m from the Project boundary. The potential for interference to mobile phone services operated by Telstra from towers within 2 km of the proposed turbine locations is discussed in Section 4.2.1.

Mobile phone network coverage maps have been obtained for Optus, Telstra and Vodafone/TPG.

Figure 12 shows the Optus Mobile network coverage for the Project area [28]. 5G coverage is available in scattered areas within the Project boundary and extends beyond it to the southeast, west, and east. 4G coverage is generally strong outside the Project boundary, particularly to the north, southeast, and west.

Figure 13 shows the Telstra network coverage for the Project area [29]. 4G coverage is generally good across the centre and northeastern section of the Project, with patches of no coverage in the southwestern portion of the Project. Coverage surrounds the town of Darkan in the north and extends toward Arthur River northeast of the Project. No 5G coverage is currently available within the Project boundary or its immediate surroundings.

Figure 14 shows the Vodafone/TPG network coverage for the Project area [30]. 5G coverage is available beyond the Project boundaries to the southeast, west, and north. Within the centre and northern portion of the site, 4G coverage is limited and the southern portion of the Project experiences large areas with no coverage.

In general, for areas with good coverage, interference to mobile phone signals is unlikely. However, for areas where the reception is likely to be marginal the possibility for interference exists if a wind turbine intercepts the signal between a mobile phone and the tower.

4.11.2 Stakeholder consultation

DNV has contacted Optus and Telstra to inform them of the proposed Project and to seek feedback on any potential impact that the Project could have on their services. As detailed in Table 17, no concerns have been raised by Optus and no response has been received from Telstra. DNV recommends also contacting Vodafone/TPG to seek feedback on the potential for interference to their services.

4.11.3 Mitigation options

Potential mitigation options for impacts to the mobile phone services operated by Telstra from towers within 2 km of the proposed turbine locations are discussed in Section 4.2.3.

As noted above, interference with other mobile phone signals is considered unlikely. If localised interference is experienced by mobile phone users, this can often be rectified by the user moving a short distance to a new or higher location until the signal improves, or using an external antenna to improve the signal reception. For interference over a larger area, or in cases where it would not be possible or practical for the user to change their location, mitigation options may include increasing the signal strength from the affected tower or alternative towers, or installing an additional tower on the opposite side of the Project.

4.12 Wireless internet

Wireless internet services in Australia include wireless broadband provided by mobile phone network operators and other internet service providers, and fixed wireless or satellite internet services through the National Broadband Network (NBN).

4.12.1 Wireless broadband services

Wireless broadband services allow the user to connect to the internet without the need for a phone line or cable connection. The wireless signals may operate by line of sight between a base station and the user's antenna as part of a point-to-multipoint network, or may use point-to-area style transmissions such as mobile phone networks.

4.12.1.1 Availability of wireless broadband services and potential for interference

Residents in the vicinity of the Project may use wireless broadband services provided by Optus, Telstra, and Vodafone/TPG. These wireless broadband services use the same networks as mobile phone services, and therefore the comments made in Section 4.11.1 are applicable here. Specifically, there is a low theoretical potential for interference in areas with marginal reception if a wind turbine intercepts the signal between a receiver and the tower.

4.12.1.2 Stakeholder consultation

DNV has contacted Optus and Telstra, as discussed in Section 4.11.2, to seek feedback on any potential impact that the Project could have on their services. As detailed in Table 17, no concerns have been raised by Optus and no response has been received from Telstra. DNV recommends also contacting Vodafone/TPG to seek feedback on the potential for interference to their services.

4.12.1.3 Mitigation options

Potential mitigation options for impacts to wireless broadband services operated by Telstra from towers within 2 km of the proposed turbine locations are discussed in Section 4.2.3.

As noted above, interference with other wireless broadband services is considered unlikely. If interference to the wireless broadband services provided by mobile phone networks occurs, the mitigation options given in Section 4.11.3 may be applicable. Specifically, localised interference can often be rectified by the user moving a short distance or using an external antenna to improve signal reception. For interference over a larger area, or in cases where it would not be possible or practical for the user to change their location, mitigation options may include increasing the signal strength from the affected tower or alternative towers, or installing a signal repeater or additional tower on the opposite side of the Project.

4.12.2 National Broadband Network

The NBN is a national wholesale broadband access network, which consists of fixed line, fixed wireless, and satellite internet services.

NBN fixed line services use wired connections to provide internet signals directly to the user. This technology is typically only available in urban areas and is not expected to be affected by wind farm developments.

NBN fixed wireless services are available in many rural and regional areas. The signals operate by line of sight between an NBN tower and the user's antenna, with a range between 14 km and 29 km [31, 32]. Consequently, the signals may be affected by physical obstructions such as terrain, vegetation, and wind turbines [33].

For rural and remote users in areas that are not able to receive fixed line or fixed wireless services, NBN satellite internet signals are available from the NBN Sky Muster I and II satellites.

4.12.2.1 Availability of NBN services and potential for interference

The NBN website [34] indicates that the network is currently only available as a satellite internet service using the NBN SkyMuster I and II satellites in the areas surrounding the Project.

The potential for interference to satellite internet signals from the NBN Sky Muster I and II satellites is considered in Section 4.13.

4.13 Satellite television and internet

In some rural or remote areas, television and internet access can only be provided through satellite signals. There are two types of satellite that are typically used to provide commercial telecommunication services: geostationary satellites and low Earth orbit (LEO) satellites.

4.13.1 Geostationary satellite communication services

Geostationary satellites orbit the earth directly above the equator, at a height of 35,786 km above the Earth's surface [35]. At this altitude, the satellites travel at the same rate as the Earth's rotational speed and therefore appear to remain stationary at the same point in the sky relative to an observer at a fixed location. Additionally, due to their high altitude, each satellite can view (and therefore provide coverage to) a large portion of the Earth's surface. Geostationary orbits are typically used for weather monitoring satellites that continually observe a specific area of the Earth and for satellites that provide telecommunication services, since the satellite dish or antenna used on Earth to receive and transmit signals can be permanently pointed to the correct location in the sky. Both satellite television and satellite internet services are currently available in Australia via geostationary satellites.

Satellite television signals are delivered via a geostationary communication satellite to a satellite dish connected to a set-top box. Satellite television signals are typically transmitted to the user's antenna in one of two frequency

bands: the C-band between 4 GHz and 8 GHz, or the Ku-band between 12 GHz and 18 GHz. Signals in the C-band are susceptible to interference due to radio relay links, radar systems, and other devices operating at a similar frequency. Signals in the Ku-band are most likely to be affected by rain which acts as an excellent absorber of microwave signals at this frequency. The main geostationary satellites that transmit Australian free-to-air or subscription television channels are the Optus C1, D1, and D3 satellites and the Intelsat 19 satellite [36, 37].

In the case of internet services provided by geostationary satellites, the user's computer is connected to a satellite modem which is in turn linked to a satellite dish or antenna mounted on the building roof. When the user accesses the internet, a request is sent to the operation centre of the satellite internet provider via the satellite antenna. Data is then sent back to the user's computer via the same path as shown in the figure below. Satellite internet signals are typically transmitted in the Ku-band, as for satellite television, or the Ka-band, with frequencies ranging from 26.5 GHz to 40 GHz. Like signals in the Ku-band, signals in the Ka-band are susceptible to deterioration caused by moisture in the air, but newer satellites contain technologies that help to minimise the loss of signal quality associated with rain and other weather conditions. The main geostationary satellites for providing satellite internet in Australia are the IPSTAR (THAICOM-4) and Optus D2 satellites, and the NBN Sky Muster I and II satellites.



Two-way connection to the internet via satellite [38]

4.13.1.1 Locations of geostationary satellite vectors and potential for interference

Due to marginal coverage of some communication services, some residents in the vicinity of the Project may use satellite television and internet.

A number of satellites transmit television and internet signals that can be received in Australia. Although only a small number of satellites are likely to be providing services specifically intended for Australian audiences, DNV has considered the line of sight to dwellings in the vicinity of the Project from all theoretically viewable satellites.

The results of this analysis are shown in Table 15 and summarised in Table 3. Based on these results, turbines at the Project may intercept signals from one satellite (NSS 9) at two nearby dwellings, of which both are host dwellings. DNV understands that the NSS 9 satellite provides services that may be intended for Australian audiences. However, if the residents the identified dwellings do not use services provided by the NSS9 satellite there will be no potential for impact to that service.

Table 3 Number of satellites with potential for signals to nearby dwellings to be intercepted by the proposed Project

Satellite service	Number of potentially affected satellites	Number of potentially affected dwellings
Services intended for Australian audiences	One (NSS 9)	Two (R12 and R13)
Services intended for international audiences	None	None

4.13.1.2 Stakeholder consultation

As discussed in Section 4.13.1.1, two host dwellings have the potential to experience interference to NSS 9 satellite services. DNV recommends that the Customer engages with the occupants of these dwellings prior to construction of the Project to determine whether they are currently inhabited or expected to be inhabited during the lifetime of the Project and whether the residents are currently receiving or intending to receive signals from the NSS 9 satellite, and to establish an understanding of how any impact to those services may be mitigated.

4.13.1.3 Mitigation options

If nearby residents that are currently using television services provided via geostationary satellites experience interference to those services caused by the Project, several mitigation options may be available. If an alternative source of the same programming is available, the satellite dishes at affected dwellings can simply be re-directed to receive signals from the other satellite. In some cases, residents may also be able to access the affected programs directly over the internet. If an alternative source of programming is not available, it may be possible to rectify interference by installing a larger or higher-quality satellite dish, or by changing the height or location of the dish to obtain a stronger signal.

4.13.2 Low Earth orbit satellite communication services

Satellites in LEO occupy heights between 160 km and 1000 km above the Earth's surface [35]. At these altitudes, the satellites travel significantly faster than the Earth's rotational speed and typically complete a full orbit in approximately 90 minutes. Unlike geostationary satellites, LEO satellites do not have to follow a particular path around the Earth and their orbits are usually tilted with respect to the equator. However, due to their low altitude, each satellite can only observe or communicate with a small portion of the Earth's surface at a time and this, together with their fast movement across the sky, can limit the usefulness of LEO satellites in some situations.

For telecommunication applications, satellites in LEO offer lower latency and better performance than geostationary satellites, due to the reduced distance for the signal to travel. However, using a single LEO satellite to provide telecommunication services is often impractical due to the relatively small coverage area and significant effort required to track the satellite from the ground. To compensate for this, LEO satellites used for telecommunications usually operate as part of a large network or "constellation" of multiple satellites that work together to provide continuous coverage to large areas simultaneously. As satellites within the constellation move through the field of view of a satellite dish on Earth, the dish detects and connects to the satellite with the strongest signal and then automatically switches over to another satellite as the first moves out of view. Nevertheless, these services may be sensitive to physical obstructions such as terrain, vegetation, buildings, and other structures such as wind turbines, which can unexpectedly interrupt the signal from the connected satellite and cause the service to temporarily drop out until a new satellite can be found.

4.13.2.1 Availability of low Earth orbit services and potential for interference

Starlink is the only LEO satellite internet service currently available to customers in Australia. The current Starlink LEO constellation consists of several thousand satellites orbiting the Earth at a height of approximately 550 km [39], although this may increase to tens of thousands of satellites in the future. Starlink offers different classes of satellite dishes to users of their services: standard dishes that are considered suitable for most residential

applications, small dishes that are intended for portable use, and high performance dishes that have a wider field of view (enabling the dish to connect to more satellites, even in the presence of obstructions), a higher gain antenna, and improved performance under extreme environmental conditions [40, 41].

In the southern hemisphere, Starlink satellite dishes currently require a relatively clear view of the sky within a field of view of 100° tilted towards the south, with a minimum elevation angle of 25° above the southern horizon [42]. Although some obstructions can be tolerated, the impact of these obstacles will depend on their apparent size, their distance and direction relative to the satellite dish, and the proportion of the sky already obstructed. Obstacles below an elevation angle of 25° in the south, 40° in the east and west, and 40° in the north (allowing for locations where no tilt of the satellite dish is required) will not pose any obstruction to the field of view. However, as more satellites are launched and join the Starlink constellation, it is expected that the required angle of tilt towards the south will reduce until dishes can be pointed directly upwards, with elevation angles above the horizon of 40° in all directions [43], and the service will become less sensitive to obstructions due to the increased number of visible satellites at each location.

DNV has considered the potential for turbines at the Project to obstruct Starlink signals received at nearby dwellings, based on the relative locations of the dwellings and the nearby turbines, the elevations of the dwellings and turbines, and a turbine tip height of 253 m.

At all dwellings in the vicinity of the Project, the turbines are expected to be below an elevation angle of 25° above the horizon in all directions. Therefore, based on this analysis, it is not expected that turbines at the Project will obstruct Starlink signals for any nearby dwellings.

4.14 Radio broadcasting

Radio stations typically broadcast using one of two forms of transmission: either amplitude modulation (AM) or frequency modulation (FM). In Australia, AM radio operates in the medium wave (MW) band at frequencies between 520 kHz and 1610 kHz, while FM radio operates in the very high frequency (VHF) band between 87.5 MHz and 108 MHz.

4.14.1 AM radio

AM radio signals are diffracted by the ground as they propagate, such that they follow the curvature of the earth, and are also reflected or refracted by the ionosphere at night. This means that AM radio waves are able to travel significant distances under the right conditions. Due to their long wavelength, they can readily propagate around physical obstructions on the surface of the earth (such as wind turbines), however they do not propagate easily through some dense building materials such as brick, concrete, and aluminium.

The distance over which AM radio signals can travel means that the signal may be weak and susceptible to interference by the time it reaches a receiver. Some of the possible sources of interference to AM radio waves include changes in atmospheric conditions, signals from distant AM broadcasters operating on a similar frequency, electrical power lines, and electrical equipment including electric motors.

However, as noted above, the presence of physical obstructions such as turbines is unlikely to cause significant interference to AM radio signals. Due to the long wavelength of the signal, interference is only likely in the immediate vicinity of a turbine [44].

4.14.1.1 Locations of AM transmitters and potential for interference

The locations of AM broadcast transmitters in the vicinity of the Project were determined from the ACMA Broadcast Transmitter Database [45], and are shown in Figure 15.

It is unlikely that any permanent AM radio receivers will be located sufficiently close to the Project to be affected by interference to the radio signals from the turbines.

4.14.1.2 Mitigation options

In the event that localised interference to AM radio signals is experienced, this can potentially be rectified by installing a high-quality antenna or amplifier at the affected residence.

4.14.2 FM radio

FM radio signals are better suited to short range broadcasting. Unlike lower frequency signals (such as AM signals), they are not reflected or refracted off the ionosphere. Instead, the waves are slightly refracted by the atmosphere and curve back towards the earth, meaning they can propagate slightly beyond the visual horizon. However, FM radio signals may be blocked by significant terrain features. FM radio stations therefore tend to have only local coverage, which means that signals are less susceptible to interference from distant FM broadcasters. FM signals are also less susceptible to interference from changes in atmospheric conditions and electrical equipment than AM signals.

FM radio signals are susceptible to interference from buildings and other structures, although they are less vulnerable than higher frequency signals. Interference to FM signals can occur by two mechanisms: reflection or scattering of the radio waves, or physical obstruction and attenuation of the broadcast signal.

Reflection or scattering of radio waves by physical structures such as wind turbines can reduce the signal strength at a receiver or can cause multi-path errors through reception of a reflected signal in addition to the primary signal from the transmitter. This can result in hissing, fluttering, or distortion being heard by the listener [46]. However, this type of interference is typically only experienced in the immediate vicinity (within several tens of metres) of a wind turbine, where the signal-to-noise ratio is low [44, 47].

Wind turbines located close to an FM transmitter may also present a physical obstruction to the radio signal. If the line-of-sight between the transmitter and a radio receiver is blocked by a turbine, this can cause a noticeable decrease in signal quality or may lower the signal strength below the threshold of the receiver's sensitivity [46]. In these situations, the attenuation of the signal may be as great as 2.5 dB in the direction of the obstructing wind turbine. However, this type of interference is generally only a problem near the edges of the FM signal coverage area, where the broadcast signal is already weak. For commercial FM broadcast signals, physical obstruction of the signal may occur if the turbines are located within approximately 4 km of the transmitter [48].

4.14.2.1 Locations of FM transmitters and potential for interference

The locations of FM broadcast transmitters in the vicinity of the Project were determined from the ACMA Broadcast Transmitter Database [45], and are shown in Figure 15.

The closest FM broadcast transmitter is located approximately 39 km from the proposed Project boundary. Therefore, it is considered unlikely that the Project will cause interference to the FM radio signals from this transmitter.

It is unlikely that any permanent FM radio receivers will be located sufficiently close to the Project to be affected by reflection or scattering of the radio signals from the turbines.

4.14.2.2 Mitigation options

In the event that localised interference to FM radio signals is experienced, this can potentially be rectified by installing a high-quality antenna or amplifier at the affected residence.

4.14.3 Digital radio

Digital radio services were introduced in metropolitan licence areas in Australia in July 2009. The digital radio services offered use an updated version of the digital audio broadcasting (DAB) digital radio standard, DAB+, to broadcast digital radio to Adelaide, Brisbane, Perth, Melbourne, and Sydney [49]. Digital radio broadcasts in Australia operate in the VHF band at frequencies between 174 MHz and 230 MHz, and therefore tend to have only local coverage within the visual horizon.

The UK telecommunications regulator Ofcom [46] states that *“In contrast [to FM signals], the signal format used for DAB digital radio is designed to offer high levels of robustness in difficult conditions and it is not materially affected by reflections. FM and DAB reception can be affected where a structure blocks signals and both may cease to function if signals are reduced below a certain threshold”*. DNV has therefore concluded that DAB signals are not affected by reflection or scattering from physical structures in the same way as FM signals, and so digital radio broadcasts are generally not susceptible to interference from wind farm developments. However, interference may be experienced if the line-of-sight between a DAB transmitter and a radio receiver is blocked by a wind turbine.

4.14.3.1 Availability of digital radio services and potential for interference

According to the digital radio coverage search function available on the Australian Broadcasting Corporation website [50], the Project is outside the intended service area for digital radio broadcasts. Since it is therefore unlikely that residents in the vicinity of the Project are currently receiving digital radio signals, it is not expected that the Project will cause interference to these services.

4.15 Terrestrial television broadcasting

Terrestrial television is broadcast in Australia by a number of networks, both public and commercial. As of December 2013, all television broadcasts in Australia are now digital broadcasts [51]. Digital television (DTV) signals are typically more robust in the presence of interference than analogue television signals, and are generally unaffected by interference from wind turbines. DNV has experience in situations where dwellings were able to receive adequate DTV reception in an area of adequate signal strength where the DTV signal was passing through a wind farm.

The susceptibility of DTV signals to interference from wind turbines is discussed further in Section A.1 of Appendix A.

4.15.1 Availability of DTV broadcasting and potential for interference

The locations of DTV broadcast transmitters in the vicinity of the Project were determined from the ACMA Broadcast Transmitter Database [51], and are shown in Figure 15. The main DTV transmitter used by residents in the vicinity of the Project is the Wagin transmitter. However, according to the Australian Government mySwitch website [52], it is also possible that residents in the vicinity of the Project are able to receive DTV signals from other nearby transmitters.

The DTV broadcast transmitters likely to be servicing the area around the Project are summarised in Table 4 below. Coverage maps for these broadcast transmitters are reproduced in Figure 16 to Figure 17.

Table 4 DTV broadcast transmitters servicing the Project area

DTV broadcast transmitter	Signal coverage in the vicinity of the Project	Figure containing coverage map
Wagin	Good to variable coverage in the northeast portion of the Project that increases towards Wagin. Coverage in the southwest direction is intermittent with small patches of good coverage.	Figure 16
Bunbury	Segments of good and variable coverage on the western boundary of the Project that increases towards Bunbury. Coverage on the eastern side of the Project is mostly variable with areas of no coverage.	Figure 17

4.15.1.1 Interference caused by large scale effects

For broadcast signals, large scale interference can generally be avoided by placing the wind turbines at some distance from the transmitter. Broadcast transmitters may be either relay or primary transmitters. Relay transmitters are more commonly found in rural areas. Primary transmitters are higher power and are more commonly located near large urban areas. A clearance of at least 1 km is recommended for relay transmitters, while a clearance of at least 6 km is recommended for primary transmitters [11].

The closest DTV transmitter to the Project is the Wagin primary transmitter, which is approximately 44 km away. Therefore, it is considered unlikely that the Project will cause large scale interference to signals from this transmitter.

4.15.1.2 Interference caused by reflection or scattering

Although DTV signals are generally unlikely to be susceptible to interference from wind turbines in areas of adequate coverage, interference could be encountered in areas where coverage is marginal and antennas at dwellings may receive a reflected signal from a turbine that is of sufficient power to interfere with the signal received directly from the transmitter. Based on the coverage maps for the area around the Project, it is possible that some areas could be deemed to have marginal reception and interference could be encountered.

Due to the lack of an accurate theoretical scattering model, DNV has not performed detailed scatter calculations to predict DTV interference. Instead, dwellings that have increased potential to receive back-scattered or forward-scattered signals from a turbine at the Project (assuming an antenna with a sufficiently narrow beam width and sufficiently high front-to-back ratio is being used) have been highlighted using the 'keyhole' approach described in Section A.3 of Appendix A, with a forward-scatter distance of 5 km and a back-scatter distance of 500 m.

The results of the analysis can be seen in Table 16 and Figure 16 to Figure 17. The dwellings most likely to be susceptible to interference include those within the possible interference zones, as summarised in Table 5.

Note that if the signal received at a dwelling from the transmitter is sufficiently weak, or an antenna with insufficient directional discrimination is installed (i.e., a low gain or omni-directional antenna), interference may still occur at dwellings outside of the identified interference zones. Circumstances under which interference may occur outside the interference zones typically established using the 'keyhole' approach are discussed further in Section A.2 of Appendix A.

In particular, although DNV has considered the potential for interference to DTV signals at dwellings within 5 km of the proposed turbine locations, previous advice received from BAI Communications, who are responsible for broadcasting of national public television services in Australia, has indicated that interference to DTV broadcasting may be experienced at distances of up to 10 km from turbines. For comparison, Figure 16 and Figure 17 also show the area within 10 km of the proposed turbine locations. DNV recommends contacting BAI

Communications, as discussed in Section 4.15.2, to confirm the potential for interference to DTV signals received at dwellings outside the 'keyhole' interference zones.

Table 5 Number of dwellings located within potential interference zones for digital television broadcast transmitters in the vicinity of the Project

DTV broadcast transmitter	Number of dwellings in potential interference zone	Signal coverage in potential interference zone
Wagin	15 (13 host dwellings)	Variable - most dwellings in the potential interference zone are unlikely to be receiving signals from this transmitter.
Bunbury	17 (10 host dwellings)	Variable – most dwellings in the potential interference zone are unlikely to be receiving signals from this transmitter

The method used here to assess the potential interference to television signals from the Project represents a simplified approach which is expected to capture locations where interference is most likely to occur. This simplified analysis is deemed appropriate in most cases as the implications of potential television interference are typically low. If reception difficulties are encountered, there are a number of mitigation options available as discussed in further detail in Section 4.15.3.

4.15.2 Stakeholder consultation

DNV recommends contacting BAI Communications, who are responsible for broadcasting of national public television services in Australia, to inform them of the proposed Project and seek feedback on any potential impact that the Project could have on DTV signals in the surrounding area.

4.15.3 Mitigation options

In the event that DTV interference is experienced at nearby dwellings as a result of the Project, potential mitigation options may include:

1. Realigning the user's television antenna more directly towards their existing transmitter.
2. Tuning the user's antenna into alternative sources of the same television signal or a substitute signal.
3. Installing a more directional or higher gain antenna at the affected dwelling.
4. Relocating the antenna to a less affected position.
5. Installing cable or satellite television at the affected dwelling.
6. Installing a television relay transmitter.

In the event of significant interference in the backscatter region, realigning the antenna or installing a more directional antenna should ensure a stronger signal from the transmitter since the backscattered signal will originate from a different direction. However, the effectiveness of this mitigation may be reduced if there is no clear line of sight from the antenna to the transmitter. In these cases, it may be more effective to move the antenna to a location where there is a clearer line of sight to the transmitter or to tune the antenna into an alternative or substitute signal (if one is available).

In the case of forward scatter, the antenna will be pointed towards both the original and scattered signal and hence a more aligned or directional antenna may not alleviate a forward scatter issue. Alternative mitigation measures to resolve issues caused by forward scatter could include tuning the antenna into an alternative signal (if one is available) or installing cable or satellite television at the affected dwelling. However, as noted in [53], DVB-T reception quality may not be substantially affected in the forward scatter region.

The ITU [54] identified that the receiver height can also affect interference. In areas that are relatively flat and free of vegetation, reflections can enhance or decrease the received signal strength relative to the free path signal

strength. The ITU found that the received signal strength may not increase monotonically with receiver height. In other words, lowering the receiver height can improve reception in some cases.

In the event that terrestrial DTV reception is reduced, satellite television represents another potential amelioration option. Satellite based television comprises of both free to air and subscription-based broadcasts. Residents in areas which are unable to receive DTV through their normal television antenna due to local interference, terrain, or distance from the transmitter in their area may be eligible to access the Australian Government funded Viewer Access Satellite Television (VAST) service [55].

5 CONCLUSIONS

Broadcast towers and transmission paths around the Project were investigated to determine if EMI would be experienced as a result of the development and operation of the Project. The Project will involve the installation of up to 92 wind turbine generators. DNV has considered a turbine geometry that will be conservative for turbine configurations with dimensions satisfying all of the following criteria: a rotor diameter of up to 184 m or less, an upper tip height of 253 m or less, and a lower tip height of 59 m or more.

The results of this assessment are summarised in Table 6.

There is potential for the Project to interfere with point-to-area communications, including public mobile phone services and emergency services communications, hosted on three radiocommunication towers located within 2 km of the proposed turbine locations. Consultation with the relevant service operators - Western Australia Police (WA Police), St John Ambulance Western Australia, the Department of Fire and Emergency Services of WA and Telstra Limited is ongoing. Consultation with the Shire of West Arthur is planned to be undertaken at a later stage.

Through consultation, WA Police have raised concerns about the potential for interference to their point-to-area communications hosted on towers in the vicinity of the proposed turbine locations, and their point-to-point links crossing the Project site. To address the potential for interference to these services, DNV recommends that a quantitative assessment of the expected impacts of reflection and scattering and near-field effects is undertaken, as requested by WA Police. If the assessment shows that the performance of these services is likely to be adversely affected, mitigation measures would need to be determined through further investigation and consultation with WA Police but may include upgrading the equipment for the affected links, re-routing links via an existing or new tower, or replacing links with alternative communication technologies. Alternatively, turbines 89, 92, 93 and 94 could be relocated to be a minimum distance of 250 m from the point-to-point links and towers as requested by WA Police.

Based on a preliminary turbine layout, Electricity Networks Corporation (Western Power) advised of a planned point-to-point link that crosses the southeastern portion of the Project, south of T73 and T74, and advised that moving turbines further south in the Project may increase the potential for interference to the planned link path. In the current turbine layout T73 has been moved southwest compared to the preliminary turbine layout. However, based on the figures shown in Western Power's previous response it is not expected that this adjustment will impact the proposed link path. The current turbine layout has been shared with Western Power for their review and feedback.

Turbines at the Project may interfere with other point-to-area style services such as mobile phone signals, radio broadcasting, and terrestrial television broadcasting, particularly in areas with poor or marginal signal coverage. Dwellings within approximately 5-10 km of the Project that are currently receiving weak signals from the Bunbury and Wagin television broadcast transmitters may experience interference to those services. However, coverage maps indicate that most dwellings within the potential interference zones are unlikely to receive signals from these transmitters. If interference to these services is experienced, a range of options are available to rectify difficulties.

Interference to signals from a geostationary satellite (NSS 9) that transmits programs intended for Australian audiences is possible at two nearby dwellings. DNV recommends that the Customer engages with the occupants of these dwellings prior to construction of the Project to determine whether the residents are currently receiving or intending to receive signals from the NSS 9 satellite, and to establish an understanding of how any impacts to those services may be mitigated.

Since it is not possible to determine the potential EMI impacts on point-to-multipoint links, emergency services, wireless internet services, and meteorological radar without obtaining further information from the relevant operators, DNV has consulted with organisations operating services that may be affected by the Project. The

Bureau of Meteorology (the Bureau) has advised that impacts to their radar are expected to be manageable. Consultation is ongoing with the Department of Fire and Emergency Services of WA (DFES) to clarify their response. The response received from WA Police is described above. Of the responses received from the other operators consulted as part of this assessment, no concerns have been raised.

Potential EMI impacts on other services considered in this assessment, including fixed point-to-point links, trigonometrical stations and survey marks, low earth orbit satellites and CB radio, are not expected or are considered to be minor.

DNV notes that the Project is located in an area of high wind farm development activity, with other proposed wind farms located nearby. The potential cumulative impacts of the Project in conjunction with the nearby wind farms have not been considered in detail in this assessment. However, for services where impact from the Project itself is considered either unlikely or non-existent, it is generally expected that cumulative impacts will be minimal or non-existent.

Table 6 Summary of EMI assessment results for the proposed Project

Licence or service type	Results of DNV assessment	Stakeholder feedback (to date)	Expected impact	Potential mitigation options
Radio-communication towers	3 towers within 2 km of proposed turbine locations, operated by: Western Australia Police (WA Police) St John Ambulance Western Australia Shire of West Arthur Department of Fire and Emergency Services of WA Telstra Limited	WA Police: concerns raised regarding point-to-point links and further assessment of impacts and mitigation options has been requested. DFES: consultation is ongoing. Shire of West Arthur: consultation is planned Other operators: No response received	Point-to-point links: see findings for point-to-point links Point-to-area style communications: see findings for emergency services and mobile phone networks	Point-to-point links: see mitigation for point-to-point links Point-to-area style communication: see mitigation for emergency services and mobile phone networks

**Table 6 Summary of EMI assessment results for the proposed Project
(continued)**

Licence or service type	Results of DNV assessment	Stakeholder feedback (to date)	Expected impact	Potential mitigation options
Fixed point-to-point links	5 links crossing Project boundary, operated by: Optus Mobile Pty Limited Telstra Limited Western Australia Police Optus Mobile Pty Limited links: no turbines in diffraction zones, 3 turbines in potential reflection/scattering zones, no turbines in potential near-field zones Telstra Limited link: no turbines in diffraction zones, no turbines in potential reflection/scattering zones, no turbines in potential near-field zones Western Australia Police links: no turbines in diffraction zones, 3 and 7 turbines in respective potential reflection/scattering zones, no turbines in potential near-field zones	Optus Mobile Pty Ltd: No concerns raised Telstra Limited: No response received Western Australia Police: No concerns raised regarding diffraction effects. Concerns raised regarding potential reflection and scattering and near-field effects. Further quantitative assessment of impacts and mitigation options requested. Alternatively, 250 m clearance distance advised. Electricity Networks Corporation (Western Power): Advised of a proposed link path crossing the southeastern portion of the Project and recommended that T73 and T74 are not moved further south in order to avoid interference once the link is active.	Telstra Limited link: none Western Power: low likelihood of interference however further consultation regarding the current turbine layout is ongoing Other links: low likelihood of interference through reflection or scattering of signals	Optus Mobile Pty Ltd and Western Power: If required - reroute affected links, install additional towers, replace affected links with alternative technologies Telstra Limited: none required Western Australia Police: mitigation measures are to be determined through consultation with the operator but may include relocating turbines outside of the recommended interference zone

**Table 6 Summary of EMI assessment results for the proposed Project
(continued)**

Licence or service type	Results of DNV assessment	Stakeholder feedback (to date)	Expected impact	Potential mitigation options
Fixed point-to-multipoint links	144 assignments within 75 km of Project boundary No base stations within 20 km of Project boundary	Western Power: interference is not expected. Water Corporation: no response received	Electricity Networks Corporation (Western Power): Water Corporation: Unlikely to cause interference to existing services. Further consultation required to understand the potential for interference based on the current turbine layout. Water Corporation: Potential for interference if link paths cross the Project near turbines	If required – reroute affected links, install additional towers, replace affected links with alternative technologies
Other licence types	Point-to-area style communications: see findings for emergency services, mobile phone networks, radio broadcasting, and television broadcasting	-	-	-
Emergency services	Point-to-point links: 2 Western Australia Police links crossing boundary (see above) Point-to-area style communications: potential for interference for sites within 2 km of proposed turbines	WA Police: concerns raised regarding point-to-area services and further assessment of impacts and mitigation options for point-to-point links has been requested. DFES: consultation is ongoing. Other operators: no response received	Point-to-point links: low likelihood of interference Services from towers within 2 km of turbines: potential for interference Other point-to-area style communications: unlikely to cause interference	Point-to-point links: see mitigation for point-to-point links Point-to-area style communications: if required – increase signal strength from affected tower or alternative towers, install signal repeater, install additional tower
Meteorological radar	Nearest radar: 131 km from Project	Impacts are expected to be manageable	Impacts are expected to be manageable	None required
Trigonometrical stations	Trigonometrical stations and survey marks: unlikely to be affected	No concerns raised	Unlikely to cause interference	None required
Citizen's band radio	Unlikely to be affected	Consultation not considered necessary	Unlikely to cause interference	None required

**Table 6 Summary of EMI assessment results for the proposed Project
(continued)**

Licence or service type	Results of DNV assessment	Stakeholder feedback (to date)	Expected impact	Potential mitigation options
Mobile phone networks	Telstra services: 1 tower within 2 km of turbines, variable coverage within and surrounding the Project Other services: unlikely to be affected in areas with good coverage, may experience interference in areas with marginal coverage	Optus: No concerns raised Telstra: No response received Consultation is recommended with Vodafone/TPG	Telstra services from towers within 2 km of turbines: potential for interference Other services, including Telstra services from other towers: low likelihood of interference	If required – increase signal strength from affected tower or alternative towers, install additional tower
Wireless internet	Wireless broadband service providers: mobile phone networks, NBN Co NBN: available as a satellite service only	Optus: No concerns raised Telstra: No response received Consultation is recommended with Vodafone/TPG and NBN	Wireless broadband services: see findings for mobile phone networks NBN: none	Wireless broadband services: see mitigation for mobile phone networks NBN: none required
Satellite television and internet	Geostationary satellites: signals from satellites providing services intended for Australian audiences intercepted at two dwellings; signals from satellites providing services intended for international audiences unlikely to be affected Low Earth orbit (LEO) satellites: unlikely to be affected	Geostationary satellites: consultation with operators not considered necessary; DNV recommends engaging with residents or owners of potentially affected dwellings LEO satellites: consultation not considered necessary	Geostationary satellites: potential for interference to satellite signals intended for Australian audiences LEO satellites: none	Geostationary satellites: if required – redirect satellite dish to alternative satellite, install larger or higher-quality satellite dish, change location or height of satellite dish LEO satellites: none required
Radio broadcasting	AM and FM signals: may experience interference in close proximity to turbines Digital radio signals: Project is outside the intended coverage area	Consultation not considered necessary	AM and FM signals: low likelihood of interference Digital radio signals: none	AM and FM signals: if required – install higher-quality antenna at affected location Digital radio signals: none required

**Table 6 Summary of EMI assessment results for the proposed Project
(continued)**

Licence or service type	Results of DNV assessment	Stakeholder feedback (to date)	Expected impact	Potential mitigation options
Television broadcasting	May experience interference in areas with poor or marginal reception			
	Bunbury transmitter: dwellings in the potential interference zone are unlikely to be receiving signals from this transmitter			
	17 dwellings (10 host dwellings) in potential interference zone	Consultation recommended but not undertaken	Low likelihood of interference, as dwellings may not be currently receiving a signal	If required – re-align antenna at affected dwelling to existing tower, re-direct antenna to alternative tower, install more directional or higher gain antenna, change location of antenna, install cable or satellite television, install relay transmitter
	Wagin transmitter dwellings in the potential interference zone are unlikely to be receiving signals from this transmitter			
	15 dwellings (13 host dwellings) in potential interference zone			

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APPENDIX A – TELEVISION INTERFERENCE CAUSED BY REFLECTION OR SCATTERING OF SIGNALS

A.1 Susceptibility of DTV signals to reflection or scattering

The United Kingdom telecommunications regulator Ofcom [46] states the following with regard to interference to DTV reception:

“Digital television signals are much better at coping with signal reflections, and digital television pictures do not suffer from ghosting. However a digital receiver that has to deal with reflections needs a somewhat higher signal level than one that has to deal with the direct path only. This can mean that viewers in areas where digital signals are fairly weak can experience interruptions to their reception should new reflections appear... reflections may still affect digital television reception in some areas, although the extent of the problem should be far less than for analogue television.”

DNV has drawn two conclusions from this report:

- Firstly, that DTV is very robust and does not suffer from ghosting. In most cases DTV signals are not susceptible to interference from wind farm developments.
- Secondly, that areas of weak DTV signal can experience interruptions to their reception should new reflections appear, such as those from nearby wind turbines.

For television broadcast signals, which are omni-directional or point-to-area signals, interference from wind turbines is dependent on many factors including:

- the proximity of turbines to the television broadcast transmitter
- the proximity of turbines to receivers (dwellings)
- the location of turbines in relation to dwellings and television broadcast transmitters
- the rotor blade material, rotor speed, and rotor blade direction (always into the wind)
- the properties of the receiving antenna (e.g., type, directionality, and height)
- the location of the television receiver in relation to terrain and other obstacles
- the frequency and power of the television broadcast signal.

A.2 Forward and back scatter of DTV signals

Wind turbines can cause interference to DTV signals by introducing reflections that may be received by the antenna at a dwelling, in addition to the signal received directly from the transmitter, which causes multipath errors. A wind turbine has the potential to scatter electromagnetic waves carrying DTV signals both forward and back.

Forward scatter can occur when the transmitter, one or more turbines, and receiver are almost aligned as shown in Figure A.1. The forward scatter region in this case is characterised by a shadow zone of reduced signal strength behind the turbine, where direct and scattered signals can be received, with the blade rotation introducing a rapid variation in the scattered signal [53]. Both of these effects can potentially degrade the DTV signal quality.

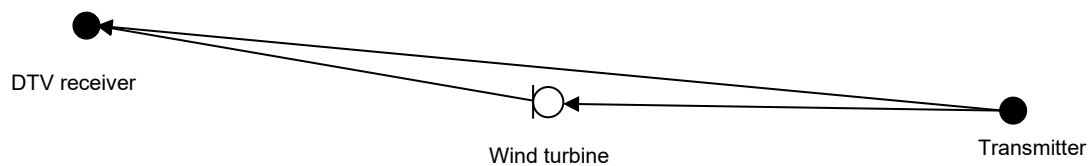


Figure A.1 Forward scatter signal path for DTV signals

Back scatter from wind turbines occurs when DTV signals are reflected from turbine towers and blades onto a receiver as shown in Figure A.2. The reflected signals are attenuated, time-delayed and phase-shifted (due to a longer path from transmitter to receiver) compared to the original signal. The reflected signals are also time-varying due to the rotation of the blades and vary with wind direction. The resultant signal at the receiver includes the original signal (transmitter to receiver) and a series of time-varying multipath signals (transmitter-turbine-receiver).

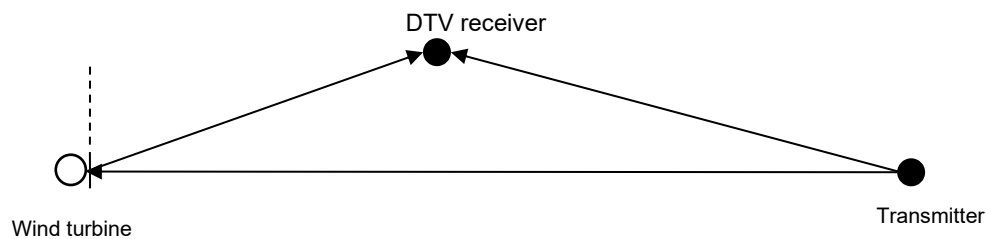


Figure A.2 Back scatter signal path for DTV signals

Interference to DTV signals from wind turbines can potentially occur in both the forward and backward scatter region. The effect of a turbine on a DTV signal can be different depending on the scattering region where the receiver is located [53].

According to Ofcom [46], the forward scatter region does not typically extend further than 5 km for the worst combination of factors [11, 56]. Interference may extend beyond 5 km if the dwellings are screened from the broadcast transmitter, but do have line-of-sight to the turbines [46]. The shape of this region, assuming a relatively high gain, directional antenna, can be represented by a circular segment with an azimuthal range of approximately $\pm 15^\circ$ to $\pm 20^\circ$, corresponding to the beam width of the antenna. If a lower gain or omni-directional antenna is being used, this region is likely to be larger.

Back scattered signals arrive at the dwelling delayed relative to the source signal from the broadcast transmitter. The back scatter region generally does not extend further than 500 m [11, 46], assuming a high gain, directional antenna that has a relatively high front-to-back ratio (meaning the signal received by the front of the antenna is much higher than that received from the back). If an antenna with a lower front-to-back ratio, or an omni-directional antenna is used, this region is likely to be larger.

The combination of the forward and back scatter regions, as shown in Figure A.3, resembles a keyhole.

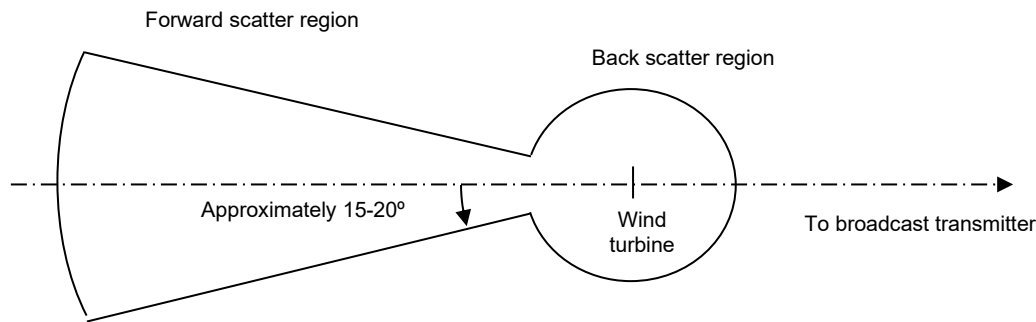


Figure A.3 Potential television interference zones around a wind turbine

Television interference mechanisms rely on many factors (as previously mentioned) and are complex to calculate. Previous experience has shown that even after great effort has been put into performing such calculations, they tend to have limited accuracy, and would require field validation after the wind farm is operational.

In Australia, DTV signals are transmitted using the DVB-T (Digital Video Broadcasting – Terrestrial) standard. The International Telecommunication Union (ITU) Recommendation BT.1893 [57] states the following in regards to the forward scatter region for DVB-T signals:

“In most of the situations where the impact of a wind farm to DVB-T reception quality was analyzed, the threshold C/N [carrier-to-noise] ratios obtained were similar to those expected in environments with the absence of wind farms. More precisely, in the forward scattering region of the wind turbines, where the transmit antenna, one or more turbines and the receive antenna are lined-up ($\pm 60^\circ$ behind the wind turbine), the DVB-T reception quality may not be affected though further work of analysis is needed in order to confirm this point, especially in the vicinity of 0° .”

In other words, wind turbines are not generally expected to affect DVB-T DTV signals in the forward scatter region. However, the ITU [54] also highlight that in the case where there is significant blockage of the direct signal, but clear line-of-sight to one or more turbines, interference to the reception of the DTV signal is possible. Results of studies reported by the ITU also suggest that interference may be more likely in areas where the existing DTV signal is already weak or degraded [54].

With regards to back scattering, the ITU states:

“In the case of the backscattering region, in those situations where the scattered signals from wind turbines are significant in amplitude and variability, the threshold C/N ratio necessary for quasi error free (QEF) condition is higher.”

In other words, the C/N ratio needs to be higher in the presence of significant back scatter to achieve the same QEF condition as is the case without the presence of turbines, which effectively means that interference is more likely to occur as coverage quality decreases.

A.3 Theoretical models for wind turbine scattering estimation

Various theoretical scatter models to predict scatter of terrestrial television signals have been proposed, some dating back to the late 1970s. A review of these models, as well as a comparison against empirical data has been reported in [58]. This comparison with empirical data found:

“...none of the analyzed methods seems to be accurate enough to provide realistic estimations of the signal scattered by the wind turbines. In conclusion, a more complete scattering model is needed in order to provide

more practical estimations of the scattered signals and evaluate their potential impact on the broadcasting services.”

Notably, the scattering model proposed by the ITU to specifically address DTV signals [57], was found to be the most inaccurate, and does not provide signal estimations in the forward scattering zone of the blades.

Additionally, DNV notes that it only applies to a single wind turbine rather than a wind farm as a whole.

As an alternative to signal scattering models, it is common practice to identify those dwellings or areas that are most likely to experience potential television interference based on likely forward and back scatter regions. As introduced above and shown in Figure A.3, this is often referred to as the 'keyhole' approach and is an established technique for predicting where terrestrial television interference is most likely, based on a number of assumptions regarding receiving antenna characteristics. The approach involves combining multiple keyhole shaped areas that are placed over each turbine location [46]. The combination of these areas forms a region where there is an increased likelihood of interference to television signals occurring.

APPENDIX B – TABULATED DATA

Table 7 Proposed turbine layout for the Project [2]

Turbine ID	Easting ¹ [m]	Northing ¹ [m]	Base elevation ² [m]	Turbine ID	Easting ¹ [m]	Northing ¹ [m]	Base elevation ² [m]
T1	465870	6305555	288	T47	471861	6306845	366
T2	467819	6305523	326	T48	471203	6306223	331
T3	468751	6305600	336	T49	474364	6307206	340
T4	466752	6304788	305	T50	474013	6306562	370
T5	467654	6304830	321	T51	472181	6306125	342
T6	468892	6304864	334	T52	473232	6306060	375
T7	464418	6304118	292	T53	473049	6305227	344
T8	466202	6303956	310	T54	474000	6305304	365
T9	468091	6303888	322	T55	472400	6304819	336
T10	468973	6304085	341	T56	473931	6304627	343
T11	465742	6302967	316	T57	473773	6303987	298
T12	466681	6303178	314	T58	472675	6303152	261
T13	468030	6303202	330	T60	472107	6302387	286
T14	469152	6303291	330	T61	472966	6302298	271
T15	470622	6303232	304	T62	473736	6302757	287
T16	471917	6303779	288	T63	472793	6301635	295
T17	467718	6302567	322	T64	473736	6301708	265
T18	468995	6302626	326	T65	471848	6305514	333
T19	467714	6301834	339	T66	472886	6303854	294
T20	468734	6302013	305	T67	474962	6305269	336
T21	466136	6301214	305	T69	473907	6298899	279
T22	468590	6301317	290	T73	475614	6297204	268
T23	467140	6301331	339	T74	475113	6296861	281
T24	465869	6300544	323	T75	472665	6308243	339
T25	468010	6300719	306	T76	472429	6307650	340
T26	468970	6300559	316	T77	473402	6307695	318
T27	468922	6299785	329	T78	472949	6306944	339
T28	465267	6298619	326	T79	478436	6308016	327
T29	466365	6298353	312	T80	478071	6307375	344
T30	469198	6298987	302	T81	477588	6306721	363
T31	468568	6298584	274	T82	480348	6306961	274
T32	467612	6298006	295	T83	481443	6306846	273
T33	470710	6298759	272	T84	477247	6306169	359
T34	467782	6297149	289	T85	478722	6306369	317
T35	468647	6297355	273	T86	478243	6305834	335
T36	471742	6301821	338	T87	479832	6305995	326
T37	473085	6300855	285	T88	480796	6306020	273
T38	469940	6300054	289	T89	477535	6305413	359
T39	473350	6299858	274	T90	479648	6305326	351
T40	469874	6299350	290	T91	480609	6305392	286
T41	470946	6299380	307	T92	478680	6305092	313
T42	473095	6299356	283	T93	479678	6304512	363
T43	474803	6298926	290	T94	480620	6304605	320
T44	466716	6305693	300	T95	480640	6303867	295

Table 7 Proposed turbine layout for the Project [2]
(continued)

Turbine ID	Easting¹ [m]	Northing¹ [m]	Base elevation² [m]	Turbine ID	Easting¹ [m]	Northing¹ [m]	Base elevation² [m]
T45	469196	6306141	337	T96	471475	6307566	356
T46	470060	6306308	357	T97	476623	6305788	356

1. Coordinate system: MGA zone 50, GDA94 datum. Coordinates were provided by the Customer in a different coordinate system and/or datum and have been converted using mapping software, which may result in small discrepancies depending on the software and transformation approach used.
2. Base elevations have been determined by DNV based on publicly available SRTM1 data.

Table 8 Dwellings within 5 km of the proposed Project boundary [3, 4, 5]

Dwelling ID ¹	Easting ² [m]	Northing ² [m]	Status	Distance to nearest turbine [km]
R1	477903	6301838	Neighbour	3.2
<u>R2</u>	<u>469530</u>	<u>6307814</u>	<u>Wind Farm Host</u>	<u>1.6</u>
R3	481319	6309949	Neighbour	3.1
R4	481664	6309767	Neighbour	2.9
<u>R5</u>	<u>480120</u>	<u>6308555</u>	<u>Wind Farm Host</u>	<u>1.6</u>
R6	475503	6303550	Neighbour	1.8
<u>R7</u>	<u>474587</u>	<u>6308775</u>	<u>Wind Farm Host</u>	<u>1.6</u>
<u>R8</u>	<u>477265</u>	<u>6303924</u>	<u>Wind Farm Host</u>	<u>1.5</u>
R9	475094	6300410	Neighbour	1.5
<u>R10</u>	<u>470522</u>	<u>6304737</u>	<u>Wind Farm Host</u>	<u>1.5</u>
<u>R11</u>	<u>472236</u>	<u>6310790</u>	<u>Wind Farm Host</u>	<u>2.6</u>
<u>R12</u>	<u>471768</u>	<u>6300519</u>	<u>Wind Farm Host</u>	<u>1.3</u>
<u>R13</u>	<u>470469</u>	<u>6301591</u>	<u>Wind Farm Host</u>	<u>1.3</u>
<u>R14</u>	<u>469992</u>	<u>6307805</u>	<u>Wind Farm Host</u>	<u>1.5</u>
R15	482793	6300417	Neighbour	4.1
<u>R16</u>	<u>469884</u>	<u>6297651</u>	<u>Wind Farm Host</u>	<u>1.3</u>
<u>R17</u>	<u>466861</u>	<u>6299631</u>	<u>Wind Farm Host</u>	<u>1.3</u>
R18	465177	6307574	Neighbour	2.1
R19	477893	6302389	Neighbour	2.8
<u>R20</u>	<u>464343</u>	<u>6301953</u>	<u>Wind Farm Host</u>	<u>1.7</u>
<u>R21</u>	<u>471911</u>	<u>6300440</u>	<u>Wind Farm Host</u>	<u>1.2</u>
R22	470045	6295480	Neighbour	2.3
<u>R23</u>	<u>475593</u>	<u>6306515</u>	<u>Wind Farm Host</u>	<u>1.3</u>
<u>R24</u>	<u>475558</u>	<u>6306385</u>	<u>Wind Farm Host</u>	<u>1.2</u>
R25	477339	6299523	Neighbour	2.6
R26	479609	6297038	Neighbour	4.0
R27	478303	6295927	Neighbour	3.0
<u>R28</u>	<u>476049</u>	<u>6295545</u>	<u>Wind Farm Host</u>	<u>1.6</u>
R29	475531	6295224	Neighbour	1.7

1. Host dwellings are indicated by underlined italic text.
2. Coordinate system: MGA zone 50, GDA94 datum. Coordinates were provided by the Customer in a different coordinate system and/or datum and have been converted using mapping software, which may result in small discrepancies depending on the software and transformation approach used.

Table 9 Details of point-to-point links crossing the proposed Project

Link no.	Licence number	Assignment ID	Frequency [Hz]	Licence owner
1	11672172/2	12860502	11405000000	Optus Mobile Pty Limited 4G TXN 1 Lyonpark Road Macquarie Park NSW 2113
		12860503	11405000000	
		12860504	10915000000	
		12860505	10915000000	
2	11672173/2	12860506	11405000000	
		12860507	11405000000	
		12860508	10915000000	
		12860509	10915000000	
3	10757928/1	5826779	11175000000	Telstra Corporation Limited Radio, Transport Engineering (Attn Nik Patel) Locked Bag 3501 Brisbane QLD 4001
		5826780	11665000000	
		5826781	11665000000	
		5826782	11175000000	
4	9961166/1	1474566	7704500000	Western Australia Police Radio & Electronic Services Unit 21 Swanbank Road Att: Phillip Manna Maylands WA 6051
		1474567	7704500000	
		1474568	7543500000	
		1474569	7543500000	
5	9969333/1	1475602	11225000000	
		1475603	11225000000	
		1475604	10735000000	
		1475605	10735000000	

Table 10 Details of point-to-multipoint licences within 75 km of the proposed Project

Assignment ID	Site ID	Licence no.	Latitude [GDA94]	Longitude [GDA94]	Distance to Project [km]	Licence owner
1480206	9027810	9967458/1	-33.5384	116.1159	48	Bureau of Meteorology 700 Collins Street Docklands VIC 3008
1480209	9027810	9967458/1	-33.5384	116.1159	48	
1307033	602742	1620448/1	-33.3888	115.8515	71	
1307036	602742	1620448/1	-33.3888	115.8515	71	
1480198	9027811	9967460/1	-32.6944	116.6135	73	
1480201	9027811	9967460/1	-32.6944	116.6135	73	CipherTel Pty Ltd PO Box 1368 Bunbury WA 6230
4350106	139932	10545572/1	-33.2775	115.9031	68	Electricity Generation and Retail Corporation Synergy GPO Box F366 Perth WA 6841
4350109	139932	10545572/1	-33.2775	115.9031	68	
14051863	10029046	12900622/1	-33.4456	116.3059	29	
14051866	10029046	12900622/1	-33.4456	116.3059	29	
3185342	9008513	10341816/1	-33.4461	116.3056	29	
3185345	9008513	10341816/1	-33.4461	116.3056	29	
3185350	9009309	10341816/1	-33.4056	116.2739	32	
3185353	9009309	10341816/1	-33.4056	116.2739	32	
3185346	600942	10341816/1	-33.3840	116.2609	33	
3185349	600942	10341816/1	-33.3840	116.2609	33	
14051888	27700	12900752/1	-33.4506	116.3088	29	
14051889	27700	12900752/1	-33.4506	116.3088	29	
3593378	9011357	1968902/2	-33.8059	116.7184	33	
3593379	9011357	1968902/2	-33.8059	116.7184	33	
14051896	603280	12900754/1	-33.7482	116.3377	39	
14051897	603280	12900754/1	-33.7482	116.3377	39	
1235399	28999	1911554/1	-32.9658	116.4492	48	Electricity Networks Corporation Western Power GPO Box L921 Attn: Comms Operations & Maintenance Perth WA 6842
1235400	28999	1911554/1	-32.9658	116.4492	48	
1235391	28233	1911552/1	-32.8932	117.1608	61	
1235392	28233	1911552/1	-32.8932	117.1608	61	
1536033	27653	9998095/1	-33.1977	115.9701	64	
1536036	27653	9998095/1	-33.1977	115.9701	64	
14051880	27653	12900750/1	-33.1977	115.9701	64	
14051881	27653	12900750/1	-33.1977	115.9701	64	
7611191	603279	11195359/1	-33.9201	116.1371	65	
7611192	603279	11195359/1	-33.9201	116.1371	65	
14157128	603279	12907914/1	-33.9201	116.1371	65	
14157129	603279	12907914/1	-33.9201	116.1371	65	
7611175	10022861	11195355/1	-33.8294	116.0500	66	
7611176	10022861	11195355/1	-33.8294	116.0500	66	
14157112	10022861	12907910/1	-33.8294	116.0500	66	
14157113	10022861	12907910/1	-33.8294	116.0500	66	
1234773	27944	1568081/1	-34.0415	116.2583	69	
1234774	27944	1568081/1	-34.0415	116.2583	69	
7611179	27944	11195356/1	-34.0415	116.2583	69	
7611180	27944	11195356/1	-34.0415	116.2583	69	
14157116	27944	12907911/1	-34.0415	116.2583	69	
14157117	27944	12907911/1	-34.0415	116.2583	69	
14157108	10014374	12907909/1	-33.7079	115.9367	69	
14157109	10014374	12907909/1	-33.7079	115.9367	69	
1235919	9018576	1964022/1	-33.5253	115.8558	72	
1235922	9018576	1964022/1	-33.5253	115.8558	72	
14157120	9018576	12907912/1	-33.5253	115.8558	72	
14157121	9018576	12907912/1	-33.5253	115.8558	72	
1236073	28201	1971923/1	-32.6770	116.6988	74	

Table 10 Details of point-to-multipoint licences within 75 km of the proposed Project (continued)

Assignment ID	Site ID	Licence no.	Latitude [GDA94]	Longitude [GDA94]	Distance to Project [km]	Licence owner
1236076	28201	1971923/1	-32.6770	116.6988	74	Newmont Boddington Gold Pty Ltd Attn NBG FMS Department MTS Newmont Boddington Gold Mine Road Boddington WA 6390
9384327	10025228	11721831/1	-32.8173	116.3809	65	
9384330	10025228	11721831/1	-32.8173	116.3809	65	
10528659	10006939	12043818/1	-32.7828	116.3804	69	
10528662	10006939	12043818/1	-32.7828	116.3804	69	
9229084	9007015	11674266/1	-32.7523	116.3445	73	
9229087	9007015	11674266/1	-32.7523	116.3445	73	
9311525	9007015	11697023/1	-32.7523	116.3445	73	
9311528	9007015	11697023/1	-32.7523	116.3445	73	
9384327	10025228	11721831/1	-32.8173	116.3809	65	
9384330	10025228	11721831/1	-32.8173	116.3809	65	
865711	27678	1903747/1	-33.3999	116.2969	30	Premier Coal Limited Pty Ltd Attention: Chris van den Heever P.O. Box 21 Collie WA 6225
865714	27678	1903747/1	-33.3999	116.2969	30	
865703	9008381	1903746/1	-33.3917	116.2910	30	
865706	9008381	1903746/1	-33.3917	116.2910	30	
865719	9008380	1903748/1	-33.3949	116.2754	32	
865722	9008380	1903748/1	-33.3949	116.2754	32	
13463968	10035383	12834224/1	-32.9829	116.5246	43	South32 Worsley Alumina Pty Ltd BHP Billiton Worsley Alumina Pty Ltd Gastaldo Rd Collie WA 6225
13463971	10035383	12834224/1	-32.9829	116.5246	43	
13463972	10035383	12834225/1	-32.9829	116.5246	43	
13463975	10035383	12834225/1	-32.9829	116.5246	43	
927444	28979	1947125/1	-32.9659	116.4496	48	
927447	28979	1947125/1	-32.9659	116.4496	48	
13463964	28999	12834223/1	-32.9658	116.4492	48	
13463967	28999	12834223/1	-32.9658	116.4492	48	
13463940	9017322	12834217/1	-33.2371	116.0722	54	
13463943	9017322	12834217/1	-33.2371	116.0722	54	
13463944	9017322	12834218/1	-33.2371	116.0722	54	
13463947	9017322	12834218/1	-33.2371	116.0722	54	
8014615	10025486	11256668/1	-33.2331	116.0700	54	
8014618	10025486	11256668/1	-33.2331	116.0700	54	
13463932	9023585	12834215/1	-33.2312	116.0604	55	
13463935	9023585	12834215/1	-33.2312	116.0604	55	
13463936	9023585	12834216/1	-33.2312	116.0604	55	
13463939	9023585	12834216/1	-33.2312	116.0604	55	
13463956	9009319	12834221/1	-32.8934	116.4500	55	
13463959	9009319	12834221/1	-32.8934	116.4500	55	
13463960	9009319	12834222/1	-32.8934	116.4500	55	
13463963	9009319	12834222/1	-32.8934	116.4500	55	
13463948	9009320	12834219/1	-32.8316	116.4571	61	
13463951	9009320	12834219/1	-32.8316	116.4571	61	
13463952	9009320	12834220/1	-32.8316	116.4571	61	
13463955	9009320	12834220/1	-32.8316	116.4571	61	
13463992	10041984	12834230/1	-32.8132	116.4015	65	
13463995	10041984	12834230/1	-32.8132	116.4015	65	
13463996	10041984	12834231/1	-32.8132	116.4015	65	
13463999	10041984	12834231/1	-32.8132	116.4015	65	
13463984	10041983	12834228/1	-32.7908	116.3922	68	
13463987	10041983	12834228/1	-32.7908	116.3922	68	
13463988	10041983	12834229/1	-32.7908	116.3922	68	
13463991	10041983	12834229/1	-32.7908	116.3922	68	
13463976	10035690	12834226/1	-32.7741	116.3930	69	

**Table 10 Details of point-to-multipoint licences within 75 km of the proposed Project
(continued)**

Assignment ID	Site ID	Licence no.	Latitude [GDA94]	Longitude [GDA94]	Distance to Project [km]	Licence owner
13463979	10035690	12834226/1	-32.7741	116.3930	69	Talison Lithium Australia Pty Ltd PO Box 31 Greenbushes WA 6254
13463980	10035690	12834227/1	-32.7741	116.3930	69	
13463983	10035690	12834227/1	-32.7741	116.3930	69	
10934568	10017944	11136489/2	-33.8525	116.0627	66	
10934571	10017944	11136489/2	-33.8525	116.0627	66	
10934572	10017944	11136490/2	-33.8525	116.0627	66	
10934575	10017944	11136490/2	-33.8525	116.0627	66	
10934576	10017944	11136491/2	-33.8525	116.0627	66	
10934579	10017944	11136491/2	-33.8525	116.0627	66	
10934580	10017944	11136492/2	-33.8525	116.0627	66	
10934583	10017944	11136492/2	-33.8525	116.0627	66	
1250669	27674	1900016/1	-33.2897	116.4086	23	
1250672	27674	1900016/1	-33.2897	116.4086	23	
1250665	27668	1900015/1	-33.3446	116.1598	43	
1250668	27668	1900015/1	-33.3446	116.1598	43	
1250733	9007255	1901014/1	-33.8419	116.3761	44	
1250736	9007255	1901014/1	-33.8419	116.3761	44	
1250661	9007080	1900014/1	-33.2531	116.1368	47	
1250664	9007080	1900014/1	-33.2531	116.1368	47	
1251180	9016482	1952766/1	-33.8462	116.0616	66	
1251183	9016482	1952766/1	-33.8462	116.0616	66	
9496552	9016482	11777618/1	-33.8462	116.0616	66	
9496555	9016482	11777618/1	-33.8462	116.0616	66	
9496544	9012532	11777616/1	-33.9411	116.1580	66	
9496547	9012532	11777616/1	-33.9411	116.1580	66	
1250085	54234	1605283/1	-33.3203	115.8809	69	
1250088	54234	1605283/1	-33.3203	115.8809	69	
1251176	9016484	1952765/1	-33.9601	116.1274	69	
1251179	9016484	1952765/1	-33.9601	116.1274	69	
1398515	9027192	9892646/1	-33.7961	115.9782	70	
1398518	9027192	9892646/1	-33.7961	115.9782	70	
1250368	602275	1617297/1	-33.0865	115.9508	71	
1250371	602275	1617297/1	-33.0865	115.9508	71	
1250515	603040	1622274/1	-33.0826	115.9200	74	
1250518	603040	1622274/1	-33.0826	115.9200	74	
9496536	9009514	11777614/1	-33.5730	115.8378	74	
9496539	9009514	11777614/1	-33.5730	115.8378	74	
7100222	10021298	11002714/1	-33.0971	115.9001	74	
7100225	10021298	11002714/1	-33.0971	115.9001	74	
1250077	600634	1605281/1	-33.0701	115.9118	75	
1250080	600634	1605281/1	-33.0701	115.9118	75	

Table 11 Details of other licences identified within 75 km of the proposed Project

Licence category	Licence type	Number of assignment IDs
1800 MHz Band	Spectrum	358
2 GHz Band	Spectrum	250
2.3 GHz Band	Spectrum	2061
2.5 GHz Band	Spectrum	244
3.4 GHz Band	Spectrum	716
700 MHz Band	Spectrum	824
800 MHz Band	Spectrum	434
850/900 MHz Band	Spectrum	392
AWL - Standard	Spectrum	94
Aeronautical Assigned System	Aeronautical	8
Amateur Repeater	Amateur	28
Ambulatory - Initial	Land Mobile	2
Ambulatory System	Land Mobile	264
CBRS Repeater	Land Mobile	12
Commercial Radio	Broadcasting	9
Commercial Television	Broadcasting	15
Community Broadcasting	Broadcasting	1
Earth Receive	Earth Receive	1
Fixed Receive	Fixed Receive	3
Land Mobile System - > 30MHz	Land Mobile	1071
Land Mobile System 0-30MHz	Land Mobile	154
Narrowband Area Service station(s)	Broadcasting	1
Narrowcasting Service (Fixed Tax)	Broadcasting	1
Narrowcasting Service (LPON)	Broadcasting	20
National Broadcasting	Broadcasting	18
PMTS Class B	PTS	408
Paging System - Interior	Land Mobile	4
Radiodetermination	Radiodetermination	4
Retransmission	Broadcasting	6
Temporary Community Broadcasting	Broadcasting	4

Table 12 Emergency services with radiocommunication assets in the vicinity of the proposed Project

Emergency service	Contact details	Distance from closest site to Project boundary [km]
Department of Biodiversity Conservation and Attractions	Department of Biodiversity Conservation and Attractions Department of Environment and Conservation Att: Coordinator, Telecommunications Systems Locked Bag 104 Office of Information Management Bentley DC WA 6983	23
Department of Fire and Emergency Services of WA	Department of Fire and Emergency Services of WA Attn Manager Radio Communications PO Box P1174 Perth WA 6844	Within Project boundary
St John Ambulance Western Australia LTD.	St John Ambulance Western Australia LTD. St John Ambulance (Western Australia) INC. PO Box 183 Belmont WA 6104	Within Project boundary
St. John Ambulance Australia Incorporated	St. John Ambulance Australia Incorporated Technical Services 601-609 Blackburn Road Notting Hill VIC 3168	33
Western Australia Police	Western Australia Police Radio & Electronic Services Unit 21 Swanbank Road Att: Phillip Manna Maylands WA 6051	Within Project boundary

Table 13 Bureau of Meteorology radar sites in the vicinity of the proposed Project

Site ID	Site name	Latitude [GDA94]	Longitude [GDA94]	Distance to Project [km]
138152	Bureau of Meteorology across the road from runway Lot 164 (286) Yangedi Rd Hopeland	-32.3917	115.8670	131
44829	Walnut Rd Bickley	-32.0077	116.1349	157
601351	Bureau of Meteorology Office Northern Perimeter Road Perth Airport	-31.9274	115.9765	171
140115	Bureau of Meteorology Met Office Albany Airport Albany	-34.9418	117.8164	190
10000627	BOM Station Approximately 1.2km South of Fire Road South Doodlakine	-31.7770	117.9529	206
10000625	Off Lake Grace-Newdegate Road Newdegate	-33.0970	119.0087	207
10000636	Off Edawa Road	-30.3600	116.2896	333

Table 14 Trigonometrical stations in the vicinity of the proposed Project

Station name	Datum	Latitude [GDA94]	Longitude [GDA94]	Distance to Project [km]
Collie 13	AGD66, AGD84, GDA94	-33.2906	116.7699	5
Collie 294	AGD84	-33.4672	116.5481	7
Collie 4	AGD66, AGD84, GDA94	-33.6199	116.6517	12
Collie 5	AGD66, AGD84, GDA94	-33.5908	116.5831	11
Collie 6	AGD66, AGD84, GDA94	-33.5499	116.4888	15
Collie 6 T	AGD84	-33.5533	116.4965	15
Collie 7	AGD66, AGD84, GDA94	-33.5143	116.4070	Within Project boundary
Fisher	AGD66, AGD84, GDA94	-33.4024	116.7804	Within Project boundary
R 229 T	AGD84	-33.4023	116.7791	16
Trigwells	AGD66, AGD84, GDA94	-33.6509	116.5924	3
U 10	GDA94	-33.3338	116.7255	2
U 9	GDA94	-33.3359	116.7479	18
Wild Horse	AGD66, AGD84, GDA94	-33.1856	116.6887	5

Table 15 Satellite vectors with potential to be intercepted by the proposed Project

Intercepted satellite	Services provided [59]	Affected dwellings¹
NSS 9	Programs intended for Australian audiences	<u><i>R12, R13</i></u>

1. Host dwellings are indicated by underlined italic text.

Table 16 Dwellings with increased potential to experience EMI to DTV from television broadcast transmitters

Dwelling ID ¹	Easting ² [m]	Northing ² [m]	Located in potential interference zone	
			Wagin	Bunbury
R1	477903	6301838		X
<u>R2</u>	<u>469530</u>	<u>6307814</u>	X	
<u>R5</u>	<u>480120</u>	<u>6308555</u>		X
R6	475503	6303550	X	X
<u>R7</u>	<u>474587</u>	<u>6308775</u>	X	X
<u>R8</u>	<u>477265</u>	<u>6303924</u>	X	X
R9	475094	6300410		X
<u>R10</u>	<u>470522</u>	<u>6304737</u>	X	X
<u>R12</u>	<u>471768</u>	<u>6300519</u>	X	X
<u>R13</u>	<u>470469</u>	<u>6301591</u>	X	X
<u>R14</u>	<u>469992</u>	<u>6307805</u>	X	
<u>R16</u>	<u>469884</u>	<u>6297651</u>	X	X
<u>R17</u>	<u>466861</u>	<u>6299631</u>	X	
R19	477893	6302389	X	X
<u>R20</u>	<u>464343</u>	<u>6301953</u>	X	
<u>R21</u>	<u>471911</u>	<u>6300440</u>	X	X
<u>R23</u>	<u>475593</u>	<u>6306515</u>	X	X
<u>R24</u>	<u>475558</u>	<u>6306385</u>	X	X
R25	477339	6299523		X
R26	479609	6297038		X
R27	478303	6295927		X

1. Host dwellings are indicated by underlined italic text.
2. Coordinate system: MGA zone 50, GDA94 datum. Coordinates were provided by the Customer in a different coordinate system and/or datum and have been converted using mapping software, which may result in small discrepancies depending on the software and transformation approach used.

Table 17 Summary of service operators contacted by DNV and responses received to date

Licence/service type and distance of closest site	Operator name and DNV reference	Response received to date
Fixed point-to-point: 2 links crossing the Project site Point-to-point #1 and #2: No turbines in diffraction exclusion zone established by DNV, 3 turbines (T79, T82 and T88) in potential reflection/scattering interference zone established by DNV, No turbines in potential near-field interference zone established by DNV PMTS/spectrum (mobile phone): 2 km from the Project boundary	Optus Mobile Pty Ltd (Optus) 10601779-AUMEL-L01-B	<u>Response received by email, based on the preliminary turbine layout, on 15 June 2026:</u> "Optus technical team have reviewed the proposal for West Arthur Wind Farm and advised no interference issues with Optus equipment." Further consultation is not considered necessary
Fixed point-to-point: 1 link crossing the Project site Point-to-point #3: No turbines in diffraction exclusion zone established by DNV, No turbines in respective potential reflection/scattering interference zones established by DNV, No turbines in potential near-field interference zone established by DNV PMTS/spectrum (mobile phone): within the Project boundary	Telstra Limited (Telstra) 10601779-AUMEL-L02-B	No response received to date

**Table 17 Summary of service operators contacted by DNV and responses received to date
(continued)**

Licence/service type and distance of closest site	Operator name and DNV reference	Response received to date
Fixed point-to-point: 2 links crossing the Project site Point-to-point #4: No turbines in diffraction exclusion zone established by DNV, 3 turbines (T93, T94 and T95) in respective potential reflection/scattering interference zones established by DNV, No turbines in potential near-field interference zone established by DNV Point-to-point #5: No turbines in diffraction exclusion zone established by DNV, turbines (T49, T75, T84, T89, T92, T93, T97) in respective potential reflection/scattering interference zones established by DNV, No turbines in potential near-field interference zone established by DNV Emergency services point-to-area: within the Project boundary	Western Australia Police (WA Police) 10601779-AUMEL-L03-B	<u>Response received by email, based on the preliminary turbine layout, on 29 May 2026:</u> <i>"This document provides a formal engineering assessment of the DNV report regarding the proposed West Arthur Wind Farm and its potential impacts on WA Police radio communication assets. The assessment focuses on point-to-point microwave links, including the CGS7-5 Darkan to Mt Fisher link...</i> <i>...WA Police accept the methodology and conclusions relating to diffraction and Fresnel zone clearance. The use of second Fresnel zone modelling, inclusion of turbine rotor radius, and application of positional uncertainty buffers represents a conservative engineering approach. Accordingly, the risk of direct line-of-sight obstruction is considered low...</i> <i>...The report identifies reflection and scattering as potential mechanisms but does not quantify the impact on link performance. At frequencies between 7 GHz and 11 GHz, rotating turbine blades may introduce time-varying multipath effects, resulting in fading and signal instability...</i> <i>...The proximity of turbines near the Mt Fisher site (approximately 300 metres) presents a credible near-field interaction risk. At this distance, turbines may fall within antenna sidelobe regions, potentially resulting in strong reflections and rapid fading...</i> <i>WA Police recommend the following actions prior to acceptance:</i> <i>1. Detailed multipath and fade analysis using ITU-R P.530 or equivalent.</i> <i>2. Verification of turbine and antenna coordinates and separation distances.</i> <i>3. Quantitative carrier-to-interference analysis.</i> <i>4. Assessment of mitigation measures including antenna adjustment or diversity techniques.</i> <i>Conclusion</i> <i>While the study demonstrates that direct path obstruction is unlikely, there remains credible risk of signal degradation due to reflection, scattering, and near-field effects. Further detailed engineering analysis is required before operational acceptance can be confirmed.</i> <i>Brief Summary:</i> <i>As with previous windfarms, general rule-of-thumb distance of Turbines from WA Police uWave paths to provide reasonable confidence of minimal interference is 250m. This provides reasonable clearance from the Diffraction Exclusion Zone and allows for variations in Fresnel due to link frequency and path height. In this submission there are 4 Turbines that are of immediate concern being:</i> <i>T89 & T94 both of which are approximately 160m from the uWave path.</i> <i>T92 which is approximately 200m from the uWave path.</i> <i>& T93 which sits approx. 250m from the Mt Fisher (CGS7-6) site."</i> <u>Current turbine layout provided on 5 August 2026, no response received to date</u>

**Table 17 Summary of service operators contacted by DNV and responses received to date
(continued)**

Licence/service type and distance of closest site	Operator name and DNV reference	Response received to date
4 Fixed point-to-multipoint: 48 km from Project boundary Meteorological radar: 131 km from Project boundary	Bureau of Meteorology 10601779-AUMEL-L04-B	<u>Response received by email, based on the preliminary turbine layout, on 29 May 2026:</u> <i>“Our assessment of the current West Arthur Wind Farm proposal has determined that, under normal atmospheric conditions, it poses a manageable risk to Bureau radar and radiocommunication assets.</i> <i>As a result, the Bureau has no objections to the proposed development proceeding, as detailed in the documentation provided for assessment.</i> <i>Modifications to the wind farms parameters, including layout designs, turbine locations, or heights, will require a new assessment.”</i> <u>Current turbine layout provided on 5 August 2026, no response received to date</u>
5 Fixed point-to-multipoint: 29 km from Project boundary	Electricity Networks Corporation (Western Power) 10601779-AUMEL-L06-B	<u>Response received by email, based on the preliminary turbine layout, on 9 June 2026:</u> <i>“There are currently no point-to-point links that will be impacted by the new wind farm...</i> <i>... Of the DA bases in the area, it can be seen that installation of the wind farm should not impact line of sight to existing remotes [point-to-multipoint links]...</i> <i>... The proposed Microwave path between Cordering Terminal and Arthur River should not be subject to interference from the current turbine locations. T74 centre-point is currently 684m from the path. Considering the turbine diameter, the Microwave link should not be impacted by diffraction effects. Neither near-field nor reflection clearance zones are considered impacted for this link. If turbines are moved further South this would need re-evaluating...</i> <i>... There is a chance that there may be a small impact to WP existing MR coverage of Distribution assets, but this is not considered significant to warrant any mitigation.</i> <i>By avoiding shifting the turbines T74 and T73 any further South (or moving any other turbines South of their location), this will avoid impacting WP’s proposed MW link between Arthur River and Cordering Terminal...”</i> <u>Current turbine layout provided on 5 August 2026, no response received to date</u>
6 Fixed point-to-multipoint: 23 km from Project boundary	Water Corporation 10601779-AUMEL-L07-B	No response received to date

**Table 17 Summary of service operators contacted by DNV and responses received to date
(continued)**

Licence/service type and distance of closest site	Operator name and DNV reference	Response received to date
7 Emergency services point-to-area: within the Project boundary	Department of Fire and Emergency Services of WA (DFES) 10601779-AUMEL-L08-B	<u>Response received, based on the preliminary turbine layout, by email on 6 June 2026:</u> <i>"Thank you for your correspondence advising us of the proposed windfarm. With regards to point to point links to/from the existing DFES site (ACMA site id 29013 Darkan) I have assessed this proposal and conclude this should not have an effect on the Department of Fire and Emergency Services (DFES).</i> <i>However, due to the proposed proximity of several of the turbines to the existing DFES site (ACMA site id 29013 Darkan) being only 300m I will flag that general EMI emissions from turbines of this nature may produce enough emissions to affect the DFES receiver and affect DFES communications. As I do not have enough information on the possible EMI emissions levels of turbines on whether this is likely to cause degradation on any of our services at the 29013 Darkan site, I will flag these services do not experience any issues currently, and emphasise the terrain in this area adds to the difficulty of effective radio communications already, any degradation would be an impact to the local fire services."</i> <u>Further consultation regarding point-to-area services within the Project boundary is ongoing</u>
8 Emergency services point-to-area: within the Project boundary	St John Ambulance Western Australia Ltd (St John Ambulance WA) 10601779-AUMEL-L09-B	No response received to date
9 Trigonometrical station: within the Project boundary GNSS station: 56 km from Project boundary	Geoscience Australia 10601779-AUMEL-L10-B	<u>Response received by email, based on the preliminary turbine layout, on 22 May 2026:</u> <i>"Geoscience Australia do not foresee any interference to our GNSS infrastructure as a result of the proposed West Aurthur Windfarm."</i> Further consultation is not considered necessary



DNV

APPENDIX C – MAPS

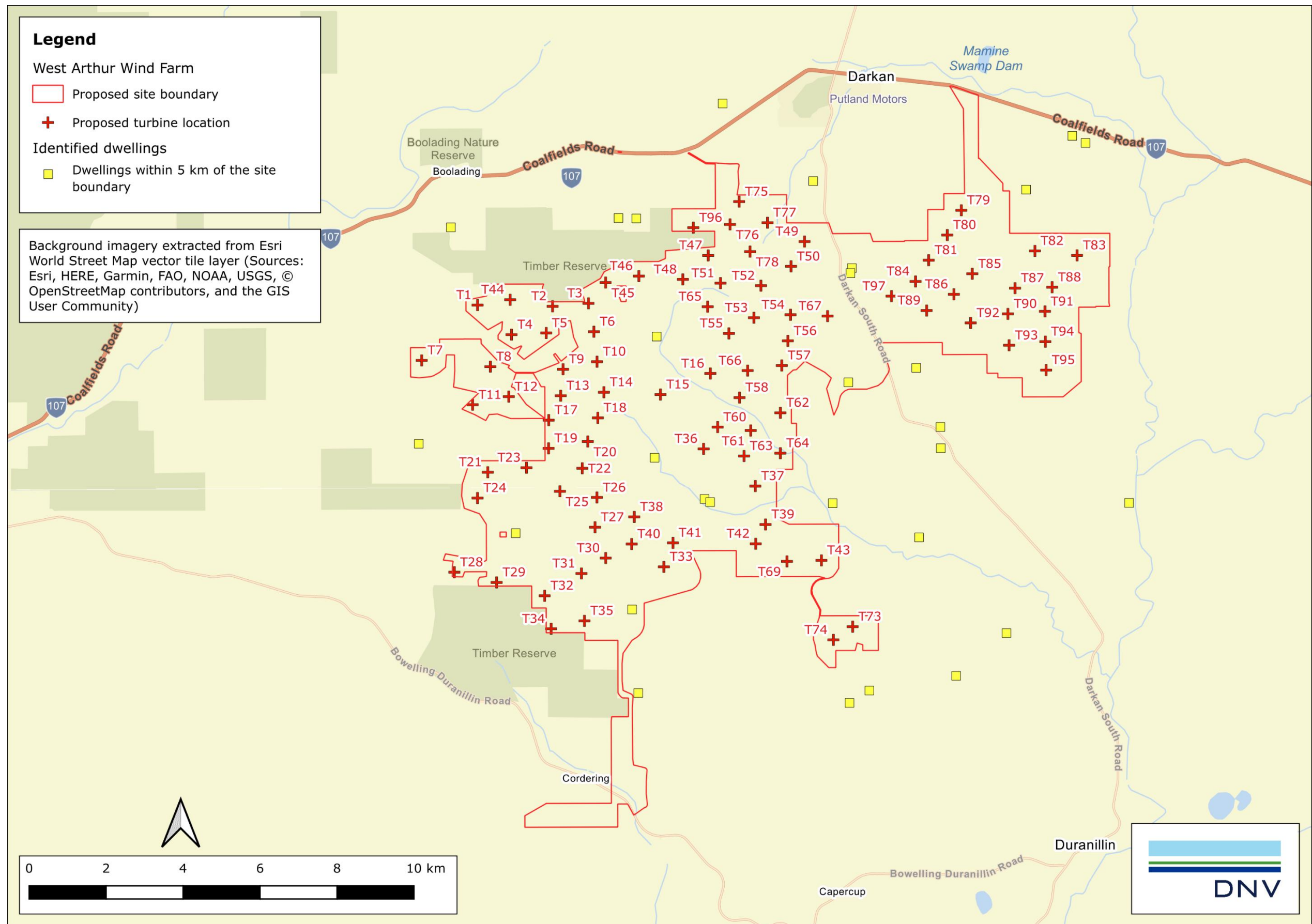


Figure 1 Map of the proposed Project, showing proposed boundary, turbine locations, and locations of nearby dwellings

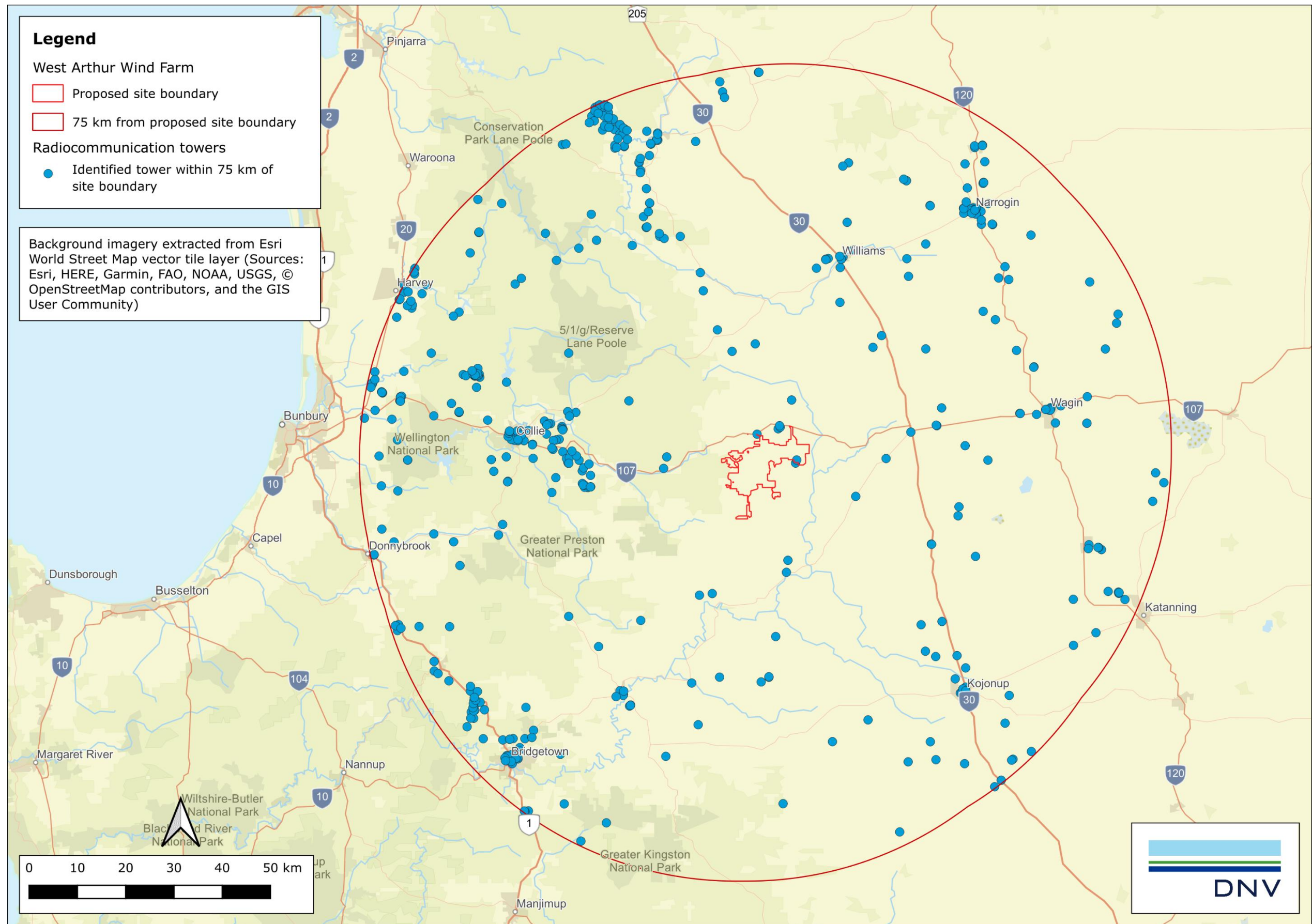


Figure 2 Location of the proposed Project and identified nearby radiocommunication sites

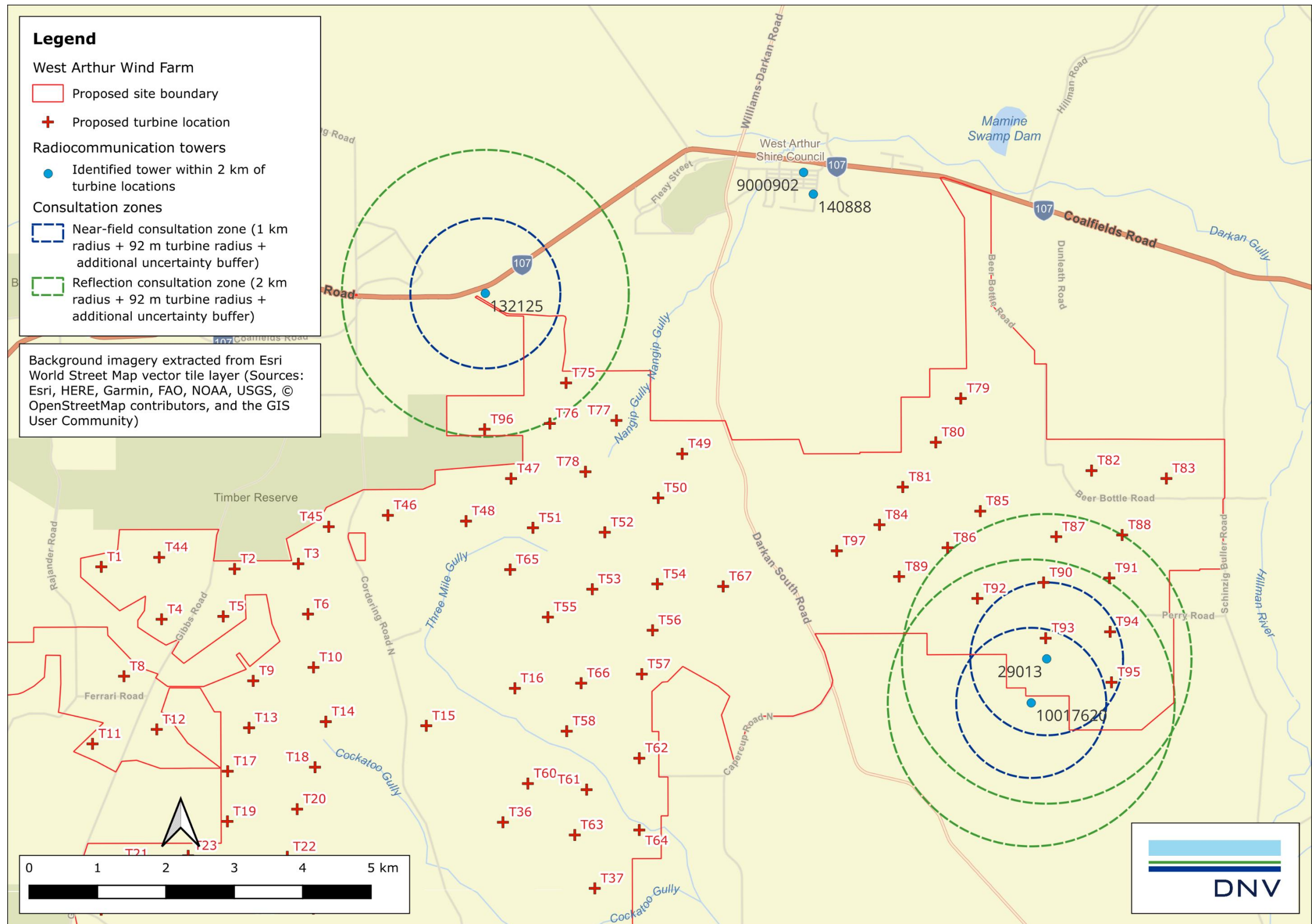


Figure 3 Identified radiocommunication sites within 2 km of the turbine locations for the proposed Project

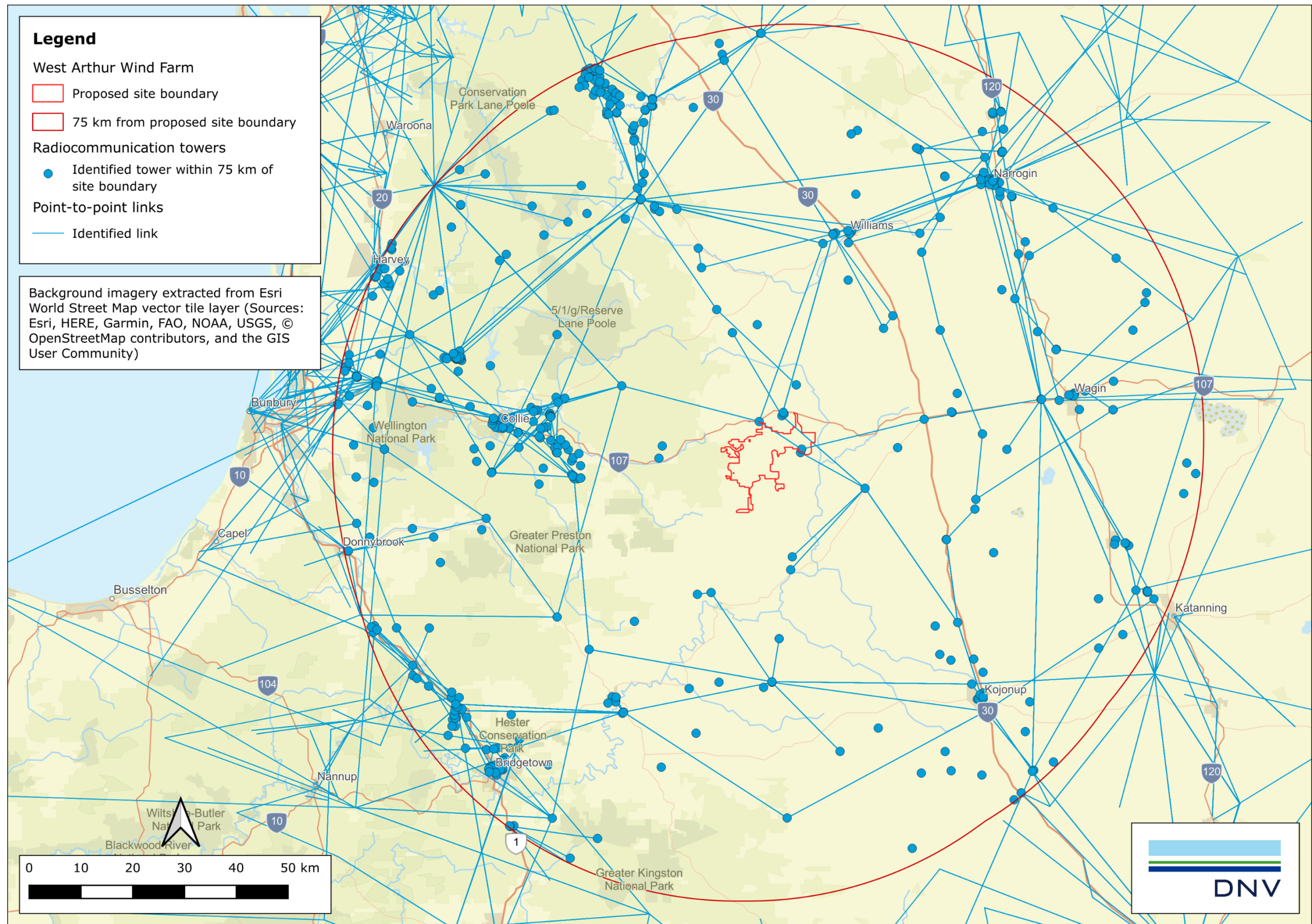


Figure 4 Identified transmission vectors for fixed licences of point-to-point type in the vicinity of the proposed Project

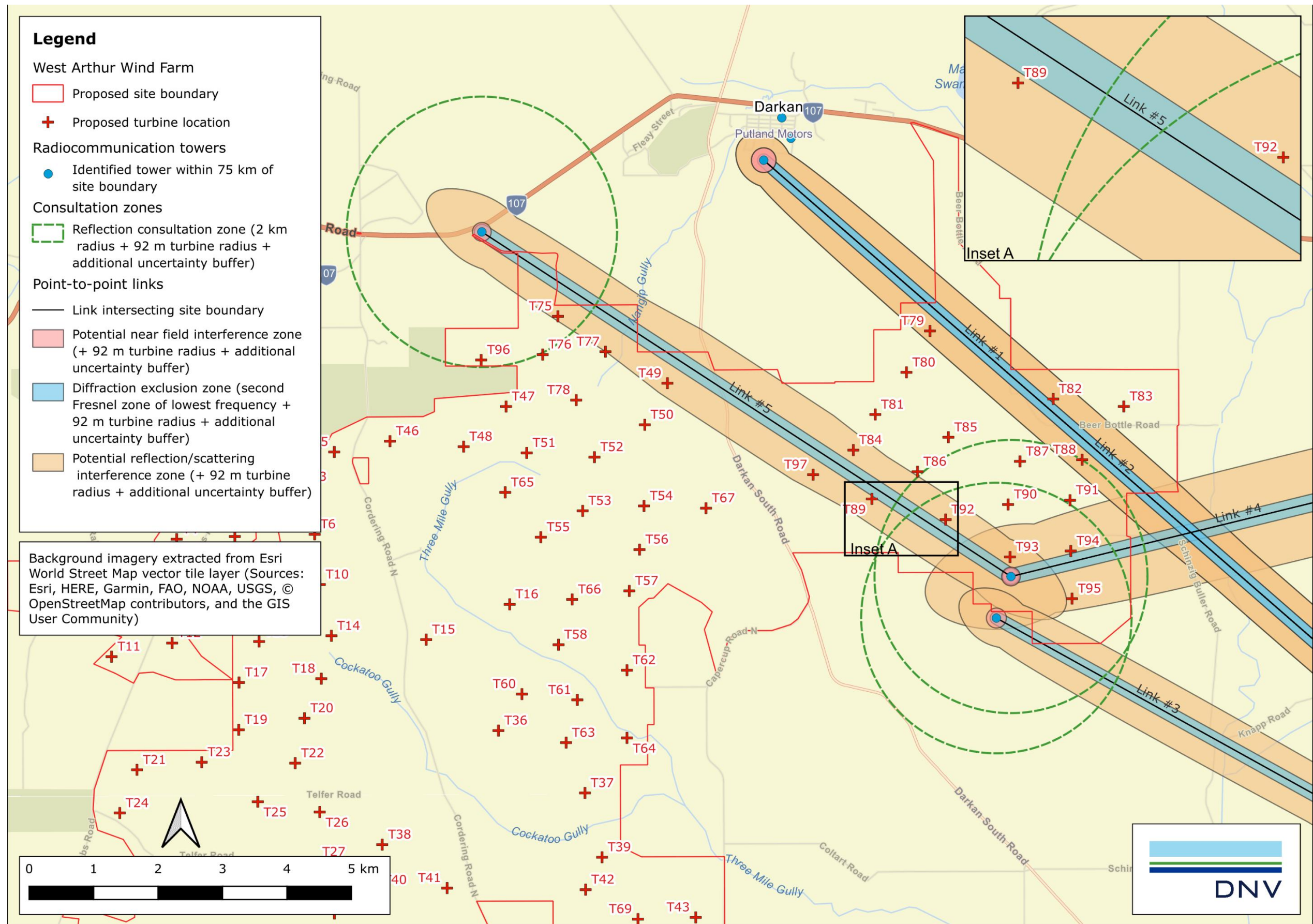


Figure 5 Identified point-to-point radiocommunication vectors crossing the proposed Project and calculated interference zones

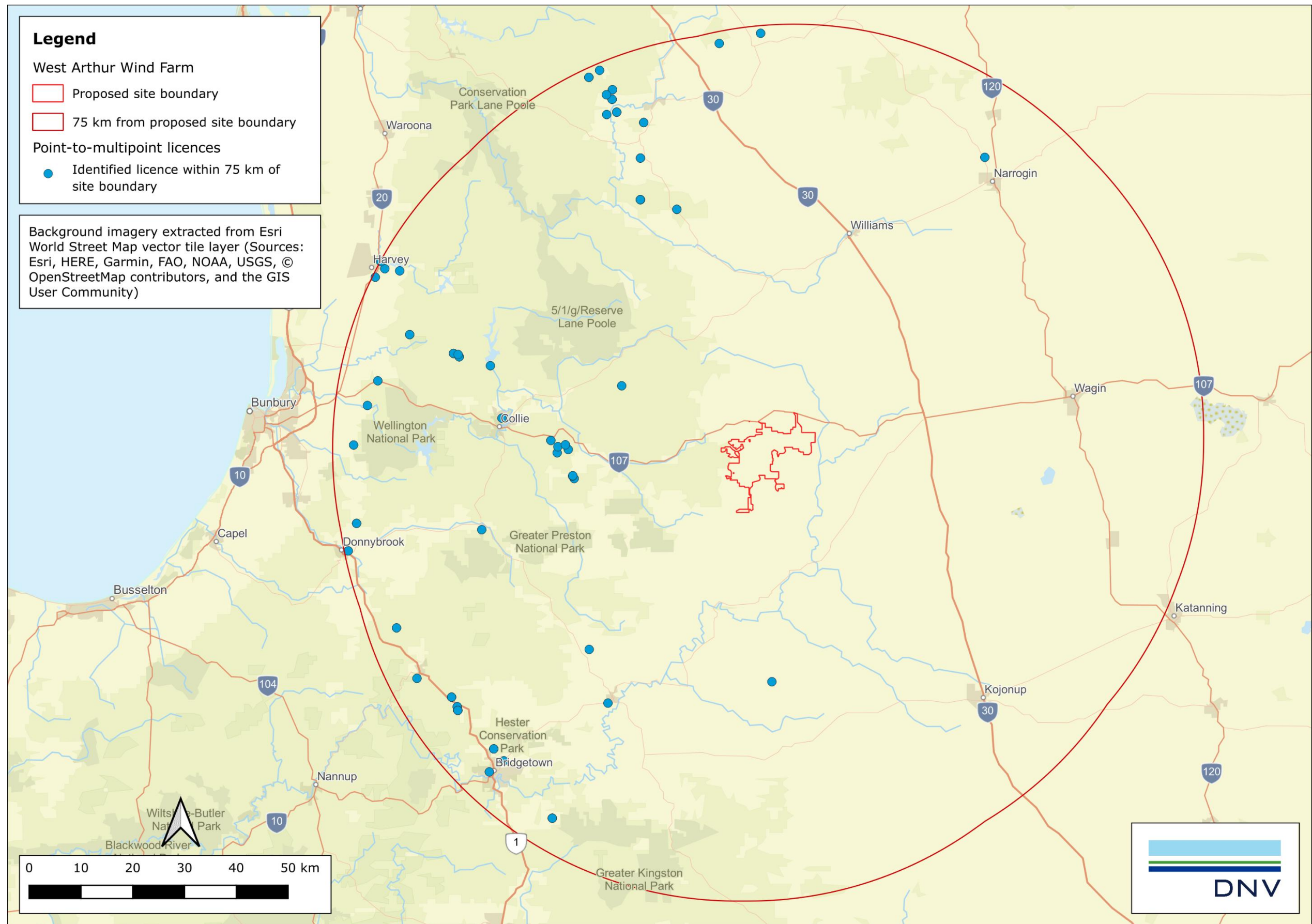


Figure 6 Location of point-to-multipoint licences in the vicinity of the proposed Project

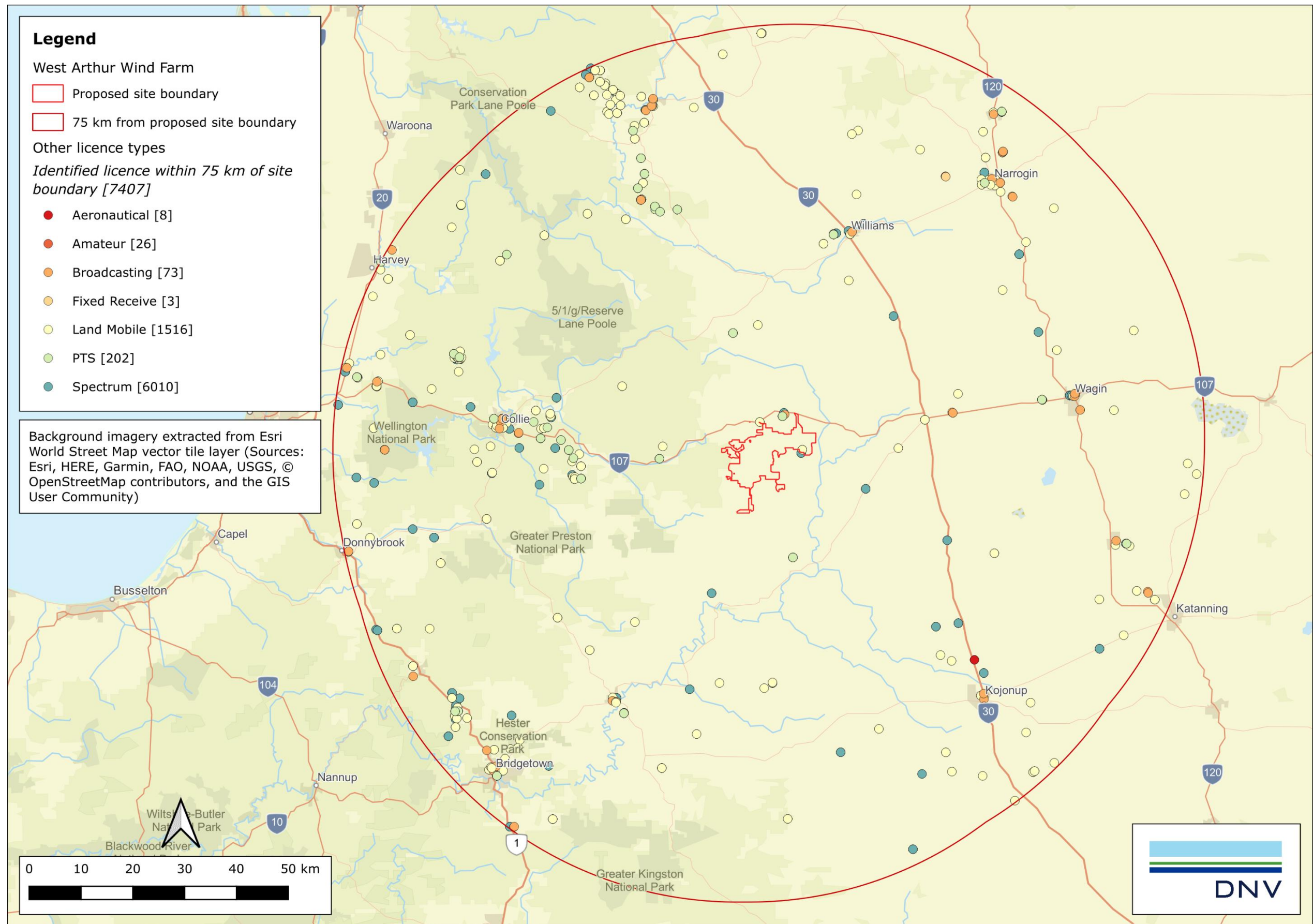


Figure 7 Location of other licence types within 75km of the proposed Project

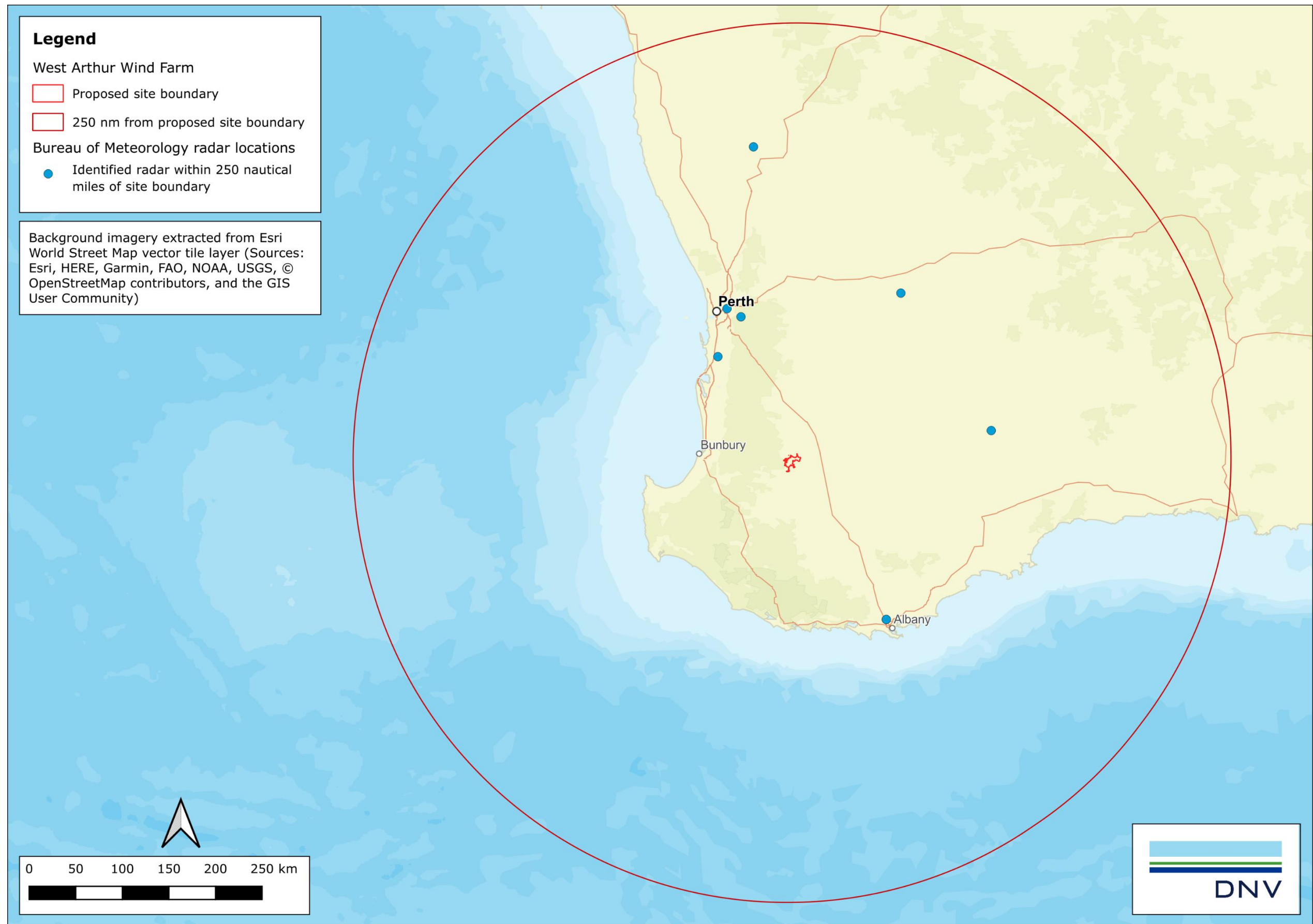


Figure 8 Location of meteorological radar sites within 250 nautical miles of the proposed Project

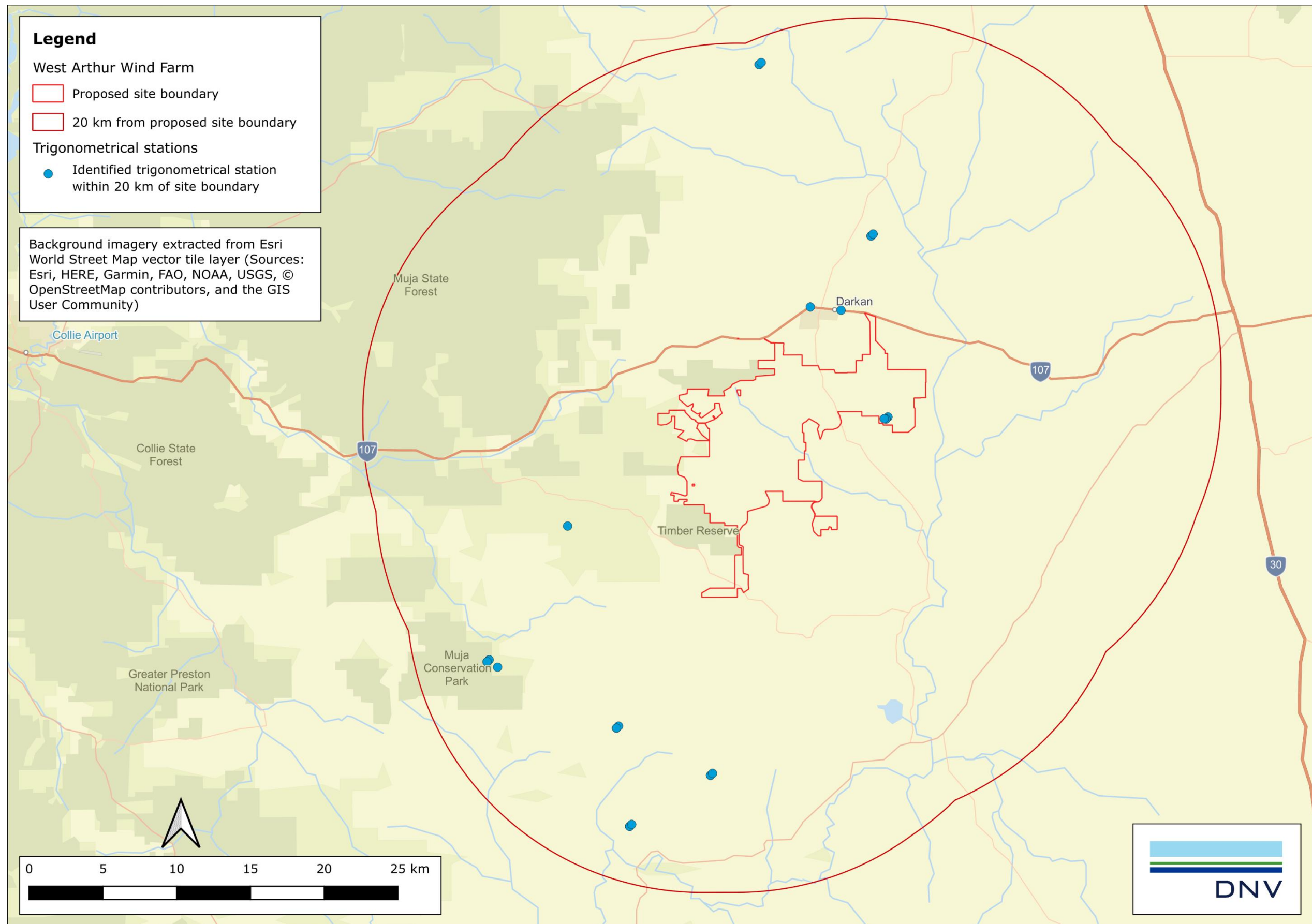


Figure 9 Location of trigonometrical stations within 20 km of the proposed Project

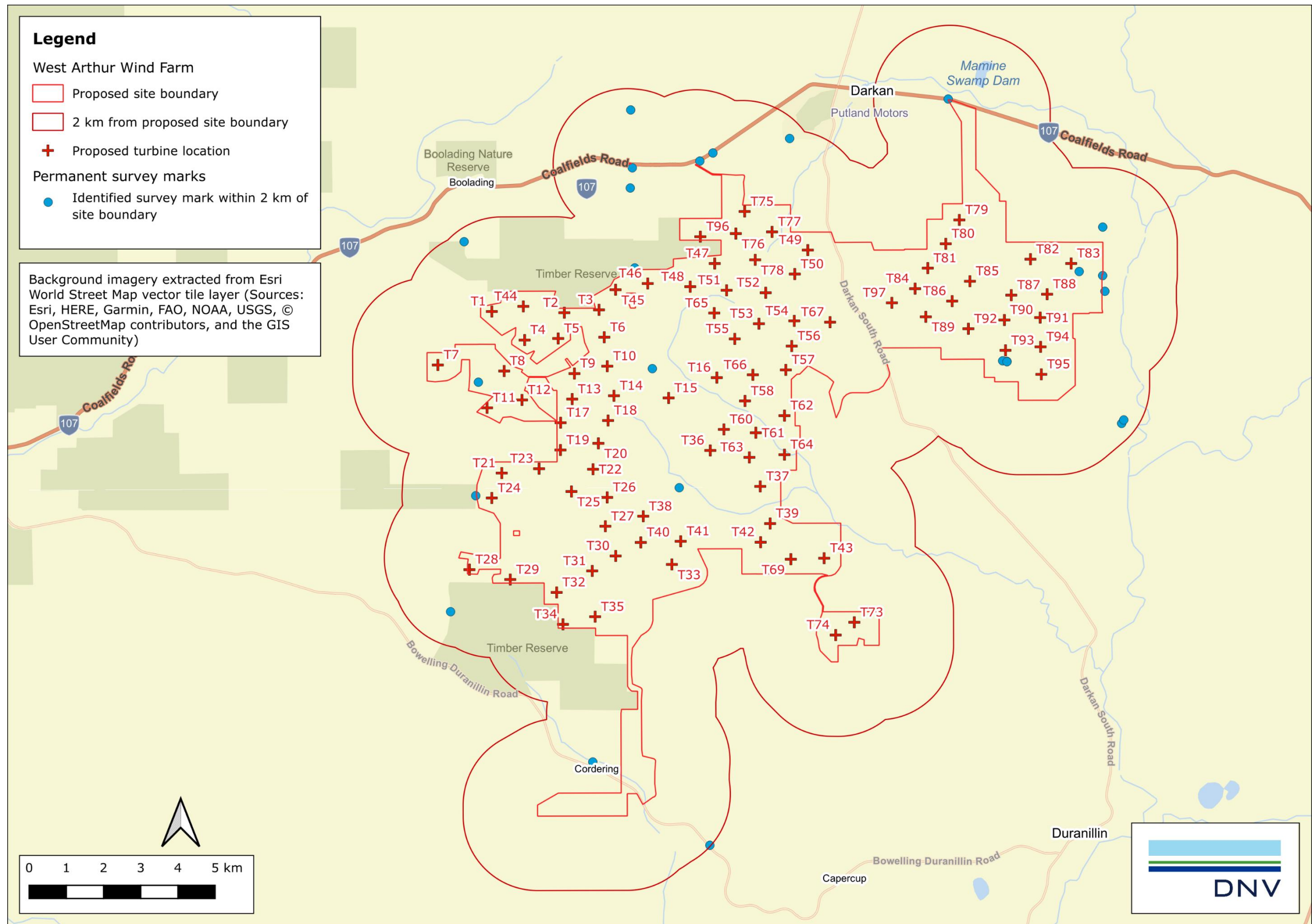


Figure 10 Location of permanent survey marks within 2 km of the proposed Project boundary

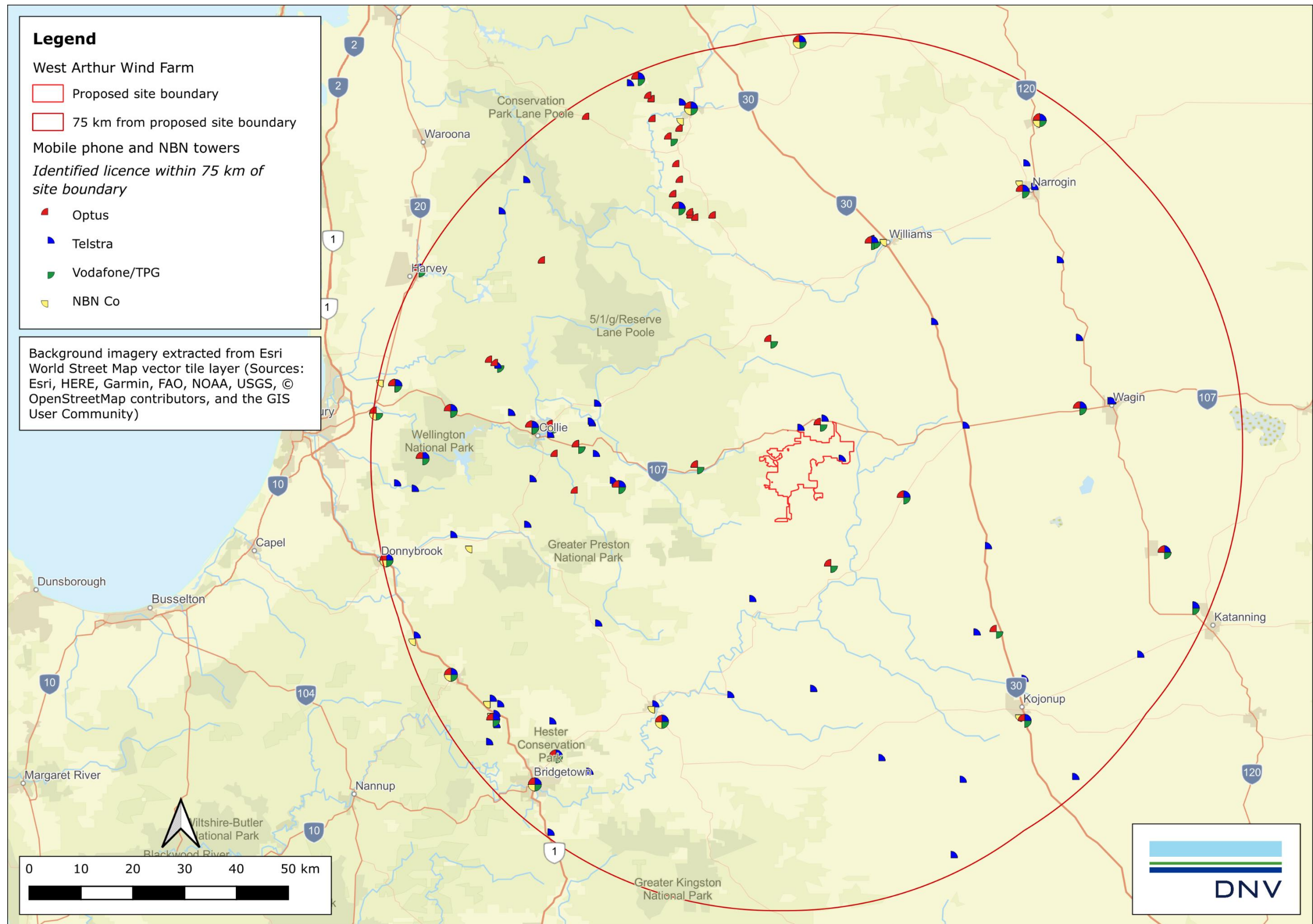


Figure 11 Location of mobile phone and NBN towers within 75 km of the proposed Project

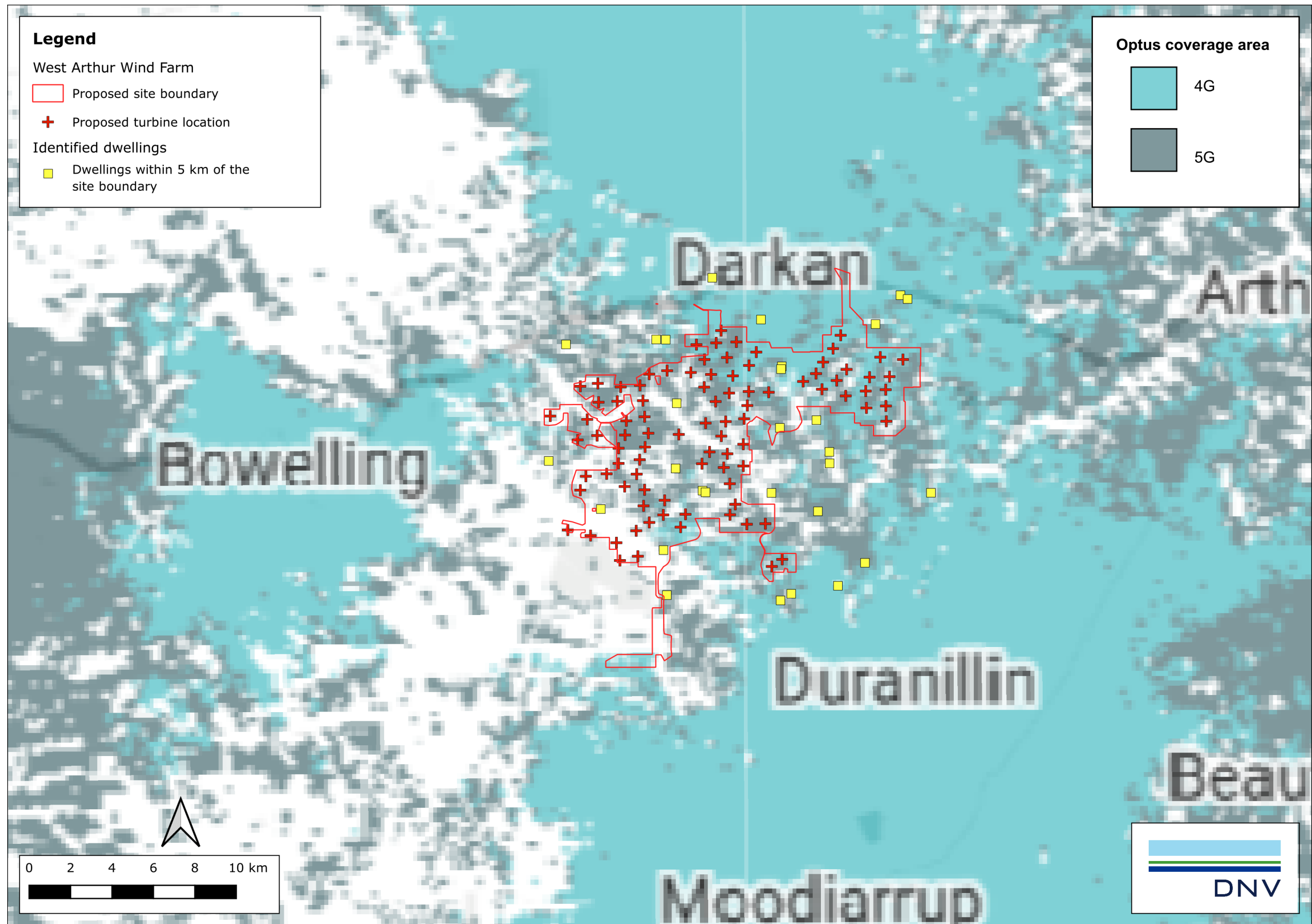


Figure 12 Optus Mobile network coverage for the proposed Project

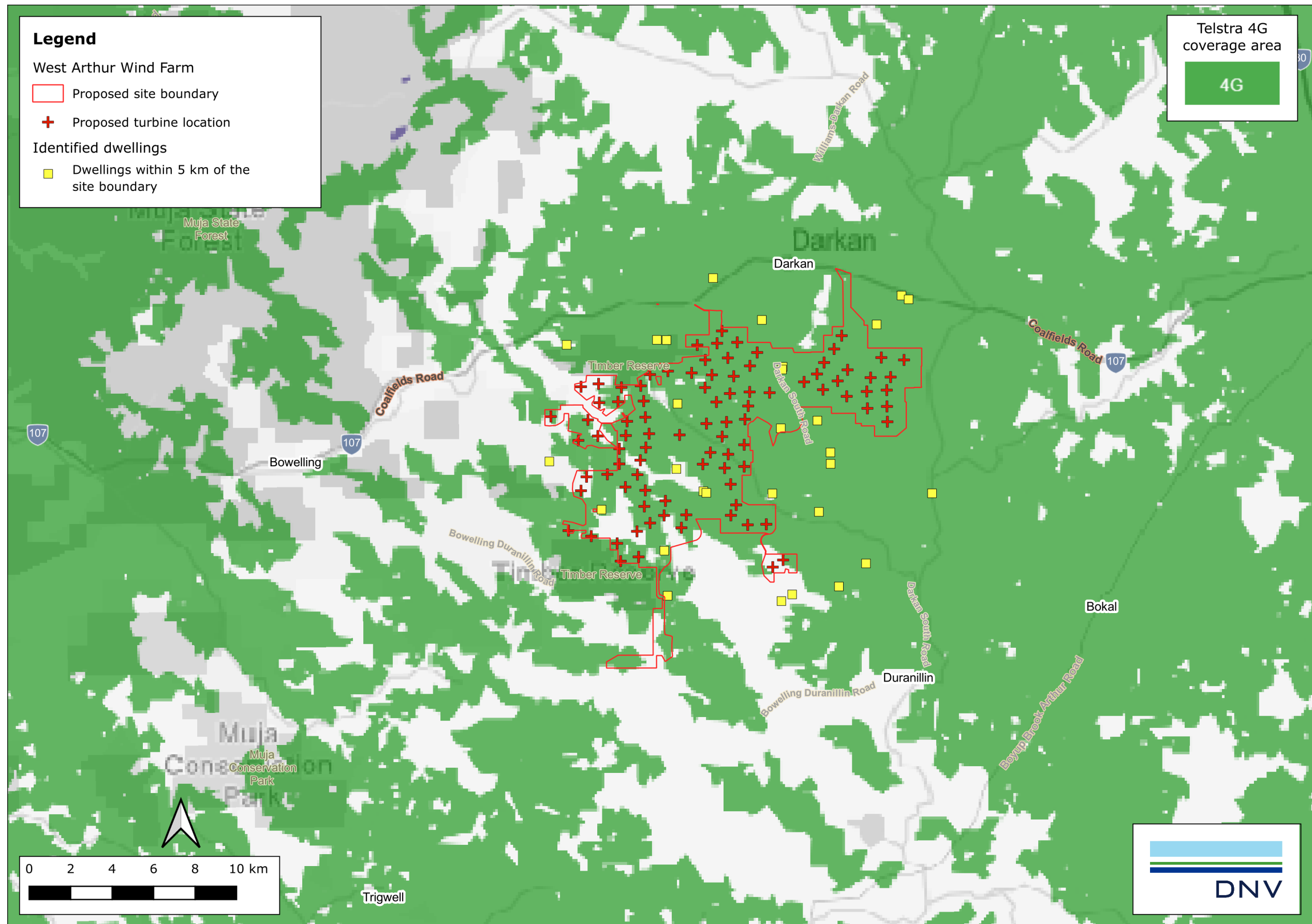


Figure 13 Telstra network coverage for the proposed Project

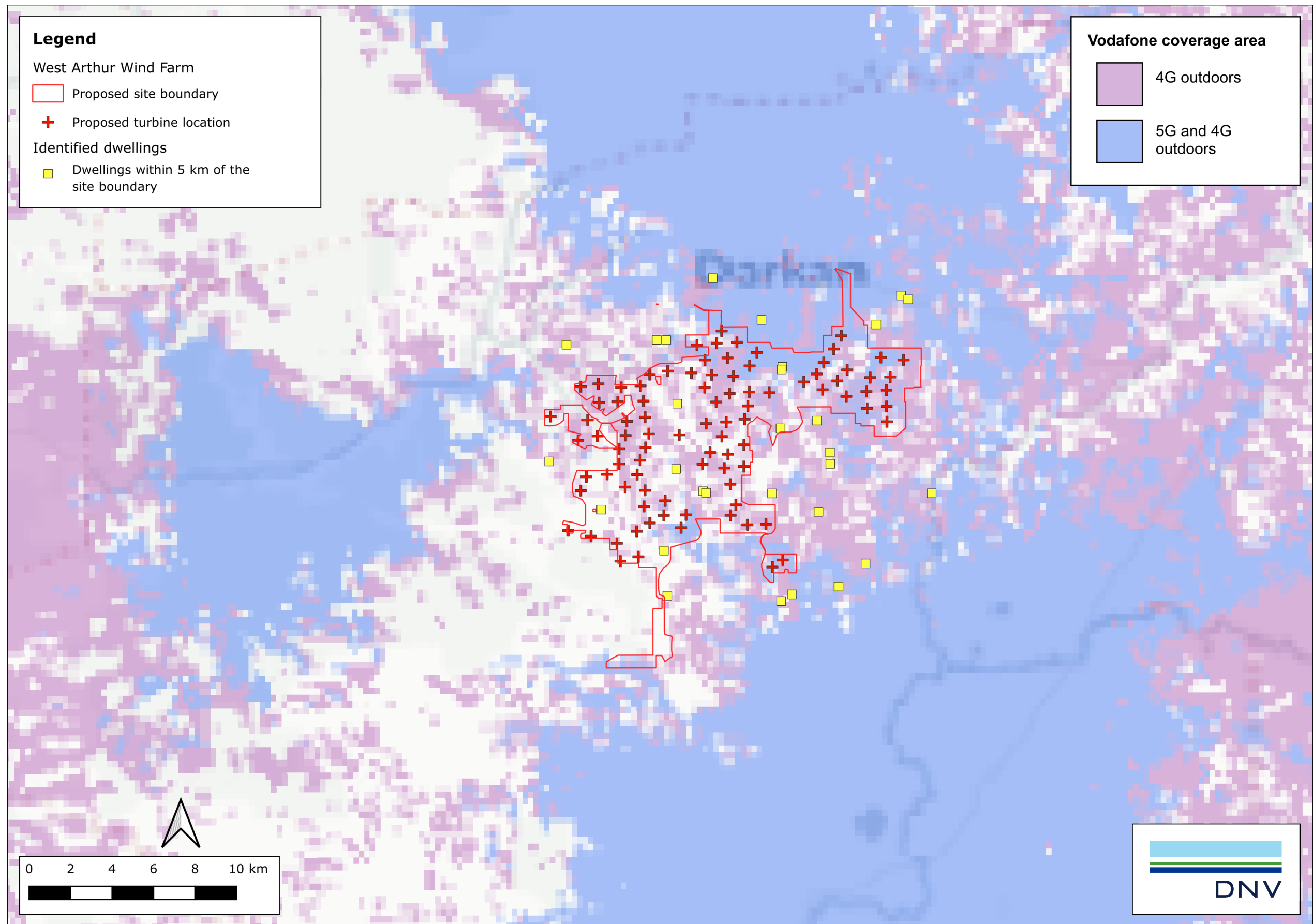


Figure 14 Vodafone network coverage for the proposed Project

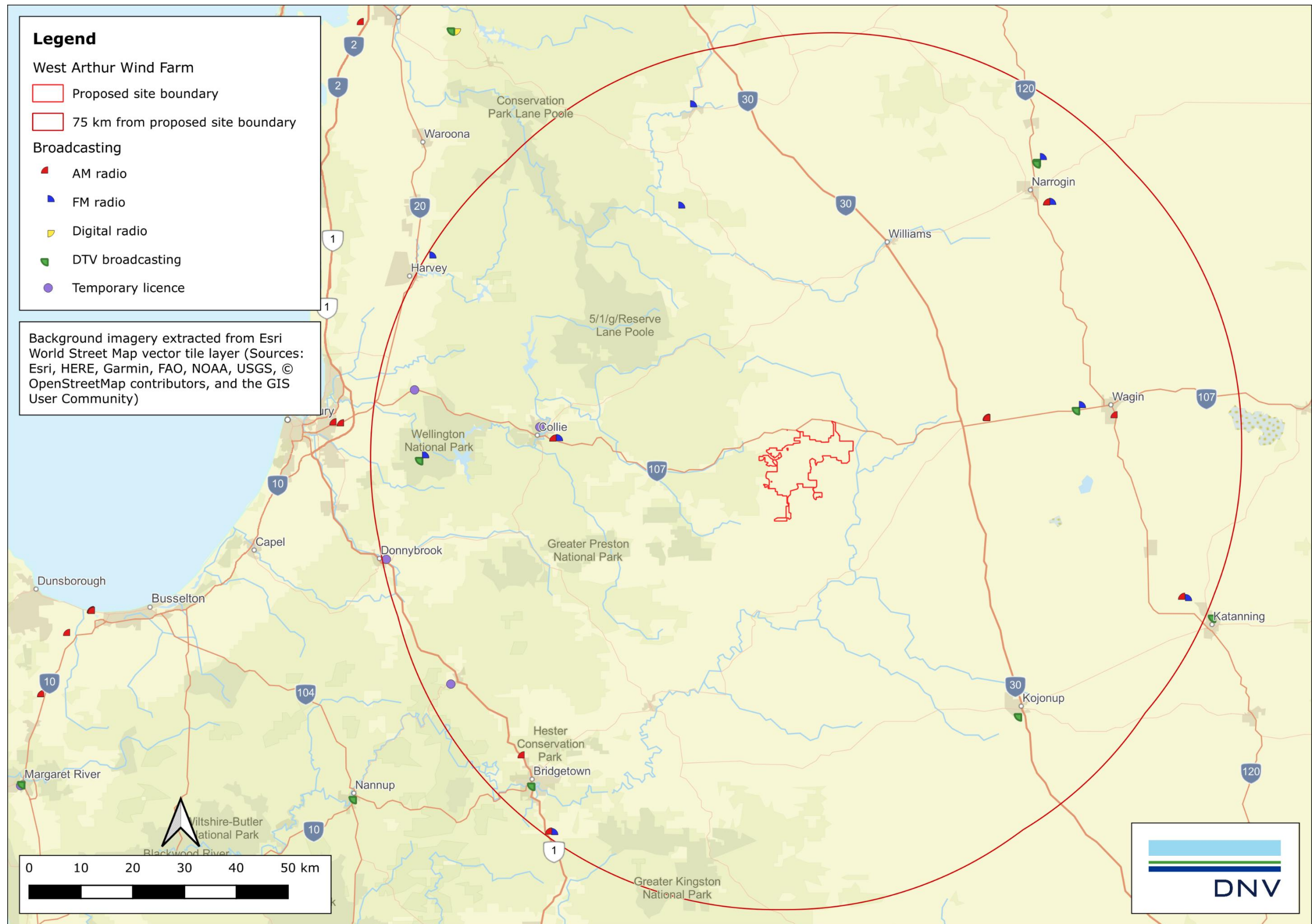


Figure 15 Location of broadcast transmitters in the vicinity of the proposed Project

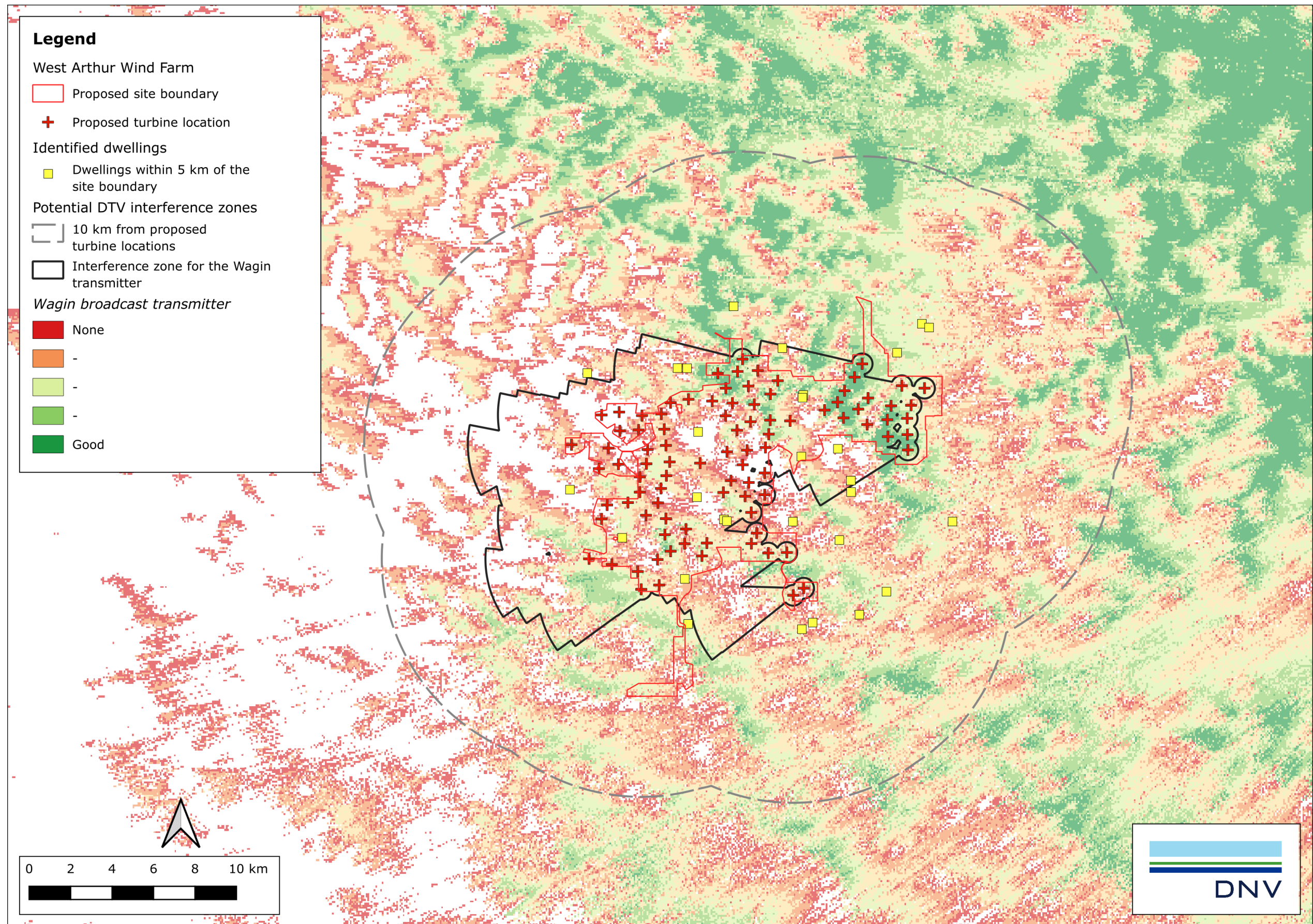


Figure 16 Potential television EMI zones for the Wagin broadcast transmitter from the proposed Project

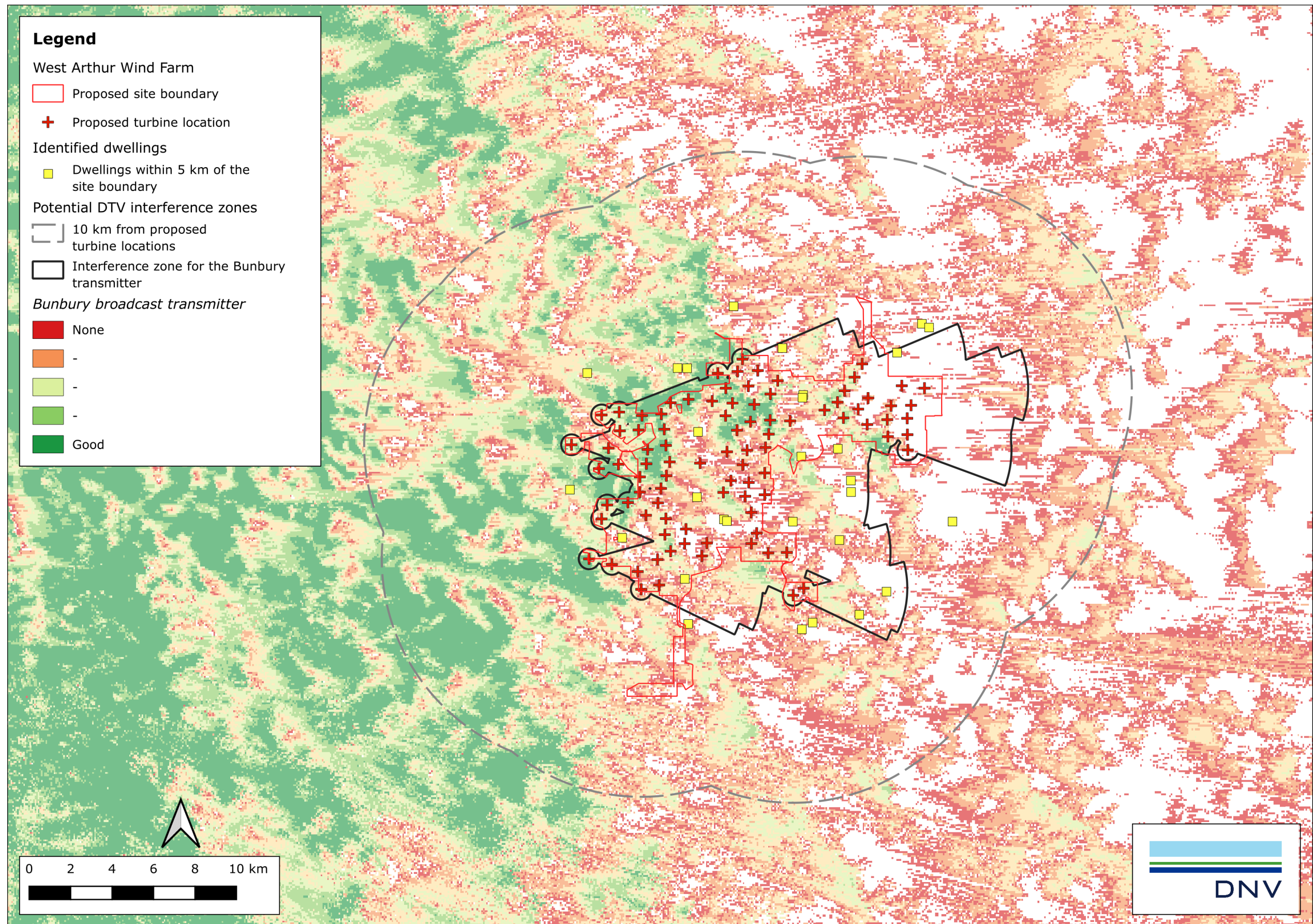


Figure 17 Potential television EMI zones for the Bunbury broadcast transmitter from the proposed Project



About DNV

DNV is the independent expert in risk management and assurance, operating in more than 100 countries. Through its broad experience and deep expertise DNV advances safety and sustainable performance, sets industry benchmarks, and inspires and invents solutions.

Whether assessing a new ship design, optimising the performance of a wind farm, analysing sensor data from a gas pipeline or certifying a food company's supply chain, DNV enables its customers and their stakeholders to make critical decisions with confidence.

Driven by its purpose, to safeguard life, property, and the environment, DNV helps tackle the challenges and global transformations facing its customers and the world today and is a trusted voice for many of the world's most successful and forward-thinking companies.