Australian Government | acma

Australian Communications and Media Authority

Antenna survey report

Summary of the 2022 household TV antenna survey – Western Australia

FEBRUARY 2023

Canberra
Red Building
Benjamin Offices
Chan Street
Belconnen ACT

PO Box 78
Belconnen ACT 2616

T +61 2 6219 5555
F +61 2 6219 5353

Melbourne
Level 32
Melbourne Central Tower
360 Elizabeth Street
Melbourne VIC

PO Box 13112
Law Courts
Melbourne VIC 8010

T +61 3 9963 6800
F +61 3 9963 6899

Sydney
Level 5
The Bay Centre
65 Pirrama Road
Pyrmont NSW

PO Box Q500
Queen Victoria Building
NSW 1230

T +61 2 9334 7700 or 1800 226 667
F +61 2 9334 7799

Contents

Executive summary

Background

Household television antenna surveys were conducted in Western Australia between March and April 2022 by an external provider/antenna installer under contract to the ACMA. The surveys were conducted in the areas around local repeaters in the Perth TV1 licence area. The key objective of this exercise was to identify areas where households predominantly point their antennas to the local repeaters instead of the main transmitter.

This would give an indication of the number and location of households using the local repeaters for the reception of terrestrial television services, which would potentially be affected by any changes to channel arrangements at those sites.

The survey areas included the areas in and around the following repeaters:

1. Perth City
2. Perth Coastal
3. Mandurah
4. Roleystone
5. Lancelin and Two Rocks
6. Toodyay.

We determined the general size and location of the survey areas using computer modelling and the 'best server' approach, that is, identifying areas where local repeaters provide better coverage (in terms of the signal strength), compared to the main Adelaide site. Detailed survey planning and implementation considerations were determined by the contractor undertaking the surveys.

The survey results collected a large amount of data and descriptive information about viewer antenna pointing behaviour, which is presented in detail in this report.

Findings

The survey's findings were broadly consistent with the expected pointing behaviour of household antennas based on our computer-generated predictions.

However, a key observation was that in many of the surveyed areas, viewers are still relying on coverage from the main high-power Perth site, even in some areas where predictions show that the local repeater may provide a stronger signal.

In some cases, antenna direction siting choices are possibly due to historical reasons, that is, some antennas were installed before the new repeater sites were established.

In areas with known reception issues from the main Perth site, for example, due to terrain obstructions, it was observed that households' antennas were pointed towards the local repeater. Household antennas were pointing to local repeaters in the suburbs of Roleystone, Lancelin, Nilgen, Ledge Point, Karakin, West Toodyay, Toodyay and Dumbarton. In all these areas coverage from the main Perth site is obstructed due to

terrain to some extent. In should also be noted that more generally in the areas closer to the local repeaters an increase in antennas pointing towards local repeaters was observed.

The majority of the antennas observed in this survey pointing to the local repeaters were installed at roof height (nominally at 5 m). The antennas pointing to the main Perth site were installed at roof height (nominally at 5 m) if there was clear line of site to the household and it was not too far away from the main transmission site otherwise antennas were installed up to 10 m in height above ground level with mast head amplifiers[1].

Detailed description and survey results for the Western Australian survey areas are presented in separate sections in this report.

[1] A masthead amplifier is a device used to boost a TV signal at the TV antenna, prior to processing by the TV receiver.

1. Introduction

The ACMA has conducted a survey of households' television (TV) antenna type (VHF and/or UHF), orientation and height in identified areas. The aim of this work is to support the evidence base for the considerations of the potential impact to consumers under different TV channel planning scenarios that may arise from a future restack channel planning exercise to support terrestrial television technology transition.

This work is one component of technical research conducted under the Television Research and Policy Development Program[2]. This work was also foreshadowed in the *Five-year spectrum outlook 2022–27* and 2022-23 work program.

The work program consists of preparatory activities to ready the ACMA to undertake channel replanning activities if required to support possible future government policy decisions that may require replanning of TV channels.

An approach to market for antenna surveys in Western Australia was issued to 5 companies on 3 March 2022 with responses closing on 15 March 2022. The contractor engaged was MMB Electrical Services Pty Ltd.

The surveys in Perth and surrounding areas of Western Australia commenced in March 2022 and were completed in April 2022. This report provides a summary of the results of the surveys conducted in Western Australia.

Purpose and scope

The purpose of this work was to survey households' TV antenna type, orientation and height in identified survey areas.

The aim was to inform a reliable estimation of:

- the number and location of the households in a particular survey area that rely on (point their antenna to) the local TV (repeater) sites versus the main TV site for TV reception
- in the case of areas covered by a single frequency network (SFN), the number and location of households that rely on (point their antenna to) a particular TV transmission site (within a SFN) for TV reception.

The Perth TV1 licence area is predominantly served by the high-power main Perth VHF transmitters, which are located in Bickley and Carmel[3]. However, there are lower-power metro repeaters located around Perth TV1 licence area, which are used to address local coverage issues.

The survey included areas around local repeaters within the Perth TV1 licence area, including areas around the Mandurah repeater site in the overlap[4] area with the Remote and Regional WA TV1 licence area[5]. The sites which were included in the

[2] Budget Paper No. 2, 2022-23 (p. 145) included in the Appropriation Bill (No. 3) 2021-22 (p. 61)
[3] The commercial services are broadcast from a site on a hill in the suburb of Carmel. The national services are broadcast from a site around 2 km away from the TXA site, and it is located on a hill in the suburb of Bickley. The location of the Bickley site is used for the presentational purposes only and is referred to as the main Perth site in this report.
[4] An overlap area in this context is an area where two TV licence areas overlap. Mandurah is in an overlap area between Perth TV1 and Remote and Regional WA TV1 licence areas.
[5] Details of broadcasting licence areas are available on the ACMA website.

studies are shown in Figure 1. The list of the sites and the corresponding survey areas is shown in Table 1.

Figure 1: TV broadcast transmission sites included in the household antenna survey in Western Australia (Shaded area is Perth TV1 licence area)

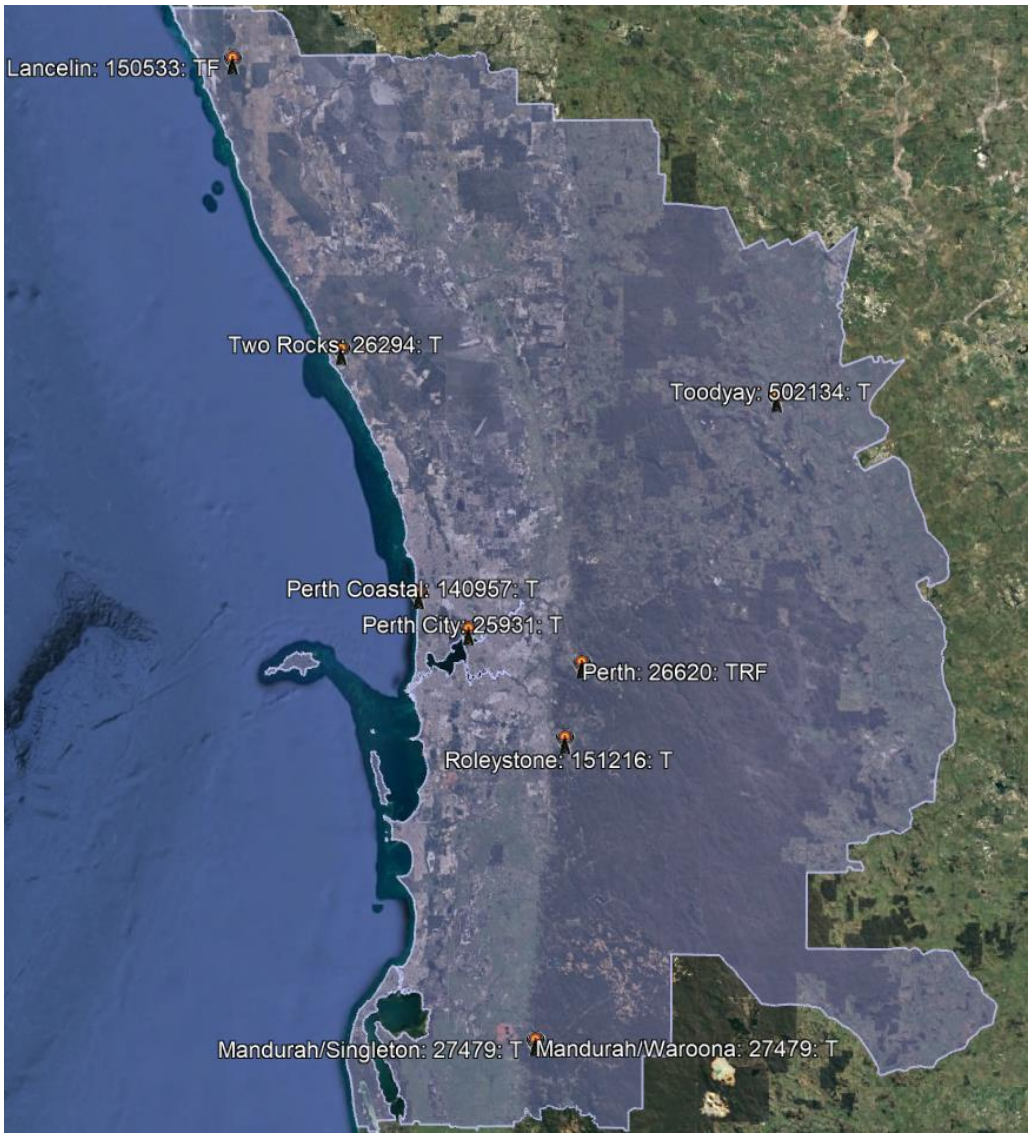


Table 1: List of survey areas in Western Australia

Local transmission (repeater) site	TV Block	Surveyed areas
Perth City	Block E (in an SFN with Perth Coastal)	Perth CBD, Northbridge, East Perth, South Perth, Como, Highgate, Mount Lawley, North Perth, Leederville, West Leederville, Subiaco.
		Maida Vale, Kalamunda, Forrestfield, Orange Grove, High Wycombe, Gooseberry Hill, Wattle Grove
Perth Coastal	Block E (in an SFN with Perth City)	Hillarys/Sorrento, North Beach (WA), Karrinyup, Scarborough (WA), Doubleview, Wembley Downs, Wembley Downs Valley, City Beach, Innaloo, Duncraig
Mandurah/Singleton	Block D and upper half of Block B	Rockingham, Cooloongup, Warnbro, Baldivis, Port Kennedy, Secret Harbour, Singleton, Golden Bay, Mandurah, Falcon, Dawesville, Bouvard, Herron, Lake Clifton, Pinjarra.
Roleystone	Block D	Roleystone, Karragullen, Kelmscott, Mount Nasura, Seville Grove, Armadale, Mount Richon, Bedfordale.
Two Rocks	Block B	Clarkson, Mindarie, Merriwa, Ridgewood, Quinns Rock, Jindalee, Butler, Alkimos, Yanchep, Two Rocks (including the western area around Oregano Dr and Countryside Dr), Lancelin, Karakin, Nilgen, Ledge Point, Seabird, Gabbadah, Guilderton, Woodridge.
Lancelin	Block D	
Toodyay	Block E	Toodyay, Toodyay West, Toodyay South, Dumbarton

Methodology

Surveys were performed by the contractor physically visiting the identified survey areas and visually observing and collecting household antenna information. The data was obtained by observing types (that is, UHF or VHF), height and orientations of antennas across identified survey areas and assessing percentage (proportion) estimates for each antenna type within each survey area. The surveys have been conducted by an experienced technical expert with detailed knowledge about the survey areas.

In addition to the proportion estimates, descriptive information was provided for all survey areas, including general descriptions of the survey areas and any relevant observations, such as:

- the size of the area surveyed
- how representative the area is
- impressions about the direction the antennas were generally pointing
- impressions of whether the viewers ‘try hard’ to get the reception based on the general antenna heights.

The surveys also provided other observations such as:

- the geography of the area (flat, hilly, valley, etc)
- clutter (trees, type of buildings in the area, any other specifics)
- any parts of the surveyed area with arrangements different from the rest of the area
- a general impression about the survey.

All the survey results for each survey area as per Table 1 are presented in the corresponding Sections of this report and they are compared with the best server computer-based predictions. Best server predictions are plots which show, for each transmitter, in which areas they provide the strongest signal (that is, they are the best server in that area, compared to all other transmitters that could potentially provide the coverage in that area). In addition, the descriptive summaries about the general and specific observations are also provided for each area under survey results in each section of this report. It should be noted that the survey findings were based on the external observations only and therefore, no information was obtained about whether the antennas were functional and in use.

2. Perth City area

Overview

The Perth City repeater is located about 22 km to the north-west of the main Perth site. This repeater was established to provide coverage in the CBD and surrounding suburbs where coverage from the main Perth site is obstructed primarily due to the high-rise buildings in the Perth CBD. The Perth City repeater is also predicted to provide better coverage to some parts of the Perth foothills area which are shielding from the main Perth site by the terrain directly underneath the main transmitter tower.

The Perth City repeater operates in an SFN with the Perth Coastal repeater on Block E. The Perth City repeater was planned on the basis that its coverage will be protected within suburban level reception against interference from other broadcasting services.

The survey areas around the Perth City repeater and the foothills area are shown in Figure 2. The areas were identified using the best server approach, that is, identifying areas where the local repeater provides the strongest signal compared to the main Perth site. The Perth CBD is a mix of high-rise and low-rise buildings. It was generally difficult to observe television antennas in the Perth CBD area due to the height of the buildings. The areas around the Perth CBD are generally suburban residential areas, and it was easy to observe household antennas in those areas.

A total of 11 suburbs/local areas were surveyed in and around the Perth CBD and 7 suburbs/local areas were surveyed in the foothills area on the eastern side of the city (as per Figure 2).

Figure 2: Repeater (green dot): Perth City repeater; survey areas (red ovals): Perth CBD, Northbridge, East Perth, South Perth, Como, Highgate, Mount Lawley, North Perth, Leederville, West Leederville, Subiaco, Maida Vale, Forrestfield, Orange Grove, High Wycombe, Gooseberry Hill, Wattle Grove

Survey results

Survey results for the areas around the Perth City repeater are shown in Figure 3 and are overlayed on the best server plot. The actual percentage breakdowns corresponding to the results in Figure 3 are presented in Figure 4.

Survey results for the areas around the Perth foothills are shown in Figure 5 and are overlayed on the best server plot. The percentage breakdowns corresponding to the results in Figure 5 are presented in Figure 6.

The survey results are generally consistent with the predictions, revealing that the antennas in this survey area mainly pointed towards the main Perth site. In some areas closer to the local Perth City repeater, in the foothills, and in low lying areas, a small number of UHF antennas pointing to the local repeater were observed. These areas included Subiaco, West Leederville, Leederville, Northbridge, East Peth, South Perth, Gooseberry Hill, Kalamunda and Forrestfield. However, even in these areas, the majority of antennas observed were VHF antennas pointing to the main Perth site.

In the Perth CBD, only a small number of antennas were observed because the visibility was obstructed by tall buildings. The observed antennas were UHF antennas pointing to the Perth City repeater. Due to a small sample size in the Perth CBD, the information for Perth CBD is not captured in the results graph (Figure 3) as it is not clear whether that was a representative sample.

In North Perth only VHF/UHF combination antennas[6] were observed. As both the main Perth site and the Perth City repeater are in the similar direction it was not clear from which site the reception was obtained. However, no UHF antennas pointing to the Perth City repeater were observed. There were no obvious obstructions to the main transmitters in this survey area other than where houses are on the low side of hills. There is also a clear line of sight to the Perth City repeater from this suburb.

In general, it was observed that older residences had antennas pointed to the main Perth site and newer buildings either had antennas pointed towards the Perth City repeater or the main Perth site. As there were more older buildings in the area, the majority of the observed antennas were pointing to the main Perth site. Antennas were pointed to the Perth City repeater generally only when coverage from the main Perth site was obstructed by other buildings, terrain or in low-lying areas like the western edge of the East Perth area.

[6] VHF/UHF combination TV antennas are designed to receive signals from a wide range of TV channels in both the VHF and UHF frequency bands.

Figure 3: Survey results overlayed on the coverage predications plot – Peth City repeater (CBD and surrounding areas); coverage prediction background colour code: Yellow – Main Perth Site, Blue – Perth City

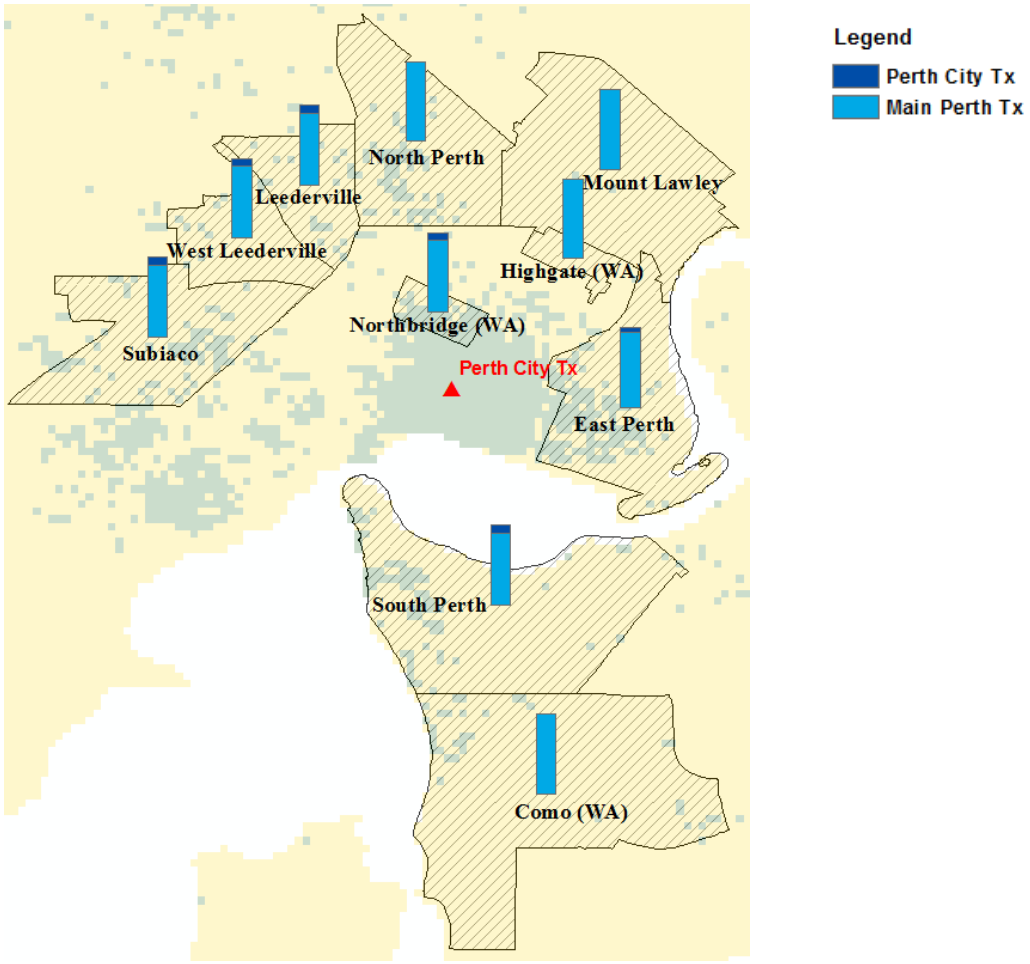


Figure 4: Percentage breakdown for each suburb in the survey area – Perth City (CBD and surrounding areas)

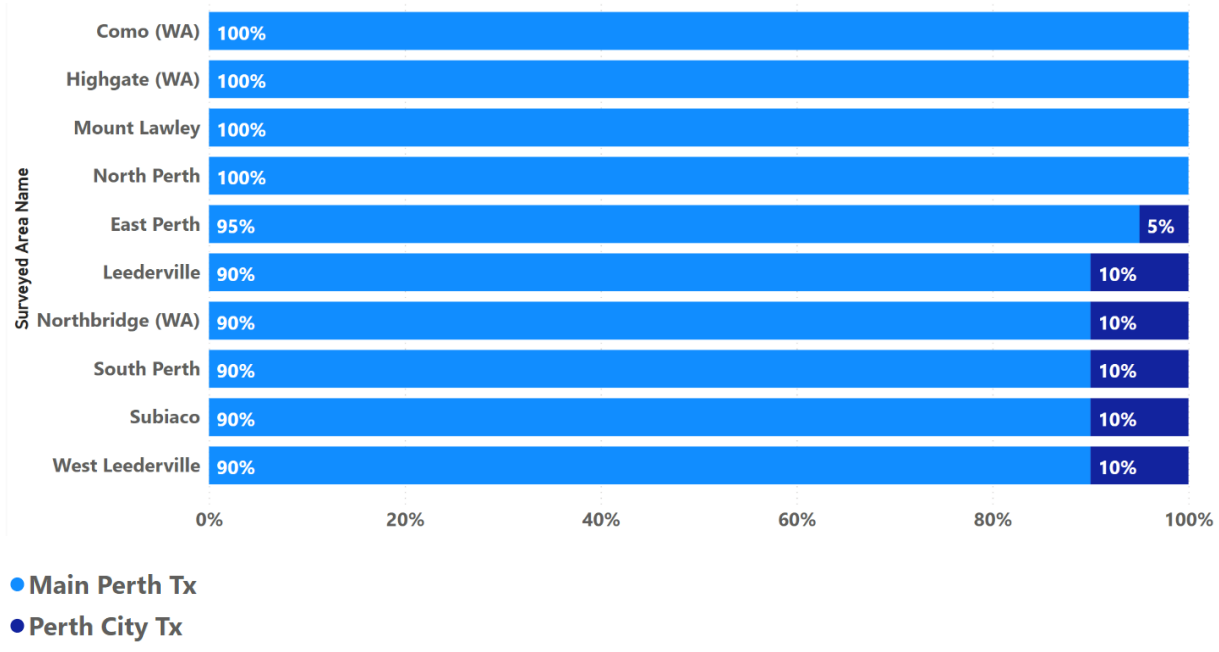


Figure 5: Survey results overlayed on the coverage predications plot – Perth City repeater (Perth foothills area); coverage prediction background colour code: Yellow – Main Perth Site, Blue – Perth City

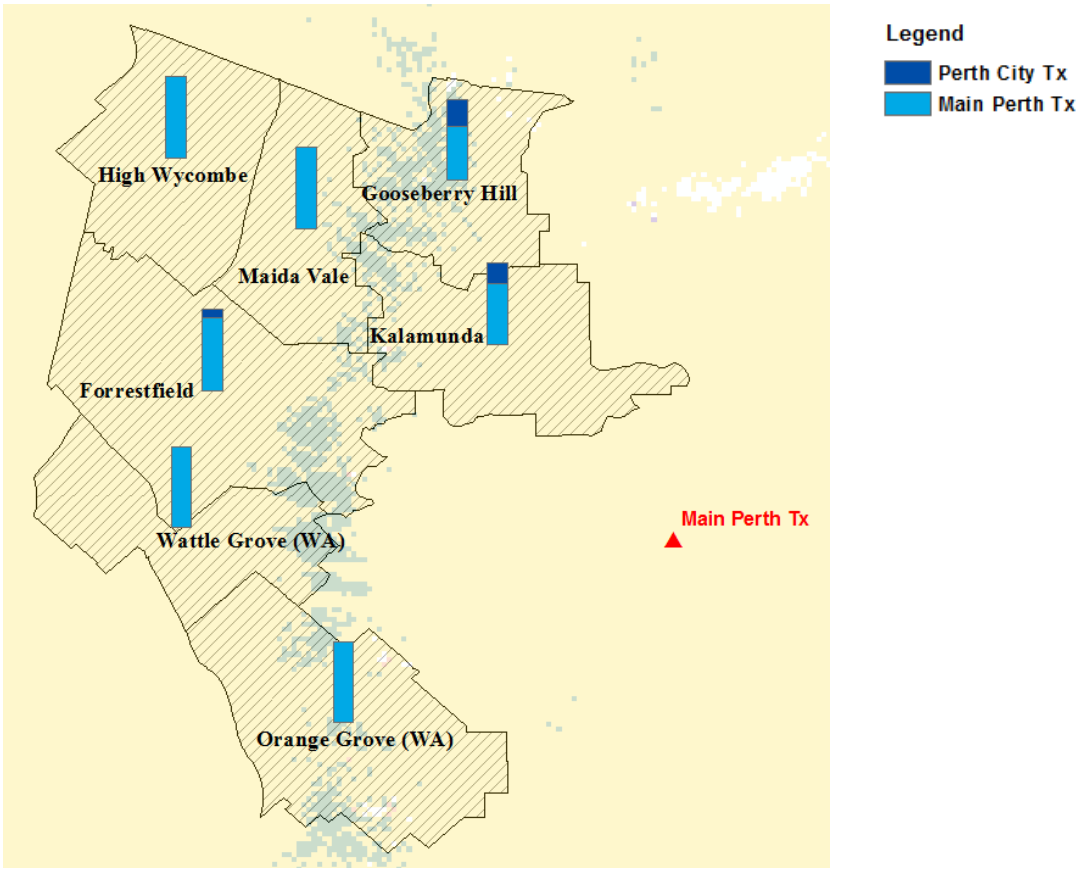
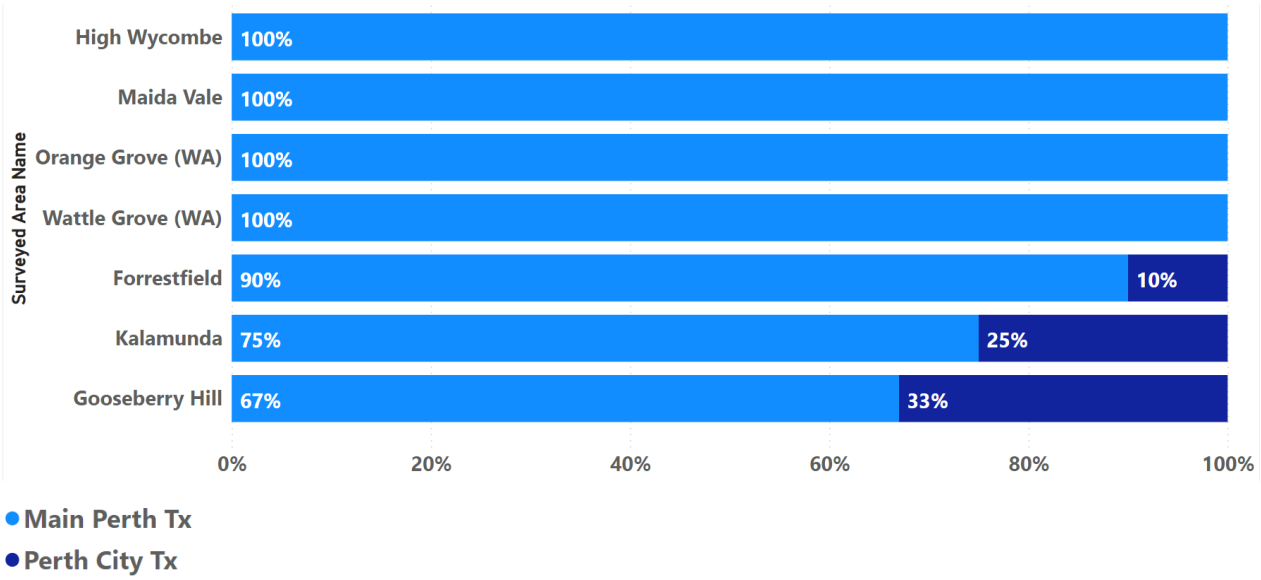


Figure 6: Percentage breakdown for each suburb in the survey area – Perth foothills



3. Perth Coastal area

Overview

The main Perth site is located about 33 km in the east-south-east direction from the Perth Coastal repeater site and it is predicted to provide good coverage in the general Perth Coastal area. The Perth Coastal repeater is located at Observation City, Scarborough and its goal is to provide coverage in the low-lying coastal and other areas where the coverage from the main Perth site may be deficient due to obstructions caused by local terrain. The Perth Coastal repeater operates in an SFN with the Perth City repeater on Block E. The Perth Coastal repeater was planned on the basis that its coverage will be protected within suburban level reception against interference from other broadcasting services.

The Perth Coastal survey area is shown in Figure 7. The area was identified using the best server approach, that is, identifying areas where the local repeater provides strongest signal compared to the main Perth site. The suburbs with tall buildings were generally more difficult to survey due to limited visibility of the antenna systems, whereas those suburbs where the dwellings are not as tall were easier to survey. These were generally the suburbs which are further away from the CBD. A total of 11 suburbs/local areas were surveyed in the Perth Coastal area.

Figure 7: Repeaters (green dot): Perth Coastal repeater; survey area (red oval)

Survey results

Survey results for the Perth Coastal area are shown in Figure 8 and are overlayed on the best server plot. The actual percentage breakdowns corresponding to the results in Figure 8 are presented in Figure 9.

The survey results are generally consistent with the predictions, revealing that the antennas in the survey are mainly pointing towards the main Perth site. In some areas closer to the local Perth Coastal repeater, in low lying areas and areas of undulating terrain, an increased proportion of UHF antennas pointing to the local repeater were observed. This was observed in the suburbs of Scarborough, North Beach, Karrinyup and Wembley Downs Valley. However, in these areas the majority of antennas were VHF antennas pointing to the main Perth site, especially further east from the coast.

Across the Perth Coastal survey area, the majority of the observed antennas were at roof height (gutter to 5 m), but in some areas such as Karrinyup, Wembley Downs Valley and City Beach, antennas at heights of up to 10 m were observed. In City Beach, it was also observed that there was a significant proportion of two storey residences. In North Beach, most antennas pointing to the main Perth site were at 2 to 5 m above roof height with mast head amplifiers. Antennas with mast head amplifiers on higher masts were also observed in Wembley Downs Valley, generally pointing to the main Perth site, but some were also pointing to the local Perth Coastal repeater site.

Figure 8: Survey results overlayed on the coverage predications plot. Coverage prediction background colour code: Yellow – Main Perth Site and Red – Perth Coastal

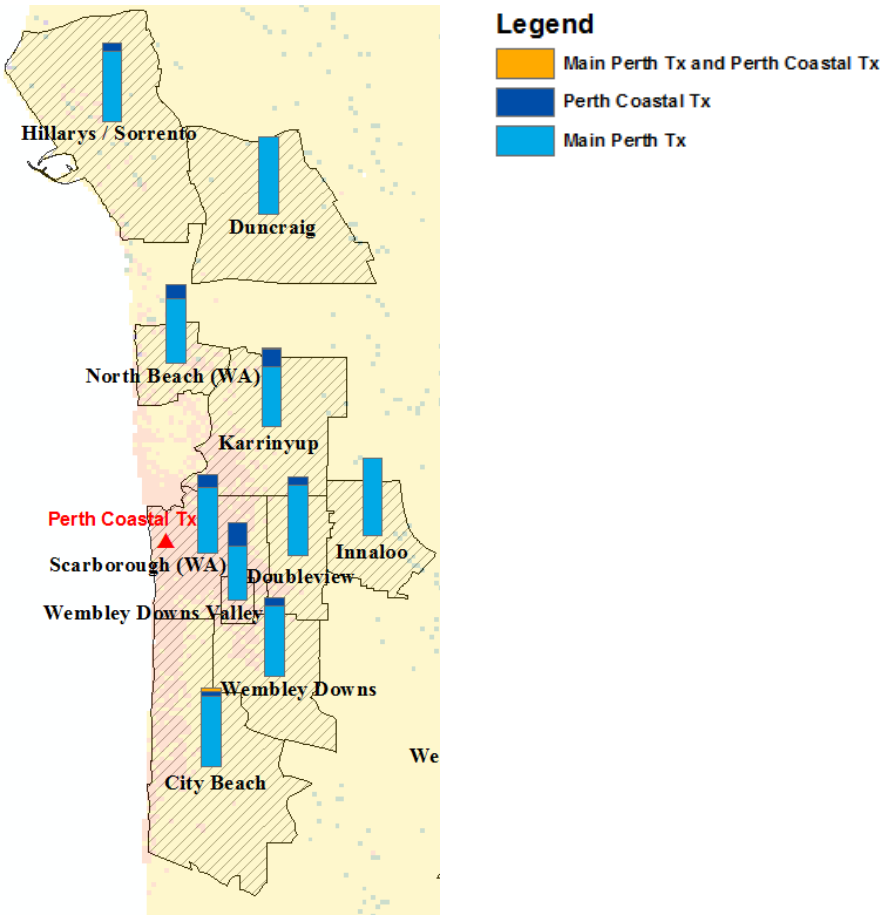
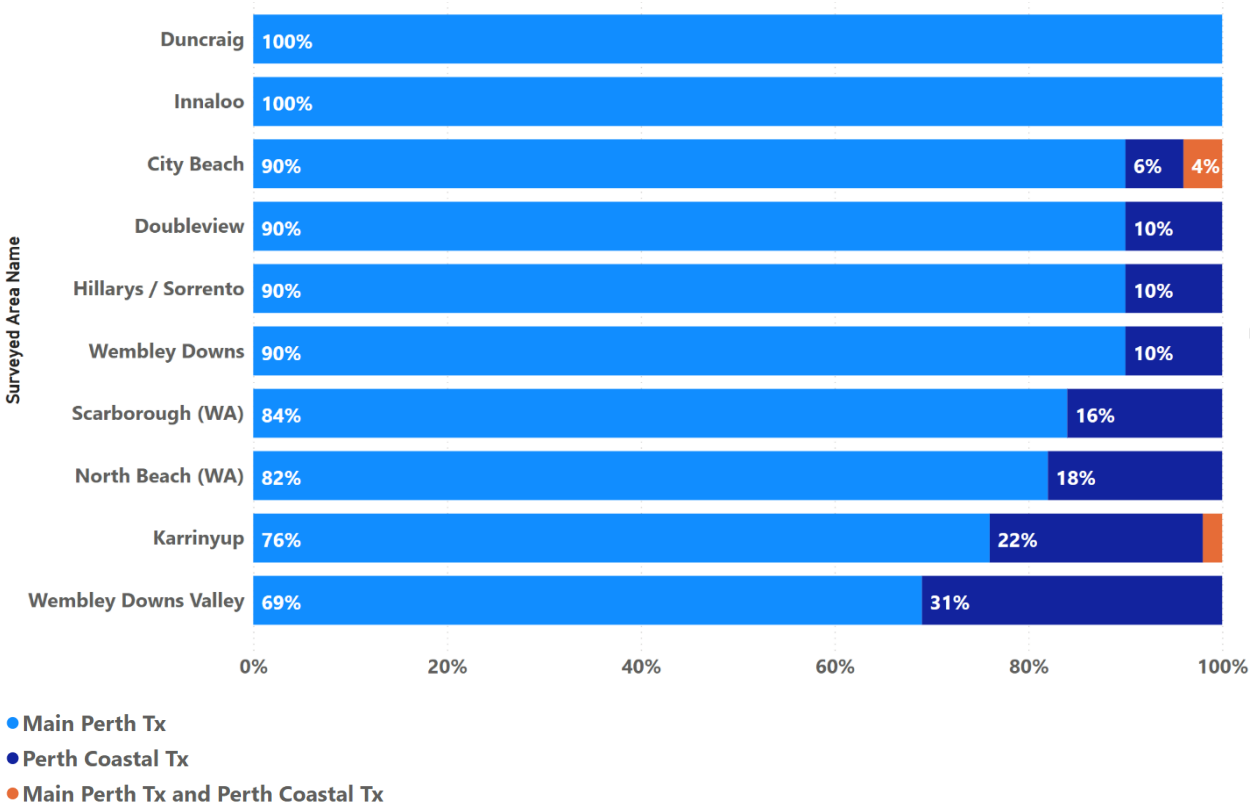


Figure 9: Percentage breakdown for each suburb in the survey area – Perth Coastal



4. Mandurah area

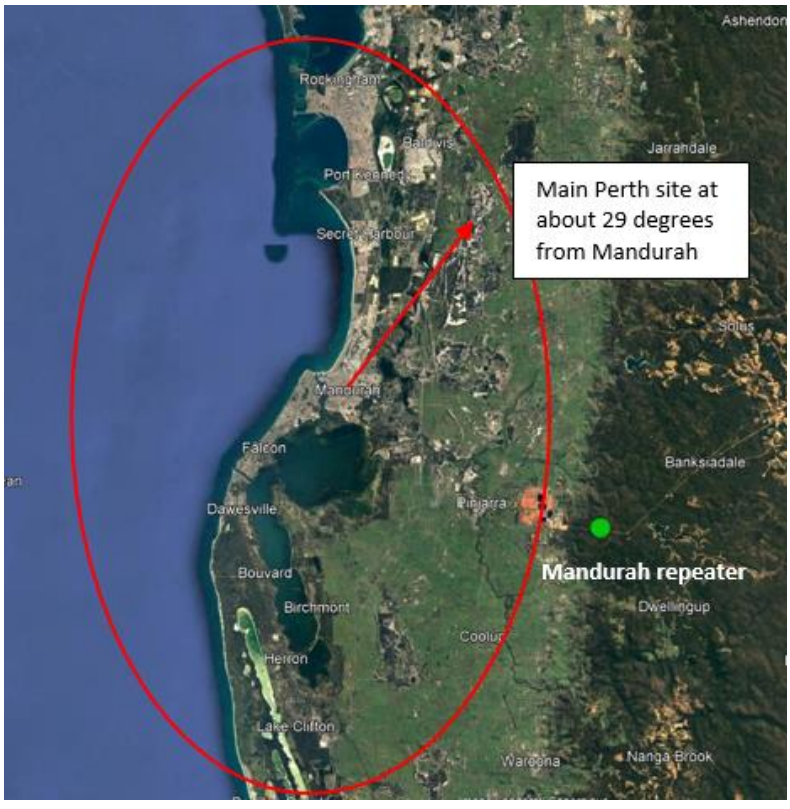
Overview

The Mandurah survey area is included in both the Perth TV1 and Remote and Regional WA TV1 licence areas. Consequently, 8 TV services are provided from the Mandurah repeater to the area – 3 metro commercial, 3 regional commercial and 2 national services. The commercial metro services use different antennas from other services and operate on the upper half of Block B, whereas the regional commercial and national services operate on Block D.

The main Perth site is located about 65 km in the north-north-east direction from Mandurah township and it is predicted to provide variable coverage in the Mandurah survey area. The predictions showed that northern parts of the survey area, between Mandurah and Rockingham, should have good coverage form the main Perth site, while in some areas south of Mandurah township this coverage may be patchy. The Mandurah repeater is located on a hill east of Pinjarra, and its goal is to provide coverage in the general area in and around Mandurah. The 3 commercial metro services at this site were planned on the basis that their coverage will be protected within suburban level reception against interference from other broadcasting services.

The survey area for the sites is shown in Figure 10. The area was identified using the best server approach, that is, identifying areas where the local repeater provides strongest signal compared to the main Perth site. A total of 15 suburbs/local areas were surveyed in the Mandurah area.

Figure 10: Repeater (green dot): Mandurah repeater; survey area (red oval): Rockingham, Baldivis, Port Kennedy, Secret Harbour, Mandurah, Falcon, Dawesville, Bouvard, Herron, Lake Clifton, Pinjarra



Survey results

Survey results for this area are shown in Figure 11 and are overlayed on the best server plot. The actual percentage breakdowns corresponding to the results in Figure 11 are presented in Figure 12.

The survey results are generally consistent with the coverage predictions from the main Perth site, showing that in the northern part of the survey area, a large proportion of the observed antennas were pointed towards the main Perth site. In areas in and south of Mandurah, the observed antennas were mainly pointing to the main Perth site, but an increase in the proportion of households having 2 separate antennas, a VHF antenna pointing to the main Perth site and a UHF antenna pointing to the local Mandurah repeater, was observed.

The observations made north of Mandurah were consistent across several suburbs. The observed antennas were mostly at the roof height or slightly above, with mast head amplifiers. In Secret Harbour, one TV reticulation antenna pole at corner of Warnbro Sound Avenue and Maratea Parade was observed[7]. The pole has antennas pointed to Main transmitters and Mandurah repeater. All other observed antennas in the Secret Harbor area were VHF//UHF combination antennas pointing to the main Perth site.

Golden Bay and Singleton are coastal areas to the North of Mandurah township in a low-lying coastal plain, with high dunes to East of Singleton township. Due to the terrain, it was observed that it may be more difficult to receive TV signals both from main Perth site and Mandurah repeater in these areas. The antennas in Golden Bay and Singleton are mostly pointed to main Perth site and included mast head amplifiers, some at height of up to 10 m. The antennas pointing to the Mandurah repeater were of a similar height and also included mast head amplifiers. There were 3 newly developed estates in the Golden Bay township, with all observed antennas pointing to the main Perth site at roof height or just above with mast head amplifiers.

In Mandurah township, the terrain is generally low-lying around an estuary and lake system, extending to low rolling hills with some steep hills creating areas potentially shielded from transmitters. The majority of households' antennas were pointing to the main Perth site mostly at roof height or just above with mast head amplifiers. There are areas where masts were up to 10 m above roof height, generally when behind hills or significant trees. There were antennas pointed to the Mandurah repeater in greater numbers to Eastern areas.

South of Mandurah, similar observations were made in terms of antenna pointing behaviour. The area is generally a mix of low-lying, hilly, and flat parts, and southern parts around Bouvard, Herron and Lake Clifton are also feature dense vegetation, with residences on large bush blocks set well back from roads. The survey showed that antennas were mainly pointing towards the main Perth site, with a proportion of dwellings having 2 separate antennas pointing to each at the main Perth site and local Mandurah repeater.

In Pinjarra, a low-lying suburban area to east of Mandurah and close to the Mandurah repeater, the observations showed that there were a mix of antennas up to 5 m above rooftops with mast head amplifiers pointed to the main Perth site, and households with 2 separate antennas pointing to each of the main Perth site and Mandurah repeater.

[7] In a TV reticulation system TV signal is received at a single (reticulation) point and then distributed to multiple dwellings in the area.

Figure 11: Survey results overlayed on the coverage predications plot. Coverage prediction background colour code: Yellow – Main Perth Site and Red – Mandurah

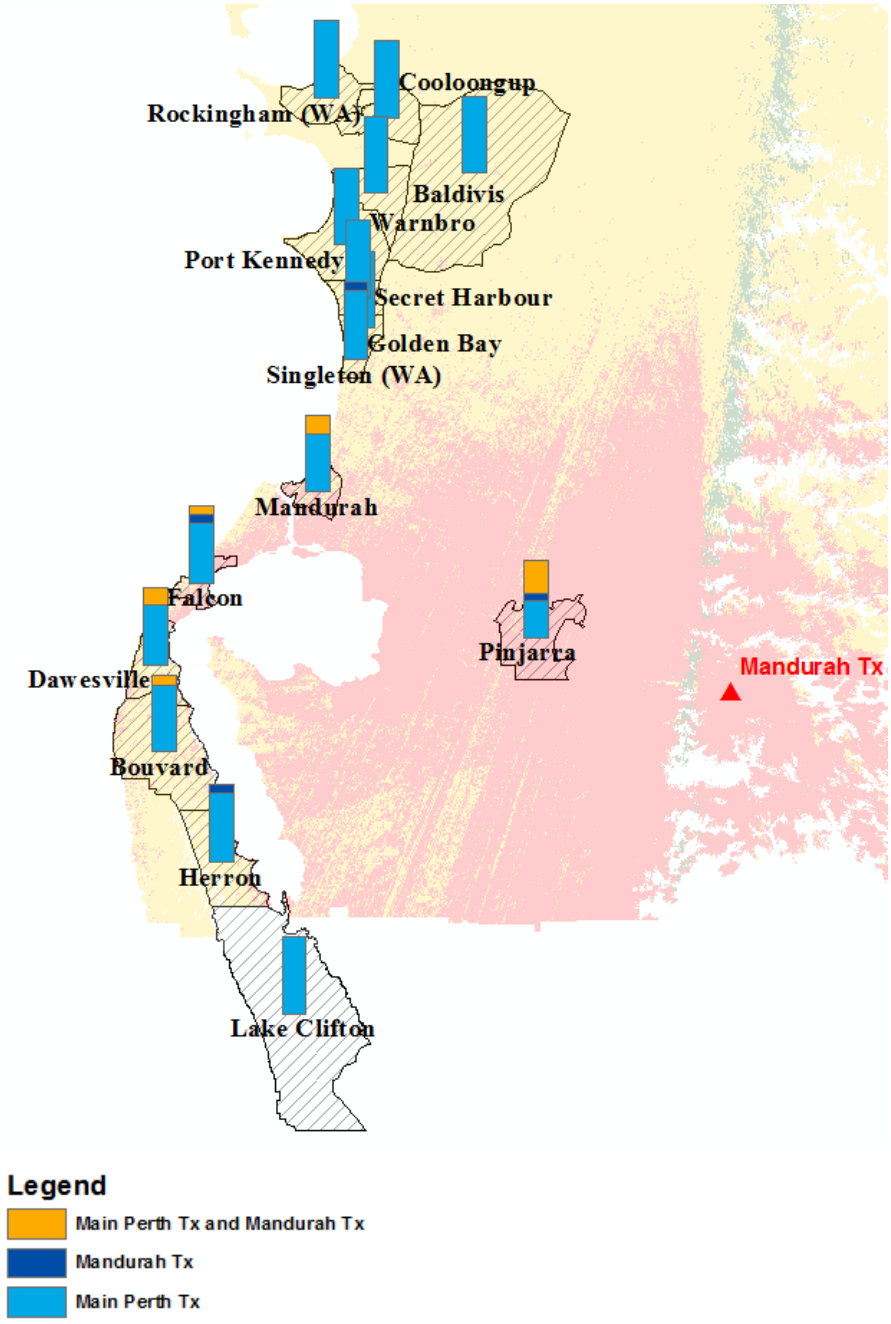
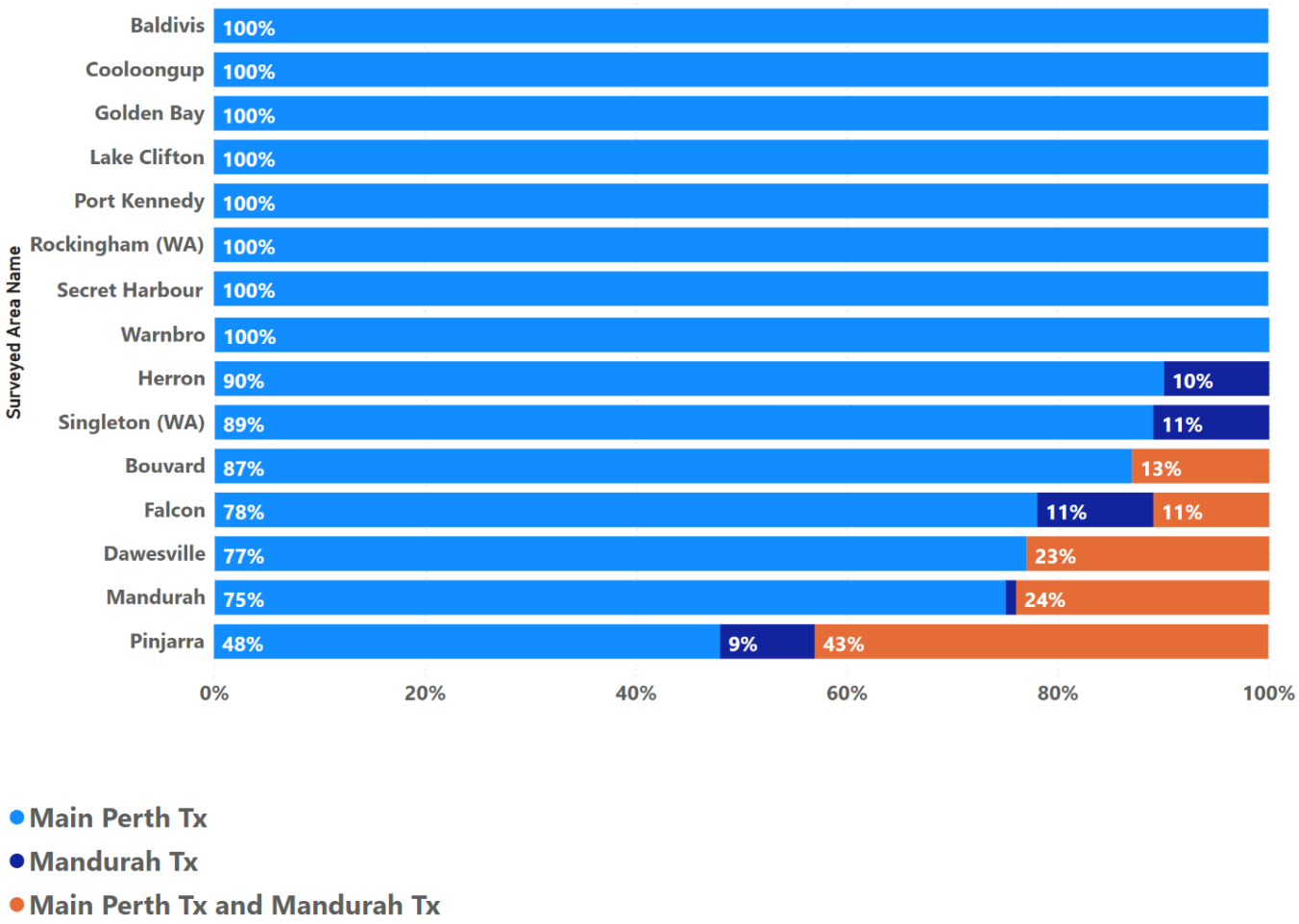


Figure 12: Percentage breakdown for each suburb in the survey area – Mandurah



5. Roleystone area

Overview

The Roleystone repeater is located 14 km to the south of the main Perth site in Bedfordale, 3 km to the south of Roleystone. The Roleystone repeater operates on Block D and was established to provide television coverage to the area where the coverage from main Perth site is deficient due to terrain shielding. The Canning River has created a valley through the Perth escarpment causing a significant area that is shadowed from the main Perth site. There are other suburbs in the Southern foothills of the escarpment that may be able to receive better coverage from the Roleystone repeater. The Roleystone repeater was planned on the basis that its coverage will be protected within suburban level reception against interference from other broadcasting services.

The survey area around Roleystone is shown in Figure 13. The areas were identified using the best server approach, that is, identifying areas where the local repeater provides the strongest signal compared to the main Perth site. A total of 8 suburbs/local areas were surveyed.

Figure 13: Repeater (green dot): Roleystone repeater; survey area (red oval): Roleystone, Karragullen, Kelmscott, Mount Nasura, Seville Grove, Armadale, Mount Richon, Bedfordale

Survey results

Survey results for the Roleystone area are shown in Figure 14 and are overlayed on the best server plot. The actual percentage breakdowns corresponding to the results in Figure 14 are presented in Figure 15.

The survey results are generally consistent with the predictions, revealing that the antennas in the survey are mainly pointing towards the main Perth site, except for the area where the coverage from the main Perth site is obstructed, mainly due to hilly terrain.

The suburb of Roleystone is a hilly area with significant vegetation that starts on top of an escarpment and descends into a valley. Households are mostly on large blocks on hillsides. In the parts of the area at higher elevation, the antennas were observed installed at roof height (nominally at 5 m) and pointing to the main Perth site as there is no line of site to the local repeater. In low lying areas the antennas were observed to be installed up to 10 m in height with mast head amplifiers pointing to the main Perth site. However, the majority of the antennas were at roof height with mast head amplifiers pointing to the Roleystone repeater.

In Kelmscott, the majority of the observed antennas were installed at roof height (nominally at 5 m) and were pointed to the main Perth site. Most of the antennas on the west side of the Albany highway were pointing to the main Perth site and most of the antennas on the east side of the Albany highway closer to the hills were pointing to the Roleystone repeater.

In Mount Nasura, around 60% of the observed antennas were installed at roof height (nominally at 5 m) and were pointed to the main Perth site. In the northern parts of the area there were more antennas pointing to the main Perth site, whereas in the southern parts of the area there were similar proportions of antennas pointing to the main Perth site and the Roleystone repeater.

In Karragullen, Bedfordale and Armadale all observed antennas were pointed to the main Perth site. As Bedfordale was hilly, the observed antennas were installed at up to 10 m in height with mast head amplifiers.

In Seville Grove and Mount Richon, the majority of the observed antennas were pointed to the main Perth site.

Figure 14: Survey results overlayed on the coverage predications plot. Coverage prediction background colour code: Yellow – Main Perth Site, Purple – Roleystone and Green – Perth City

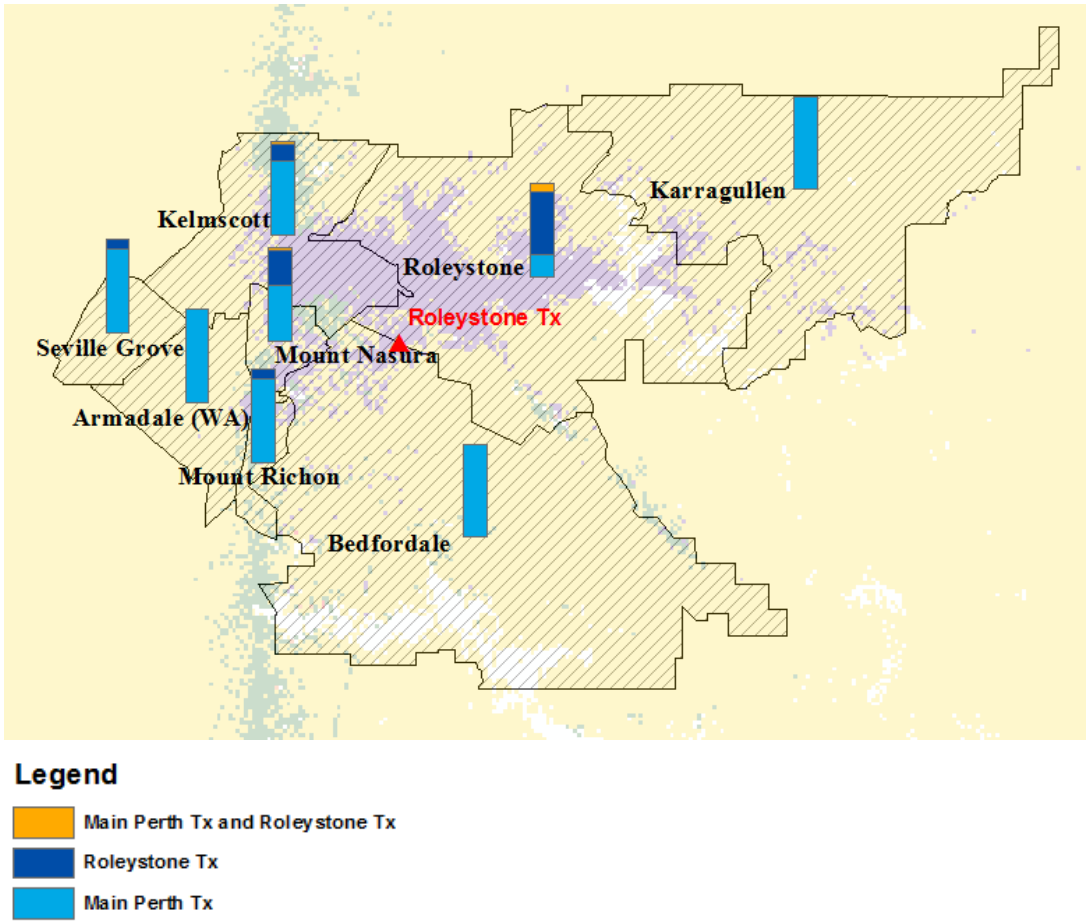
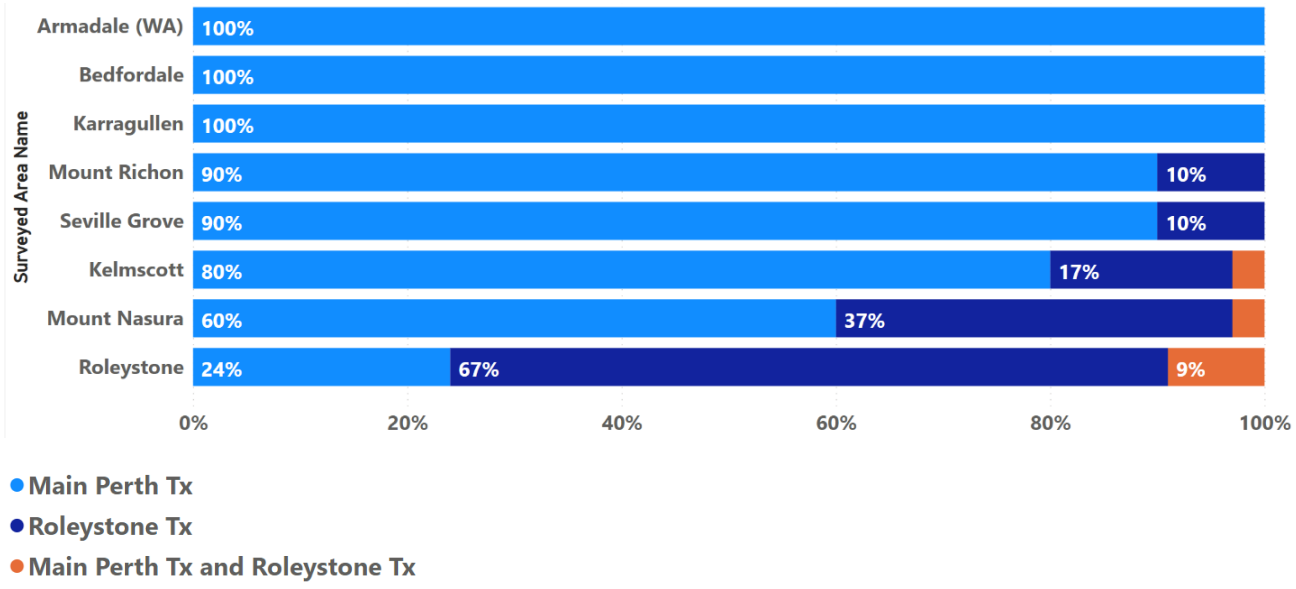


Figure 15: Percentage breakdown for each suburb in the survey area – Roleystone



6. Lancelin and Two Rocks areas

Overview

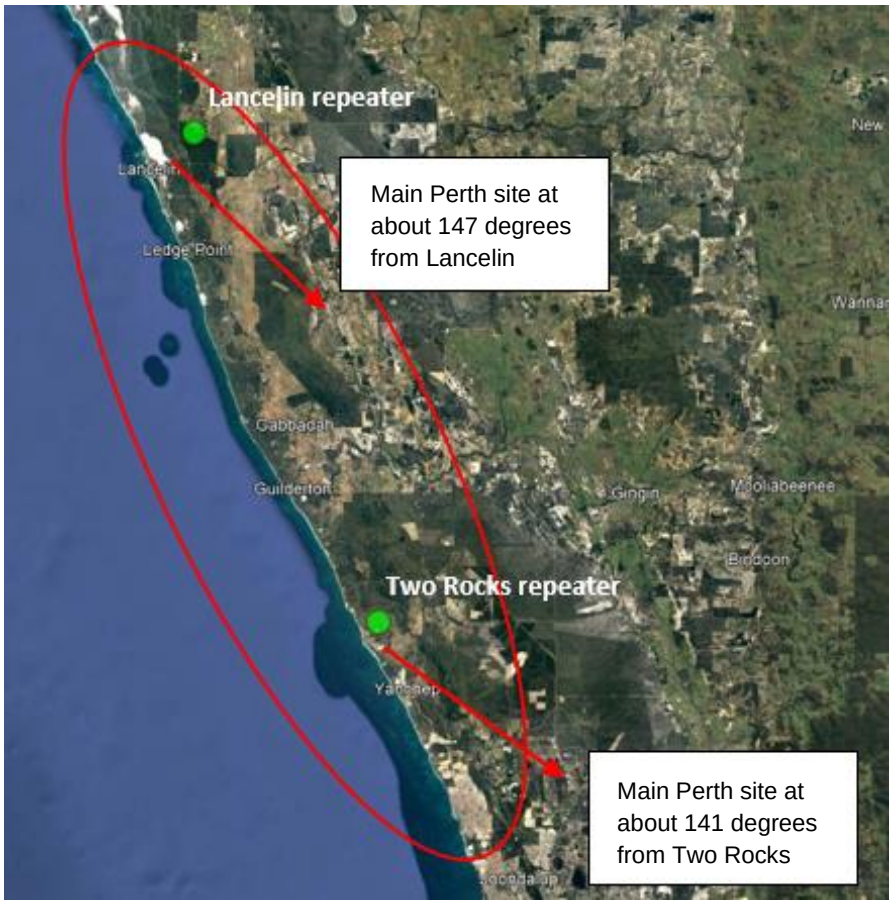
The Lancelin repeater is located 132 km to the north-west of the main Perth site and operates on Block D. The Lancelin repeater was established to provide television coverage to the area as no coverage is predicted from the main Perth site due to the terrain and distance from the site. The Lancelin repeater is located 6 km north-east of the Lancelin township and provides television coverage to the area and the immediate surroundings.

The Two Rocks repeater is located 74 km to the north-west of the main Perth site and operates on Block B. The Two Rocks repeater was established to provide television coverage to the area where the coverage from main Perth site is deficient due to the terrain. The Two Rocks repeater is located northeast of the Two Rocks township and provides television coverage to the area and the immediate surroundings.

Both the Lancelin and Two Rocks repeaters were planned on the basis that their coverage will be protected within suburban level reception against interference from other broadcasting services.

The survey areas around the Lancelin and Two Rocks repeaters are shown in Figure 16. The areas were identified using the best server approach, that is, identifying areas where the local repeater provides the strongest signal compared to the main Perth site. The Lancelin area is a mixture of low-lying coastal areas, low rolling hills and semi-rural bush blocks. It was generally more difficult to survey the semi-rural bush blocks due to limited visibility of the antenna systems. A total of 20 suburbs/local areas were surveyed.

Figure 16: Repeater (green dot): Lancelin and Two Rocks repeaters; survey area (red oval): Clarkson, Mindarie, Merriwa, Ridgewood, Quinns Rock, Jindalee, Butler, Alkimos, Yanchep, Two Rocks (including the western area around Oregano Dr and Countryside Dr), Lancelin, Karakin, Nilgen, Ledge Point, Seabird, Gabbadah, Guilderton, Woodridge



Survey results

Survey results for the Lancelin and Two Rocks area are shown in figures 17 and 19, respectively, and are overlayed on the best server plot. The actual percentage breakdowns corresponding to the results are presented in figures 18 and 20, respectively.

The survey results are generally consistent with the predictions, revealing that the antennas in Lancelin and the neighbouring areas are all pointing towards the Lancelin repeater. However, in Seabird to the south of the Lancelin repeater, it was observed that a very small number of households had 2 antennas, a UHF antenna directed at the Lancelin repeater and a VHF antenna directed at the main Perth site.

In areas in the South of the survey area, such as Gabbadah, Guilderton and Woodridge, no antennas were observed pointing to the Lancelin repeater and some antennas pointing to the Two Rocks repeater were observed. The majority of the antennas were pointing to the main Perth site in these suburbs.

In Two Rocks, a relatively even mix of antennas pointing to the main Perth site and the Two Rocks repeater was observed in the original part of the town. Households in the newer housing developments of Atlantis Beach were observed to all point their

antennas towards the local Two Rocks repeater. South of the Two Rocks repeater, in the majority of the areas, households had antennas pointing to the main Perth site, except for Quinns Rocks where a few antennas were pointed to the Two Rocks repeater. TV reticulation systems were observed in Yanchep, Alkimos, Butler and Jindalee. All other observed external antennas in those areas were pointing to the main Perth site, mostly VHF/UHF combination antennas installed with mast head amplifiers.

Figure 17: Survey results overlayed on the coverage predications plot. Coverage prediction background colour code: Yellow – Main Perth Site, Red - Lancelin and Purple – Two Rocks

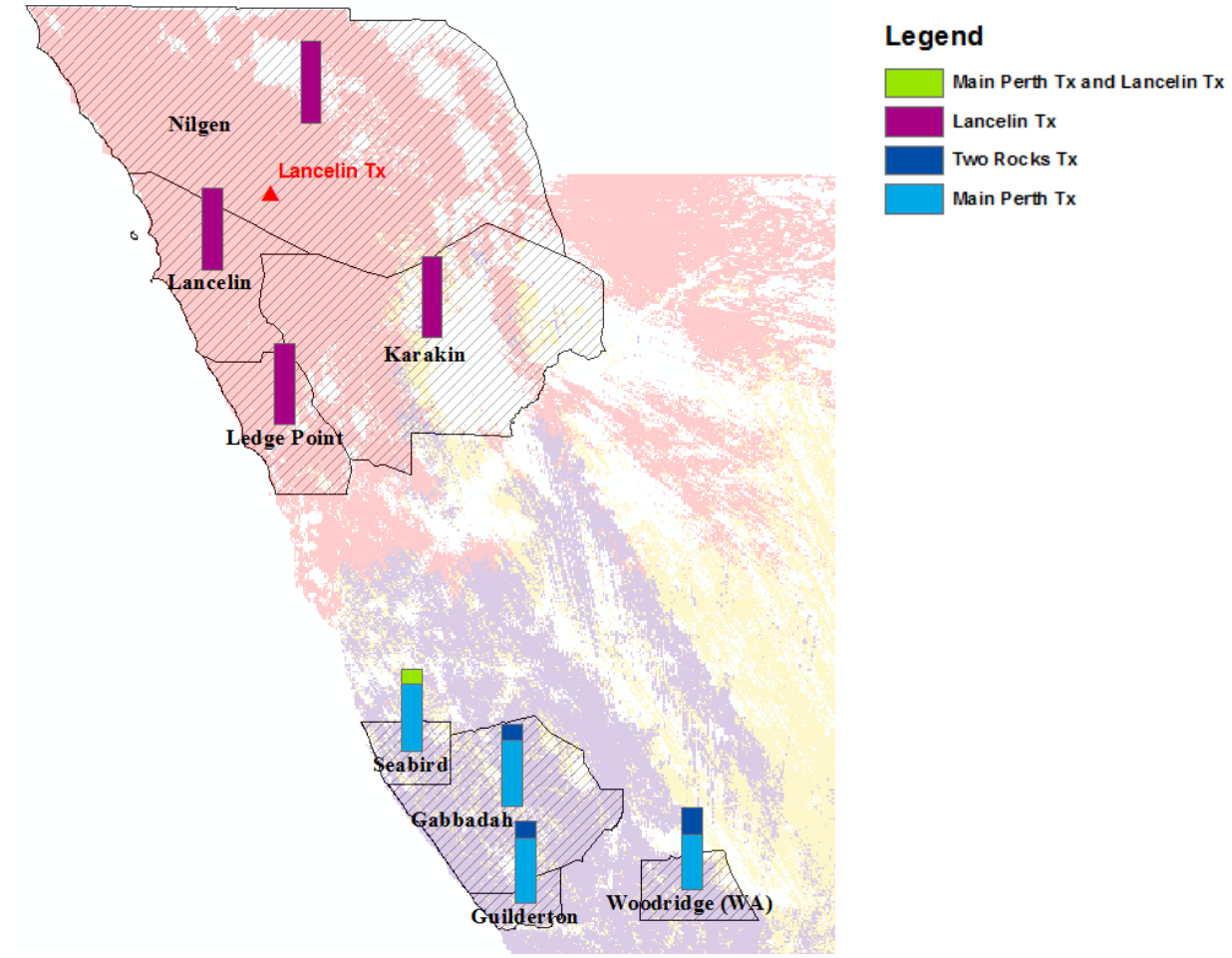


Figure 18: Percentage breakdown for each suburb in the survey area – Lancelin

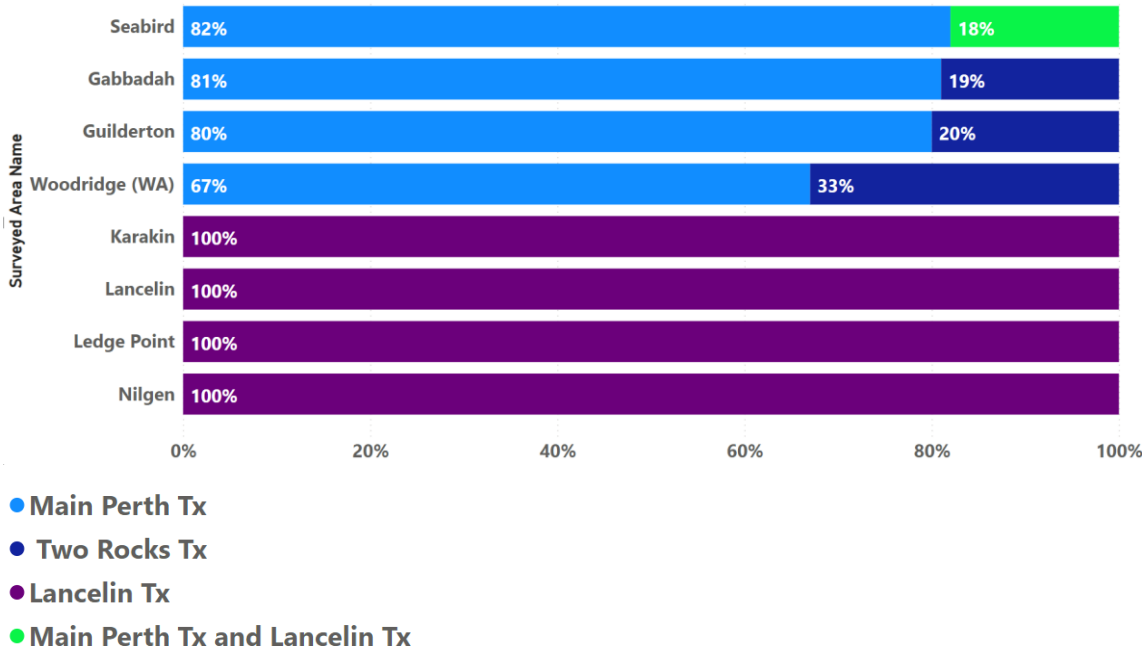
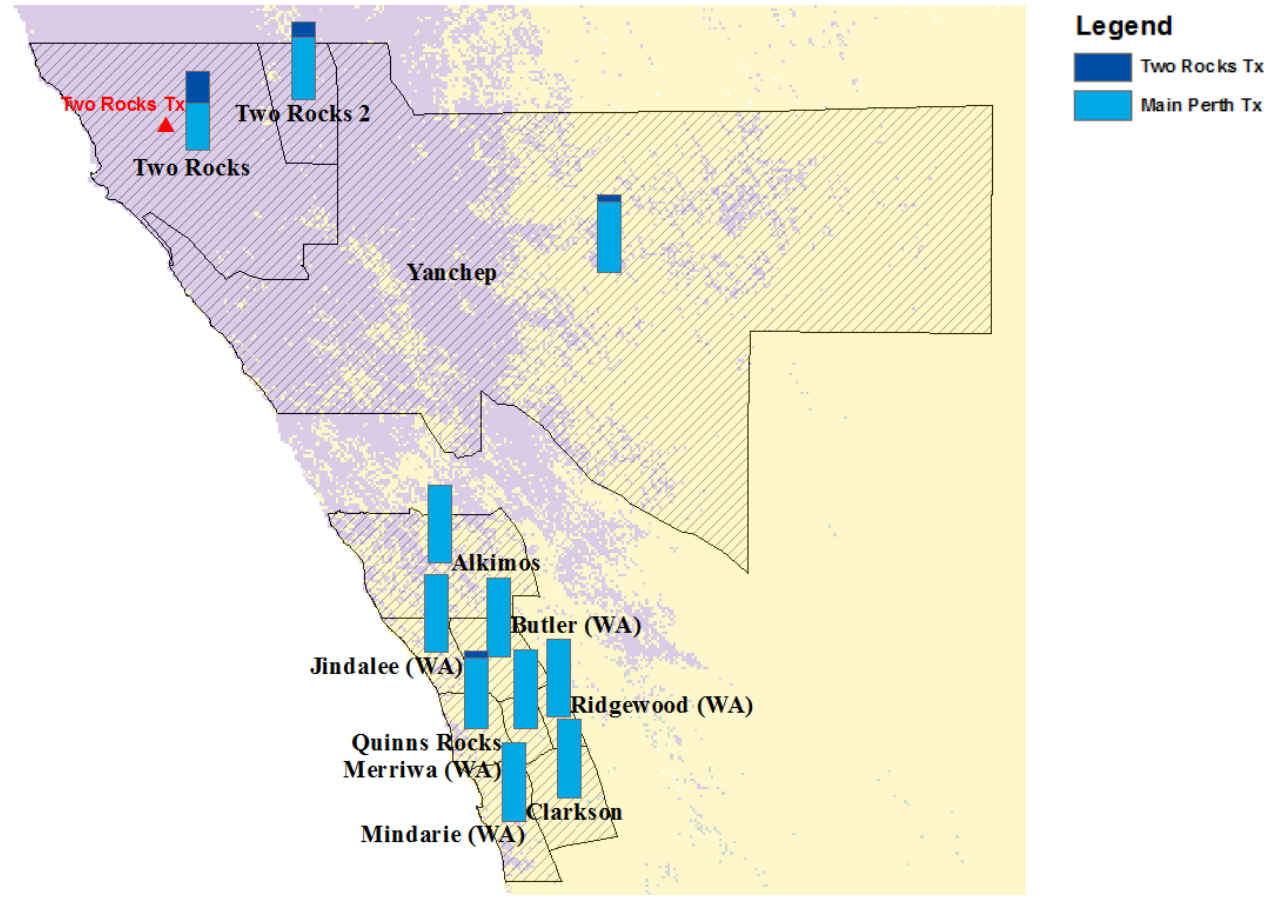
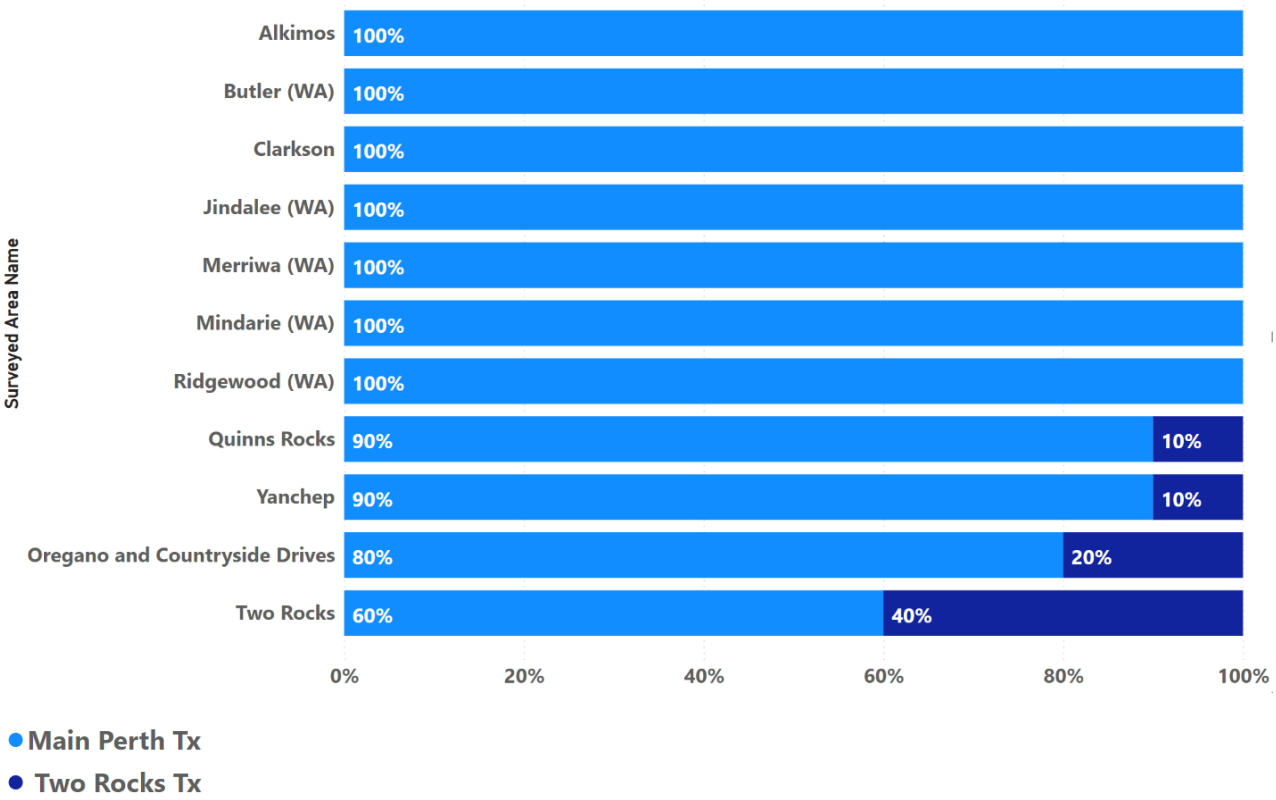


Figure 19: Survey results overlayed on the coverage predications plot. Coverage prediction background colour code: Yellow – Main Perth Site and Purple – Two Rocks



*Two Rocks 2 is Oregano Drive and Countryside Drive in Two Rocks

Figure 20: Percentage breakdown for each suburb in the survey area – Two Rocks



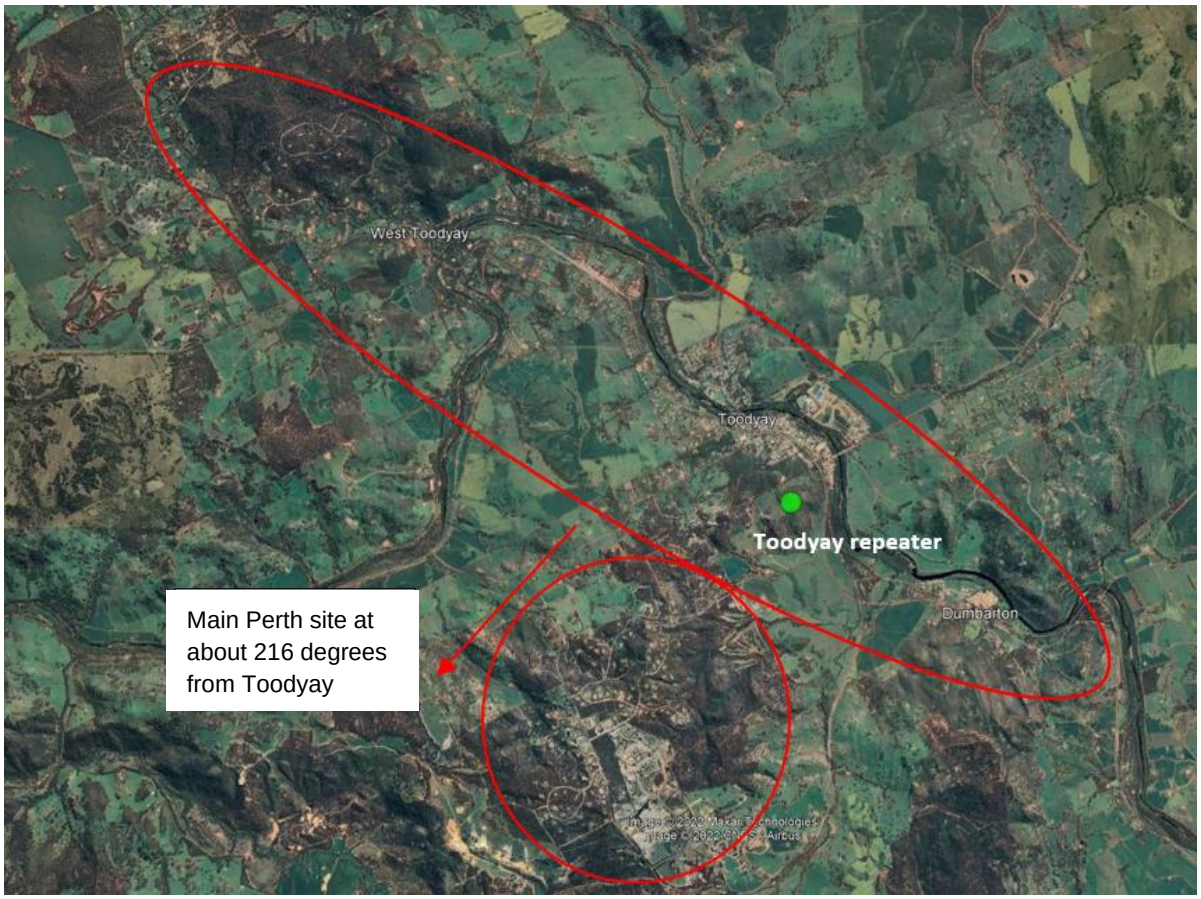
7. Toodyay area

Overview

The Toodyay repeater is located 62 km to the north-east of the main Perth site and operates on Block E. The Toodyay township as well as Toodyay West and Dumbarton localities are situated along a valley created by the Avon River. There are several surrounding hills that shadow these locations from the main Perth site. The Toodyay repeater is located on a hill to the south of the Toodyay township and provides television coverage to the area and the immediate surroundings.

The survey areas around Toodyay are shown in Figure 21. The areas were identified using the best server approach, that is, identifying areas where the local repeater provides the strongest signal compared to the main Perth site. A total of 4 suburbs/local areas were surveyed.

Figure 21: Repeater (green dot): Toodyay repeater; survey area (red circle/oval): Toodyay, Toodyay West, Dumbarton



Survey results

Survey results for the Toodyay area are shown in Figure 22 and are overlayed on the best server plot. The actual percentage breakdowns corresponding to the results in Figure 22 are presented in Figure 23.

All antennas observed in the main Toodyay township and the Dumbarton area were installed at roof height (nominally at 5 m) and were pointing to the Toodyay repeater.

This is consistent with the predictions, which showed that the coverage from the main Perth site in that area is expected to be poor due to a hill

Toodyay West consists of large farmhouses and there are large hills surrounding the area. Hence the observed antennas were mostly installed on 5 to 10 m masts above rooftops with mast head amplifiers and pointing towards the Toodyay repeater.

There is a hill to the south of the survey area. All observed antennas on the side of the hill facing the Toodyay repeater were installed at 10 m in height and pointing to the Toodyay repeater. All the antennas observed on the other side of the hill were installed at roof height (nominally at 5 m) with mast head amplifiers and pointing to the main Perth site. This observation is consistent with the coverage predictions which indicate that due to the terrain in the southern parts of survey area, the main Perth site provides better coverage than the Toodyay repeater.

Figure 22: Survey results overlayed on the coverage predications plot – Toodyay repeater. Coverage prediction background colour code: Yellow – Main Perth Site and Purple – Toodyay.

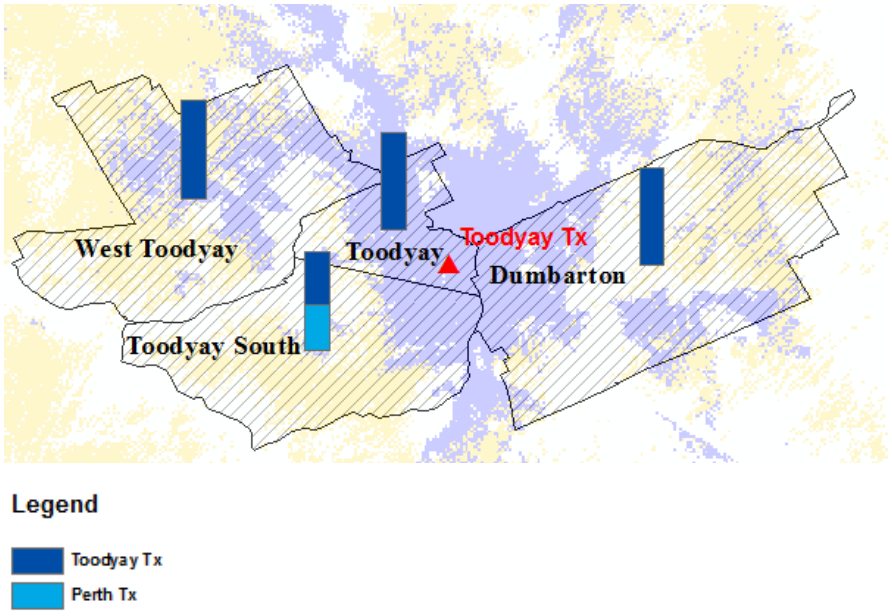


Figure 23: Percentage breakdown for each suburb in the survey area – Toodyay area.