DNV·GL

RYAN CORNER WIND FARM

EMI Assessment

Ryan Corner Development Pty Ltd

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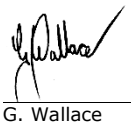		
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1 EXECUTIVE SUMMARY

Garrad Hassan Pacific Pty Ltd, now trading as DNV GL, has been commissioned by Ryan Corner Development Pty Ltd (the "Customer") to independently assess the potential electromagnetic interference (EMI) issues associated with the development and operation of the proposed Ryan Corner Wind Farm (the "Project").

This report summarises the results of an EMI assessment conducted for the site. Information relating to nearby telecommunication licences has been obtained from the Australian Communications and Media Authority (ACMA). In accordance with the planning guidelines relevant to the Project, this document assesses the potential risks regarding interference with radiocommunication services operating in the vicinity of the wind farm, and makes the findings and recommendations discussed below.

Wind turbines may cause interference to television broadcast signals. Historically, analogue television signals have been more likely to suffer from interference. However, digital television services have recently replaced analogue broadcasts and are generally more robust to interference from wind farms. Large scale interference to television signals can generally be avoided by placing the wind turbines distant from the broadcast tower. No television broadcast tower has been identified in close proximity to the Project site boundary, with the nearest broadcast tower approximately 19 km from the site, at Tower Hill near Warrnambool. The Digital TV Switchover Australia website indicates that the digital television signal from the Warrnambool broadcast tower has reasonably 'good' coverage across most of the site, with some areas having 'variable' coverage. The website also indicates that some areas surrounding the Ryan Corner Wind Farm could receive television signals from the Western Victoria and Portland broadcast towers located near Mt Dundas and Narrawong respectively, however these towers also have 'variable ' coverage in some areas around the site. This report highlights the areas around the Project site where interference to terrestrial television broadcasts is most likely to occur. A total of 26 houses were identified in the potential interference zone for the Warrnambool tower, including three (3) dwellings belonging to participating landowners. Eighteen and 17 houses were observed in the potential interference zones for the Western Victoria and Portland towers respectively. If residents currently experience poor or marginal reception of the digital signals, they may be susceptible to interference from the wind farm. For such cases, there are a range of mitigation options available to rectify difficulties encountered with television reception, and dwellings in the area may be able to receive the government funded satellite television service.

Wind turbines can potentially cause interference to fixed point-to-point links through diffraction, scattering or near-field effects. However it is possible to design around this issue, as the path and interference zone of point-to-point signals is generally well known. It has been found that two fixed point-to-point links cross the proposed wind farm site, consisting of four separate fixed licences. An exclusion zone has been established around each point-to-point link based on a standard industry methodology. Two (2) turbines proposed for the Project are located within the calculated exclusion zone. DNV GL has contacted the owner of the links, Powercor, to seek feedback regarding potential interference from the Project on Powercor's operations and services. Powercor has indicated that the proposed wind farm development and operation should not adversely impact their services provided that turbines remain outside of an alternative exclusion zone which it has specified. The alternative exclusion zone does not contain these two turbines;

however Powercor has nevertheless requested that consideration be given to re-positioning these turbines, if possible.

Wind turbines can also cause interference with fixed point-to-multipoint links; however it is not possible to identify link paths for point-to-multipoint links as only the base-station is licensed and contained in the ACMA Radiocommunications Database. There are four (4) point-to-multipoint base stations listed in the ACMA database within 20km of the proposed Project site boundary. Two of these stations are owned by Aussie Broadband (Site IDs 9002831 and 9000480). The other two stations are owned by Wannon Water (Site IDs 302384 and 305626). DNV GL has contacted both station operators as part of an extensive consultation process. To date, no formal response has been received by DNV GL from Aussie Broadband. Wannon Water has indicated that they do not foresee any potential impact to their systems.

There are a number of point-to-multipoint stations at a distance of greater than 20 km from the site. Although it is unlikely that stations at this distance will be servicing customers in the vicinity of the site, DNV GL has contacted the operators of these stations as part of the current consultation process to seek feedback on any potential impact that the wind farm could have on their services. Feedback has been received from a number of operators, and to date no concerns have been raised.

In general, Very High Frequency (VHF) and Ultra High Frequency (UHF) frequency band radio signals, and digital voice based technologies such as mobile phones (e.g. 3G and 4G networks) are unaffected by wind farm development. Some interference is theoretically possible in areas where coverage is marginal and a wind turbine intercepts the signal. However, the signals are generally robust, and should interference from any source occur, the user can move to an area of better reception. DNV GL has contacted mobile phone network operators as part of the current consultation process to seek feedback on any potential impact that the wind farm could have on their services. To date, feedback has been received from Telstra and Optus, who have both indicated that the Project will have no impact on their services.

Emergency services operating radiocommunications assets in the vicinity of the Project have been identified. The majority of the licences identified can be broadly described as base to mobile station style communications. As per the above paragraph, these services are typically unaffected by wind farm development. Regardless, the operators of these stations have been contacted as part of the current consultation process to seek feedback on any potential impact that the wind farm could have on their services. Feedback has been received from a number of operators, and to date no concerns have been raised.

It is possible that wind turbines could cause interference to satellite television and internet services if a wind turbine intercepts the signal between a satellite and ground based receiver. However it is expected that interference to satellite television or internet services resulting from the development and operation of the Project is unlikely.

Broadcast radio signals do not generally suffer from interference from wind turbines. AM radio signals are very unlikely to be affected by wind farms. FM radio signals may experience interference in the form of low level hiss or distortion, but generally only in close proximity to the wind turbines. Any reception difficulties are likely to be easily rectified through the installation of a high quality antenna.

Wind turbines have the potential to interfere with meteorological and aviation radars. Reflection of radar signals by wind turbine blades may give false readings or create a radar "shadow" behind the turbines. Due to the distance from radar assets, and the high probability that the turbines will lie below the radar line-of-sight, it is unlikely that the Project will cause interference to aviation radar, or any significant interference to meteorological radar. DNV GL has contacted the Bureau of Meteorology to seek feedback regarding the potential EMI impact of the Project on their meteorological radar operations; no formal response has been received by DNV GL to date. DNV GL has not considered impact to aircraft navigation systems or aviation radar, as it is assumed these will be considered as part of an aviation impact assessment.

There is a possibility that wind farms can interfere with trigonometrical stations (or trig points) used for surveying purposes. A review of trigonometrical stations in proximity to the wind farm has been conducted and it is unlikely that these stations will be subject to electromagnetic interference from the wind farm. However, it is possible that there may be other stations in the area that have not been identified or that the sight lines to some nearby stations may be blocked by turbines. To assess these potential impacts, Geoscience Australia and the Victorian Department of Environment, Land, Water and Planning Services (DELWP) have been notified of the development as part of the consultation process. To date, feedback has been received from GeoScience Australia, indicating that the Project is not expected to have any impact on their stations.

It is anticipated that the current wind farm configuration has fewer turbines that could potentially cause interference to fixed point-to-point links passing over the Project boundary, compared to the previous configuration.

For terrestrial television broadcasts, the current project configuration may result in increased potential for interference to television signals, due to the increase in the size of the turbines. However, the large number of mitigation options available (as discussed in 4.15.5) mean that it is likely that any potential interference could be rectified.

For other services considered in this assessment, either impacts are considered to be minor or impact changes have been assessed through consultation with the service operators. Based on the responses to the consultation process conducted for this assessment to date, DNV GL does not believe that the current layout will have significantly different impacts to these services.

Conclusions and recommendations from this analysis have been made in Section 5 of this report.

2 INTRODUCTION

Union Fenosa Wind Australia Pty Ltd on behalf of Ryan Corner Development Pty Ltd (the "Customer") is developing the proposed Ryan Corner Wind Farm (the "Project"), located in Western Victoria, Australia. The Customer has instructed Garrad Hassan Pacific Pty Ltd, now trading as DNV GL ("DNV GL"), to carry out an independent analysis of potential electromagnetic interference (EMI) related impacts associated with the proposed Ryan Corner Wind Farm. The results of the work are reported here.

This document has been prepared pursuant to the DNV GL proposal 170492-AUME-P-001-A, dated 5 September 2014, and is subject to the terms and conditions contained therein.

In accordance with relevant planning guidelines, this assessment investigates the impact of the proposed wind farm on:

- Fixed point-to-point links,
- Fixed point-to-multipoint links,
- Radiocommunications assets belonging to emergency services,
- Aviation and meteorological radars,
- Trigonometrical stations,
- Citizens Band (CB) radio and mobile phones,
- Wireless internet,
- Broadcast radio,
- Satellite television and internet, and
- Broadcast television.

In order to conduct the EMI assessment, information regarding radiocommunication licences in the vicinity of the wind farm have been obtained from the Australian Communication and Media Authority (ACMA) database [1].

'Radiocommunications' is used as a broad term in this report to encompass all services that rely on electromagnetic or radio waves to transfer information. There are many methods of transmitting information via radiocommunication. Radiocommunication services operating in the vicinity of the Project, and their susceptibility to interference from the wind farm, are discussed in this document.

The prospective turbine dimensions and layout considered in this analysis have been provided by the Customer [2] and are detailed in Table 1 and Table 2.

DNV GL has initiated a consultation process with organisations operating services that may be impacted by the wind farm developments and operation. This has involved dissemination of basic information on the wind farm, and a request for the organisation to respond regarding whether they foresee any potential impacts. A number of responses have been received, and these are described throughout this report and summarised in Table 12.

3 DESCRIPTION OF THE SITE AND PROJECT

3.1 General site description

The location of the Project is approximately 10 km northwest of Port Fairy, Victoria. The wind farm covers an area of around 3400 hectares.

The location of the site is shown in Figure 1.

3.2 The Project

The Customer has provided a layout for the wind farm, which is composed of 56 wind turbine generators [2] and has been used for the purpose of the EMI study. DNV GL has considered a turbine geometry that will be conservative for turbine configurations with dimensions satisfying all of the following criteria: a rotor diameter of 130 m or less, and an upper tip height of 180 m or less.

Figure 2 shows a map of the site with the proposed turbine layout and locations of houses in the vicinity of the wind farm as provided by the Customer [3]. The proposed wind turbine layout and coordinates of existing dwellings are listed in Table 2 and Table 3 respectively. DNV GL has assumed that all existing dwellings are occupied.

3.3 Planning guidelines

There are two sets of guidelines that are potentially relevant to the assessment of electromagnetic interference impacts for wind farms in Victoria.

The Policy and planning guidelines for development of wind energy facilities in Victoria (Victorian Guidelines), published by the Victorian Department of Planning, Transport and Local Infrastructure in November 2015 [4] state that "*a wind energy facility can affect the amenity of the surrounding area due to … electromagnetic interference*." and that "[*t*]*he potential for electromagnetic interference from the generation of electricity from a wind energy facility should be minimised, if not eliminated, through appropriate turbine design and siting*".

The Environmental Protection and Heritage Council (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 (Draft National Guidelines) [5]. The Draft National Guidelines cover a range of issues spanning the different stages of wind farm development.

The main purpose of the Draft National Guidelines is to provide detailed methodologies to assess issues related to wind farms including community consultations, shadow flicker, noise monitoring, electromagnetic interference, impacts on landscapes, and flora and fauna. Other issues that are covered to a lesser extent in the draft guidelines include aircraft safety, blade glint, risk of fire and indigenous heritage.

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.

DNV GL considers that the recommendations of the Draft National Guidelines meet, if not exceed, the recommendations of the Victorian Guidelines, and it is noted that the Victorian Guidelines refer directly to the Draft National Guidelines.

4 METHODOLOGY, ANALYSIS AND RESULTS

If not properly designed, wind farms have the potential to interfere with radiocommunications services. Two services that are most likely to be affected include television broadcast signals and fixed point-to-point microwave signals. Terrestrial broadcast signals are commonly used to transmit domestic television, while microwave 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 Draft National Guidelines recommend that a radial distance of 50-60 km from the centre of the 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 telecommunication towers within approximately 75 km of the proposed wind farm boundary, and then assess the telecommunication licences attached to these towers. This is to reduce the likelihood that telecommunications links crossing the site are inadvertently excluded from the assessment.

Other services with the potential to experience interference from the project have also been identified, and the potential for interference to those services discussed.

4.1 Telecommunication towers

An image of the ACMA database dated January 2015 was used for this assessment [1]. From the database, there are 366 telecommunication towers within a nominal 75 km of the wind farm. The locations of these telecommunication towers relative to the proposed wind farm are shown in Figure 1.

4.2 Fixed licences of point-to-point (microwave) type

4.2.1 Diffraction

Wind turbines can potentially cause interference, or diffraction, of point-to-point microwave signals and in some cases, point-to-point UHF signals. It is possible to design around this issue as the path and interference zone of these signals are well known. The frequency of common microwave signals varies from approximately 1 GHz to 30 GHz. For this analysis DNV GL has used a wider and more conservative frequency range of 0 to 50 GHz. 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 criteria used for avoiding diffraction effects of point-to-point signals are normally based on an exclusion zone of circular cross-section around the direct path from the transmitter to the receiver (often called boresight) [5] [6] [7]. This exclusion zone is defined in terms of Fresnel zones. The *n*th Fresnel zone is comprised of all points for which, if the radio 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.

To avoid interference to point-to-point signals, wind turbines, including the blades, should be kept outside the second Fresnel zone [8]. The radius of the second Fresnel zone varies along the length of the signal, and is given by:

$$R_{F2} = \sqrt{\frac{2\lambda d_1 d_2}{D}}$$

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, i.e. $d_1+d_2 = D$

The registered communications licences for each tower according to the ACMA database were analysed to determine the transmission paths of licenced links that may experience interference from wind turbines. Each individual link is given an "Assignment ID" by the ACMA so it can be readily identified. The paths resulting from the towers analysed are shown in Figure 3. 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 Country Fire Authority (CFA) towers.

A review of the ACMA database shows that there are two links passing over the proposed wind farm site (operated by Powercor) and another link passing approximately 500 m north of the wind farm site boundary (operated by Aussie Broadband Pty Ltd ("Aussie Broadband")). The links are shown in greater detail in Figure 4.

References [5] [6] [7] state that turbines should be located outside of either the first or second Fresnel zone in order to avoid interference to that link. For each of the identified links around the site, an exclusion zone has been established based on the second Fresnel zone, plus the blade length for turbines with a 130 m rotor diameter. The exclusion zones are also shown in Figure 4.

It is common practice to have multiple assignment ID's for the same physical link to cover practicalities such as licensing for sending and/or receiving signals. Accordingly, the Fresnel zone setback has been calculated on the Assignment ID with the lowest frequency. Details of the links are provided in Table 4.

The Draft National Guidelines recommend consultation is required if a turbine is within 2 km of a telecommunication site or if a turbine is located within the second Fresnel zone of a point-to-point link. There are two turbines (B8 and B18) located within the interference buffer zone for the point-to-point link 1317787-1314524, which passes over the southern side of the site and is operated by Powercor. One turbine (B16) is located at approximately 150 m north of the exclusion zone.

As such, DNV GL has consulted with Powercor, to determine if there is any potential for interference to the link. As part of this process, Powercor has provided updated coordinates for the towers and these have been considered in the current analysis [8]. It is also noted that Powercor has undertaken an internal review of the potential for the Project to cause interference to their operations and services. Following this review, Powercor has provided revised exclusion zones, which have also been considered here. It is noted that there are no turbines within the exclusion zones specified by Powercor, and Powercor has indicated that in general, they do not envisage any issues impacting their services caused by the Project. However, turbines B8 and B18 are nevertheless within the exclusion zone calculated by DNV GL, as can be seen in Figure 4, and Powercor has requested that consideration be given to re-positioning turbines B8 and B18, if possible.

A preliminary assessment was also carried out to determine if the link passes over the Project at a height that was well above the highest point of the turbines (Hub height + blade length = 180 m). This was achieved by examining the elevation and tower heights at each end of the link, as well as the approximate elevation of the areas within the wind farm boundaries over which the link crosses. It was determined that the link does cross the site at a height which has the potential to intersect with turbine blades.

4.2.2 Near field effects and scattering

The Draft National Guidelines [5] mention the possibility of interference to point-to-point links from two additional mechanisms, near field effects and scattering.

According to the Draft National Guidelines, near field effects are usually limited to approximately 720 m from a communication tower and it is recommended that consultation is required if a turbine is within 1 km of a telecommunication site. The Draft National Guidelines also state that scattering is best avoided by placing wind turbines more than 2 km from a communication tower.

All communication towers are greater than 2 km from the Project, with the closest telecommunication tower (Site ID 305387) located approximately 2.1 km from the proposed site boundary or 3.1 km southwest of the nearest proposed wind turbine (B10). It is not expected that the neighbouring communication towers will experience interference due to near field effects or scattering.

4.3 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 licence register. A point-to-multipoint licence allows communication between one or more static sites and multiple points or between the points. The point-to-multipoint type is usually licensed for a defined operational area.

Administratively, the ACMA database details the location of the static station for a fixed licence of the point-to-multipoint type. Hence, the location of the transmission vectors is not readily identifiable. A review of fixed licences of the point-to-multipoint type was undertaken and 133 Assignment ID's were identified within approximately 75 km of the proposed site boundary. These licences are shown in Figure 5. The details of the licence holders as per the ACMA database are provided in Table 5.

There are four point-to-multipoint base stations listed in the ACMA database within approximately 20 km of the centre of the site. Two of these stations are owned by Aussie Broadband (Site IDs 9002831 and 9000480). The other two stations are owned by Wannon Region Water Corporation ("Wannon Water") (Site IDs 302384 and 305626). It is not possible to determine if there are any potential impacts without knowing the locations of each station in the multipoint network, however DNV GL has contacted the link owners as part of an extensive consultation process, to seek feedback on whether their services are likely to be affected by the Project. Wannon Water has indicated that they do not foresee any potential impact to their systems caused by the Project. To date, no formal response has been received by DNV GL from Aussie Broadband.

There are a number of point-to-multipoint stations at a distance of greater than 20 km from the centre of the site. Although it is unlikely that stations at this distance will be servicing customers

in the vicinity of the site, DNV GL has contacted operators of the stations within 60 km from the centre of the wind farm, to seek feedback on any potential impact that the Project could have on their services. Feedback has been received from a number of operators, and to date no concerns have been raised.

4.4 Other licence types

A review of the ACMA database for other licences was conducted. These licences are shown in Table 6 and Figure 6.

Many of the licences identified can be broadly described as base to mobile station style communications, including radio broadcasting, commercial and private mobile telephony. 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. Should reception difficulty be encountered, the amelioration method consists of the user simply moving to receive a clearer signal.

A number of broadcasting licences have been identified. These are likely to consist of radio and television broadcasting services, and are broadly covered 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 GL assumes that potential impacts to these services will be considered as part of an aviation impact study.

4.5 Emergency Services

A review of the ACMA database was conducted to identify emergency services with licences for radiocommunications assets operating in the vicinity of the wind farm. The groups identified are listed in Table 9 along with their contact details. While no direct interference to services has been identified, DNV GL has contacted operators of all stations within 60km from the centre of the wind farm and sought feedback regarding any potential impact that the Project could have on their services. Feedback has been received from a number of operators, and to date no concerns have been raised. The responses received can be seen in Table 12.

4.6 Aircraft Navigation Systems

DNV GL assumes that an aviation impact study will be undertaken to assess the impact of the Project on nearby aviation systems and operations.

4.7 Aviation radar

Primary surveillance radar (PSR) is used for air traffic control and requires line-of-sight to the target object for successful detection. PSR transmits a pulse of energy that is reflected back to the radar receiver by the target object. Some combinations of turbine orientation and blade angle can cause significant Doppler returns to the illuminating radar, thereby creating false targets on the radar screen. The sporadic nature of these false positives makes them difficult to filter with current radar software. Further, turbines may create a radar obstruction or "shadow" where aircraft are not detected. In Australia, PSR installations are located at major airports and typically have a range of approximately 50 nautical miles (93 km).

Secondary surveillance radar (SSR) is less vulnerable to interference from wind turbines as SSR does not rely on reflections from objects for detection. Aircraft are required to carry a transponder, which replies to radar interrogations. However, SSR may still be affected by a wind farm as an aircraft transponder may respond to a reflected signal and give a false position reading, or SSR may be obstructed by a wind farm similar to PSR. SSR installations are also typically located at major airports, and have a range of approximately 250 nautical miles (463 km) when detecting aircraft at high altitude. However, at or near ground level, the range of SSR is expected to be less due to terrain obstructions and curvature of the earth.

The Draft National Guidelines recommend that radar operators be notified of the development of wind farms within 250 nautical miles (463 km) of aviation radar operators [5]. Radar installations are typically located at major airports. As shown in Figure 7, the Project is located approximately 245 km from Melbourne international airport. There are three secondary airports within 205 km to 260 km of the site which also serve Melbourne, and numerous regional airports across Victoria. The closest regional airport is the Warrnambool airport, located at approximately 24 km east of the Project boundaries. DNV GL understands that there is no radar installation at the Warrnambool airport.

Due to the significant distance from major airports, and the high probability that the turbines will lie below the radar line-of-sight, it is unlikely that the Project will cause interference with aviation radar. However, DNV GL assumes that an aviation impact study will be undertaken to assess the impact of the Project to aviation related radar systems.

4.8 Meteorological radar

The Bureau of Meteorology (BoM) operates a network of weather stations across Australia and uses radar instruments for measuring wind speeds in the upper atmosphere (known as "wind finding" radar), and determining rain and storm activity (known as "weather watch" radar).

The "wind finding" radar uses radar echoes from a target to determine the wind speeds and direction. The radar target is attached to a balloon and tracked by the ground radar. The "weather watch" radar, or "weather surveillance" radar, consists of a rotating antenna located on a building, and kept free from any physical obstruction. The antenna is used to direct a thin beam of radio energy upward into the atmosphere which is then reflected back by a cloud mass. The location of the cloud is then determined by the direction and travel time of the reflected beam.

Wind profile measurements are 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. "Weather watch" radars monitor weather situations and are able to indicate the possibility of severe storms out to as distance of 250 km or more. Hence, whilst 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.

Wind farms located at distances greater than 5 km from a BoM field station are unlikely to affect wind finding operations [5]. Generally, the optimal coverage area for "weather watch" radar extends approximately 200 km from the radar installation at a height of approximately 3000 m [9] [10], and approximately 100 km at a height of 1000 m [10]. Theoretically, wind farms can impact upon weather watch radar when located within several hundred kilometres of a radar station, however, due to the curvature of the earth, and intervening terrain, the range at or near ground level is generally less.

According to the Draft National Wind Farm Development Guidelines, consultations with operators of weather stations within 250 nautical miles (463 km) of the proposed wind farm should be undertaken [5]. It has been identified that the BoM operates six (6) weather stations within that range with the closest station "Mt Gambier" located approximately 130 km northwest of the Project site. The locations of these stations are shown in Figure 7 and the details of each station can be found in Table 7.

It is not expected that the wind farm will cause interference with BoM radar installations, as given the distance between the site and radar installations, and the nature of the intervening terrain, it is likely that radar signals will be intercepted before they are able to be influenced by the wind farm.

The Draft National Guidelines recommend that the Bureau of Meteorology be contacted regarding the potential for interference from the Project. DNV GL has contacted the Bureau of Meteorology (BoM) regarding the Project, to seek feedback on whether interference to their services is possible. To date, no formal response has been received by DNV GL from the BoM.

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 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 to 5 km while microwave systems can measure distances up to 150 km. However, such systems are not limited by the line of sight or affected by visibility [11].

The Global Navigation Satellite Systems (GNSS) Network is comprised of permanent stations which provide the geodetic framework for the spatial data infrastructure in Australia and its territories. The GNSS network also provides information to the International GNSS Service. Eight stations from the GNSS database in Australia form the Australian Fiducial Network (AFN) [12] [13]. The AFN stations are equipped with EDM devices and GPS receivers and transmit data to GeoScience Australia via phone lines, internet and/or satellite [14].

The closest GNSS station is located at approximately 126 km east of the Project, in Colac, Victoria. Due to the significant distance between the Project and the GNSS stations, it is deemed unlikely that the Project will cause interference to the GNSS network.

DNV GL has also undertaken a review of the Primary Geodetic Network of Australia [15] and it has been observed that the Project is located within the first-order triangulation region. 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 will then be used for second-order triangulation network and so forth, with the degree of accuracy decreasing for subsequent networks.

According to the database from Geoscience Australia [16], there are 53 trigonometrical stations within 75 km of the Project site boundary. The details of all the trigonometrical stations are provided in Table 10 and illustrated in Figure 8.

Although it is unlikely that the trig points in close proximity to the wind farm host EDM devices or other equipment that is likely to be subject to electromagnetic interference, DNV GL has contacted Geoscience Australia and the Victorian Department of Environment, Land, Water and Planning (DELWP) to inform them of the Project development, and seek feedback regarding whether interference to their systems is possible. To date, feedback has been received by DNV GL from GeoScience Australia, indicating that the Project is not expected to have any impact on their trigonometrical or GNSS stations. No formal response has been received by DNV GL from DELWP to date.

4.10 Citizens 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. 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 communications activities, telemetry and telecommand applications. The radio service operates on two frequency bands, namely the High Frequency (HF) band at between 26.965 MHz and 27.405 MHz, and the Ultra High Frequency (UHF) band at between 476.425 MHz and 477.400 MHz.

The 27 MHz CB radio service was legalised in Australia in the 1970s as a temporary move to switch to UHF CB over the following five years. 27 MHz CB transmit signals in either AM 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 27 MHz 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 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 "line-of-sight" and is easily hindered by hilly terrain and forested areas. If located on a hilltop, CB radio signals can be transmitted over at least 50 km. Repeater stations are 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.

Since users of CB radio service 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. The impact of the Project on CB radio service is expected to be minimal. In the event of interference from the wind turbines, simple steps such as moving a short distance until the signal strength improves would help to mitigate the impact.

4.11 Mobile phones

Mobile phone networks typically operate at frequencies of either between 800 and 900 MHz, or between 1800 and 2100 MHz. At such frequencies, signals are likely to 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, although there is little evidence of this in the literature.

A review of mobile phone towers in the vicinity of the proposed wind farm has been carried out. The nearest mobile phone tower is located approximately 3 km to the southeast of the proposed turbine locations.

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

Figure 9 shows the Optus network coverage for the wind farm area [17]. The map shows outdoor 3G coverage in the vicinity of the wind farm, including some areas of outdoor 4G coverage.

Figure 10 shows the Telstra network coverage for the wind farm area [18]. The map shows 3G coverage in the vicinity of the wind farm, however only some areas show 3G device only coverage. Other areas require an external antenna to receive 3G coverage.

Figure 11 shows the Vodafone network coverage for the wind farm area [19]. Most locations in the vicinity of the wind farm have outdoor and limited indoor coverage, however some locations only have outdoor 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, such as those where an external antenna is required, the possibility for interference exists if a wind turbine intercepts the signal between a mobile phone and the tower.

DNV GL has contacted Optus, Telstra and Vodafone to inform them of the Project development as part of the current consultation process, and to seek feedback on any potential impact that the wind farm could have on their services. To date, DNV GL has received feedback from Telstra and Optus indicating that they both do not foresee any impacts on their services as a result of the Project. No formal response has been received by DNV GL from Vodafone to date.

In cases of marginal network coverage, simple procedures are available to mitigate interference, such as moving a short distance to a new or higher location until the signal improves, or using an external antenna to improve the signal.

4.12 Wireless Internet

Aussie Broadband hold several point-to-multipoint licences in in the vicinity of the wind farm with two base stations located within 10 km from the site (Site IDs 9002831 and 9000480). As the locations of Aussie Broadband customers are not known, it is not possible to determine whether there is the potential for interference to Aussie Broadband's service, however it is possible that a station at this distance may be servicing customers in the vicinity of the proposed wind farm. Aussie Broadband has been contacted by DNV GL to seek feedback regarding the potential for interference to their services. No formal response has been received to date.

Additionally, residents in the vicinity of the wind farm are likely to utilise Telstra wireless broadband services. Telstra's wireless broadband service utilises the same network as Telstra's

mobile phone service, and therefore the comments made in Section 4.11 are applicable here. Specifically, the presence of wind turbines is unlikely to cause any interference. However should interference occur, the simple mitigation options given in Section 4.11 may be applicable.

The NBN (National Broadband Network) website [20] indicates that the NBN service is currently available in areas surrounding the wind farm (Yambuk and St Helens). Therefore residents also have the opportunity to access wireless internet via the NBN. NBN Co has been contacted to seek feedback on whether there is the potential for interference to their services. No formal response has been received to date.

4.13 Satellite Television and Internet

In some rural or remote areas, television and internet access can be provided through satellite only. Satellite television is delivered via a communication satellite to a satellite dish connected to a set-top box. The satellite transmits television signals to the user's antenna at two frequency bands; the C band at between 4 GHz and 8 GHz, and the Ku band at 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 while 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. DNV GL understands that there are currently 21 satellites that provide television to the east coast of Australia [21].

In the case of satellite internet, the user's computer is connected to a satellite modem which is in turn linked to a satellite dish/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.

2 way connection to the Internet via Satellite [22]

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

A number of satellite ISPs service rural areas across Australia. DNV GL has analysed the line-of-sight from satellites that commonly provide internet access in Australia (e.g., IPSTAR, Optus D2) to the houses in the vicinity of the Project and concluded that it is unlikely that the signals from these satellites will be intercepted by turbines at the wind farm for any of the existing house locations considered in this analysis.

The main satellites for free-to-air and subscription TV in Australia are the Optus C1, D1, and D2 satellites [23]. From the SHWF WEF site, the Optus C1, D1, and D2 satellites have elevations of

approximately 44.5°, 43.1°, and 45.5° respectively [24]. Therefore it is unlikely that the proposed SHWF WEF will impact upon the line-of-sight from these satellites to any house.

4.14 Radio broadcasting

DNV GL has assumed that broadcast radio includes both Amplitude Modulation (AM) and Frequency Modulation (FM) radio used to broadcast audio signals. In Australia, AM radio operates in the Medium Wave (MW) band at frequencies of between 520 kHz and 1610 kHz, while FM radio operates in the very high frequency band (VHF) between 87.5 MHz and 108 MHz. The locations of the AM and FM broadcast transmitters in the vicinity of the Project are shown in Figure 12.

4.14.1 AM Radio

Amplitude Modulation, or 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 relatively small physical obstructions on the surface of the earth (such as wind turbine), 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.

As AM radio signals are able to propagate around obstructions such as turbines, it is expected that a wind farm would not cause significant interference for a receiver. Additionally, due to the long wavelength of the signal, interference is only likely in the immediate vicinity of a turbine [25]. Any interference problems are likely to be easily resolved through the installation of a high quality antenna and/or amplifier.

4.14.2 FM Radio

Frequency Modulation, or FM, radio signals are suited to short range broadcasting. Unlike lower frequency signals (such as AM signals), they are not reflected or refracted off the ionosphere. The waves are slightly refracted by the atmosphere and curve back towards the earth, meaning they can propagate slightly beyond the visual horizon, however they may be blocked by significant terrain features. FM radio stations therefore tend to have only local coverage and this 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. Reflection or scattering of radio waves by physical structures can reduce 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 cause hissing or distortion to be heard by a listener. However, generally any interference will only be likely in the immediate vicinity of the wind turbine [25], and should be easily rectified through the installation of a high quality antenna and/or amplifier.

4.14.3 Digital Radio

Digital radio services have been introduced in metropolitan licence areas from 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 [26]. According to the digital radio coverage map available on the ABC website [27], digital radio is not yet available in the Project region.

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 Victoria are now digital broadcasts [28]. 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 GL has experience in situations where houses were able to receive adequate digital television reception in an area of adequate signal strength where the digital television signal is passing through a wind farm.

However, the UK telecommunications regulator Ofcom [29], states the following with regard to interference to digital television 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 GL has drawn two conclusions from this report:

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

The Broadcast Transmitter Database [30] was examined to identify broadcasters nearby to the proposed wind farm, with those found shown in Figure 12. The main television transmitter used by residents in the vicinity of the wind farm is the Warrnambool transmitter at Tower Hill. However, it is also possible that residents to the north and west of the site receive television signals from the Western Victoria and Portland transmitters respectively.

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

- proximity of wind turbines to television broadcast tower;
- proximity of wind turbines to receivers (houses);
- location of wind turbines in relation to houses and television broadcast towers;
- the rotor blade material, rotor speed and rotor blade direction (always into the wind);

- type of receiving antenna (e.g. directional and height);
- location of the television receiver in relation to terrain and other obstacles; and
- frequency and power of the television broadcast signal.

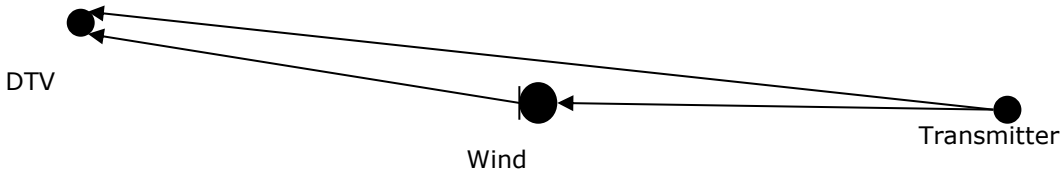
4.15.1 Large Scale Interference

For broadcast signals large scale interference can generally be avoided by placing the wind turbines distant from the broadcast tower. Broadcast towers may be either relay or primary transmitters. Relay TV transmitters are more commonly found in rural areas. Primary TV transmitter towers are higher power and are more commonly located near large urban areas. A clearance of at least 1 km is recommended for relay TV transmitters, while a clearance of at least 6 km is recommended for primary TV transmitters [6]. The closest digital television transmitter to the Project is the Warrnambool transmitter at Tower Hill, which is approximately 19 km away, therefore the wind farm is not expected to cause large scale interference.

4.15.2 Forward and Back Scatter

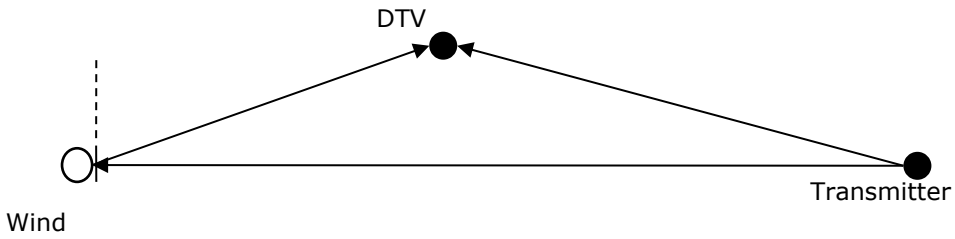
Wind turbines cause interference to television signals by introducing reflections that may be received by the antenna at a dwelling, in addition to the signal received directly from the transmitter, which causes multipath errors. A wind turbine has the potential to scatter electromagnetic waves carrying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

Forward scatter can occur when the transmitter, one or more wind turbines, and receiver are almost aligned as shown below. 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 [31]. Both of these effects can potentially degrade the DTV signal quality.



Forward Scatter Signal Path

Back scatter from wind turbines occurs when DTV signals are reflected from turbine towers and turbine blades onto a DTV receiver as shown below. 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).



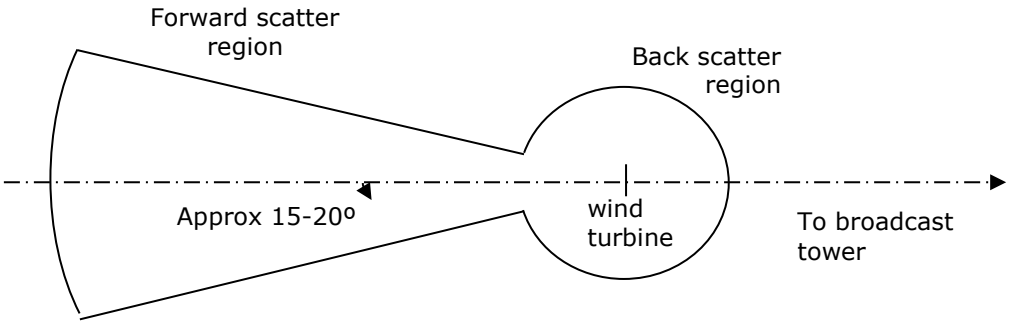
Back Scatter Signal Path

Interference of DTV signals from wind turbine developments can potentially occur in both the forward and backward scatter region. The effect of a wind turbine on a DTV signal can be different depending on the scattering region where the receiver is located [31].

According to Ofcom [29], the forward scatter region does not typically extend further than 5 km for the worst combination of factors [6] [32]. Interference may extend beyond 5 km if the houses are screened from the broadcast tower, but do have line-of-sight to the wind turbines [29]. 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 ±15° to ±20°, 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 house delayed relative to the source signal from the broadcast tower. The back scatter region generally does not extend further than 500 m [6] [33], 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 be larger.

The combination of the forward and back scatter regions, as shown in the following figure, resembles a keyhole.



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, digital television signals are transmitted using the DVB-T (Digital Video Broadcasting – Terrestrial) standard. The International Telecommunication Union (ITU) Recommendation BT.1893 [34] 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 (±60° 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 [35] also highlight that in the case where there is significant blockage of the direct signal, but clear line-of-sight to one or more wind 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 [35].

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 wind turbines.

4.15.3 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 [36]. 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 [34], was found to be the most inaccurate, and does not provide signal estimations in the forward scattering zone of the blades. Additionally, DNV GL notes that it only applies to a single wind turbine rather that a wind farm as a whole. Due to the lack of an accurate scattering model, DNV GL has not performed detailed scatter calculations to predict DTV interference.

As an alternative, 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, 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 [29]. The union of these areas forms a region where there is an increased likelihood of interference to television signals occurring.

4.15.4 Potentially affected dwellings

Dwellings that have increased potential to receive back-scattered or forward-scattered signals from a turbine, (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 above.

The results of the analysis can be seen in Figure 13 and Table 11. The dwellings that are most likely to be susceptible to interference include those within the possible interference zone. A total of 26 houses were identified in the potential interference zone for the Warrnambool broadcast tower at Tower Hill, including three (3) dwellings belonging to participating landowners. Additionally, 17 houses were identified in the potential interference zone for the Portland broadcast tower and 18 houses were identified in the potential interference zone for the Western Victoria broadcast tower, and further details can be seen in to Table 11. 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 outside of the identified interference zones.

According to the Australian Government myswitch website [37], the area around the Project is able to receive digital television signals from the Warrnambool broadcast tower, Portland broadcast tower and Western Victoria broadcast tower. Coverage maps from the myswitch website (reproduced in Figure 14 to Figure 16) suggest that the majority of the area surrounding the wind farm receives reasonably good coverage with some areas of 'variable' coverage. However, an area that receives variable coverage from one transmitter, may, in fact, receive good coverage from one of the other transmitters.

Thus, although digital television signals are generally unlikely to be susceptible to interference from wind turbines in areas of adequate signal strength, interference could be encountered in areas where reception 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. If reception difficulties are encountered, there are a number of mitigations options available, and these are discussed in further detail in Section 4.15.5.

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 as the implications of potential television interference are reasonably low given the large range of mitigation options available.

4.15.5 Mitigation Options

In the event that TV interference is an issue during wind farm construction or after wind farm commissioning, there are several amelioration options available, in approximate order of increasing cost:

1. Realigning the householder's TV antenna more directly towards their existing transmitter;
2. Tuning the householder's antenna into alternative sources of the same or suitable TV signal;
3. The installation of more directional and/or higher gain antenna at the affected house;
4. Relocating the antenna to a less affected position;

5. The installation of cable/satellite TV at the affected house; and
6. Installation of a TV relay station.

In the event of significant interference in the backscatter region, a more directional antenna should ensure a stronger signal from the transmitter since the backscattered signal will originate from a different direction. In the case of forward scatter, the antenna will be pointed towards both the original and scattered signal and hence a more directional antenna may not alleviate a forward scatter issue, however, as noted in [38] DVB-T reception quality may not be substantially affected in the forward scatter region.

The ITU [33] 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 cannot be improved, 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 digital TV through their normal TV 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 [39].

4.16 Anticipated Change

The relative change anticipated in EMI impacts since the previous assessment, which was carried out in 2009 [40], is considered here.

The key differences between the current and previous proposed wind farm layout and turbine geometry are as follows:

- The number of turbines has decreased from 68 to 56;
- The maximum rotor diameter has increased from 101 m to 130 m; and
- The maximum blade tip height has increased from 130.5 m to 180 m.

For both the current and previous layouts, a total of two fixed point-to-point links cross the Project boundary, with the links crossing the site at heights which have the potential to intersect with turbine blades. Under the current layout, there are two turbines that have the potential to cause interference to the link operated by Powercor (although these turbines are outside of Powercor's exclusion zone). The assessment of the previous layout identified up to four turbines with the potential to cause interference, for turbine types with a rotor diameter greater than 100 m. It should be pointed out that the exclusion zones considered in the previous assessment were based on the first Fresnel zone plus the turbine blade length, while the exclusion zones considered in the current assessment are based on the second Fresnel zone plus an increased blade length. Therefore, the current layout has fewer turbines that could potentially cause interference, despite the wider exclusion zones currently considered, compared to the previous layout.

The proposed turbine locations in both the current and previous layouts are over 2 km from the nearest telecommunication tower, and therefore no change in potential near field effects or scattering is expected.

The current wind farm layout is approximately 19 km from the nearest television broadcast tower, compared to 20 km for the previous layout, and therefore no change is expected regarding the potential for large scale interference to television signals.

A comparison of the number of houses where interference to television signals could potentially occur, based on the current and previous wind farm layouts, is presented below. The comparison is given for each of the television broadcast towers considered in both assessments:

- Warrnambool tower: the number of houses in the potential interference zone is 26 for both current and previous layouts.
- Portland tower: the number of houses in the potential interference zone is 17 and 18 for the current and previous wind farm layouts, respectively.
- Western Victoria tower: the number of houses in the potential interference zone is 18 and 19 for the current and previous wind farm layouts, respectively.

However, the potential for interference to television signals caused by a wind turbine is likely to be proportional to the radar cross section (RCS) of the turbine, which is typically proportional to the turbine dimensions [41]. Therefore, the increased turbine dimensions associated with the current configuration of the Project may increase the potential for interference when compared with the previous configuration. However, the large number of mitigation options available (as discussed in 4.15.5) mean that it is likely that any potential interference could be rectified.

For other services considered in this assessment, either impacts are considered to be minor or impacts have been assessed through consultation with the service operators. Based on the responses to the consultation process conducted for this assessment to date, it is not expected that the current layout will have significantly different impacts.

Additionally, it is assumed that any changes to the impact of the Project on aviation radar and navigation systems arising from the revised wind farm layout will be identified as part of an aviation impact study.

5 CONCLUSIONS

Broadcast towers and transmission paths around the Project were investigated to see if EMI would be experienced as a result of the development of the Project. The proposed wind farm would involve the installation of 56 wind turbine generators. DNV GL has considered a turbine geometry that will be conservative for turbine configurations with dimensions satisfying all of the following criteria: a rotor diameter of 130 m or less, and an upper tip height of 180 m or less.

5.1 Fixed point-to-point microwave links

Several point-to-point microwave links were identified with a path over, or near to the proposed wind farm boundary. Of these links, two links (involving four fixed licences in total) were identified passing within the site boundary. The potential exclusion zones around these point-to-point links have been identified and it has been found that two (2) turbines from the Project have the potential to cause interference to the southernmost link. DNV GL has contacted the operator of the link, Powercor. Powercor has provided an alternative exclusion zone which does not include any turbine locations, and has indicated that in general, the proposed wind farm development should not adversely impact their services. However, the two turbines are within the larger exclusion zone calculated by DNV GL, and Powercor has requested that consideration be given to potentially re-positioning these turbines, if possible.

5.2 Point-to-multipoint microwave links

There are four (4) point-to-multipoint base stations listed in the ACMA database within 20 km of the Project boundary. Two of these stations are owned by Aussie Broadband (Site IDs 9002831 and 9000480) while the other two stations are owned by Wannon Water (Site IDs 302384 and 305626). It is not possible to determine if there are any potential impacts without knowing the locations of each station in the multipoint network, however DNV GL has contacted both stakeholders to seek feedback regarding any potential EMI impacts that may arise from the development and operation of the Project. To date, no formal response has been received by DNV GL from Aussie Broadband. Wannon Water has indicated that they do not foresee any potential impact to their systems from the Project.

There are a number of point-to-multipoint stations at a distance of greater than 20 km from the site. Again, it is not possible to determine if there are any potential impacts without knowing the locations of each station in the multipoint network. However, it is unlikely that stations at this distance will be servicing customers in the vicinity of the site. DNV GL has contacted operators of these stations to inform them of the proposed development and to seek feedback on any potential impact that the wind farm could have on their services. Feedback has been received from a number of operators, and to date no concerns have been raised.

5.3 Other licence types

A review of other licences within 75 km of the Project site was conducted. Many of the licences identified can broadly be described as base to mobile station style communication, and include radio broadcasting, commercial and private mobile telephony. 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. For most services, should reception difficulty be

encountered, the amelioration method consists of the user simply moving to receive a clearer signal.

A number of aeronautical and radiodetermination licenses have been identified. DNV GL assumes that potential impacts to these services will be considered as part of an aviation impact study.

5.4 Emergency Services

Emergency services with radiocommunications assets in the vicinity of the site have been identified and contacted to seek feedback on the potential for adverse impacts to their services. Feedback has been received from a number of operators, and to date no concerns have been raised. The responses received can be seen in Table 12.

5.5 Aircraft Navigation Systems

DNV GL assumes that an aviation impact study will be undertaken to assess the impact of the Project on nearby aviation systems.

5.6 Aviation Radar

The Project is located approximately 245 km from Melbourne Airport. Due to the significant distance of the major airports from the wind farm and the high probability that the turbines will lie below the aviation radar line-of-sight, it is unlikely that the Project will have an impact on aviation radar. However, it is recommended that organisations operating aviation radar assets are consulted as part of a detailed aviation study.

5.7 Meteorological Radar

DNV GL has also undertaken an assessment of the Bureau of Meteorology (BoM) radar stations operating in the vicinity of the proposed wind farm and the closest station is located at approximately 130 km northwest of the site. Due to the distance between the station and the site, and the intervening terrain, it is unlikely that the wind farm would have an impact on meteorological radar operations. However, in accordance with the Draft National Wind Farm Development Guidelines, the BoM has been contacted by DNV GL, to inform them of the Project and to seek feedback on the potential for interference. To date, no formal response has been received by DNV GL from the BoM.

5.8 Trigonometrical Stations

A total of 53 trigonometrical stations have been identified within 75 km of the Project, and although they are unlikely to host equipment that is susceptible to electromagnetic interference, Geoscience Australia and the Victorian Department of Environment, Land, Water and Planning (DELWP) have been contacted to inform them of the Project development, and to seek feedback regarding whether there is potential for interference to their systems. To date, feedback has been received by DNV GL from GeoScience Australia, indicating that the Project is not expected to have any impact on their stations. No formal response has been received by DNV GL from DELWP to date.

5.9 Citizens Band Radio

Users of Citizen Band radio do not require a licence and DNV GL is not able to identify the users of the service and their locations. The channels are shared equally among the different users without the right of protection from interference. If interference is experienced it should be possible to improve signal quality by moving a short distance. It is therefore considered that the impact of the wind farm on the CB radio service shall be minimal.

5.10 Mobile Phones

In general, mobile phone signals are not susceptible to interference from wind turbines. The nearest mobile phone base station is located approximately 3 km southeast of the proposed turbine locations.

Published mobile network coverage has been reviewed for the area around the proposed wind farm. It has been found that there is generally good network coverage in most areas around the proposed wind farm, and mobile signals are unlikely to be affected. However there are some areas where coverage may be marginal and therefore mobile signals may be susceptible to interference from the wind farm.

Optus, Telstra and Vodafone have been contacted to seek feedback on any potential impact that the wind farm could have on their services. To date, DNV GL has received feedback from Telstra and Optus indicating that they both do not foresee any impacts on their services as a result of the Project. No formal response has been received by DNV GL from Vodafone to date.

DNV GL notes that if interference is encountered, mitigation options are available, such as installation of an external antenna or moving a short distance until the signal improves.

5.11 Wireless Internet

Aussie Broadband may provide wireless internet services to houses in the vicinity of the Project; however it is not possible to identify customers who are using the Aussie Broadband service. Aussie Broadband has been contacted by DNV GL as part of the extensive consultation process. No formal response has been received to date.

A review of the NBN availability map indicates that work for a fixed wireless network has commenced for the area surrounding the wind farm, however the NBN roll out is not available at this stage. NBN Co has been contacted to seek feedback on whether there is the potential for interference to their services. No formal response has been received to date.

DNV GL's comments on Telstra's mobile coverage in the above section are also applicable to Telstra's wireless broadband services.

5.12 Satellite Television and Internet

Residents in the vicinity of the wind farm may also have access to satellite television and internet. DNV GL has reviewed the line-of-sight of commonly used TV and internet satellites and it has been found that no turbine intercepts the line-of-sight between the houses and satellites considered in the analysis.

5.13 Radio Broadcasting

An examination of the likely impact of the wind farm on radio broadcasting has also been carried out. It is unlikely that the proposed wind farm will have an impact on AM radio as the signals are able to propagate around obstructions and buildings. FM signals however may be susceptible to interference from objects such as wind turbines, resulting in hissing and distortion of the signal. This can be mitigated by the installation of a high quality antenna. At present, digital radio is not available in the Project area.

5.14 Television Broadcasting

Broadcast towers around the proposed Project were investigated to see if television interference is possible as a result of the Project. Television interference mechanisms are complex to calculate and can have limited predictive accuracy. Television interference around wind turbines is generally limited to less than 5 km and is a function of the visibility of the wind turbines and the transmitter from the receptor. Digital terrestrial broadcasts have recently replaced analogue broadcasts in Victoria and are generally much less susceptible to interference from wind farms. However, interference is possible in some areas of low signal strength.

DNV GL has highlighted the areas around the Project site where interference to terrestrial television broadcasts is more likely occur. According to MySwitch website, residents around the Ryan Corner Wind Farm can receive television signals from the Warrnambool, Portland and Western Victoria broadcast towers, with the majority of the site receiving signals from the Warrnambool tower. A total of 26 houses were identified in the potential interference zone for the Warrnambool broadcast tower at Tower Hill, including three (3) dwellings belonging to participating landowners. Seventeen and 18 houses were identified in the potential interference zones from the Portland and Western Victoria towers respectively.

The Project is in a location for which there is reasonably 'good' coverage across most of the site, with some areas having 'variable' coverage according to the Australian Government Digital Ready MySwitch website, and therefore interference could be encountered.

In areas where digital reception is marginal, residents in the vicinity of the Project may be eligible to receive access to the Government-funded satellite television service to view free-to-air television.

Should interference be encountered that is attributable to the wind farm, the amelioration options below should be followed in order to rectify the problem:

1. Realigning the householders TV antenna more directly towards their existing transmitter;
2. Adjusting the height of the TV antenna;
3. Tuning the householders antenna into alternative sources of the same or suitable TV signal;
4. The installation of a more directional and/or higher gain antenna at the affected building;
5. Relocating the antenna to a less affected position;
6. The installation of a cable or satellite TV receiver at the affected house;
7. Installation of a TV relay station.

5.15 Anticipated Change

DNV GL has considered the relative change anticipated in EMI impacts from the current proposed wind farm layout and geometry, compared to the previous layout assessed in 2009.

It is anticipated that the current wind farm layout has fewer turbines that could potentially cause interference to fixed point-to-point links passing over the Project boundary, compared to the previous layout.

For terrestrial television broadcasts, the current project configuration may result in increased potential for interference to television signals, due to the increase in the size of the turbines. However, the large number of mitigation options available (as discussed in 4.15.5) mean that it is likely that any potential interference could be rectified.

For other services considered in this assessment, either impacts are considered to be minor or impact changes have been assessed through consultation with the service operators. Based on the responses to the consultation process conducted for this assessment to date, DNV GL does not believe that the current layout will have significantly different impacts to these services.

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No of Turbines	56
Rotor diameter (m)	130 or less
Upper Tip Height (m)	180 or less

Table 1 - Turbine assumptions for the assessment of EMI.

NAME	Easting[1]	Northing[1]	NAME	Easting[1]	Northing[1]
B6	598757	5758884	B39	597911	5763523
B8	599580	5759399	B40	598734	5763844
B9	599046	5759421	B41	598302	5763921
B10	597757	5758672	B43	598516	5764577
B13	597858	5759298	B44	598133	5764316
B14	597305	5759354	B45	597353	5764138
B15	597523	5759851	B46	596825	5763915
B16	597291	5760468	B47	597384	5763720
B17	597818	5760511	B48	596493	5763534
B18	598232	5760192	B49	597048	5763375
B20	599229	5760008	B52	596999	5762670
B21	599568	5760455	B54	596538	5762502
B22	598922	5760458	B55	597162	5762223
B23	598493	5760673	B58	596563	5762043
B24	599196	5760931	B59	597195	5761778
B25	598687	5761099	B60	597771	5761728
B26	598099	5760974	B62	596360	5761472
B28	599422	5761378	B63	596923	5761397
B29	598768	5761513	B64	597556	5761138
B30	598310	5761771	B66	596605	5760859
B31	599170	5762065	B67	597053	5760926
B32	598757	5762109	B69	595952	5760279
B33	598794	5762791	B70	595849	5759805
B34	598143	5762373	B72	596522	5760128
B35	599017	5763152	B73	597094	5759789
B36	598332	5762921	B74	596421	5759720
B37	597836	5763071	B75	598345	5759377
B38	598479	5763372	B76	598296	5758739

Note: 1. Coordinate system used is Zone 54H, AGD66 datum

Table 2 - Proposed turbine layout for the Project.

Dwelling ID	Status	Easting[1] [m]	Northing[1] [m]	Nearest Turbine	Distance from nearest turbine [km]
H1	Local Landholder	597975	5756143	B10	2.5
H2	Local Landholder	597878	5756402	B10	2.3
H3	Local Landholder	597981	5756747	B10	1.9
H4	Participating Landholder	597543	5756971	B10	1.7
H5	Participating Landholder	597114	5757134	B10	1.7
H6	Local Landholder	597484	5757347	B10	1.4
H7	Local Landholder	597445	5757618	B10	1.1
H8	Participating Landholder	596985	5758281	B10	0.9
H9	Local Landholder	596409	5758436	B14	1.3
H10	Local Landholder	596143	5758383	B74	1.4
H11	Local Landholder	597717	5765306	B44	1.1
H12	Local Landholder	604630	5753104	B8	8.1
H13	Local Landholder	603817	5753670	B8	7.1
H14	Local Landholder	603420	5754084	B8	6.6
H15	Local Landholder	603370	5754550	B8	6.2
H16	Local Landholder	603058	5755340	B8	5.3
H17	Local Landholder	603865	5755329	B8	5.9
H18	Local Landholder	603766	5755796	B8	5.5
H19	Local Landholder	603660	5756021	B8	5.3
H20	Local Landholder	603411	5758532	B8	3.9
H21	Local Landholder	602957	5759722	B8	3.4
H22	Local Landholder	602613	5760102	B21	3.1
H23	Local Landholder	602358	5760760	B21	2.8
H24	Participating Landholder	601413	5760961	B21	1.9
H25	Local Landholder	601277	5761304	B28	1.9
H26	Local Landholder	600505	5762154	B28	1.3
H27	Local Landholder	600206	5763008	B35	1.2
H28	Participating Landholder	599961	5762673	B31	1.0
H29	Local Landholder	599864	5763944	B40	1.1
H30	Participating Landholder	599672	5764614	B43	1.2
H31	Local Landholder	599747	5764685	B43	1.2
H32	Local Landholder	599198	5765407	B43	1.1
H33	Local Landholder	598442	5766120	B43	1.5
H35	Local Landholder	598464	5767743	B43	3.2
H36	Local Landholder	598304	5768202	B43	3.6
H37	Local Landholder	603583	5756999	B8	4.7
H38	Local Landholder	598335	5768563	B43	4.0
H39	Local Landholder	599327	5765854	B43	1.5

Note 1: Coordinate system used is Zone 54 H, AGD66 datum

Table 3 - Existing Dwellings in the vicinity of the Project Wind Farm (Continued)

Dwelling ID	Status	Easting[1] [m]	Northing[1] [m]	Nearest Turbine	Distance from nearest turbine [km]
H40	Local Landholder	601682	5765530	B43	3.3
H41	Local Landholder	601688	5765503	B43	3.3
H42	Local Landholder	603023	5766174	B43	4.8
H43	Local Landholder	603149	5766336	B43	4.9
H44	Local Landholder	601673	5765507	B43	3.3
H45	Local Landholder	604208	5766335	B43	5.9
H46	Local Landholder	604305	5766271	B43	6.0
H47	Local Landholder	604371	5763651	B35	5.4
H48	Local Landholder	604258	5763410	B35	5.2
H49	Local Landholder	604108	5762116	B28	4.7
H50	Local Landholder	603909	5759583	B8	4.3
H51	Local Landholder	604080	5767164	B43	6.1
H52	Local Landholder	604884	5760860	B21	5.3
H53	Local Landholder	606155	5759651	B8	6.6
H54	Local Landholder	606057	5758536	B8	6.5
H55	Local Landholder	601828	5762954	B31	2.8
H56	Local Landholder	602065	5762934	B31	3.0
H57	Local Landholder	604892	5762497	B28	5.6
H58	Local Landholder	605747	5762311	B28	6.4
H59	Local Landholder	607068	5762746	B28	7.8
H60	Local Landholder	597138	5768213	B43	3.9
H61	Local Landholder	596888	5768507	B43	4.3
H62	Local Landholder	596668	5767554	B45	3.5
H63	Local Landholder	596419	5767007	B45	3.0
H64	Local Landholder	595034	5766551	B46	3.2
H65	Local Landholder	594208	5764955	B48	2.7
H66	Local Landholder	593706	5765039	B48	3.2
H67	Local Landholder	593665	5764869	B48	3.1
H68	Local Landholder	593571	5765006	B48	3.3
H69	Local Landholder	593218	5764987	B48	3.6
H70	Local Landholder	592447	5764982	B48	4.3
H71	Local Landholder	593393	5766801	B46	4.5
H72	Local Landholder	593391	5765794	B48	3.8
H73	Local Landholder	593389	5765028	B48	3.4
H74	Local Landholder	593355	5764456	B48	3.3
H75	Local Landholder	593354	5763088	B54	3.2
H76	Local Landholder	592993	5761115	B69	3.1

Note 1: Coordinate system used is Zone 54 H, AGD66 datum

Table 3 - Existing Dwellings in the vicinity of the Project Wind Farm (Continued)

Dwelling ID	Status	Easting[1] [m]	Northing[1] [m]	Nearest Turbine	Distance from nearest turbine [km]
H77	Local Landholder	594399	5760739	B69	1.6
H78	Participating Landholder	595399	5761105	B65	0.8
H79	Participating Landholder	595442	5762217	B54	1.1
H80	Local Landholder	594850	5758295	B70	1.8
H81	Local Landholder	594802	5757453	B70	2.6
H82	Local Landholder	594649	5757124	B70	2.9
H83	Local Landholder	593568	5758118	B70	2.8
H84	Local Landholder	593765	5757948	B70	2.8
H85	Local Landholder	593857	5757869	B70	2.8
H86	Local Landholder	594088	5757591	B70	2.8
H87	Local Landholder	594465	5757221	B70	2.9
H88	Local Landholder	594886	5756274	B70	3.7
H89	Local Landholder	595363	5756082	B10	3.5
H91	Local Landholder	596050	5755830	B10	3.3
H92	Local Landholder	596476	5755382	B10	3.5
H93	Local Landholder	596806	5755033	B10	3.8
H94	Local Landholder	597289	5754740	B10	4.0
H95	Local Landholder	597115	5753882	B10	4.8
H96	Local Landholder	598847	5754153	B76	4.6
H97	Local Landholder	599056	5754284	B76	4.5
H98	Local Landholder	599934	5753384	B76	5.6
H99	Local Landholder	600495	5753780	B6	5.4
H100	Local Landholder	600296	5753102	B76	6.0
H101	Local Landholder	600296	5753102	B76	6.0
H102	Local Landholder	600554	5752786	B6	6.4
H103	Local Landholder	600486	5752655	B6	6.5
H104	Local Landholder	593815	5759371	B70	2.1
H105	Participating Landholder	593906	5759353	B70	2.0
H106	Local Landholder	594013	5759713	B70	1.8
H107	Local Landholder	594600	5756537	B70	3.5
H108	Local Landholder	605095	5757584	B8	5.8
H109	Local Landholder	605164	5757571	B8	5.9
H110	Local Landholder	605306	5757550	B8	6.0
H111	Local Landholder	605699	5758051	B8	6.3
H112	Local Landholder	605285	5751821	B8	9.5

Note 1: Coordinate system used is Zone 54 H, AGD66 datum

Table 3 - Existing Dwellings in the vicinity of the Project Wind Farm (Concluded)

Link No.	Assignment ID	Licence Number	Frequency (MHz)	Postal Address
Point-to-point link crossing the wind farm site				
1	1317135-1314017	1320080	1,442.5	Powercor Australia Ltd C/- Commander Enterprise Service Pty Ltd 064651109 PO Box 58 (C/- P Dessens) CASTLEMAINE VIC 3450
	1317134-1314017	1320080	1,503.0	
	1317134-1314018	1320080	1,503.0	
	1317135-1314018	1320080	1,442.5	
2	1317787-1314524	1320888	450.9	
	1317787-1314525	1320888	450.9	
	1317786-1314524	1320888	460.4	
	1317786-1314525	1320888	460.4	
	1317795-1314535	1320891	853.4	
	1317795-1314536	1320891	853.4	
	8161258-8154189	1424226	856.9	
	8161258-8154194	1424226	856.9	
	1317794-1314535	1320891	929.4	
	1317794-1314536	1320891	929.4	
	8161255-8154181	1424226	932.9	
	8161255-8154182	1424226	932.9	
Point-to-point link passing north of the wind farm site				
3	8177841-8177848	1186912	5,945.2	Aussie Broadband Pty Ltd PO Box 3351 Gippsland VIC 3841
	8177841-8177847	1186912	5,945.2	
	8177842-8177849	1186912	6,197.2	
	8177842-8177850	1186912	6,197.2	

Table 4 - Details of point-to-point links in the vicinity of the Project

Assignment ID	Site ID	Licence No.	Location (AGD66)	Distance to wind farm (km)	Licence Owner
8178016-8178135	9002831	1187154	591869E 5765057N Zone 54	8	Aussie Broadband Pty Ltd PO Box 3351 Gippsland MC VIC 3841
8178019-8178138	9002831	1187154	591869E 5765057N Zone 54	8	
8251719-8273854	9002831	1920128	591869E 5765057N Zone 54	8	
1147600-2220930	9000480	1142108	605278E 5751821N Zone 54	12	
1147601-2220930	9000480	1142108	605278E 5751821N Zone 54	12	
1147885-2221182	9000480	1142842	605278E 5751821N Zone 54	12	
1147886-2221182	9000480	1142842	605278E 5751821N Zone 54	12	
1147887-2221183	9000480	1142843	605278E 5751821N Zone 54	12	
1147888-2221183	9000480	1142843	605278E 5751821N Zone 54	12	
1147889-2221184	9000480	1142844	605278E 5751821N Zone 54	12	
1147890-2221184	9000480	1142844	605278E 5751821N Zone 54	12	
1808497-2225487	9000480	1182336	605278E 5751821N Zone 54	12	
1808498-2225487	9000480	1182336	605278E 5751821N Zone 54	12	
1808499-2225488	9000480	1182337	605278E 5751821N Zone 54	12	
1808500-2225488	9000480	1182337	605278E 5751821N Zone 54	12	
8251707-8273842	9000480	1920124	605278E 5751821N Zone 54	12	
1147865-2221172	133844	1142705	624279E 5766588N Zone 54	26	
1147866-2221172	133844	1142705	624279E 5766588N Zone 54	26	
1147898-2221189	133844	1142886	624279E 5766588N Zone 54	26	
1147899-2221189	133844	1142886	624279E 5766588N Zone 54	26	
1147900-2221190	133844	1142887	624279E 5766588N Zone 54	26	
1147901-2221190	133844	1142887	624279E 5766588N Zone 54	26	
1427459-1421772	133844	1146332	624279E 5766588N Zone 54	26	
1427460-1421772	133844	1146332	624279E 5766588N Zone 54	26	
1808483-2225479	133844	1182330	624279E 5766588N Zone 54	26	
1808484-2225479	133844	1182330	624279E 5766588N Zone 54	26	
1810405-2227256	133844	1182425	624279E 5766588N Zone 54	26	
1810406-2227257	133844	1182426	624279E 5766588N Zone 54	26	
8251715-8273850	133844	1920117	624279E 5766588N Zone 54	26	
8251717-8273852	9010840	1920132	628238E 5751439N Zone 54	31	
1147598-2220929	34523	1142107	628396E 5751456N Zone 54	31	
1147599-2220929	34523	1142107	628396E 5751456N Zone 54	31	
1147867-2221173	34523	1142833	628396E 5751456N Zone 54	31	
1147868-2221173	34523	1142833	628396E 5751456N Zone 54	31	
1147869-2221174	34523	1142834	628396E 5751456N Zone 54	31	
1147870-2221174	34523	1142834	628396E 5751456N Zone 54	31	
1147871-2221175	34523	1142835	628396E 5751456N Zone 54	31	
1147872-2221175	34523	1142835	628396E 5751456N Zone 54	31	
1808493-2225485	34523	1182334	628396E 5751456N Zone 54	31	
1808494-2225485	34523	1182334	628396E 5751456N Zone 54	31	
1808495-2225486	34523	1182335	628396E 5751456N Zone 54	31	
1808496-2225486	34523	1182335	628396E 5751456N Zone 54	31	
8251689-8273830	9010188	1920101	580179E 5789914N Zone 54	34	
1147863-2221171	133843	1142704	579646E 5790708N Zone 54	35	
1147864-2221171	133843	1142704	579646E 5790708N Zone 54	35	
1147902-2221191	133843	1142888	579646E 5790708N Zone 54	35	
1147903-2221191	133843	1142888	579646E 5790708N Zone 54	35	
1147904-2221192	133843	1142889	579646E 5790708N Zone 54	35	
1147905-2221192	133843	1142889	579646E 5790708N Zone 54	35	
1427457-1421771	133843	1146331	579646E 5790708N Zone 54	35	
1427458-1421771	133843	1146331	579646E 5790708N Zone 54	35	
1808485-2225480	133843	1182331	579646E 5790708N Zone 54	35	
1808486-2225480	133843	1182331	579646E 5790708N Zone 54	35	
1147583-2220918	41655	1142106	561430E 5769780N Zone 54	38	
1147584-2220918	41655	1142106	561430E 5769780N Zone 54	38	
1808501-2225489	41655	1182338	561430E 5769780N Zone 54	38	

Table 5 - Details of point-to-multipoint licences within 75 km of the Project

Assignment ID	Site ID	Licence No.	Location (AGD66)	Distance to wind farm (km)	Licence Owner
1808502-2225489	41655	1182338	561430E 5769780N Zone 54	38	Aussie Broadband Pty Ltd PO Box 3351 Gippsland MC VIC 3841
1808503-2225490	41655	1182339	561430E 5769780N Zone 54	38	
1808504-2225490	41655	1182339	561430E 5769780N Zone 54	38	
1808505-2225491	41655	1182340	561430E 5769780N Zone 54	38	
1808506-2225491	41655	1182340	561430E 5769780N Zone 54	38	
1808507-2225492	41655	1182341	561430E 5769780N Zone 54	38	
1808508-2225492	41655	1182341	561430E 5769780N Zone 54	38	
1808509-2225493	41655	1182342	561430E 5769780N Zone 54	38	
1808510-2225493	41655	1182342	561430E 5769780N Zone 54	38	
1808511-2225494	41655	1182343	561430E 5769780N Zone 54	38	
1808512-2225494	41655	1182343	561430E 5769780N Zone 54	38	
1808513-2225495	41655	1182344	561430E 5769780N Zone 54	38	
1808514-2225495	41655	1182344	561430E 5769780N Zone 54	38	
1808515-2225496	41655	1182345	561430E 5769780N Zone 54	38	
1808516-2225496	41655	1182345	561430E 5769780N Zone 54	38	
1810401-2227249	41655	1182421	561430E 5769780N Zone 54	38	
1810402-2227250	41655	1182422	561430E 5769780N Zone 54	38	
8251703-8273838	41655	1920109	561430E 5769780N Zone 54	38	
1147602-2220931	9000478	1142109	651869E 5758728N Zone 54	53	
1147603-2220931	9000478	1142109	651869E 5758728N Zone 54	53	
1147879-2221179	9000478	1142839	651869E 5758728N Zone 54	53	
1147880-2221179	9000478	1142839	651869E 5758728N Zone 54	53	
1147881-2221180	9000478	1142840	651869E 5758728N Zone 54	53	
1147882-2221180	9000478	1142840	651869E 5758728N Zone 54	53	
1147883-2221181	9000478	1142841	651869E 5758728N Zone 54	53	
1147884-2221181	9000478	1142841	651869E 5758728N Zone 54	53	
1808489-2225483	9000478	1182332	651869E 5758728N Zone 54	53	
1808490-2225483	9000478	1182332	651869E 5758728N Zone 54	53	
1808491-2225484	9000478	1182333	651869E 5758728N Zone 54	53	
1808492-2225484	9000478	1182333	651869E 5758728N Zone 54	53	
8251704-8273839	9000478	1920119	651869E 5758728N Zone 54	53	
1810414-2227269	303604	1186570	592934E 5818689N Zone 54	58	
1810415-2227270	303604	1186571	592934E 5818689N Zone 54	58	
8187727-8192455	303604	1562642	592934E 5818689N Zone 54	58	
8187738-8192466	303604	1562642	592934E 5818689N Zone 54	58	
8251698-8273832	303604	1920108	592934E 5818689N Zone 54	58	
1147604-2220932	9000479	1142110	658847E 5786258N Zone 54	65	
1147605-2220932	9000479	1142110	658847E 5786258N Zone 54	65	
1147873-2221176	9000479	1142836	658847E 5786258N Zone 54	65	
1147874-2221176	9000479	1142836	658847E 5786258N Zone 54	65	
1147875-2221177	9000479	1142837	658847E 5786258N Zone 54	65	
1147876-2221177	9000479	1142837	658847E 5786258N Zone 54	65	
1147877-2221178	9000479	1142838	658847E 5786258N Zone 54	65	
1147878-2221178	9000479	1142838	658847E 5786258N Zone 54	65	
8251699-8273836	9000479	1920116	658847E 5786258N Zone 54	65	

Table 5 - Details of point-to-multipoint licences within 75 km of the Project (continued)

Assignment ID	Site ID	Licence No.	Location (WGS84)	Distance to wind farm (km)	Licence Owner
8364084-8409924	303649	1956932	561467E 5769788N Zone 54	38	(C/- P Dessens) Powercor Australia Ltd C/- Commander Enterprise Service Pty Ltd 064651109 PO Box 58 Castlemaine VIC 3450
8364087-8409927	303649	1956932	561467E 5769788N Zone 54	38	
8219286-8232730	305790	1327796	658820E 5786250N Zone 54	65	
8219292-8232738	305790	1327796	658820E 5786250N Zone 54	65	
8219365-8232865	305790	354784	658820E 5786250N Zone 54	65	
8219367-8232867	305790	354784	658820E 5786250N Zone 54	65	
8324377-8362923	305790	1945114	658820E 5786250N Zone 54	65	
8324378-8362924	305790	1945114	658820E 5786250N Zone 54	65	
8235685-8253447	43176	1914862	554250E 5755250N Zone 54	45	Alcoa Portland Aluminium Pty Ltd
8235689-8253451	43176	1914862	554250E 5755250N Zone 54	45	
8410290-8471779	11703	1977975	589804E 5828647N Zone 54	68	Vertical Telecoms Pty Ltd Alexandria PO Box 126 Rosebery NSW 2018
1149204-2222450	302384	1143861	604897E 5750254N Zone 54	13	Wannon Region Water Corporation PO Box 1158 Warrnambool VIC 3280
1149205-2222450	302384	1143861	604897E 5750254N Zone 54	13	
1312120-1309704	302384	1314696	604897E 5750254N Zone 54	13	
8226531-8242242	302384	1909709	604897E 5750254N Zone 54	13	
8226537-8242253	302384	1909709	604897E 5750254N Zone 54	13	
1325573-1320539	305626	1326838	620040E 5758930N Zone 54	22	
1325574-1320539	305626	1326838	620040E 5758930N Zone 54	22	
1325571-1320538	40981	1326837	629880E 5751150N Zone 54	33	
1325572-1320538	40981	1326837	629880E 5751150N Zone 54	33	
1303972-1303120	300881	1305841	631030E 5750410N Zone 54	34	
1303973-1303120	300881	1305841	631030E 5750410N Zone 54	34	
1312636-1310179	300881	1315436	631030E 5750410N Zone 54	34	
1149184-2222434	133996	1143860	553128E 5750868N Zone 54	46	
1149185-2222434	133996	1143860	553128E 5750868N Zone 54	46	
8387467-8440068	133996	1945302	553128E 5750868N Zone 54	46	
8387468-8440069	133996	1945302	553128E 5750868N Zone 54	46	
8325086-8363758	41654	1945301	614251E 5806249N Zone 54	48	
8325087-8363759	41654	1945301	614251E 5806249N Zone 54	48	
1303964-1303116	300879	1305803	627070E 5802110N Zone 54	50	
1303965-1303116	300879	1305803	627070E 5802110N Zone 54	50	
1303954-1303111	300876	1305799	658530E 5785340N Zone 54	65	
1303955-1303111	300876	1305799	658530E 5785340N Zone 54	65	
1325575-1320540	300876	1326839	658530E 5785340N Zone 54	65	
1325576-1320540	300876	1326839	658530E 5785340N Zone 54	65	
8183292-8185887	11703	1191982	589804E 5828647N Zone 54	68	
8183310-8185907	11703	1191982	589804E 5828647N Zone 54	68	
1313731-1311169	302771	1316464	666650E 5765450N Zone 54	68	
8197035-8205869	36007	1900207	636300E 5827700N Zone 54	76	
8197036-8205870	36007	1900207	636300E 5827700N Zone 54	76	
1325567-1320536	46455	1326835	672600E 5737500N Zone 54	78	
1325568-1320536	46455	1326835	672600E 5737500N Zone 54	78	
1810261-2227043	136307	1185110	627315E 5749974N Zone 54	26	Warrnambool Golf Club Inc Younger St Warrnambool VIC 3280

Table 5 - Details of point-to-multipoint licences within 75 km of the Project (concluded)

Licence Type	Licence Category	Number of Instances
1800 MHz Band	Spectrum	42
2 GHz Band	Spectrum	104
2.3 GHz Band	Spectrum	512
800 MHz Band	Spectrum	180
ACA Assigned	ACA	34
Aeronautical Assigned System	Aeronautical	3
Amateur Beacon	Amateur	5
Amateur Repeater	Amateur	9
Ambulatory System	Land Mobile	3
Broadcast Service	Broadcasting	74
CBRS Repeater	Land Mobile	8
Land Mobile System - > 30MHz	Land Mobile	688
Land Mobile System 0-30MHz	Land Mobile	82
Limited Coast Assigned System	Maritime Coast	4
Narrowband Area Service station(s)	Broadcasting	3
Narrowcasting Service station(s)	Broadcasting	13
Narrowcasting Service stations (HPON)	Broadcasting	4
PABX Cordless Telephone Service	Land Mobile	1
Paging System - Exterior	Land Mobile	34
Paging System - Interior	Land Mobile	3
PMTS Class B (2110-2170 MHz)	PTS	232
PMTS Class B (935-960 MHz)	PTS	226
Point to Multipoint	Fixed	143
Point to Multipoint - Land Mobile Spec	Fixed	2
Radiodetermination	Radiodetermination	3

Table 6 - Details of other licences identified within 75 km of the Project

BoM Radar site	Location[1]		Approximate Distance from the Project [km]
Mildura	S34.23°	E142.08°	449
Mt Gambier	S37.75°	E140.77°	132
Melbourne	S37.86°	E144.76°	233
Yarrawonga	S36.03°	E146.03°	426
Sellicks Hill	S35.33°	E138.50°	462
NW Tasmania	S41.181°	E145.58°	435

Note: 1. Coordinate system used is Lat/Long WGS84 datum

Table 7 - BoM Radar sites in the vicinity of the Project

Airport	Location[1]		Approximate Distance from the Project [km]
Melbourne	S37.67°	E144.85°	245
Avalon	S38.04°	E144.47°	210
Essendon	S37.73°	E144.90°	252
Moorabbin	S37.98°	E145.10°	263

Note: 1. Coordinate system used is Lat/Long WGS84 datum

Table 8 - Airports in the vicinity of the Project

Emergency Service	Contact Details	Distance of closest Site from centre of wind farm [km]
Ambulance Victoria	Ambulance Victoria Attn: Tim McCallum 303 Gillies St North Wendouree VIC 3355	32
Country Fire Authority	Country Fire Authority PO Box 701 MOUNT WAVERLEY VIC 3149	7
Police Department	Police Department Attn: Natalie Leao Level 7 Tower 2 637 Flinders St MELBOURNE□VIC 3005	61
St John Ambulance Australia (Victoria)	St John Ambulance Australia (Victoria) Inc PO Box 573 Mt Waverley VIC 3149	28
St John Ambulance Australia Incorporated	St John Ambulance Australia Incorporated Mr P LeCornu CEO PO Box 3895 Manuka ACT 2603	31
Victoria State Emergency Service	Victoria State Emergency Service 168 Sturt St Southbank VIC 3006	14

Table 9 - Emergency services with radiocommunication assets in the vicinity of the Project

Station Name	Datum	Latitude	Longitude	Distance to site (km)
Badger Creek	AGD66	S38°17' 31"	E141°31' 17"	53
Badger Creek RM1	AGD66	S38°17' 30"	E141°31' 19"	53
Bainbridge	AGD66	S37°41' 4"	E142°1' 6"	68
Bald Hill	AGD66	S38°23' 12"	E141°36' 15"	47
Cape Bridgewater	AGD66	S38°23' 17"	E141°24' 22"	64
Cape Nelson	AGD66	S38°25' 53"	E141°32' 24"	53
Cape Nelson LH	AGD66	S38°25' 56"	E141°32' 29"	53
Chaucer	AGD66	S38°23' 13"	E141°31' 32"	53
Clay	AGD84	S38°13' 3"	E141°42' 7"	38
	AGD66	S38°13' 3"	E141°42' 7"	38
	GDA94	S38°12' 57"	E141°42' 12"	38
Clay Mwt	AGD66	S38°13' 5"	E141°42' 7"	38
Crowes Hill	AGD66	S38°14' 50"	E141°49' 48"	26
Dryden	AGD66	S38°20' 35"	E141°23' 55"	64
Flaxmans Hill	AGD84	S38°32' 30"	E142°44' 51"	61
	AGD66	S38°32' 30"	E142°44' 51"	61
	GDA94	S38°32' 25"	E142°44' 56"	61
Foleys Road	AGD66	S38°18' 57"	E141°31' 27"	53
Grasstree Hill	AGD66	S38°19' 54"	E141°28' 30"	57
Henty	ITRF2000	S38°21' 5"	E141°36' 31"	46
Hopkins Point	AGD66	S38°23' 49"	E142°31' 34"	37
Hopkins Point RM4	AGD66	S38°23' 51"	E142°31' 29"	37
Hummocks	AGD66	S38°21' 38"	E142°5' 59"	8
Kincaid	AGD66	S38°10' 59"	E141°22' 5"	67
McCunnies	AGD84	S38°19' 4"	E142°55' 30"	70
	AGD66	S38°19' 4"	E142°55' 30"	70
	GDA94	S38°18' 59"	E142°55' 35"	70
McCunnies RM M	AGD66	S38°19' 2"	E142°55' 37"	70
McCunnies RM R	AGD66	S38°18' 58"	E142°55' 27"	70
Melrose	AGD66	S37°47' 50"	E141°58' 0"	57
Mortlake No 1	AGD66	S38°22' 53"	E142°31' 56"	37
Napier	AGD84	S37°53' 43"	E142°3' 27"	44
	AGD66	S37°53' 43"	E142°3' 27"	44
	GDA94	S37°53' 38"	E142°3' 32"	44
Nigretta	AGD66	S37°41' 46"	E141°57' 17"	68
Noorat	AGD66	S38°10' 43"	E142°56' 6"	72
Pickering Point	AGD66	S38°23' 59"	E142°28' 4"	32
Picnic Hill	AGD66	S38°24' 20"	E141°32' 39"	52
Picnic Hill ECCE A	AGD66	S38°24' 18"	E141°32' 39"	52
Picnic Hill ECCE B	AGD66	S38°24' 18"	E141°32' 37"	52
Picnic Hill West	AGD66	S38°24' 22"	E141°32' 31"	52
PierrePoint	AGD66	S37°46' 26"	E142°3' 18"	58
Port Fairy	AGD66	S38°23' 17"	E142°12' 48"	13
	ITRF2000	S38°22' 32"	E142°13' 45"	13
Portland	GDA94	S38°18' 53"	E141°31' 33"	52
Portland Hospital	AGD66	S38°20' 31"	E141°36' 16"	46
Richmond	AGD84	S38°16' 8"	E141°24' 59"	62
	AGD66	S38°16' 8"	E141°24' 59"	62
	GDA94	S38°16' 3"	E141°25' 4"	62
Richmond ECCE G	AGD66	S38°16' 8"	E141°25' 0"	62
Richmond ECCE S	AGD66	S38°16' 8"	E141°25' 0"	62
Rooneys	AGD66	S38°21' 54"	E142°26' 49"	29
Satchells	AGD66	S37°59' 12"	E141°44' 6"	48

Table 10 - Trigonometrical Stations in the vicinity of the Project

Station Name	Datum	Latitude	Longitude	Distance to site (km)
Shadwell	ASTRO	S38°3' 29"	E142°48' 37"	65
	AGD84	S38°3' 26"	E142°48' 38"	65
	AGD66	S38°3' 26"	E142°48' 38"	65
	GDA94	S38°3' 21"	E142°48' 43"	65
Struans	AGD66	S38°12' 23"	E141°20' 29"	69
The Cove	AGD66	S38°28' 46"	E142°39' 12"	51
The Cove RM4	AGD66	S38°28' 46"	E142°39' 12"	51
Tower Hill	AGD66	S38°19' 22"	E142°21' 30"	21
	GDA94	S38°19' 16"	E142°21' 35"	21
	AGD84	S38°19' 14"	E142°22' 25"	22
	AGD66	S38°19' 14"	E142°22' 25"	22
	GDA94	S38°19' 9"	E142°22' 30"	22
Tower Hill Mwt	AGD66	S38°19' 6"	E142°22' 36"	22
Vandyke	AGD84	S38°3' 59"	E141°24' 52"	67
	AGD66	S38°3' 59"	E141°24' 52"	67
	GDA94	S38°3' 53"	E141°24' 57"	67
Warrnambool	AGD84	S38°18' 25"	E142°44' 18"	54
	AGD66	S38°18' 25"	E142°44' 18"	54
	GDA94	S38°18' 20"	E142°44' 23"	54
Warrnambool WT	AGD66	S38°22' 42"	E142°29' 12"	33
Watertank Hill	AGD66	S38°18' 48"	E141°35' 15"	47
Yarraman Oval	AGD66	S38°21' 51"	E141°35' 6"	48

Table 10 - Trigonometrical Stations in the vicinity of the Project (concluded)

House ID	Easting[1] [m]	Northing[1] [m]	Located in the potential interference zone		
			Warrnambool	Portland	West Vic
1	597975	5756143			x
2	597878	5756402			x
3	597981	5756747			x
4 (s)	597543	5756971			x
5 (s)	597114	5757134			x
6	597484	5757347			x
7	597445	5757618			x
8 (s)	596985	5758281			x
9	596409	5758436	x		x
10	596143	5758383	x		x
20	603411	5758532		x	
21	602957	5759722		x	
22	602613	5760102		x	
23	602358	5760760		x	
24 (s)	601413	5760961		x	
25	601277	5761304		x	
26	600505	5762154		x	
27	600206	5763008		x	
28 (s)	599961	5762673		x	
29	599864	5763944		x	
30 (s)	599672	5764614		x	
31	599747	5764685		x	
36	603583	5756999		x	
49	604108	5762116		x	
50	603909	5759583		x	
55	601828	5762954		x	
56	602065	5762934		x	
64	595034	5766551	x		
65	594208	5764955	x		
66	593706	5765039	x		
67	593665	5764869	x		
68	593571	5765006	x		
69	593218	5764987	x		
70	592447	5764982	x		
71	593393	5766801	x		
72	593391	5765794	x		
73	593389	5765028	x		
74	593355	5764456	x		
75	593354	5763088	x		
76	592993	5761115	x		
77	594399	5760739	x		

Table 11 - Houses with potential to experience EMI to DTV from television broadcast towers

House ID	Easting[1] [m]	Northing[1] [m]	Located in the potential interference zone		
			Warrnambool	Portland	West Vic
78 (s)	595399	5761105	x		
79 (s)	595442	5762217	x		
80	594850	5758295	x		
83	593568	5758118	x		
84	593765	5757948	x		
85	593857	5757869	x		
86	594088	5757591	x		
89	595363	5756082			x
91	596050	5755830			x
92	596476	5755382			x
93	596806	5755033			x
94	597289	5754740			x
95	597115	5753882			x
96	598847	5754153			x
97	599056	5754284			x
104	593815	5759371	x		
105 (s)	593906	5759353	x		
106	594013	5759713	x		
Total			**26**	**17**	**18**

Note 1: Coordinate system used is Zone 54 H, WGS84 datum
2: 'S' denotes participating landholders (i.e. 'stakeholders')

Table 11 - Houses with potential to experience EMI to DTV from television broadcast towers

	Licence type	Closest distance to Wind Farm [km]	Operator	DNV GL Reference	Response received
1	Fixed point-to-point	No turbines in exclusion zone set by Powercor; two turbines (B08, B18) within 2nd Fresnel zone set by DNV GL	Powercor Australia Ltd	170492-AUME-L-01A	Response received on 04-09-2015: *Turbine 08 and 18 are on the fringe of the Powercor exclusion zone boundary. [Could you] re-position these two turbines […] to ensure there is no blade infringement into the exclusion zone […] (if the turbine layout is still in design stage and this is achievable).* *In general we accept the exclusion zones provided in your turbine layout design and do not envisage any issues with the continued operation of the Powercor links.*
2	Fixed point-to-multipoint	8.5	Wannon Region Water Corporation	170492-AUME-L-04A	Response received on 22-09-2015: *After careful review of the supplied information, at this point in time Wannon Water cannot foresee any potential impact on our systems posed by the proposed wind farm.*
3	Fixed point-to-multipoint	27	Warrnambool Golf Club Inc	170492-AUME-L-33	Response received on 25-11-2015: *[Licence] is for staff to staff communication and controlling irrigation equipment. [DNV GL note that comms links are therefore unlikely to be crossing wind farm sites.]*
4	Fixed point-to-point, land mobile system	3	Country Fire Authority	170492-AUME-L-06A	Response received on 15-09-2015: *I confirm that the CFA radio services (fixed radio links and land mobile services) are not affected by the proposed wind turbines at Ryan Corner wind farm.*
5	Land mobile system	56	Victoria Police	170492-AUME-L-07A	Response received on 30-09-2015: *Based on the provided data, we expect nil impact to police radio communications.*
6	Trigonometrical stations, Global Navigational Satellite System stations	5	GeoScience Australia	170492-AUME-L-11A	Response received on 21-09-2015: *Geoscience Australia does not […] foresee any impact to our trigonometrical stations, Global Navigational Satellite System stations, equipment, facilities or services [due to] the proposed Ryan Corner Wind Farm*
7	Spectrum	> 13	Telstra	170492-AUME-L-13A	Response received on 18-09-2015: *No Telstra radio links will affect the proposed Ryan Corner Wind farm. The closest ray line passes 1 km away from [the] wind farm area.*

Table 12 – Summary of responses received to date to consultation undertaken by DNV GL

	Licence type	Closest distance to Wind Farm [km]	Operator	DNV GL Reference	Response received
8	PTMS Class B	> 13	Optus	170492-AUME-L-14A	Response received on 14-09-2015: *There is no impact on the existing or planned microwave radio links in the area in Optus Network.* Response received on 16-09-2015: *We believe there are no issues for the mobile network with the proposed wind farm.*

Table 12 – Summary of responses received to date to consultation undertaken by DNV GL

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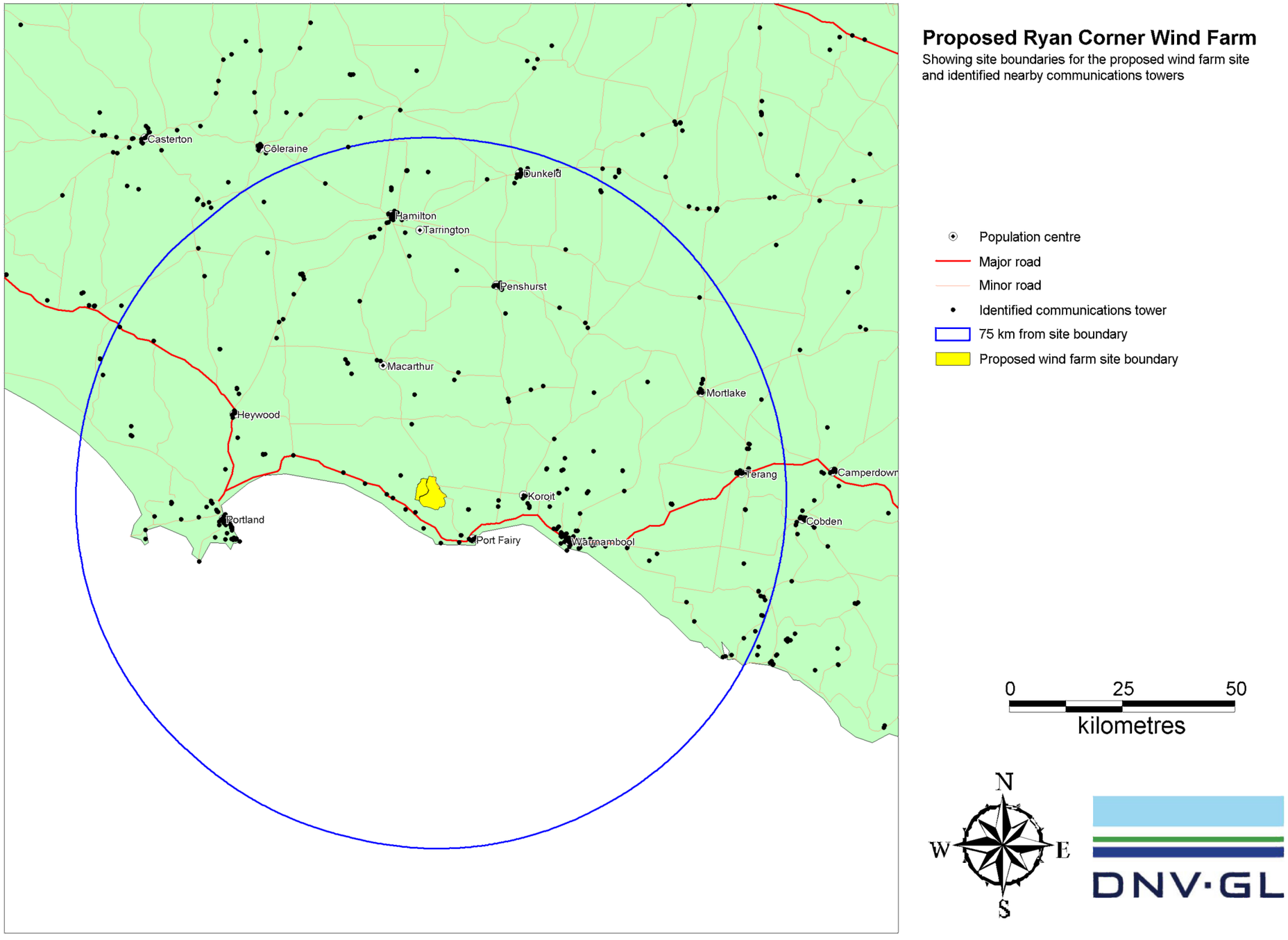
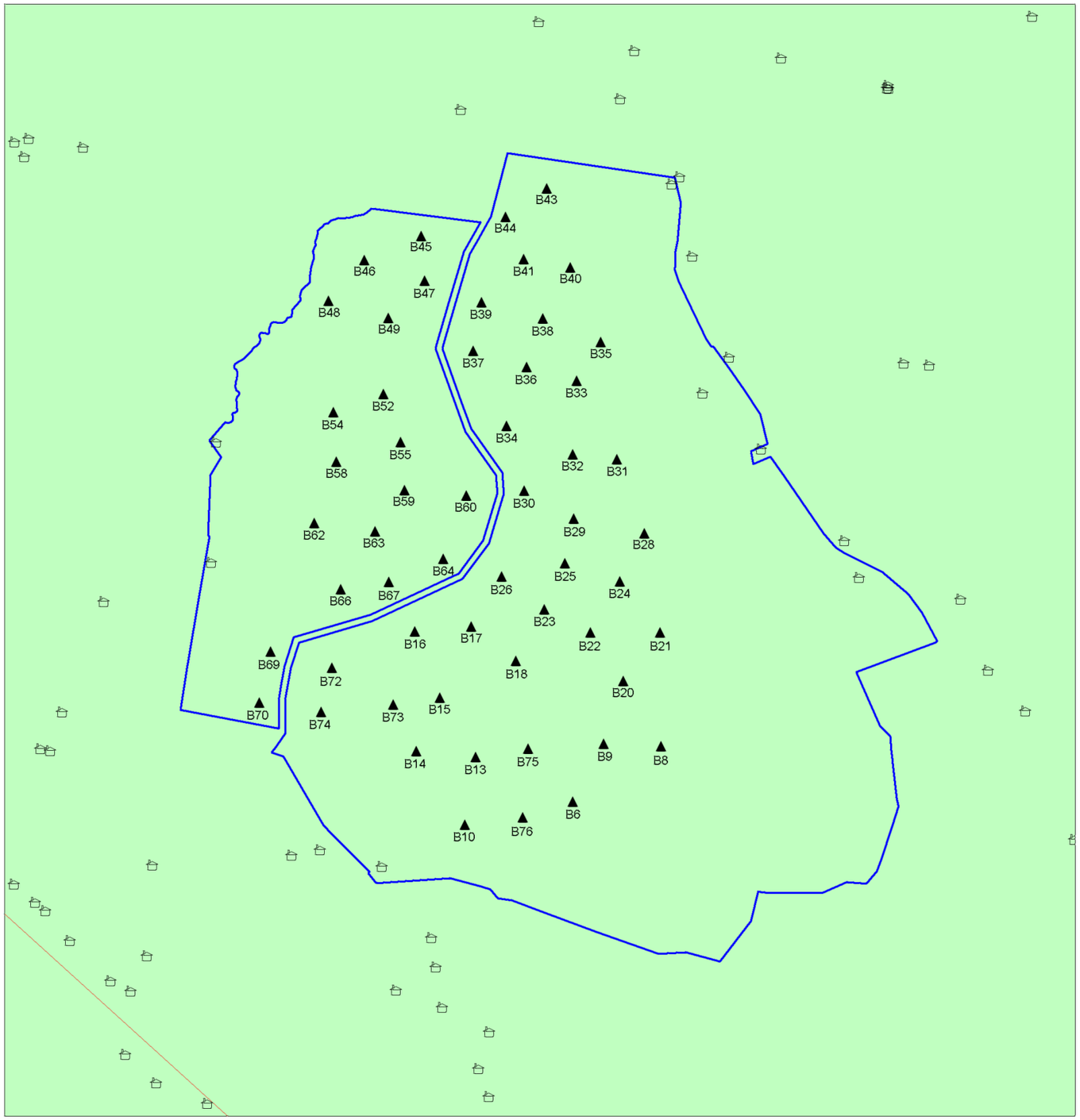


Figure 1 Location of the Project and identified proximate radiocommunication sites



Proposed Ryan Corner Wind Farm

Showing proposed turbine layout and locations
of existing dwellings.

Road

Proposed wind farm site boundary

Exisisting dwelling

Proposed turbine location

0 1 2
kilometres

N
W E
S

DNV·GL

Figure 2 Map of the Project

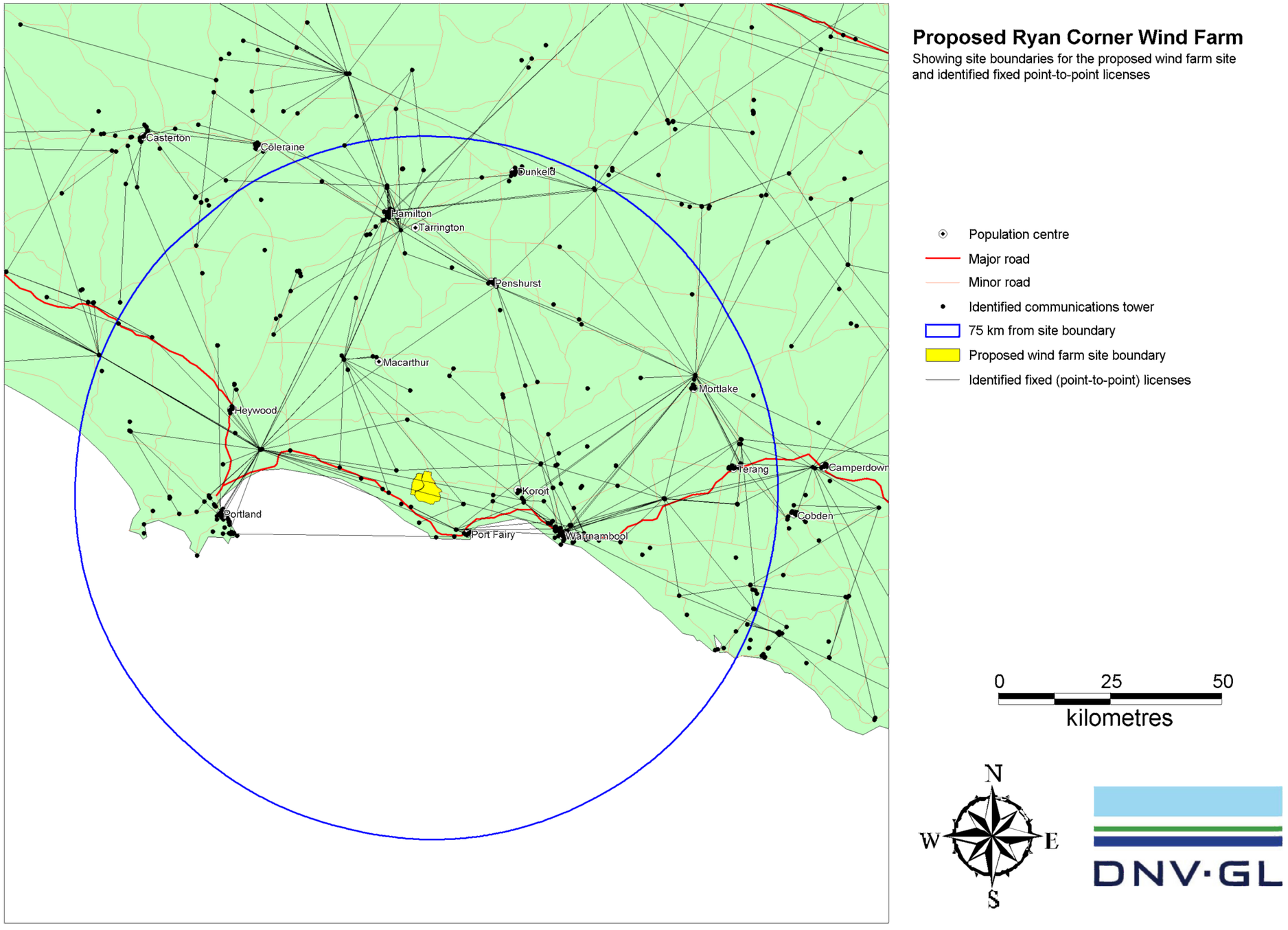


Figure 3 **Identified transmission vectors for fixed licences of point-to-point type proximate to the Project**

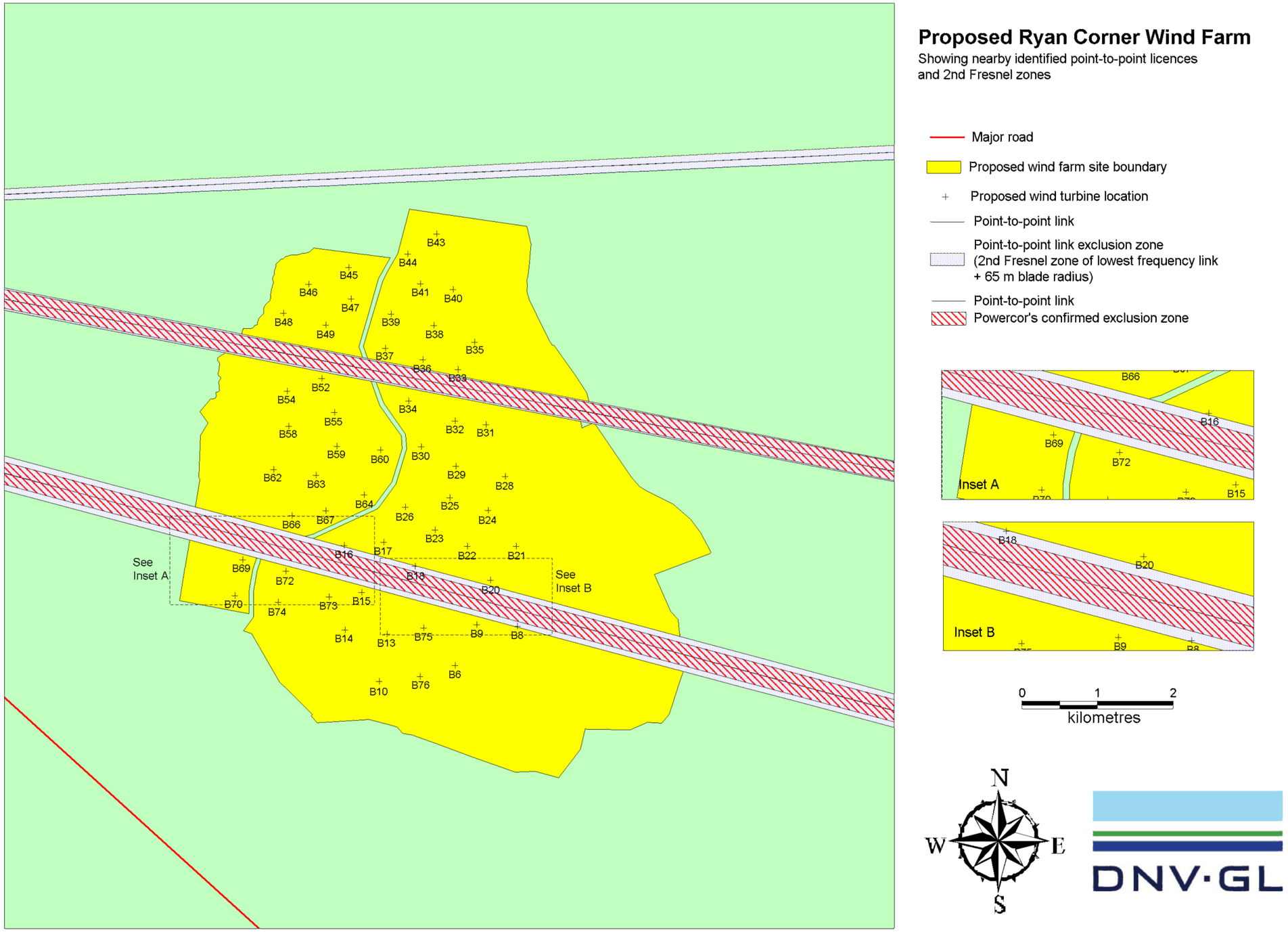


Figure 4 Identified point-to-point vectors and exclusion zones for the Project

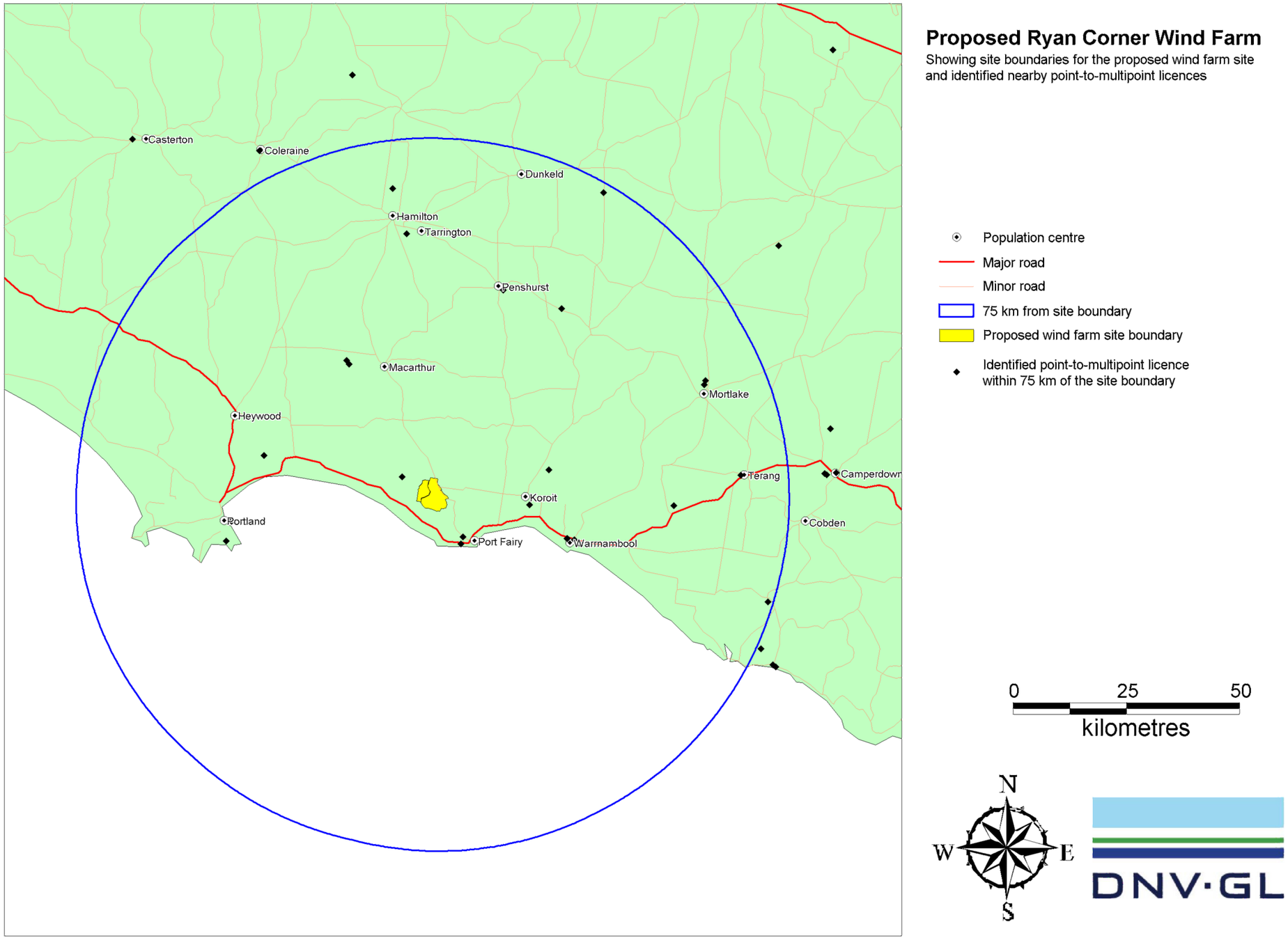


Figure 5 Location of point-to-multipoint stations within 75 km of the Project

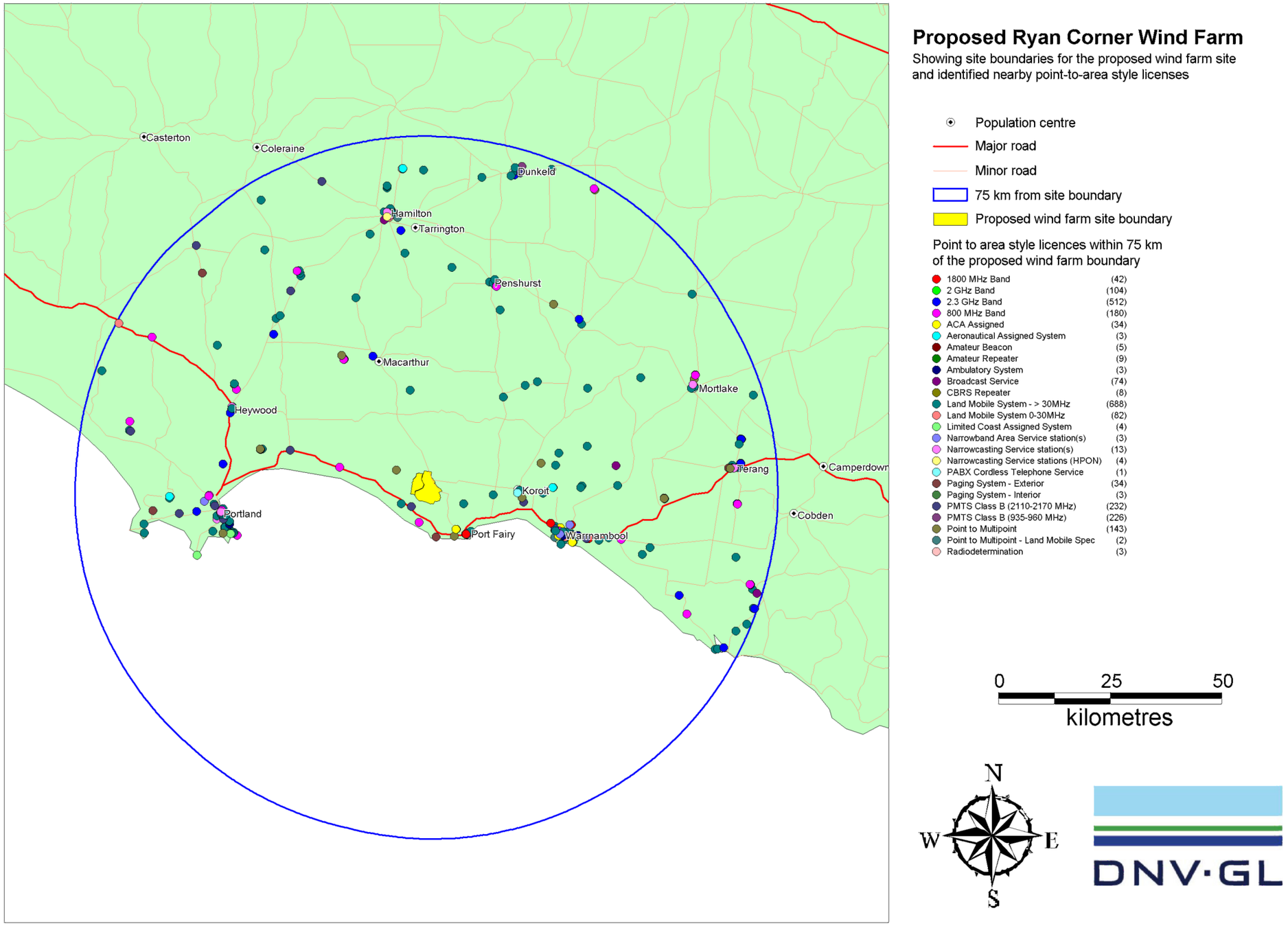


Figure 6 Location of general point to area style licences within 75km of the Project

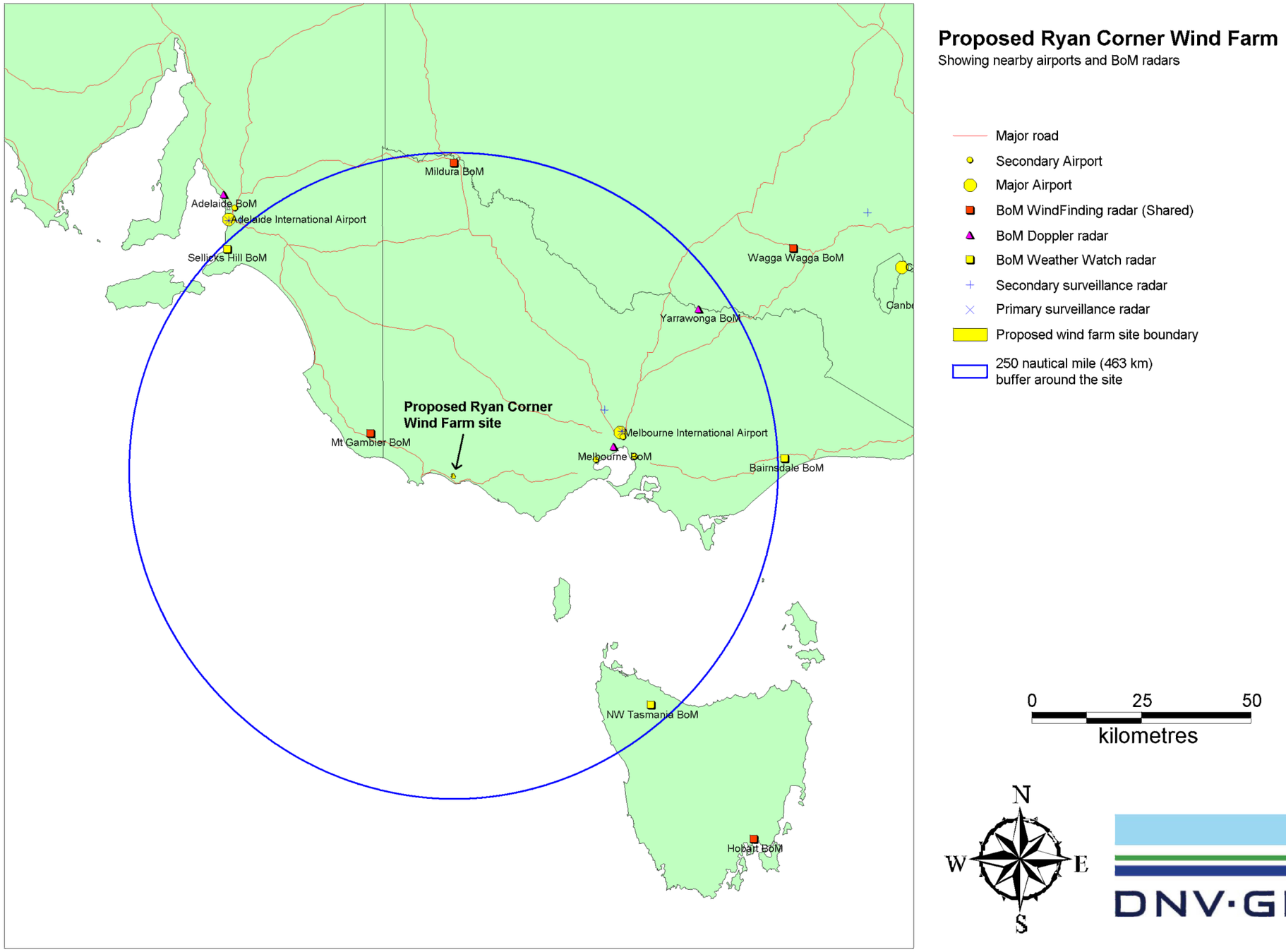


Figure 7 **Location of major airports and Bureau of Meteorology weather watch radar sites within 250 nautical miles of the Project**

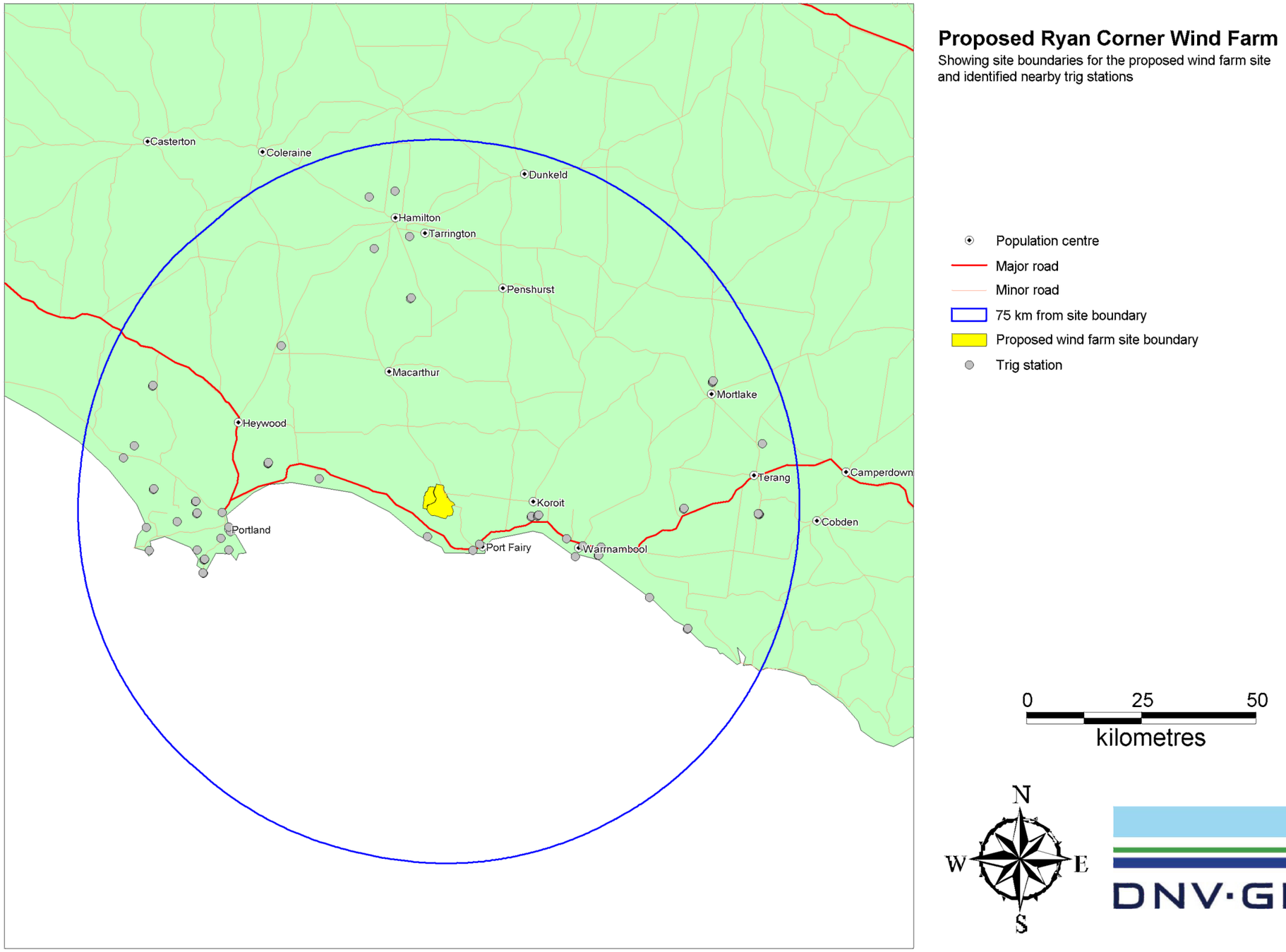


Figure 8 Location of trig stations within 75 km of the Project

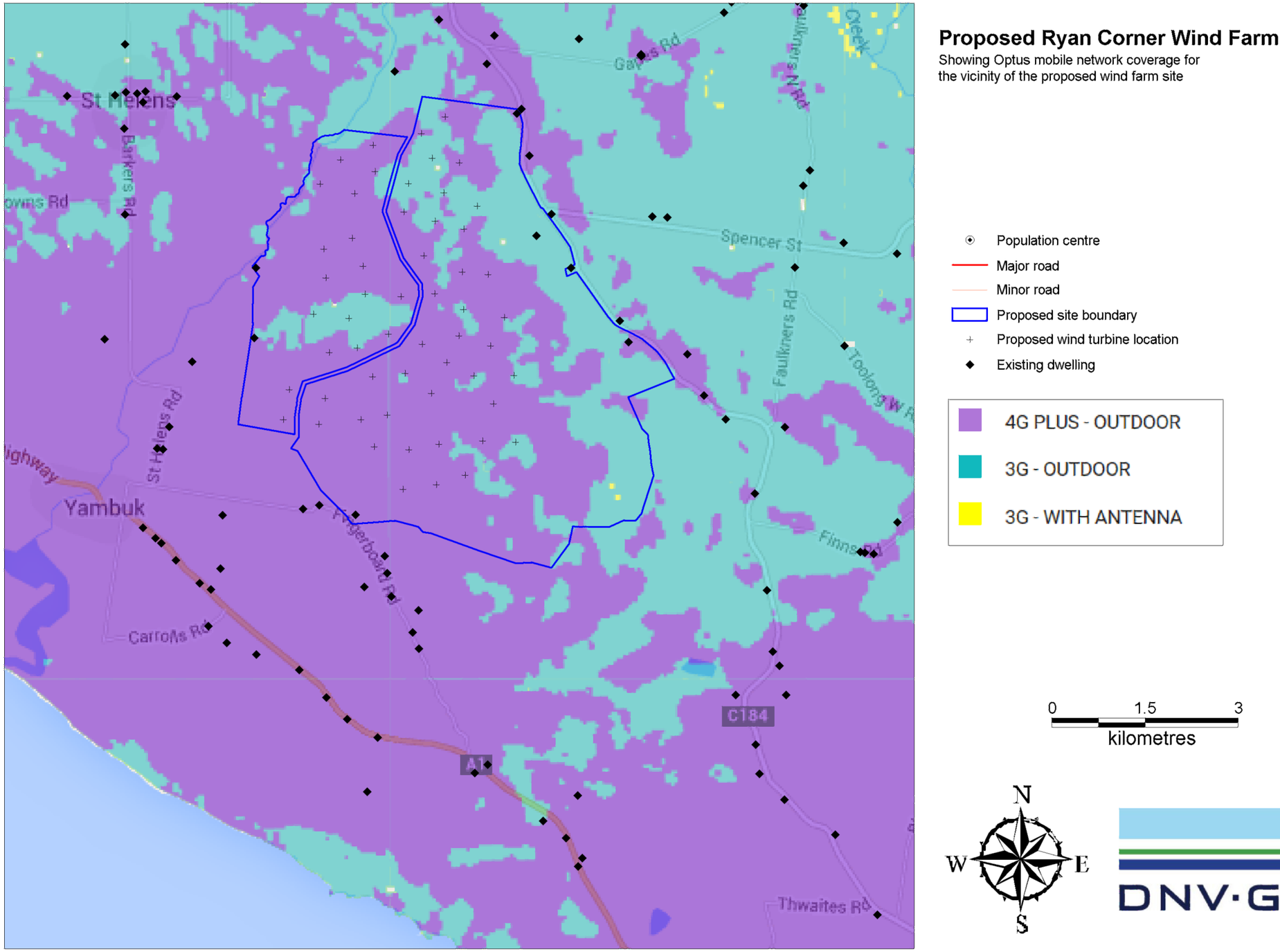


Figure 9 Optus Mobile network coverage for the Project

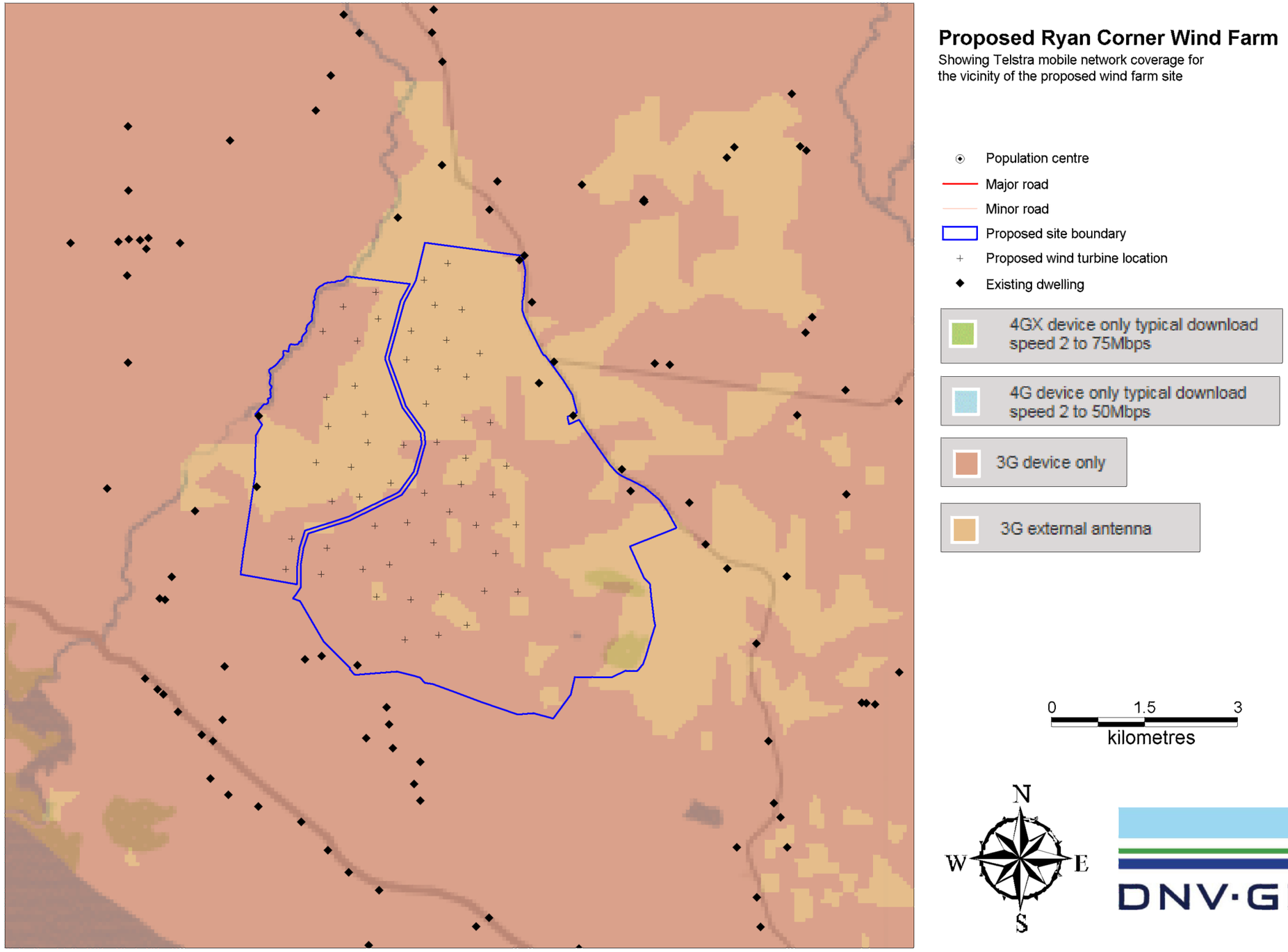


Figure 10 Telstra network coverage map

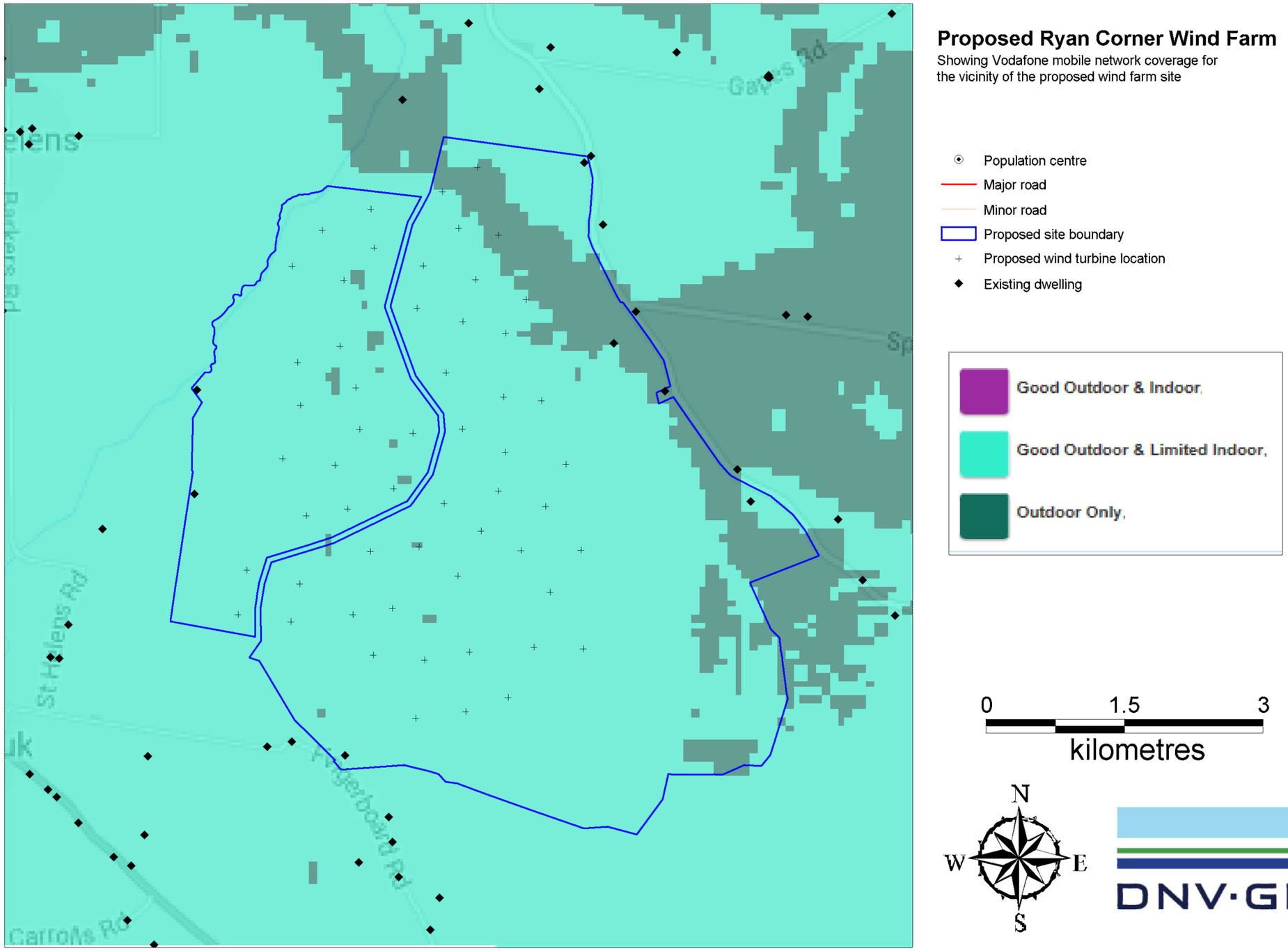


Figure 11 Vodafone network coverage map

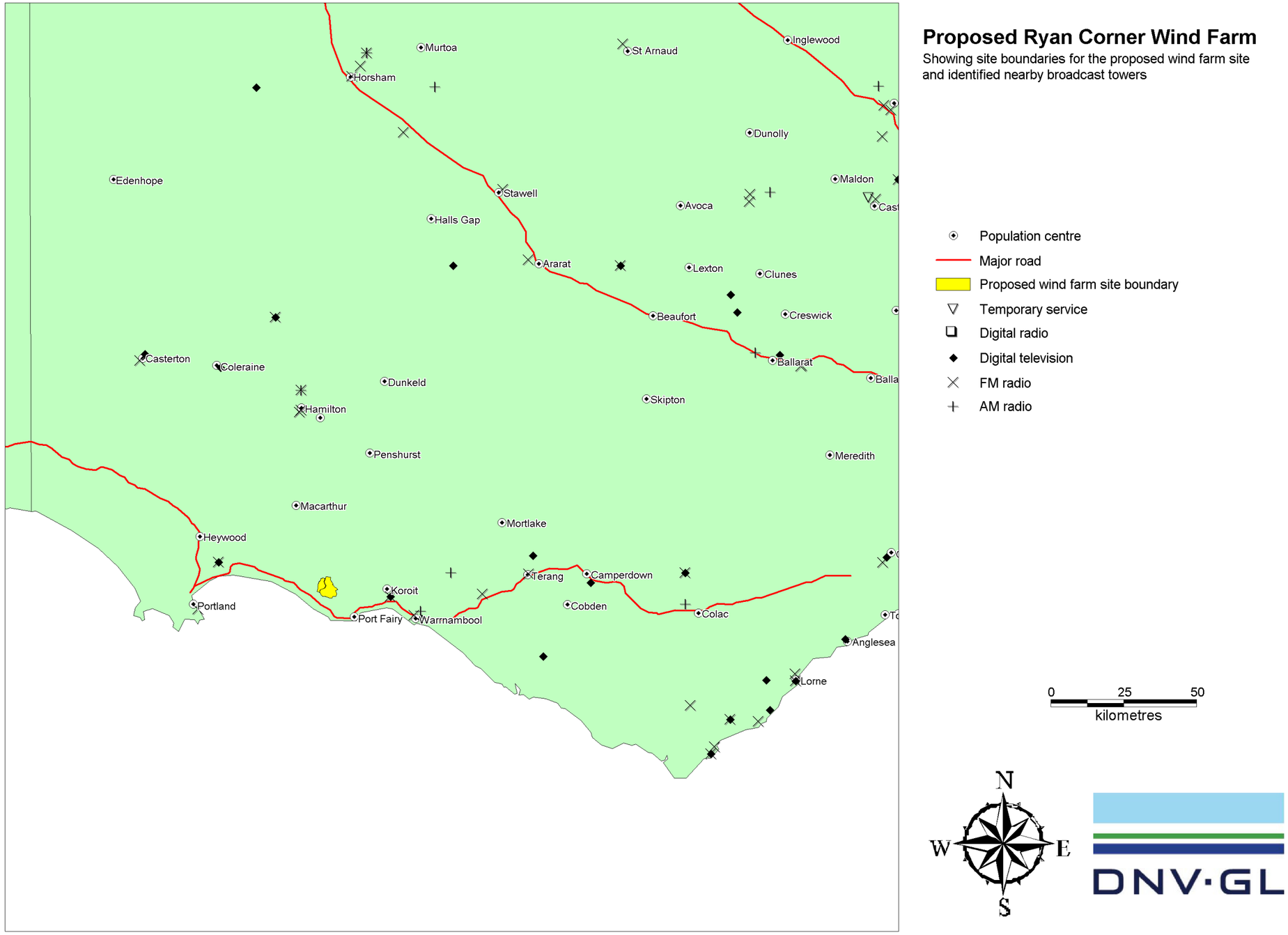


Figure 12 Location of broadcast transmitters in the vicinity of the Project

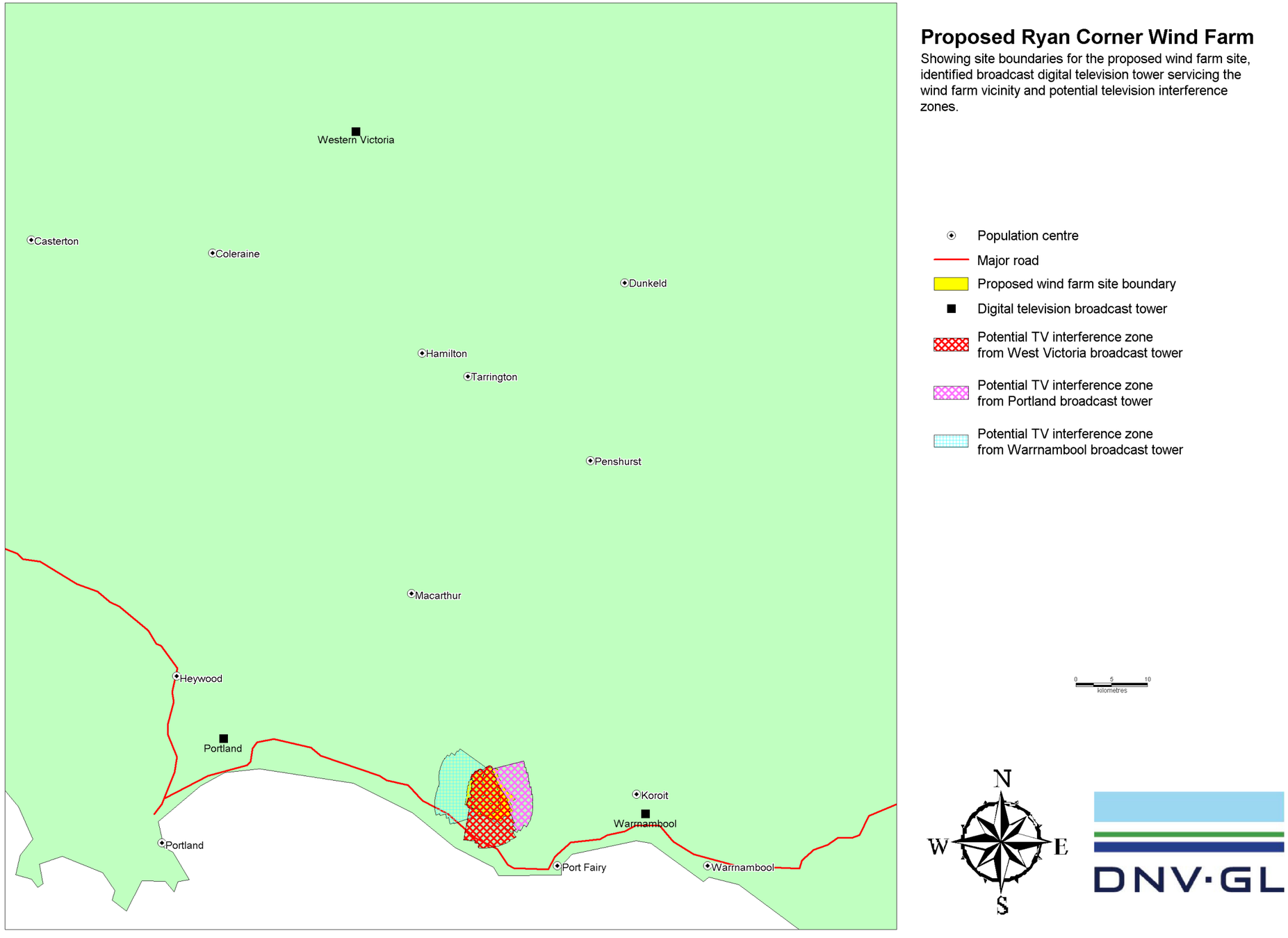


Figure 13 Location of television broadcast towers in the vicinity of the Project

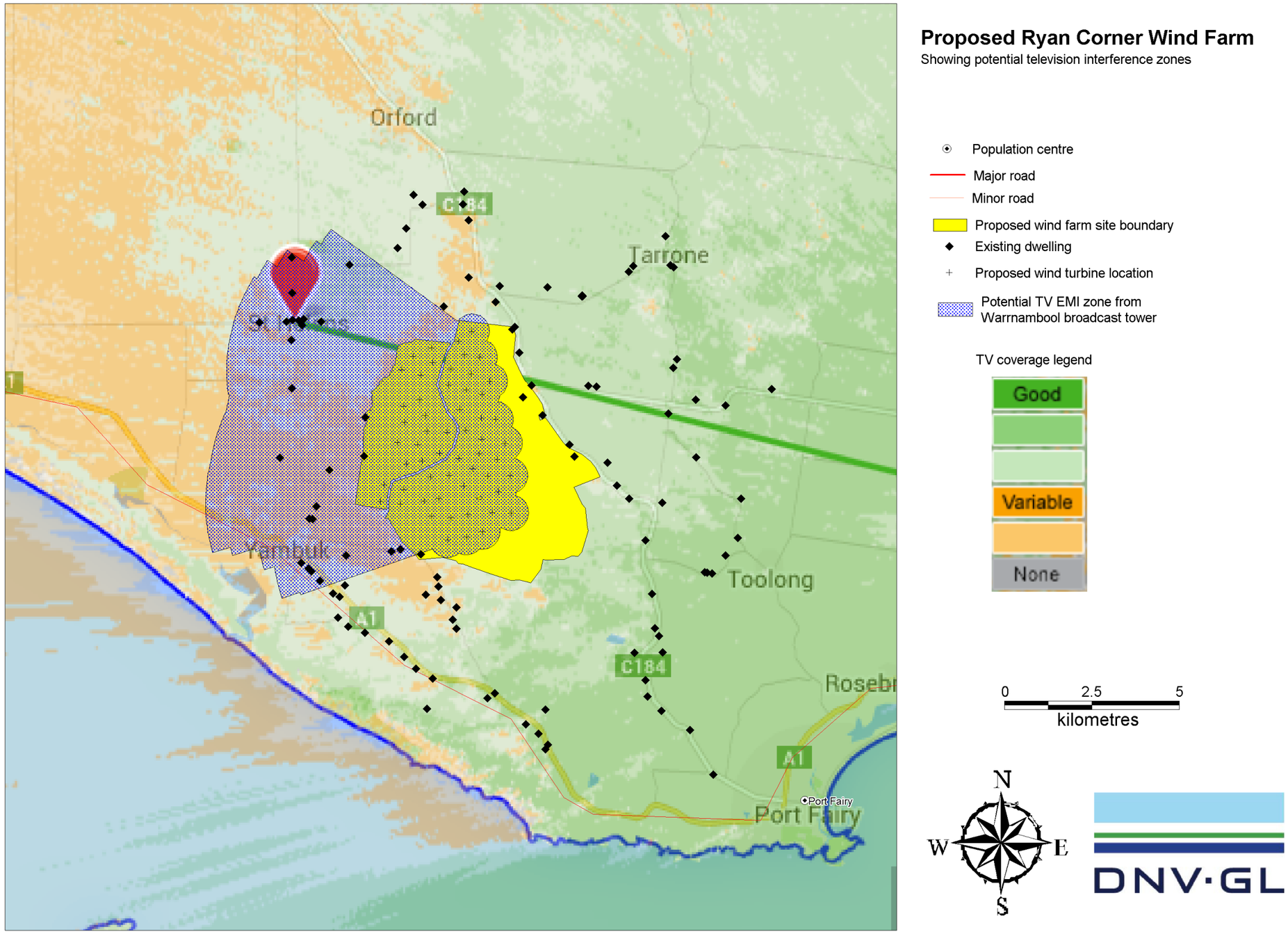
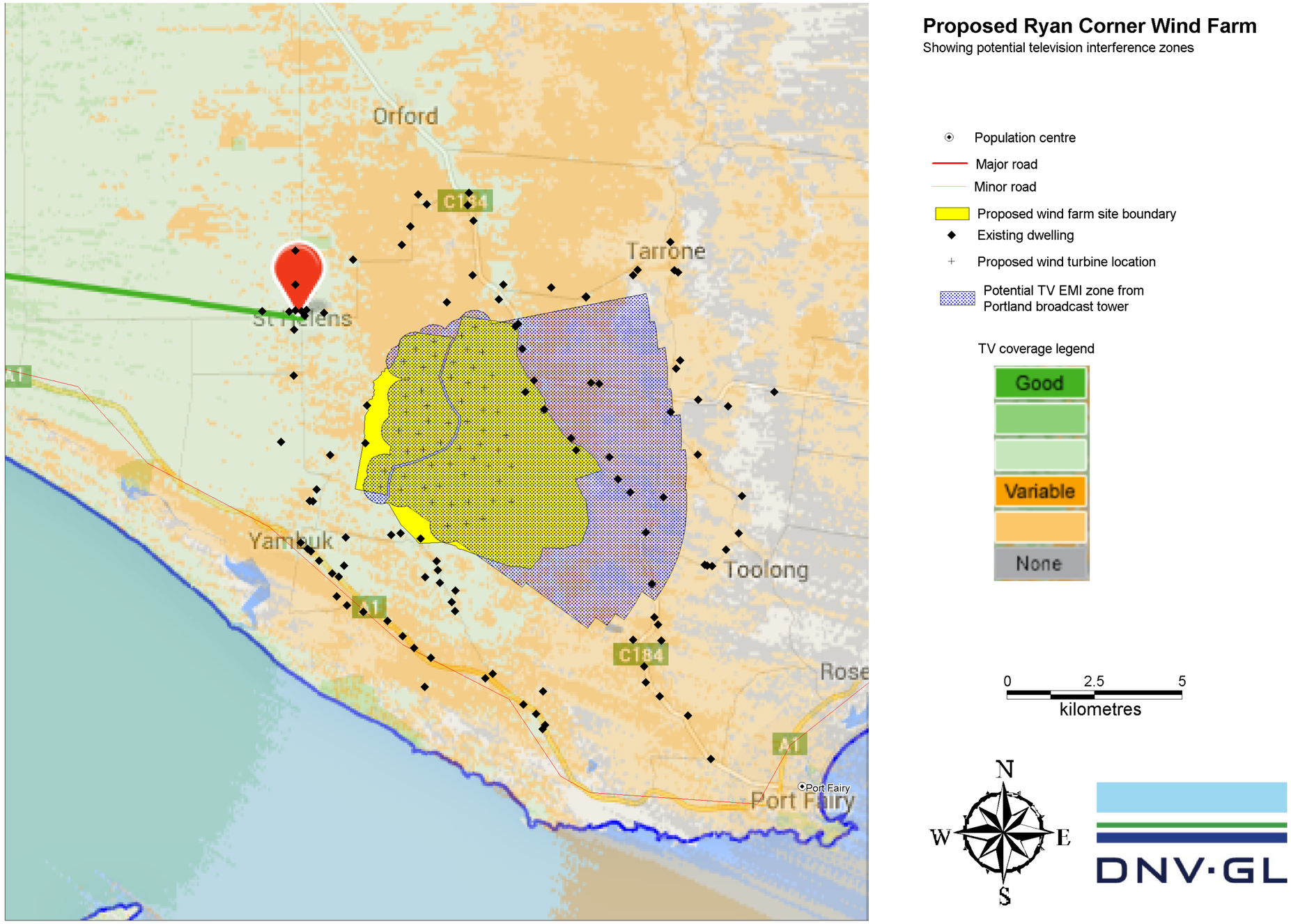


Figure 14 Potential TV EMI zones from the Warrnambool broadcast tower



Proposed Ryan Corner Wind Farm

Showing potential television interference zones

- Population centre
- Major road
- Minor road
- Proposed wind farm site boundary
- Existing dwelling
- Proposed wind turbine location
- Potential TV EMI zone from Portland broadcast tower

TV coverage legend

- Good
- Variable
- None

0 2.5 5
kilometres

N
W E
S

DNV·GL

Figure 15 Potential TV EMI zones from the Portland broadcast tower

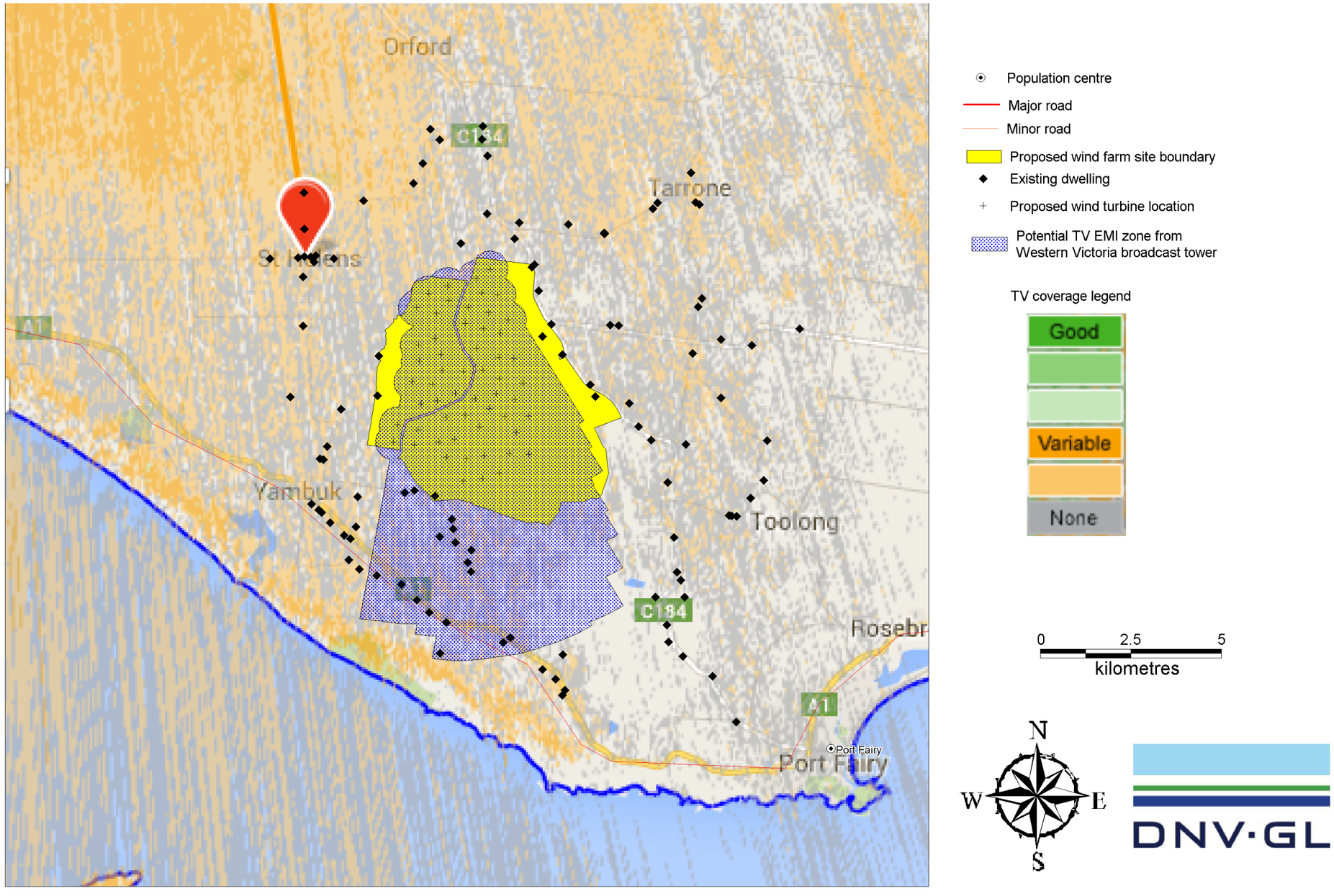


Figure 16 Potential TV EMI zones from the Western Victoria broadcast tower

About DNV GL

Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.