# DSSN Region Digital Connectivity Business Case

**Phase 1 Deliverable:**

- LGA Regions Telecommunications Infrastructure Review
- Future Population and Visitor Demands on Telecommunications Infrastructure
- Telecommunications Infrastructure Options Analysis
- Scenario Planning for Future Connectivity Demand

**February 2024**

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# Structure and Limitations to this report

## Limitations

The review of telecommunications infrastructure and any data analysed in this report has been conducted utilising public information from reputable sources such as the ACCC and ABS. Datasets have been provided to such sources directly by telecommunications providers and census data, all of which are in the public domain.

Where specific data has not been public, proxy numbers have been used based on assumptions made from existing data sets and highlighted accordingly.

## Structure

Due to the detailed modelling and amount of data used to determine the current and future state of telecommunications infrastructure and digital connectivity access across the DSSN region (ten Local Government Areas), this report is laid out in the following structure:

1. **Chapter Summary:** The four outputs of this deliverable are presented in succinct chapters summarising the high-level approach taken and the key outcomes of the research and modelling conducted.
2. **Appendices:** The detailed methodologies and findings behind the report chapters and outcomes.

This report can be navigated using the chapter titles listed across the top of the main body pages. Appendix chapters use the main four chapter headings for ease of navigation and to inform the reader as to which chapter the appendix refers to.

# Scope of this Report

| Phase 1 Outcomes | Phase 1 Deliverables | Phase 1 Deliverables – Report Navigation | Page Numbers |
|---|---|---|---|
| 1) Deep Dive Audit | • The production of LGA Regions Telecommunications Infrastructure Heat Map | • Chapter 1: LGA Regions Telecommunications Infrastructure Review<br>• Appendix 5.1 | 14 – 32<br>128 - 172 |
| | • The production of Technology Gap Analysis | • Chapter 3: Future Demand Model Scenarios (Includes 'Future population and visitor demand on telecommunications infrastructure' and 'Scenario planning (e.g. low, baseline, high) that fulfils future connectivity demand')<br>• Appendix 5.2 – 5.3 | 46 – 66<br>173 - 224 |
| 2) Tourism and Visitor Economy Use Cases | • Five (5) Use case reports | • Chapter 4: Telecommunications Infrastructure Options Analysis: Case Studies | 67 - 112 |
| 3) Executive Summary of Potential Technology Solutions | • Executive Summary of Potential Technology Solutions | • Chapter 4: Telecommunications Options Analysis<br>• Appendix 5.4 | 67 – 126<br>225 - 268 |
| 4) Business Case Briefing Paper | • Outline of Business Case Methodology | • Provided in the Business Case final deliverable, *The Case for Improved Digital Connectivity in the Hunter and Central Coast Regions* | |

# Glossary

| TERM | DEFINITION |
|---|---|
| **3G** | The third generation in mobile technology standards prepared by the 3GPP global partnership. |
| **3GPP** | The 3rd Generation Partnership Project is an umbrella term for a consortium of mobile operators, vendors and international standards organisations that develop protocols and interfaces for mobile telecommunications, including 3G, 4G, and 5G standards. |
| **4G** | The fourth generation in mobile technology standards prepared by the 3GPP global partnership. |
| **5G** | The fifth generation in mobile technology standards prepared by the 3GPP global partnership. |
| **Busy hour** | Period of time during a day when network usage or traffic is at its highest level. It is a specific one-hour timeframe within a 24-hour day when the demand for network resources, such as bandwidth and connectivity, is most intensive. |
| **Contention Ratio** | Represents the relationship between the total available bandwidth and the bandwidth allocated to a specific group of users. |
| **Co-location** | A form of passive infrastructure sharing where a mobile network operator deploys its active equipment on the same passive infrastructure as another mobile network operator. |
| **Digital Connectivity Index** | A measure of the quality and effectiveness of digital connectivity in a selected area that indicates the capability of a location to support various digital activities such as remote work, online learning, or mobile internet usage. |
| **Gbps** | “Gigabits per second”. Represents the number of gigabits (one billion bits) that can be transmitted or processed in one second. |
| **Headroom Extra Capacity** | Additional capacity deliberately built into a system or network beyond the anticipated peak demand or regular usage. |
| **IoT** | The Internet of Things (IoT) describes physical objects (or groups of such objects) with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks. |
| **Mbps** | “Megabits per second”. Represents the number of megabits (one million bits) that can be transmitted or processed in one second. |

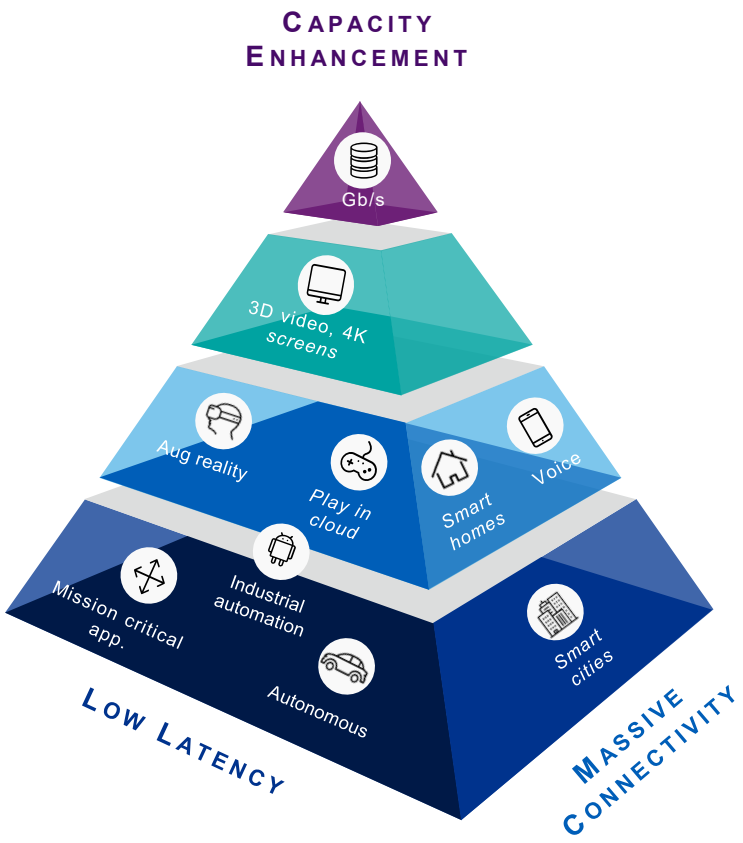
# Glossary

| TERM | DEFINITION |
|---|---|
| **Mobile network operator** | A mobile network operator supplies mobile services to customers at the retail level. Examples include Telstra, Optus and TPG Telecom. |
| **Non-IoT** | Connections that are not associated with IoT. These connections are associated with a private connection of a user, such as a resident's mobile phone to an antenna or a personal computer at internet home. |
| **Passive infrastructure** | Assets and equipment which are not part of the active layer of a telecommunications network (the signal path), including but not limited to sites, buildings, shelters, towers, masts, poles, ducts, trenches, electric power supply/generators and air conditioning. |
| **Passive sharing** | Passive infrastructure sharing is where mobile network operators share non-electronic infrastructure, such as tower, land, power and other physical elements. |
| **Spectrum** | The radio spectrum is part of the electromagnetic spectrum with frequencies from 3 Hz to 3,000 GHz (3 THz). Active equipment uses radiofrequency spectrum to provide connectivity to mobile devices. |
| **Throughput** | Speed at which data is successfully transmitted or processed through a system or network. |
| **Tower** | A structure on which a radio base station equipment can be installed. It includes telecommunications towers that are part of the National Broadband Network, radio and television broadcasting towers and other suitable towers or similar structures that could be used to improve mobile telecommunications coverage or can be used in the supply of mobile telecommunications and other radiocommunications services, including rooftops or utility masts. |
| **LGAs** | Local Government Areas. Each LGA is governed by a local Council, which is responsible for the Area. |
| **Busy Hour** | Period of time during a day when network usage or traffic is at its highest level. It is a specific one-hour time frame within a 24-hour day when the demand for network resources, such as bandwidth and connectivity, is most intensive. |
| **Contention Ratio** | Represents the relationship between the total available bandwidth and the bandwidth allocated to a specific group of users. |
| **Headroom Extra Capacity** | Additional capacity deliberately built into a system or network beyond the anticipated peak demand or regular usage. |

# Executive Summary

# Framing the Connectivity Challenge – devices drive demand

This study has been conducted using the high-level approach of ***devices driving connectivity demand***. The number of devices used by our population, including residents, businesses and visitors to the region, are expected to increase gradually over time. Digital devices include smart phones, computers, smart appliances such as televisions, mobile GPS devices used in cars, and anything else that requires the user to be connected to fixed or wireless telecommunications infrastructure.




**The Digital Connectivity Challenge is framed according to the following:**

- New demand for capacity, connectivity and low latency will stress the current connectivity infrastructure.
- Investing in the appropriate infrastructure is essential for countries and regions that want to be successful in a digital future.
- To support the wide range of digital and connectivity use cases and guarantee the quality of those services, the network will have to assure the connection of a large number of devices simultaneously, processing an immense volume of data in real time.
- **Key network performance measures are higher capacity, higher connectivity and lower latency.**

## Unique Applications of 5G

- **Smart Mobility**
- **Digital Health Services**
- **Smart distribution grids**
- **Digitisation of Agriculture**
- **Emergency Network 4.0**

# High Level Approach to Digital Connectivity Challenge

Assessing the region's telecommunications infrastructure provides insights into the capacity to meet current digital connectivity demand, identify areas for improvement, and enable informed decision-making for future demand needs. The high-level approach taken to conducting this study included the following:

### Estimation of Future Population & Visitor Demand

Compile the latest demographic data and population growth projections.
Compile the latest visitor numbers to project peak connectivity demand from visitors and the local population combined.

### Estimation of Future Number of Devices

Calculate the average number of devices per capita, estimating total IoT and non-IoT connections, using industry-specific employment rates to project industrial and individual devices.

### Connectivity Demand Model

Estimate demand on the network based on the projected future connectivity demand through to 2030.

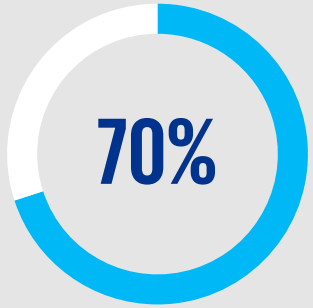
### Analysis of Existing Telecommunications Infrastructure

Examine the deployed network access types across mobile, fibre, fixed, wireless and satellite from the three major telecommunications operators (Telstra, Optus, and TPG) and the National Broadband Network (nbn).

# Key Findings: The Digital Connectivity Index for the DSSN Region

The NSW Digital Connectivity Index is a visualisation tool that measures the quality of digital connectivity across NSW and is based on metrics such as coverage, speeds, choice and performance. It is measured at a granular level by suburb and LGA, based on public and commercial datasets with more than 200 million data points. The Index helps to identify areas where better connectivity is required and should be leveraged by different levels of government and industry to develop solutions.

Metropolitan suburbs in NSW have an average Digital Connectivity Index score of 64 (Above Average connectivity), with inner Sydney being as high as 100 (Excellent connectivity). **By comparison, regional suburbs have an average score of just 16 (Poor connectivity)**.




**Of LGAs have 'average' or 'below average' digital connectivity**

- The poorest connectivity ('below average' digital connectivity index rating) are in Upper Hunter, Muswellbrook, Singleton and Cessnock.
- The three LGAs with 'above average' connectivity are Newcastle, Lake Macquarie and Maitland.

## Stationary

**(Fibre, Fixed Wireless, Satellite connectivity)**

- **No LGAs** in the DSSN region have an '**Excellent**' connectivity rating (a score of between 81-100) for Stationary digital connectivity
- **Four LGAs** have an '**Above Average**' connectivity index rating (61-80): Central Coast, Lake Macquarie, Maitland and Newcastle.
- **Five LGAs** have an '**Average**' connectivity index rating (41-60): Cessnock, Dungog, Muswellbrook, Port Stephens and Singleton.
- The Upper Hunter is the **only LGA** that has a '**Below Average**' (21-40) digital connectivity index rating.
- **No LGAs** in the DSSN region have a '**Poor**' (0-20) rating.

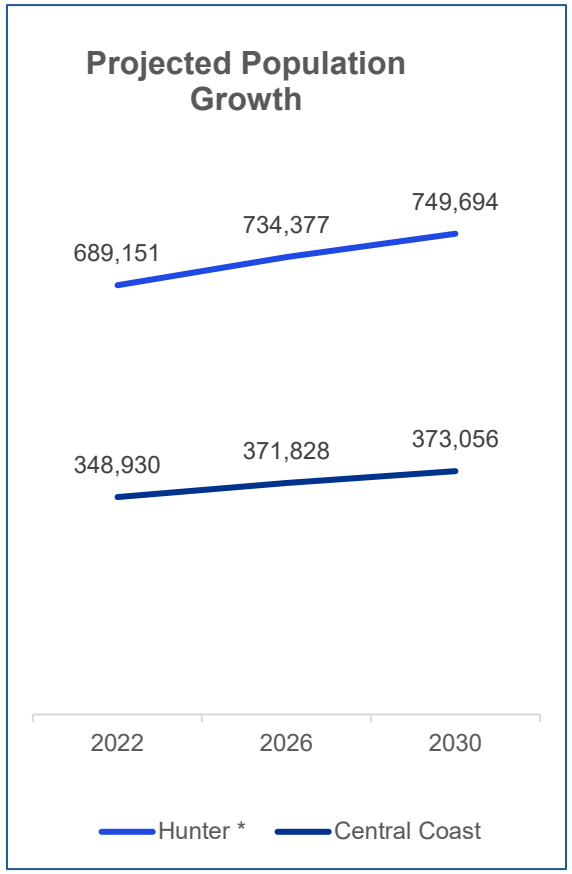
## On the Move

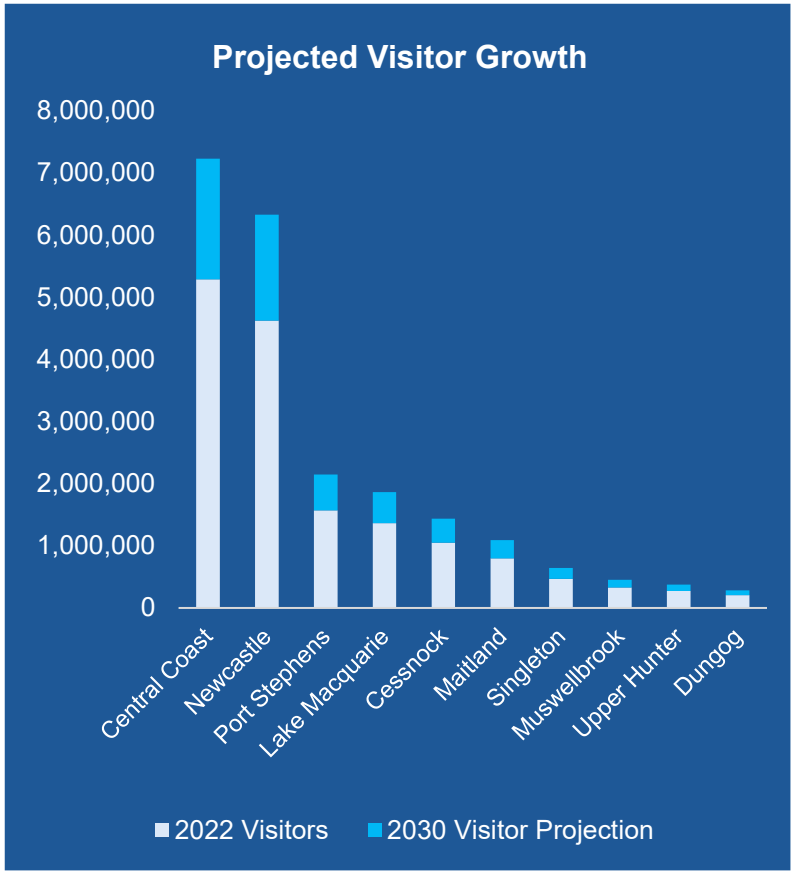
**(3G, 4G and 5G mobile connectivity)**

- **No LGAs** in the DSSN region have an '**Excellent**' connectivity rating (a score of between 81-100) for 'On the Move' digital connectivity
- **Newcastle** is the **only LGA that has an 'Above Average connectivity index rating** (61-80)
- **Four LGAs** have an '**Average**' connectivity index rating (41-60): Central Coast, Lake Macquarie, Maitland and Port Stephens
- **Five LGAs** have a '**Below Average**' connectivity index rating (21-40): Cessnock, Dungog, Muswellbrook, Singleton and Upper Hunter.
- **No LGAs** in the DSSN region have a '**Poor**' (0-20) rating.

# Key Findings: Future Connectivity Demand

The future digital connectivity demand on telecommunications infrastructure is driven by an increasing population of local residents, businesses, and visitors to the area. By 2030, the population across the Hunter and Central Coast are expected to increase by 8 per cent, and visitor numbers by 37 per cent. The number of devices projected to be in use by 2030 is driven by the increase in the number people – both residents and visitors, at home, work and whilst travelling – using stationary and mobile devices to connect to digital infrastructure. This increase in the number of expected devices to be in use puts additional demand on the existing infrastructure.




## Projected Increase in Devices by 2030

The number of digital devices calculated to be in use in 2023, and projected to be in use by 2025 and 2030, are based on the current and forecasted population and visitor numbers, multiplied by the average number of devices per person based on three scenarios: Low, Baseline and High.

| Scenario | Total Number of Devices | | |
|---|---|---|---|
| | 2023 | 2025 | 2030 |
| Low | 6.9M | 8.3M | 14.1M |
| Baseline | 9.9M | 12M | 20.4M |
| High | 14.3M | 17.2M | 29.3M |

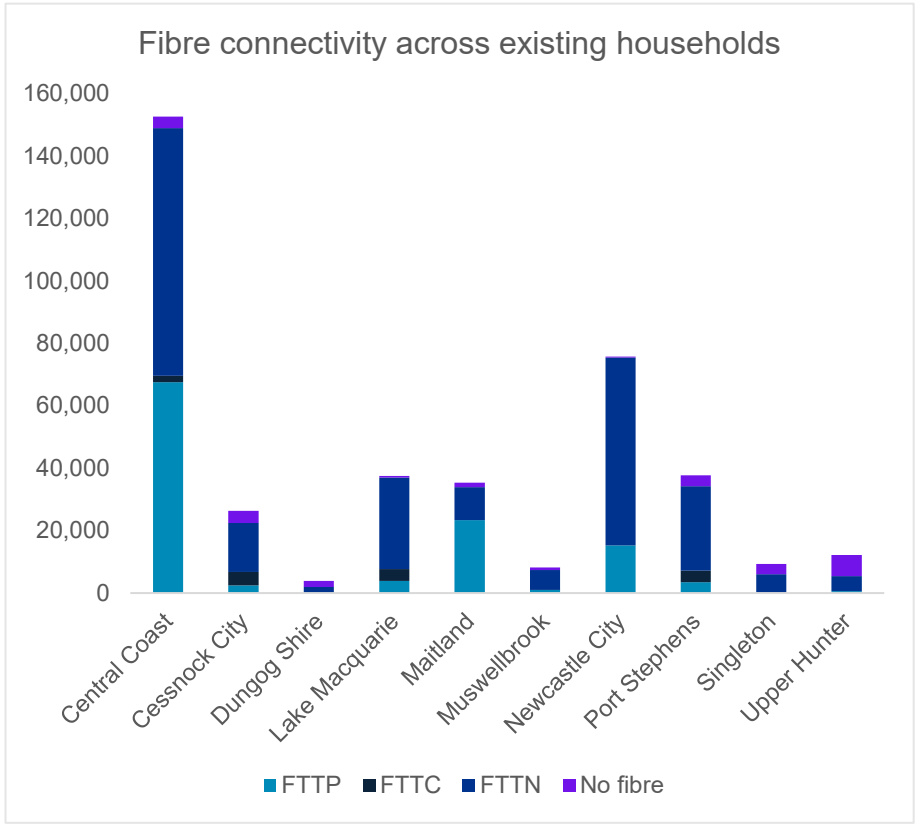
- *The DSSN Region includes all LGAs within the Hunter and Central goes region, excluding Mid-Coast LGA.*
- **Population is sourced from 2022 ABS, Forecast Percentage Growth:* Population Projections - Australian Bureau of Statistics

# Key Findings: The Digital Connectivity Gap

## Wireless

| | Low Scenario | | | Baseline Scenario | | | High Scenario | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2023 | 2025 | 2030 | 2023 | 2025 | 2030 | 2023 | 2025 | 2030 |
| Central Coast | 🟢 | 🟢 | 🟡 | 🟢 | 🟢 | 🔴 | 🟡 | 🔴 | 🔴 |
| Cessnock City | 🟢 | 🟢 | 🟢 | 🟢 | 🟡 | 🔴 | 🔴 | 🔴 | 🔴 |
| Dungog Shire | 🟢 | 🟢 | 🟢 | 🟢 | 🟡 | 🔴 | 🔴 | 🔴 | 🔴 |
| Lake Macquarie | 🟢 | 🟢 | 🟡 | 🟢 | 🟡 | 🔴 | 🔴 | 🔴 | 🔴 |
| Maitland | 🟢 | 🟢 | 🔴 | 🔴 | 🔴 | 🔴 | 🔴 | 🔴 | 🔴 |
| Muswellbrook | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🔴 |
| Newcastle City | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🔴 | 🔴 | 🔴 | 🔴 |
| Port Stephens | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🔴 | 🔴 | 🔴 | 🔴 |
| Singleton | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🔴 |
| Upper Hunter | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🟢 | 🔴 |

## Wireline



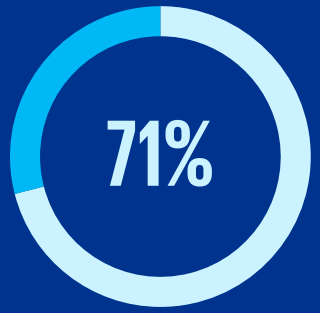
# Key Findings: The Digital Connectivity Gap

This report outlines the key findings of expected future demand from devices used by residents, businesses and visitors to the DSSN region, the current state of telecommunications infrastructure, gaps in the projected supply and demand based on that infrastructure, and how the projected demand may be met.

**782**

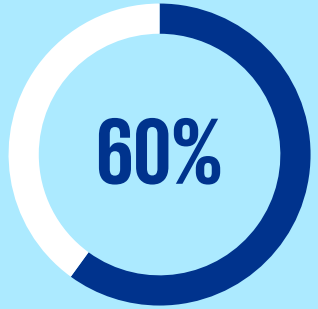
**Total number of existing mobile sites across the DSSN region.**

- Central Coast has the highest number of existing mobile sites (265), with majority being Optus (104).
- Dungog has the lowest number of mobile sites (13), with 0 TPG sites.




**The percentage of private dwellings that require FTTP upgrades.**

- 6.6 per cent of the total dwellings across the DSSN region (a total of 26,180) do not have fibre access.
- 71 per cent of the region's private dwellings (281,472 in total) require FTTP upgrades from FTTC, FTTN or no fibre.
- 52 per cent of Dungog Shire's private dwellings have no fibre access, with the remaining 48 per cent having only FTTN.




**Of LGAs not have sufficient infrastructure to meet the future demand.**

- Based on the simulations in this report, the projection is that there is a capacity issue in 2025 and 2030 for six of the ten LGAs across the DSSN region, meaning they are unlikely to have sufficient telecommunications infrastructure to meet the expected 'baseline' increase in demand (devices in use) by 2030.
- Not only will the digital gap occur because of population and visitor growth, but the real challenge is exemplified by cases of peak visitation. In this report we analyse five case studies for major planned events and peak visitation periods in Pokolbin (Hunter Valley), Morisset (Lake Macquarie), The Entrance (Central Coast) and Nelson Bay (Port Stephens).
  Given the significant network capacity gap for these peak visitation events, this report considers several technical options that can be pursued to address these peak visitor events.

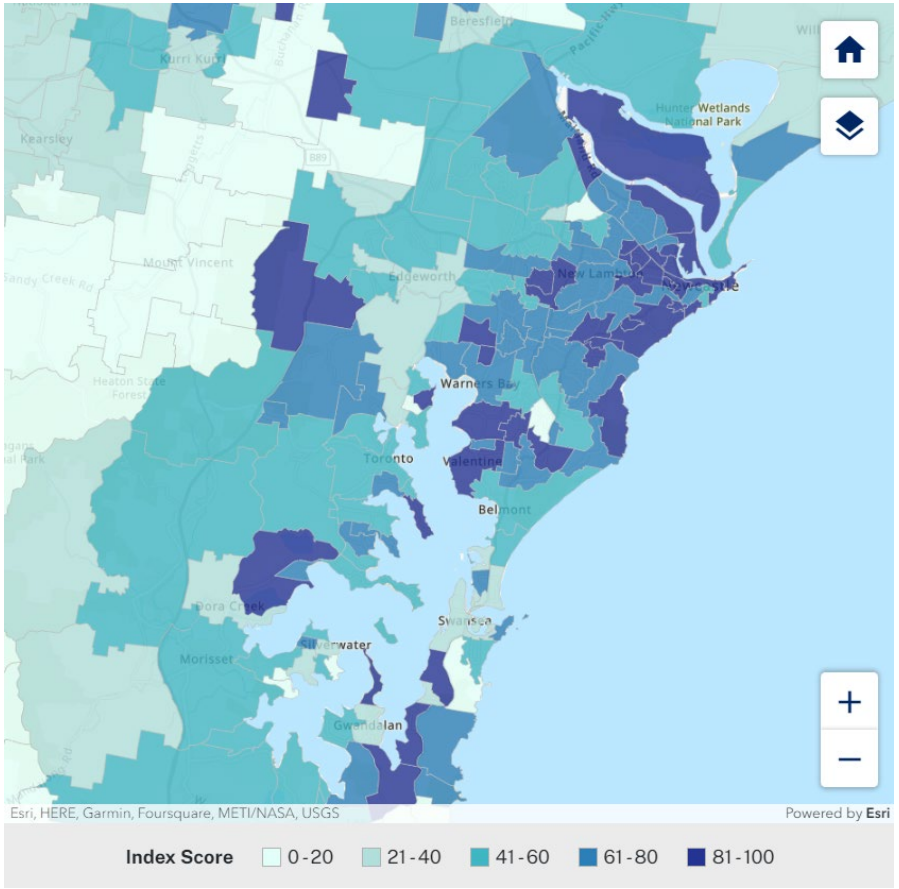
# 1.
# LGA Regions Telecommunications Infrastructure Review

Refer to Appendix 5.1 for detailed analysis

# The Digital Connectivity Index

# Digital Connectivity Index

The Connectivity Index is a visualisation tool that measures the quality of digital connectivity across NSW and is based on metrics such as coverage, speeds, choice and performance. It is measured at a granular level by suburb and LGA, based on public and commercial datasets with more than 200 million data points.




## High level insights

- Metro suburbs in NSW have an average index score of 64, inner Sydney as high as 100 and by comparison regional suburbs have an average of just 16.
- The NSW Digital Connectivity Index helps to identify areas where better connectivity is required and should be leveraged by different levels of government and industry to develop solutions.

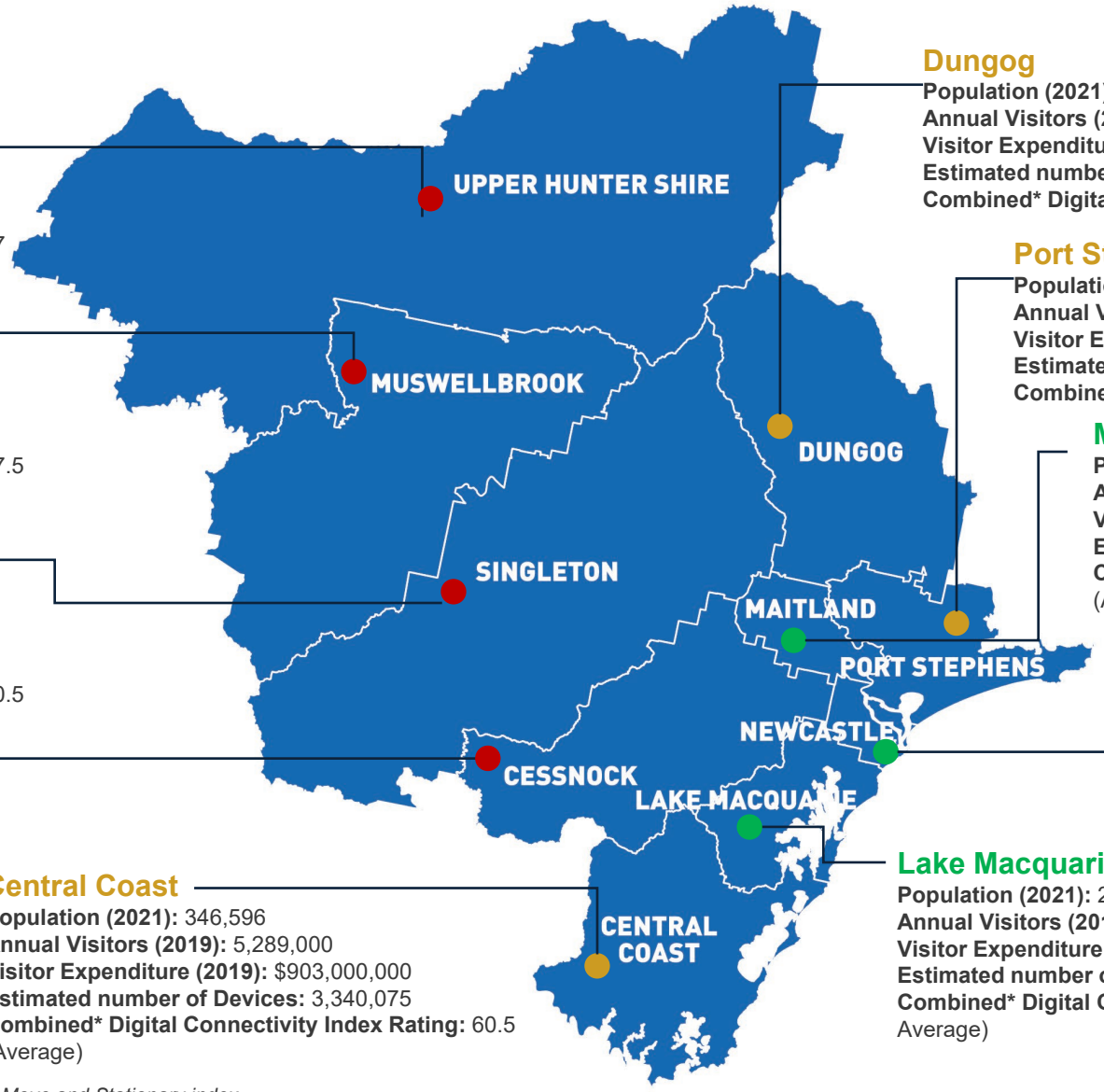
| Score | Rating | What does this score mean? |
|---|---|---|
| 81-100 | Excellent | Communities with these scores are highly likely to be able to meaningfully conduct digital activities such as working, video conferencing and accessing telehealth |
| 61-80 | Above Average | Communities with these scores are likely able to meaningfully conduct digital activities such as working, video conferencing and accessing telehealth |
| 41-60 | Average | Communities with these scores are less likely to be able to meaningfully conduct digital activities such as working, video conferencing and accessing telehealth |
| 21-40 | Below Average | Communities with these scores are unlikely to be able to meaningfully conduct digital activities such as working, video conferencing and accessing telehealth |
| 0-20 | Poor | Communities with these scores are highly unlikely to be able to meaningfully conduct digital activities such as working from home, video conferencing, gaming and online streaming |

NSW Digital Connectivity Index | NSW Government

# The DSSN Region's Digital Connectivity Current State

70 per cent of the region is experiencing average or below average digital connectivity, impacting local residents, businesses and visitors.

**Key**
- Below average connectivity
- Average connectivity
- Above average connectivity




## Upper Hunter Region Shire
**Population (2021):** 14,229
**Annual Visitors (2019):** 279,000
**Visitor Expenditure (2019):** $52,000,000
**Estimated number of Devices:** 137,471
**Combined* Digital Connectivity Index Rating:** 27 (Below Average)

## Muswellbrook
**Population (2021):** 16,357
**Annual Visitors (2019):** 335,000
**Visitor Expenditure (2019):** $59,000,000
**Estimated number of Devices:** 159,036
**Combined* Digital Connectivity Index Rating:** 37.5 (Below Average)

## Singleton
**Population (2021):** 24,577
**Annual Visitors (2019):** 473,000
**Visitor Expenditure (2019):** $123,000,000
**Estimated number of Devices:** 241,071
**Combined* Digital Connectivity Index Rating:** 40.5 (Below Average)

## Cessnock
**Population (2021):** 63,632
**Annual Visitors (2019):** 1,053,000
**Visitor Expenditure (2019):** $328,000,000
**Estimated number of Devices:** 630,315
**Combined* Digital Connectivity Index Rating:** 38.5 (Below Average)

Destination Sydney Surrounds North

## Central Coast
**Population (2021):** 346,596
**Annual Visitors (2019):** 5,289,000
**Visitor Expenditure (2019):** $903,000,000
**Estimated number of Devices:** 3,340,075
**Combined* Digital Connectivity Index Rating:** 60.5 (Average)

## Dungog
**Population (2021):** 9,541
**Annual Visitors (2019):** 211,000
**Visitor Expenditure (2019):** $28,000,000
**Estimated number of Devices:** 93,662
**Combined* Digital Connectivity Index Rating:** 42 (Average)

## Port Stephens
**Population (2021):** 75,276
**Annual Visitors (2019):** 1,573,000
**Visitor Expenditure (2019):** $563,000,000
**Estimated number of Devices:** 737,349
**Combined* Digital Connectivity Index Rating:** 46 (Average)

## Maitland
**Population (2021):** 90,226
**Annual Visitors (2019):** 801,000
**Visitor Expenditure (2019):** 1,610,370
**Estimated number of Devices:** 887,979
**Combined* Digital Connectivity Index Rating:** 62 (Above Average)

## Newcastle
**Population (2021):** 168,873
**Annual Visitors (2019):** 4,627,000
**Visitor Expenditure (2019):** $1,056,000,000
**Estimated number of Devices:** 1,662,988
**Combined* Digital Connectivity Index Rating:** 75 (Above Average)

## Lake Macquarie
**Population (2021):** 213,845
**Annual Visitors (2019):** 1,365,000
**Visitor Expenditure (2019):** $210,000,000
**Estimated number of Devices:** 2,049,942
**Combined* Digital Connectivity Index Rating:** 64.5 (Above Average)

*Combined Digital Connectivity Index Rating is the average of On the Move and Stationary index

# Technology Review Approach

# Technology Review - Approach

In the diagram below, the different steps completed for the review of existing mobile and fixed access technology for various Local Government Areas are illustrated.

## Mobile Network

**1**

**Analysis of the existing Mobile Technologies (3G, 4G, 5G)**

**2**

**Mapping the different sites by the three major Operators**

**3**

**Analysis of coverage maps and Identification of Connectivity Issues**

## Fixed Network (NBN Services)

**4**

**Analysis of different types of technology provided by the NBN**

**5**

**Analysis of NBN coverage maps (different regions) and identification of connectivity issues.**

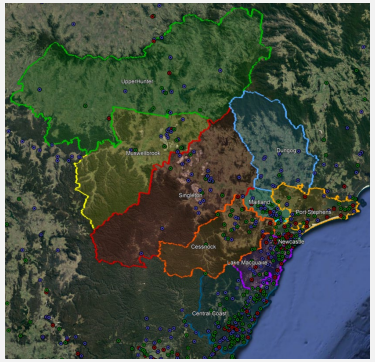
# Technology Review Findings

To understand how demand growth affects network infrastructure, it's essential to assess the current deployment status of various network access types. An evaluation was conducted on the deployment of Mobile, Fibre, Fixed Wireless, and Satellite access, focusing on the three major operators (Telstra, Optus, and TPG) and the National Broadband Network (NBN).

## Analysis of Current Network Mobile State

- Collected data on **radio sites** operated by **Telstra**, **Optus**, and **TPG** in various regions
- Conducted **coverage** assessment by mapping sites using **geographic coordinates** and **operator-provided maps**
- Examination of **3G**, **4G** and **5G** technologies

**Disclaimer:** the operators are planning to **discontinue 3G** technology in **2024.**



**Existing Number of Mobile Sites for each DSSN Region:**

| Region | Telstra | Optus | TPG | Total |
|---|---|---|---|---|
| Central Coast | 100 | 104 | 61 | 265 |
| Newcastle | 43 | 41 | 30 | 114 |
| Lake Macquarie | 40 | 39 | 32 | 111 |
| Port Stephens | 28 | 31 | 20 | 79 |
| Cessnock | 24 | 22 | 13 | 59 |
| Maitland | 22 | 18 | 10 | 50 |
| Singleton | 25 | 9 | 5 | 39 |
| Muswellbrook | 18 | 7 | 3 | 28 |
| Upper Hunter | 12 | 8 | 4 | 24 |
| Dungog | 10 | 3 | 0 | 13 |

**Sources:** ACCC Mobile Infrastructure Report | Telstra Coverage Maps | Optus Coverage Maps | TPG Coverage Maps

## Analysis of nbn Types of Technology

To analyze the current **fixed/fibre network infrastructure** for each region, the assessment focused on the deployment status of the **NBN network**.

The coverage maps for each region were scrutinized, considering **Fibre to the Premises** (FTTP), **Fibre to the Node** (FTTN), and **Fixed Wireless** and **Satellite** as the predominant access types. The following are the connection types provided by the NBN:

**Wired Connections**

**Fibre to the Premises (FTTP)** - used in circumstances where direct fibre optic line is extended from the nearest available fibre node directly to population premises.

**Fibre to the Building (FTTB) -** is typically employed by NBN when connecting apartment blocks or similar structures. It involves running a fibre optic line to the fibre node in the building's communications room and utilizing the existing connection technology within the building.

**Fibre to the Curb (FTTC) -** used in circumstances where fibre is extended close to habitational premises, connecting to a small Distribution Point Unit (DPU), generally located inside a pit on the street.

**Fibre to the Node (FTTN) -** used where the existing copper phone and internet network from a nearby fibre node is used to make the final part of the connection to the NBN network

**Wireless Connections**

**Fixed Wireless -** typically used in circumstances where the distance between premises can be many kilometres.

**Satellite -** used in remote and residential areas that do not have access to the NBN network through wired/fibre connections or fixed wireless

**Source:** NBN National Map Datasets | NBN Australia

# Technology Review by LGA: Radio Access (mobile)

# Technology Review – Summary of Radio Access

The below summarises for each LGA the digital connectivity index, types mobile services that are available from the key operators and current state connectivity insights.

| # | Region | Digital Connectivity Index (On the Move) | Type of Access | Relevant Insights |
|---|---|---|---|---|
| Local Government Area | **Central Coast** | **NSW Digital Connectivity Index**<br>55<br>**Access** 83<br>**Affordability** 86<br>**Demographics** 59 | **Telstra** / **Optus** / **TPG**<br>3G ✓ / 3G ✓ / 3G ✓<br>4G ✓ / 4G ✓ / 4G ✓<br>5G ✓ / 5G ✓ / 5G ✓ | • High Digital Connectivity Index, reflected by complete 3G and 4G coverage in residential areas.<br>• Average Download Speed of 76.06 Mbps and Upload Speed of 7.35 Mbps.*<br>• Presence of 5G in major suburbs. Connectivity gaps in 5G observed in suburbs such as Wamberal and Matcham.<br>• Remote area of Dharug National Park lacks any site infrastructure, naturally resulting in no coverage. |
| Local Government Area | **Cessnock** | **NSW Digital Connectivity Index**<br>34<br>**Access** 77<br>**Affordability** 85<br>**Demographics** 36 | **Telstra** / **Optus** / **TPG**<br>3G ✓ / 3G ✓ / 3G ✓<br>4G ✓ / 4G ✓ / 4G ✓<br>5G ✓ / 5G ✗ / 5G ✓ | • Complete 3G and 4G coverage in inhabited and industrial zones of the region.<br>• Coverage gaps identified Pokolbin State Forest and Yengo National Park.<br>• Digital connectivity index below average, attributed not to access issues but to the demographic characteristics of the region.<br>• Presence of 5G coverage in the central part of Cessnock.<br>• Absence of 5G coverage by Optus. |
| Local Government Area | **Dungog** | **NSW Digital Connectivity Index**<br>31<br>**Access** 49<br>**Affordability** 81<br>**Demographics** 59 | **Telstra** / **Optus** / **TPG**<br>3G ✓ / 3G ✓ / 3G ✗<br>4G ✓ / 4G ✓ / 4G ✗<br>5G ✗ / 5G ✗ / 5G ✗ | • TPG has not deployed any radio sites in the region.<br>• No 5G coverage is available.<br>• Majority of residential areas are covered, although there may be some connectivity gaps in the northern part of the region, which is highly rural. |

***Source:** Speedtest - Internet Providers in New South Wales

# Technology Review – Summary of Radio Access

The below summarises for each LGA the digital connectivity index, types mobile services that are available from the key operators and current state connectivity insights.

| # | Region | Digital Connectivity Index (On the Move) | Type of Access | Relevant Insights |
|---|---|---|---|---|
| Local Government Area | **Lake Macquarie** | **NSW Digital Connectivity Index** 60<br>**Access** 86<br>**Affordability** 87<br>**Demographics** 60 | **Telstra** 3G ✓ 4G ✓ 5G ✓<br>**Optus** 3G ✓ 4G ✓ 5G ✓<br>**TPG** 3G ✓ 4G ✓ 5G ✓ | • 3G and 4G connectivity available throughout the entire region.<br>• A significantly high Digital Connectivity Index, ensuring robust access.<br>• Well-developed 5G infrastructure in areas with high population density and associated industry. |
| Local Government Area | **Maitland** | **NSW Digital Connectivity Index** 58<br>**Access** 90<br>**Affordability** 91<br>**Demographics** 56 | **Telstra** 3G ✓ 4G ✓ 5G ✓<br>**Optus** 3G ✓ 4G ✓ 5G ✓<br>**TPG** 3G ✓ 4G ✓ 5G ✓ | • Download speed of 86.40 Mbps and upload speed of 8.55 Mbps.*<br>• Region with the highest index in terms of access.<br>• Complete 3G and 4G coverage for the Maitland region. The absence of extensive forested and remote areas allows for coverage throughout the region.<br>• A strong presence of 5G in the residential areas of the region. |
| Local Government Area | **Muswellbrook** | **NSW Digital Connectivity Index** 33<br>**Access** 68<br>**Affordability** 79<br>**Demographics** 34 | **Telstra** 3G ✓ 4G ✓ 5G ✓<br>**Optus** 3G ✓ 4G ✓ 5G ✗<br>**TPG** 3G ✓ 4G ✓ 5G ✗ | • 3G and 4G coverage available in residential and industrial zones.<br>• 5G coverage is limited to the central area of Muswellbrook.<br>• No 5G coverage provided by Optus and TPG for the Muswellbrook region. |

*Source: Speedtest - Internet Providers in New South Wales

# Technology Review – Summary of Radio Access

The below summarises for each LGA the digital connectivity index, types mobile services that are available from the key operators and current state connectivity insights.

| # | Region | Digital Connectivity Index (On the Move) | Type of Access | Relevant Insights |
|---|---|---|---|---|
| Local Government Area | **Newcastle** | **NSW Digital Connectivity Index** 70<br>Access 89<br>Affordability 90<br>Demographics 76 | Telstra: 3G, 4G, 5G<br>Optus: 3G, 4G, 5G<br>TPG: 3G, 4G, 5G | • 3G and 4G available throughout the region.<br>• Average download speed of 110.39 Mbps and upload speed of 8.55 Mbps.*<br>• The area has the highest digital connectivity index.<br>• Widespread implementation of 5G in the area by all three operators, with few coverage gaps. |
| Local Government Area | **Port Stephens** | **NSW Digital Connectivity Index** 41<br>Access 77<br>Affordability 79<br>Demographics 46 | Telstra: 3G, 4G, 5G<br>Optus: 3G, 4G, 5G<br>TPG: 3G, 4G, 5G | • 3G and 4G connectivity available throughout the Port Stephens region with no notable coverage issues.<br>• 5G is accessible in the main residential and tourist-interest areas of the region, provided by Telstra and Optus. |
| Local Government Area | **Singleton** | **NSW Digital Connectivity Index** 37<br>Access 59<br>Affordability 87<br>Demographics 54 | Telstra: 3G, 4G, 5G<br>Optus: 3G, 4G, 5G<br>TPG: 3G, 4G, ~~5G~~ | • 3G and 4G connectivity available throughout the inhabited region.<br>• Outlying areas such as Putty and Garland Valley, away from the central region, have 3G and 4G coverage provided by Telstra.<br>• The region has a below-average digital connectivity index.<br>• Limited 5G access is available only in the populated area of Singleton.<br>• TPG does not have any 5G base stations in the region. |

***Source:** Speedtest - Internet Providers in New South Wales

# Technology Review – Summary of Radio Access

The below summarises for each LGA and selected suburbs/clusters the digital connectivity index, types mobile services that are available from the key operators and current state connectivity insights.

| # | Region | Digital Connectivity Index (On the Move) | Type of Access | Relevant Insights |
|---|---|---|---|---|
| Local Government Area | **Upper Hunter** | **NSW Digital Connectivity Index** 23<br>Access 51<br>Affordability 74<br>Demographics 40 | Telstra: 3G ✓, 4G ✓, 5G ✓<br>Optus: 3G ✓, 4G ✓, 5G ✓<br>TPG: 3G ✓, 4G ✓, 5G ✗ | • The region has the lowest digital connectivity index among the top DSSN regions.<br>• It is an extremely rural area where 3G and 4G coverage is limited to populated areas, including residences and industry.<br>• 5G is only available in the more populated areas such as Scone and Aberdeen.<br>• TPG lacks 5G coverage in the region. |
| Suburb/Cluster | **Pokolbin** | **NSW Digital Connectivity Index** 31<br>Access 38<br>Affordability 74<br>Demographics 100 | Telstra: 3G ✓, 4G ✓, 5G ✓<br>Optus: 3G ✓, 4G ✓, 5G ✗<br>TPG: 3G ✓, 4G ✓, 5G ✗ | • The area has a total of 10 base stations distributed among the three operators.<br>• The region does not have connectivity gaps in terms of 3G and 4G in the populated zone. However, given the extent of the suburb, there may be a need to install base stations to ensure continuous coverage throughout.<br>• There is a co-located site (with antennas from all three operators) in the mountainous area, ensuring good coverage to the west.<br>• There is only one radio site with 5G technology, in the residential area. |
| Suburb/Cluster | **Cedar Mill (Morisset)** | **NSW Digital Connectivity Index** 55<br>Access 84<br>Affordability 78<br>Demographics 32 | Telstra: 3G ✓, 4G ✓, 5G ✓<br>Optus: 3G ✓, 4G ✓, 5G ✓<br>TPG: 3G ✓, 4G ✓, 5G ✓ | • A total of five base stations distributed among the three operators.<br>• 3G and 4G connectivity ensured for the entire region without apparent gaps in the residential zone.<br>• 5G is well-developed in the Morisset region with the presence of five base stations offering this technology.<br>• The Cedar Mill project's expansion may necessitate the deployment of new base stations to ensure continuous capacity in terms of network demand. |

# Technology Review – Summary of Radio Access

The below summarises for each LGA and selected suburbs/clusters the digital connectivity index, types mobile services that are available from the key operators and current state connectivity insights.

| # | Region | Digital Connectivity Index (On the Move) | Type of Access | Relevant Insights |
|---|---|---|---|---|
| Suburb/Cluster | **Nelson Bay / Shoal Bay** | **NSW Digital Connectivity Index** 49<br>Access 86<br>Affordability 70<br>Demographics 53 | Telstra: 3G, 4G, 5G<br>Optus: 3G, 4G, 5G<br>TPG: 3G, 4G, 5G | • A total of seven base stations in Nelson Bay, with no apparent coverage issues in terms of 3G and 4G connectivity.<br>• No base stations in the Shoal Bay area. The installation of a base station in this zone may be necessary to ensure 3G and 4G mobile connectivity.<br>• 5G coverage is ensured in the majority of the Nelson Bay area. |
| Suburb/Cluster | **The Entrance** | **NSW Digital Connectivity Index** 36<br>Access 80<br>Affordability 76<br>Demographics 26 | Telstra: 3G, 4G, 5G<br>Optus: 3G, 4G, 5G<br>TPG: 3G, 4G, 5G | • The suburb has a total of three mobile sites co-located, one for each operator.<br>• The Entrance is a densely populated suburb where 3G and 4G connectivity are available throughout the region,<br>• 5G coverage is available throughout the entire suburb without any coverage gaps. |

# Technology Review by LGA: Stationary (nbn access)

# Technology Review – Summary of nbn Service Access

The below summarises for each LGA the digital connectivity index, nbn services types available from service providers and current state connectivity insights.

| # | Region | Digital Connectivity Index (Stationary) | Type of Access | Relevant Insights |
|---|---|---|---|---|
| Local Government Area | **Central Coast** | **NSW Digital Connectivity Index** 66<br>**Access** 96<br>**Affordability** 90<br>**Demographics** 59 | **Fibre to the Premises** ✓<br>**Fibre to the Building** ✓<br>**Fibre to the Curb** ✓<br>**Fibre to the Node** ✓<br>**Fixed Wireless** ✓<br>**Satellite** ✓ | • Access via Fibre to the Premises is available for the Gosford and The Entrance regions.<br>• Fibre to the Node is provided for the remaining densely populated areas.<br>• Rural areas with some population density, such as Mangrove or Somersby, have access via fixed wireless. The remaining mountainous areas have access via satellite. |
| Local Government Area | **Cessnock** | **NSW Digital Connectivity Index** 43<br>**Access** 88<br>**Affordability** 90<br>**Demographics** 36 | **Fibre to the Premises** ✓<br>**Fibre to the Building** ✗<br>**Fibre to the Curb** ✓<br>**Fibre to the Node** ✓<br>**Fixed Wireless** ✓<br>**Satellite** ✓ | • Fibre to the Premises is significantly limited throughout the entire region, available only for a small part of Cessnock City.<br>• Access via Fibre to the Node is available for the remaining residential areas.<br>• Due to the rural nature of the Cessnock region, remote areas with occasional housing have access via Fixed Wireless. |
| Local Government Area | **Dungog** | **NSW Digital Connectivity Index** 53<br>**Access** 76<br>**Affordability** 88<br>**Demographics** 59 | **Fibre to the Premises** ✗<br>**Fibre to the Building** ✗<br>**Fibre to the Curb** ✗<br>**Fibre to the Node** ✓<br>**Fixed Wireless** ✓<br>**Satellite** ✓ | • In terms of fibre, only Fibre to the Node is available for the central area of Dungog and the residential area of Clarence Town.<br>• The remaining areas with housing have access via Fixed Wireless.<br>• Satellite access is provided for remote areas. |

# Technology Review – Summary of nbn Service Access

The below summarises for each LGA the digital connectivity index, nbn services types available from service providers and current state connectivity insights.

| # | Region | Digital Connectivity Index (Stationary) | Type of Access | Relevant Insights |
|---|---|---|---|---|
| Local Government Area | **Lake Macquarie** | **NSW Digital Connectivity Index**<br>69<br>**Access** 97<br>**Affordability** 91<br>**Demographics** 60 | **Fibre to the Premises** ✓<br>**Fibre to the Building** ✓<br>**Fibre to the Curb** ✓<br>**Fibre to the Node** ✓<br>**Fixed Wireless** ✓<br>**Satellite** ✓ | • Access via Fibre to the Premises is available only in certain residential areas of West Wall and North Cooranbong.<br>• Access via Fibre to the Node is provided for the area around the lake, where the most densely populated part of the region is located.<br>• Remote areas of the region have access via Fixed Wireless and satellite. |
| Local Government Area | **Maitland** | **NSW Digital Connectivity Index**<br>66<br>**Access** 99<br>**Affordability** 94<br>**Demographics** 56 | **Fibre to the Premises** ✓<br>**Fibre to the Building** ✓<br>**Fibre to the Curb** ✗<br>**Fibre to the Node** ✓<br>**Fixed Wireless** ✓<br>**Satellite** ✓ | • Average download speeds of 54.18 Mbps and upload speeds of 18 Mbps for fixed access.<br>• A considerably extensive area has access via Fibre to the Premises, with the majority of the southern region using this type of access. The remaining residential areas have access via Fibre to the Node.<br>• Fixed Wireless and Satellite options are available for more remote areas. |
| Local Government Area | **Muswellbrook** | **NSW Digital Connectivity Index**<br>42<br>**Access** 86<br>**Affordability** 83<br>**Demographics** 34 | **Fibre to the Premises** ✓<br>**Fibre to the Building** ✗<br>**Fibre to the Curb** ✓<br>**Fibre to the Node** ✓<br>**Fixed Wireless** ✓<br>**Satellite** ✓ | • Access via Fibre to the Premises is available only for part of the residential area in the region. The remaining residential zone is served by Fibre to the Node and Fixed Wireless.<br>• Given the extremely rural nature of the region, the non-residential areas have access via satellite. |

# Technology Review – Summary of nbn Service Access

The below summarises for each LGA the digital connectivity index, nbn services types available from service providers and current state connectivity insights.

| # | Region | Digital Connectivity Index (Stationary) | Type of Access | Relevant Insights |
|---|---|---|---|---|
| Local Government Area | **Newcastle** | **NSW Digital Connectivity Index** 80<br>Access 99<br>Affordability 92<br>Demographics 76 | Fibre to the Premises ✓<br>Fibre to the Building ✓<br>Fibre to the Curb ✗<br>Fibre to the Node ✓<br>Fixed Wireless ✓<br>Satellite ✓ | • Average download speeds of 51.45 Mbps and upload speeds of 18.09 Mbps for fixed access.*<br>• The Newcastle area is highly urbanised, with the entire residential zone having access via fibre.<br>• Only the area around the Hunter Wetlands National Park relies on fixed wireless.<br>• The region has the highest digital connectivity index |
| Local Government Area | **Port Stephens** | **NSW Digital Connectivity Index** 51<br>Access 91<br>Affordability 85<br>Demographics 46 | Fibre to the Premises ✓<br>Fibre to the Building ✓<br>Fibre to the Curb ✓<br>Fibre to the Node ✓<br>Fixed Wireless ✓<br>Satellite ✓ | • The residential area of Port Stephens primarily has access via fibre, with Corlette and Eagleton enjoying the best access through Fibre to the Premises.<br>• More remote areas of the region, such as Wallaroo and Medowie Park, have access via fixed wireless and satellite. |
| Local Government Area | **Singleton** | **NSW Digital Connectivity Index** 44<br>Access 72<br>Affordability 90<br>Demographics 54 | Fibre to the Premises ✓<br>Fibre to the Building ✓<br>Fibre to the Curb ✗<br>Fibre to the Node ✓<br>Fixed Wireless ✓<br>Satellite ✓ | • Due to Singleton being an extremely rural area, including the Wollemi National Park, the region is predominantly covered via fixed wireless and satellite.<br>• Access via fibre is only available in the central part of Singleton city. |

*Source: Speedtest - Internet Providers in New South Wales

# Technology Review – Summary of nbn Service Access

The below summarises for each LGA and selected suburbs/clusters the digital connectivity index, nbn services types available from service providers and current state connectivity insights.

| # | Region | Digital Connectivity Index (Stationary) | Type of Access | Relevant Insights |
|---|---|---|---|---|
| Local Government Area | **Upper Hunter** | **NSW Digital Connectivity Index** 31<br>Access 61<br>Affordability 83<br>Demographics 40 | Fibre to the Premises ✗<br>Fibre to the Building ✗<br>Fibre to the Curb ✗<br>Fibre to the Node ✓<br>Fixed Wireless ✓<br>Satellite ✓ | • The area has the lowest stationary digital connectivity index.<br>• Access via fibre is only available in the form of Fibre to the Node for the cities of Scone, Murrurundi, and Aberdeen. |
| Suburb/Cluster | **Pokolbin** | **NSW Digital Connectivity Index** 69<br>Access 69<br>Affordability 89<br>Demographics 100 | Fibre to the Premises ✓<br>Fibre to the Building ✗<br>Fibre to the Curb ✓<br>Fibre to the Node ✓<br>Fixed Wireless ✓<br>Satellite ✓ | • As Pokolbin is a rural region characterised by extensive vineyards and a distributed population across various areas without a distinct population centre, the existing fibre access is mainly provided via Fibre to the Curb. There is a small area with access via Fibre to the Premises and Fibre to the Node. |
| Suburb/Cluster | **Cedar Mill (Morisset)** | **NSW Digital Connectivity Index** 62<br>Access 95<br>Affordability 86<br>Demographics 32 | Fibre to the Premises ✓<br>Fibre to the Building ✓<br>Fibre to the Curb ✗<br>Fibre to the Node ✓<br>Fixed Wireless ✓<br>Satellite ✓ | • The Morisset area provides complete fibre access to the residential zone, with the majority of the population having access via Fibre to the Node.<br>• Some residential clusters have access via Fibre to the Premises and Fibre to the Building. |

# Technology Review – Summary of nbn Service Access

The below summarises for each LGA and selected suburbs/clusters the digital connectivity index, nbn services types available from service providers and current state connectivity insights.

| # | Region | Digital Connectivity Index (Stationary) | Type of Access | Relevant Insights |
|---|---|---|---|---|
| Suburb/Cluster | **Nelson Bay/ Shoal Bay** | **NSW Digital Connectivity Index** 60<br>**Access** 99<br>**Affordability** 78<br>**Demographics** 53 | **Fibre to the Premises** ✓<br>**Fibre to the Building** ✗<br>**Fibre to the Curb** ✗<br>**Fibre to the Node** ✓<br>**Fixed Wireless** ✓<br>**Satellite** ✓ | • The Nelson Bay/Shoal Bay area provides fibre access for the entire residential zone of the region, with this access primarily through Fibre to the Node.<br>• The more remote areas, without permanent housing or any type of industry, have access via satellite. |
| Suburb/Cluster | **The Entrance** | **NSW Digital Connectivity Index** 46<br>**Access** 98<br>**Affordability** 77<br>**Demographics** 26 | **Fibre to the Premises** ✓<br>**Fibre to the Building** ✓<br>**Fibre to the Curb** ✗<br>**Fibre to the Node** ✗<br>**Fixed Wireless** ✗<br>**Satellite** ✗ | • Access to NBN services is exclusively provided through fibre.<br>• The Entrance is a highly densely populated area, with the majority of dwellings having access to Fibre to the Premises.<br>• Commercial spaces and buildings with a higher number of floors have access via Fibre to the Building. |

# 2.
# Future population and visitor demands on telecommunications infrastructure

Refer to Appendix 5.2 for detailed methodology used to determine findings in this chapter

# Methodology for calculating visitor numbers

To obtain the peak number of visitors across the different LGAs and thereby estimate the number of devices associated with visitor demand, it was necessary to formulate a methodology, which is presented below.

## Step-by-Step Methodology

1. Obtain the number of commercial rooms for overnight visitors. This number includes rooms in hotels, motels, apartments, villas, houses, and caravan parks.
   **Source**: DSSN Accommodation Audit
2. Calculation of the number of overnight visitors staying in commercial accommodation. It was considered 1.5 people per room.
   **Source**: DSSN Assumption
3. Calculation of the additional number of overnight visitors who visit the regions to be with friends and family. To obtain this value, it was assumed a percentage of 33% of these visitors compared to overnight visitors. In the case of Central Coast, the value was 66%.
   **Source**: NSW Regional Data
4. Obtain the number of day trip visitors. To obtain this number, a ratio of 59% for day trip visitors and 41% for overnight visitors was considered, in accordance with the Hunter Valley Destination Management Plan.
   **Source**: Hunter Valley Destination Management Plan
5. Definition of the number of visitors for the different scenarios:
   - **High Scenario:** 100% of max. accommodation (day visitors + overnight visitors)
   - **Baseline Scenario:** 75% of max. accommodation (day visitors + overnight visitors)
   - **Low Scenario:** 50% of max. accommodation (day visitors + overnight visitors)

**DSSN Peak Visitor Numbers according to the accommodation for the different LGAs**

| Region | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| Central Coast | 6,631 | 9,947 | 13,263 |
| Cessnock | 6,216 | 9,324 | 12,432 |
| Dungog | 966 | 1,449 | 1,932 |
| Lake Macquarie | 3,041 | 4,562 | 6,082 |
| Maitland | 1,903 | 2,854 | 3,805 |
| Muswellbrook | 1,126 | 1,690 | 2,253 |
| Newcastle | 5,068 | 7,602 | 10,136 |
| Port Stephens | 7,097 | 10,645 | 14,194 |
| Singleton | 2,214 | 3,321 | 4,428 |
| Upper Hunter | 978 | 1,467 | 1,956 |
| **DSSN Region** | **35,240** | **52,861** | **70,481** |

# Summary: Total Number of Connections per Region (IoT & Non-IoT)

The total number of devices for each region for Industrial/IoT devices & Individual/Non-IoT devices is 9.9 million (in 2023). This has been calculated using the assumption that 9.4 devices per capita will be in use, a figure aligned with Cisco's projection for **Western Europe**, in lieu of an existing per capita prediction for the Australian market.

| Regions | Number of IoT Devices | + | Number of Non-IoT Individual Devices | + | Number of Non-IoT Visitor Devices | = | Total |
|---|---|---|---|---|---|---|---|
| Central Coast | 1,831,941 | | 1,448,001 | | 41,278 | | 3,321,220 |
| Cessnock | 345,356 | | 272,976 | | 38,320 | | 656,652 |
| Dungog | 50,963 | | 40,282 | | 6,013 | | 97,259 |
| Lake Macquarie | 1,136,283 | | 898,140 | | 18,932 | | 2,053,355 |
| Maitland | 490,875 | | 387,997 | | 11,844 | | 890,715 |
| Muswellbrook | 86,712 | | 68,539 | | 7,013 | | 162,264 |
| Newcastle | 899,438 | | 710,993 | | 31,547 | | 1,641,917 |
| Port Stephens | 401,848 | | 317,628 | | 44,175 | | 763,651 |
| Singleton | 131,648 | | 104,057 | | 13,782 | | 249,487 |
| Upper Hunter | 75,035 | | 59,309 | | 13,782 | | 140,433 |
| DSSN Region | 5,450,099 | | 4,307,863 | | 218,991 | | 9,976,952 |

# DSSN's Region Characterisation - Central Coast

The below tables summarise all the data such as population, demographics, number of devices, visitor demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Central Coast region.

## Population and Demographic Aspects

| Total Area |
|---|
| 1,682 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 98.8% |
| Rural | 1.2% |

| Total Population | |
|---|---|
| 2023 | 355,654 |
| 2025 | 366,611 |
| 2030 | 390,743 |

## Visitor Demand (per day)

| Year | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| 2023 | 6,631 | 9,947 | 13,263 |
| 2025 | 7,241 | 10,862 | 14,484 |
| 2030 | 9,024 | 13,536 | 18,049 |

## Main Events and Touristic Points

Annual Central Coast highlights include Flavours by the Sea in Terrigal held in March, ChromeFest in The Entrance held in October with over 50,000 visitors, and New Year's Eve festivities at The Entrance and Gosford. The region has 41 beaches along its 80km coastline, great walks in Bouddi National Park, and popular coastal towns such as Terrigal and The Entrance.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 23,815 | 32,046 | 67,307 |
| Utilities | 18,319 | 24,651 | 51,775 |
| Construction | 210,673 | 283,482 | 595,409 |
| Manufacturing | 108,085 | 145,439 | 305,471 |
| Wholesale and Retail Trade | 227,161 | 305,667 | 642,006 |
| Transportation & Warehousing | 67,782 | 91,207 | 191,566 |
| Finance, Insurance, Real Estate, Rental & Leasing | 89,765 | 120,788 | 253,696 |
| Professional, Scientific & Technical Services | 109,916 | 147,904 | 310,648 |
| Business, Building & other support services | 60,454 | 81,347 | 170,856 |
| Educational services | 150,219 | 202,135 | 424,552 |
| Health care and social assistance | 326,085 | 438,781 | 921,589 |
| Arts, Information, Culture & Recreation | 54,958 | 73,952 | 155,324 |
| Accommodation and food services | 128,236 | 172,554 | 362,423 |
| Other services (excluding public administration) | 69,614 | 93,672 | 196,744 |
| Public administration | 111,748 | 150,369 | 315,826 |
| Households & Consumer Goods (Individual Devices) | 1,448,001 | 1,492,613 | 1,590,864 |
| Visitor Demand (Visitor Devices) | 41,278 | 45,077 | 56,443 |

# DSSN's Region Characterisation - Cessnock

The below tables summarise all the data such as population, demographics, number of devices, visitor demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Cessnock region.

## Population and Demographic Aspects

| Total Area |
|---|
| 1,966 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 0.0% |
| Rural | 100.0% |

| Total Population | |
|---|---|
| 2023 | 67,048 |
| 2025 | 69,113 |
| 2030 | 73,663 |

## Visitor Demand (per day)

| Year | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| 2023 | 6,216 | 9,324 | 12,432 |
| 2025 | 6,788 | 10,084 | 13,576 |
| 2030 | 8,459 | 12,566 | 16,918 |

## Main Events and Touristic Points

The vineyards in Pokolbin and Lovedale are at the heart of Australia's oldest wine region. Major draws for tourists include music events at Bimbadgen and Hope Estate, and the Lovedale Long Lunch, a food and wine highlight every May. The Kurri Kurri Nostalgia Fest brings over 30,000 visitors for three days of vintage charm every March.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 34,536 | 46,471 | 97,605 |
| Utilities | 4,490 | 6,041 | 12,689 |
| Construction | 31,773 | 42,753 | 89,797 |
| Manufacturing | 25,902 | 34,853 | 73,204 |
| Wholesale and Retail Trade | 41,788 | 56,230 | 118,102 |
| Transportation & Warehousing | 14,160 | 19,053 | 40,018 |
| Finance, Insurance, Real Estate, Rental & Leasing | 10,361 | 13,941 | 29,282 |
| Professional, Scientific & Technical Services | 12,433 | 16,730 | 35,138 |
| Business, Building & other support services | 16,232 | 21,841 | 45,874 |
| Educational services | 20,721 | 27,883 | 58,563 |
| Health care and social assistance | 49,386 | 66,454 | 139,575 |
| Arts, Information, Culture & Recreation | 5,180 | 6,971 | 14,641 |
| Accommodation and food services | 30,391 | 40,895 | 85,893 |
| Other services (excluding public administration) | 15,886 | 21,377 | 44,898 |
| Public administration | 17,268 | 23,236 | 48,803 |
| Households & Consumer Goods (Individual Devices) | 272,976 | 281,386 | 299,908 |
| Visitor Demand (Visitor Devices) | 38,320 | 41,846 | 52,398 |

# DSSN's Region Characterisation - Dungog

The below tables summarise all the data such as population, demographics, number of devices, visitor demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Dungog region.

## Population and Demographic Aspects

| Total Area |
|---|
| 2,250 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 0.0% |
| Rural | 100.0% |

| Total Population | |
|---|---|
| 2023 | 9,894 |
| 2025 | 10,199 |
| 2030 | 10,870 |

## Visitor Demand (per day)

| Year | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| 2023 | 966 | 1,449 | 1,932 |
| 2025 | 1,055 | 1,582 | 2,110 |
| 2030 | 1,315 | 1,972 | 2,629 |

## Main Events and Touristic Points

Dungog is known for its country charm and nature, featuring the Barrington Tops National Park and the Williams River. Visitors frequent the region for extensive bike trails, camping adventures, the annual Dungog Show, and the popular Dungog Rodeo held in April with over 6,000 attendees in 2023.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 6,982 | 9,395 | 19,733 |
| Utilities | 764 | 1,029 | 2,161 |
| Construction | 6,268 | 8,435 | 17,716 |
| Manufacturing | 3,007 | 4,046 | 8,498 |
| Wholesale and Retail Trade | 5,402 | 7,269 | 15,268 |
| Transportation & Warehousing | 2,395 | 3,223 | 6,770 |
| Finance, Insurance, Real Estate, Rental & Leasing | 1,580 | 2,126 | 4,465 |
| Professional, Scientific & Technical Services | 2,650 | 3,556 | 7,490 |
| Business, Building & other support services | 1,631 | 2,194 | 4,609 |
| Educational services | 4,230 | 5,692 | 11,955 |
| Health care and social assistance | 6,218 | 8,366 | 17,572 |
| Arts, Information, Culture & Recreation | 663 | 891 | 1,872 |
| Accommodation and food services | 2,242 | 3,017 | 6,337 |
| Other services (excluding public administration) | 2,344 | 3,155 | 6,626 |
| Public administration | 2,446 | 3,292 | 6,914 |
| Households & Consumer Goods (Individual Devices) | 40,282 | 41,523 | 44,257 |
| Visitor Demand (Visitor Devices) | 6,013 | 6,566 | 8,222 |

# DSSN's Region Characterisation - Lake Macquarie

The below tables summarise all the data such as population, demographics, number of devices, visitor demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Lake Macquarie region.

## Population and Demographic Aspects

| Total Area |
|---|
| 649 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 91.5% |
| Rural | 8.5% |

| Total Population | |
|---|---|
| 2023 | 220,598 |
| 2025 | 227,395 |
| 2030 | 242,363 |

## Visitor Demand (per day)

| Year | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| 2023 | 3,041 | 4,562 | 6,082 |
| 2025 | 3,321 | 4,982 | 6,642 |
| 2030 | 4,138 | 6,208 | 8,277 |

## Main Events and Touristic Points

Lake Macquarie is centred around the vast lake, with scenic walking trails and a selection of beaches, including the popular Naru Beach. The annual Fast and Loud Festival attracts over 40,000 visitors, while the Lake Macquarie Food & Wine Festival provides a gourmet experience with local produce.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 34,088 | 45,869 | 96,342 |
| Utilities | 15,908 | 21,406 | 44,959 |
| Construction | 127,264 | 171,246 | 359,675 |
| Manufacturing | 65,904 | 88,681 | 186,260 |
| Wholesale and Retail Trade | 131,809 | 177,362 | 372,521 |
| Transportation & Warehousing | 43,179 | 58,101 | 122,033 |
| Finance, Insurance, Real Estate, Rental & Leasing | 51,133 | 68,804 | 144,512 |
| Professional, Scientific & Technical Services | 64,768 | 87,152 | 183,049 |
| Business, Building & other support services | 35,225 | 47,398 | 99,553 |
| Educational services | 104,538 | 140,666 | 295,448 |
| Health care and social assistance | 217,030 | 292,036 | 613,375 |
| Arts, Information, Culture & Recreation | 20,453 | 27,522 | 57,085 |
| Accommodation and food services | 71,586 | 96,326 | 202,317 |
| Other services (excluding public administration) | 46,588 | 62,688 | 131,667 |
| Public administration | 63,632 | 85,623 | 179,838 |
| Households & Consumer Goods (Individual Devices) | 898,140 | 925,811 | 986,752 |
| Visitor Demand (Visitor Devices) | 18,932 | 20,674 | 25,887 |

# DSSN's Region Characterisation - Maitland

The below tables summarise all the data such as population, demographics, number of devices, visitor demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Maitland region.

## Population and Demographic Aspects

| Total Area |
|---|
| 392 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 64.0% |
| Rural | 36.0% |

| Total Population | |
|---|---|
| 2023 | 95,299 |
| 2025 | 98,235 |
| 2030 | 104,701 |

## Visitor Demand (per day)

| Year | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| 2023 | 1,903 | 2,854 | 3,805 |
| 2025 | 2,078 | 3,117 | 4,155 |
| 2030 | 2,590 | 3,884 | 5,178 |

## Main Events and Touristic Points

Maitland is a vibrant region rich in heritage and cultural events, drawing thousands to its annual festivals. Some popular events in the region are the annual Steamfest, Aroma festival highlighting coffee and chocolate in August with 15,000 attendees, the culturally diverse Riverlights, and the three-day Taste festival for local flavours with 15,000 attendees.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 35,834 | 48,218 | 101,274 |
| Utilities | 6,872 | 9,247 | 19,422 |
| Construction | 44,179 | 59,447 | 124,859 |
| Manufacturing | 32,889 | 44,255 | 92,950 |
| Wholesale and Retail Trade | 62,341 | 83,886 | 176,190 |
| Transportation & Warehousing | 21,108 | 28,402 | 59,655 |
| Finance, Insurance, Real Estate, Rental & Leasing | 17,181 | 23,118 | 48,556 |
| Professional, Scientific & Technical Services | 23,071 | 31,044 | 65,204 |
| Business, Building & other support services | 18,162 | 24,439 | 51,331 |
| Educational services | 38,288 | 51,521 | 108,211 |
| Health care and social assistance | 79,522 | 107,004 | 224,746 |
| Arts, Information, Culture & Recreation | 6,872 | 9,247 | 19,422 |
| Accommodation and food services | 33,379 | 44,915 | 94,338 |
| Other services (excluding public administration) | 21,108 | 28,402 | 59,655 |
| Public administration | 31,907 | 42,934 | 90,176 |
| Households & Consumer Goods (Individual Devices) | 387,997 | 399,951 | 426,277 |
| Visitor Demand (Visitor Devices) | 11,844 | 12,934 | 16,195 |

# DSSN's Region Characterisation - Muswellbrook

The below tables summarise all the data such as population, demographics, number of devices, visitor demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Muswellbrook region.

## Population and Demographic Aspects

| Total Area |
|---|
| 3,405 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 0.0% |
| Rural | 100.0% |

| Total Population | |
|---|---|
| 2023 | 16,834 |
| 2025 | 17,353 |
| 2030 | 18,495 |

## Visitor Demand (per day)

| Year | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| 2023 | 1,126 | 1,690 | 2,253 |
| 2025 | 1,230 | 1,846 | 2,460 |
| 2030 | 1,532 | 2,300 | 3,066 |

## Main Events and Touristic Points

Muswellbrook LGA, at the heart of the Hunter Valley's mining region, boasts a rich blend of industry and culture. Key events include the Upper Hunter Show and the Muswellbrook Gold Cup in March, the Great Cattle Dog Muster in September, and the Upper Hunter Wine and Food Affair, highlighting the food and wine of the region including Pukara Estate.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 24,800 | 33,370 | 70,089 |
| Utilities | 3,295 | 4,434 | 9,313 |
| Construction | 4,943 | 6,651 | 13,969 |
| Manufacturing | 3,295 | 4,434 | 9,313 |
| Wholesale and Retail Trade | 9,105 | 12,251 | 25,732 |
| Transportation & Warehousing | 2,515 | 3,384 | 7,107 |
| Finance, Insurance, Real Estate, Rental & Leasing | 1,734 | 2,234 | 4,901 |
| Professional, Scientific & Technical Services | 2,168 | 2,917 | 6,127 |
| Business, Building & other support services | 4,336 | 5,834 | 12,253 |
| Educational services | 5,463 | 7,351 | 15,439 |
| Health care and social assistance | 7,804 | 10,501 | 22,056 |
| Arts, Information, Culture & Recreation | 1,214 | 1,634 | 3,431 |
| Accommodation and food services | 5,896 | 7,934 | 16,665 |
| Other services (excluding public administration) | 3,555 | 4,784 | 10,048 |
| Public administration | 3,382 | 4,550 | 9,558 |
| Households & Consumer Goods (Individual Devices) | 68,539 | 70,650 | 75,301 |
| Visitor Demand (Visitor Devices) | 7,013 | 7,659 | 9,590 |

# DSSN's Region Characterisation - Newcastle

The below tables summarise all the data such as population, demographics, number of devices, visitor demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Newcastle region.

## Population and Demographic Aspects

| Total Area |
|---|
| 187 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 100.0% |
| Rural | 0.0% |

| Total Population | |
|---|---|
| 2023 | 174,617 |
| 2025 | 179,997 |
| 2030 | 191,845 |

## Visitor Demand (per day)

| Year | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| 2023 | 5,068 | 7,602 | 10,136 |
| 2025 | 5,534 | 8,302 | 11,069 |
| 2030 | 6,897 | 10,345 | 13,794 |

## Main Events and Touristic Points

Newcastle is a coastal hub with rich culture and a vibrant events calendar. New Annual arts festival is held over 10 days, beginning in September, with over 40,000 attendees in 2022. Major concerts are being held at the McDonald Jones Stadium, including Elton John with over 50,000 tickets sold for two performances that injected over $12 million into the visitor economy.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 20,687 | 27,837 | 58,466 |
| Utilities | 10,793 | 14,523 | 30,504 |
| Construction | 70,156 | 94,402 | 198,277 |
| Manufacturing | 43,173 | 58,094 | 122,016 |
| Wholesale and Retail Trade | 93,542 | 125,869 | 264,369 |
| Transportation & Warehousing | 31,480 | 42,360 | 88,970 |
| Finance, Insurance, Real Estate, Rental & Leasing | 41,374 | 55,673 | 116,932 |
| Professional, Scientific & Technical Services | 69,257 | 93,192 | 195,735 |
| Business, Building & other support services | 26,084 | 35,098 | 73,718 |
| Educational services | 91,743 | 123,449 | 259,285 |
| Health care and social assistance | 185,284 | 249,318 | 523,654 |
| Arts, Information, Culture & Recreation | 21,587 | 29,047 | 61,008 |
| Accommodation and food services | 74,653 | 100,454 | 210,987 |
| Other services (excluding public administration) | 29,681 | 39,939 | 83,886 |
| Public administration | 57,564 | 77,458 | 162,689 |
| Households & Consumer Goods (Individual Devices) | 710,933 | 732,836 | 781,075 |
| Visitor Demand (Visitor Devices) | 31,547 | 34,450 | 43,137 |

# DSSN's Region Characterisation - Port Stephens

The below tables summarise all the data such as population, demographics, number of devices, visitor demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Port Stephens region.

## Population and Demographic Aspects

| Total Area |
|---|
| 858 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 17.4% |
| Rural | 82.6% |

| Total Population | |
|---|---|
| 2023 | 78,015 |
| 2025 | 80,418 |
| 2030 | 85,712 |

## Visitor Demand (per day)

| Year | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| 2023 | 7,097 | 10,645 | 14,194 |
| 2025 | 7,750 | 11,625 | 15,500 |
| 2030 | 9,658 | 14,486 | 19,316 |

## Main Events and Touristic Points

Port Stephens is well-known for its stunning beaches, wildlife experiences, and nature, with Shoal Bay being a popular holiday destination. Diverse nature experiences include the Stockton Sand Dunes, Tomaree Head Summit with 250,000 visitors per annum, and the 27km Tomaree Coastal Walk. Sail Port Stephens is an annual event that injected over $2 million into the visitor economy in 2022.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 12,859 | 17,303 | 36,343 |
| Utilities | 4,018 | 5,407 | 11,357 |
| Construction | 43,400 | 58,398 | 122,657 |
| Manufacturing | 24,915 | 33,525 | 70,414 |
| Wholesale and Retail Trade | 48,222 | 64,887 | 136,285 |
| Transportation & Warehousing | 19,691 | 26,496 | 55,650 |
| Finance, Insurance, Real Estate, Rental & Leasing | 13,663 | 18,385 | 38,614 |
| Professional, Scientific & Technical Services | 20,896 | 28,118 | 59,057 |
| Business, Building & other support services | 15,270 | 20,548 | 43,157 |
| Educational services | 29,737 | 40,014 | 84,043 |
| Health care and social assistance | 58,268 | 78,405 | 164,678 |
| Arts, Information, Culture & Recreation | 6,831 | 9,192 | 19,307 |
| Accommodation and food services | 36,568 | 49,206 | 103,350 |
| Other services (excluding public administration) | 17,279 | 23,251 | 48,836 |
| Public administration | 33,755 | 45,421 | 95,400 |
| Households & Consumer Goods (Individual Devices) | 317,628 | 327,414 | 348,966 |
| Visitor Demand (Visitor Devices) | 44,175 | 48,240 | 60,404 |

# DSSN's Region Characterisation - Singleton

The below tables summarise all the data such as population, demographics, number of devices, visitor demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Singleton region.

## Population and Demographic Aspects

| Total Area |
|---|
| 4,893 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 1.7% |
| Rural | 98.3% |

| Total Population | |
|---|---|
| 2023 | 25,558 |
| 2025 | 26,346 |
| 2030 | 28,080 |

## Visitor Demand (per day)

| Year | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| 2023 | 2,214 | 3,321 | 4,428 |
| 2025 | 2,418 | 3,627 | 4,835 |
| 2030 | 3,013 | 4,519 | 6,026 |

## Main Events and Touristic Points

The Singleton LGA is a prominent mining hub in the heart of Hunter Valley's wine region. The annual Singleton Firelight Festival held each May showcases the area's community spirit and distinct identity. As part of the community strategic plan, Singleton LGA commits to initiatives aimed at reinforcing Singleton's brand.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 33,439 | 44,995 | 94,505 |
| Utilities | 3,160 | 4,251 | 8,930 |
| Construction | 9,479 | 12,754 | 26,789 |
| Manufacturing | 5,529 | 7,440 | 15,627 |
| Wholesale and Retail Trade | 14,086 | 18,955 | 39,811 |
| Transportation & Warehousing | 3,818 | 5,137 | 10,790 |
| Finance, Insurance, Real Estate, Rental & Leasing | 2,633 | 3,543 | 7,441 |
| Professional, Scientific & Technical Services | 3,949 | 5,314 | 11,162 |
| Business, Building & other support services | 5,924 | 7,972 | 16,743 |
| Educational services | 7,636 | 10,274 | 21,580 |
| Health care and social assistance | 11,585 | 15,589 | 32,742 |
| Arts, Information, Culture & Recreation | 1,448 | 1,949 | 4,093 |
| Accommodation and food services | 8,952 | 12,046 | 25,300 |
| Other services (excluding public administration) | 5,793 | 7,794 | 16,371 |
| Public administration | 9,215 | 12,400 | 26,045 |
| Households & Consumer Goods (Individual Devices) | 104,057 | 107,263 | 114,324 |
| Visitor Demand (Visitor Devices) | 13,782 | 15,050 | 18,845 |

# DSSN's Region Characterisation - Upper Hunter

The below tables summarise all the data such as population, demographics, number of devices, visitor demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Upper Hunter region.

## Population and Demographic Aspects

| Total Area |
|---|
| 8,096 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 0.0% |
| Rural | 100.0% |

| Total Population | |
|---|---|
| 2023 | 14,567 |
| 2025 | 15,016 |
| 2030 | 16,005 |

## Visitor Demand (per day)

| Year | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| 2023 | 978 | 1,467 | 1,956 |
| 2025 | 1,068 | 1,602 | 2,136 |
| 2030 | 1,331 | 1,996 | 2,662 |

## Main Events and Touristic Points

Upper Hunter hosts the Scone Horse Festival in May, celebrating its equine heritage with 10,000 visitors over 10 days. The Aberdeen Highland Games are held annually in July, with the Rosto Festival of the Fleeces held in Merriwa every June with over 6,000 visitors. Warbirds over Scone attracts a loyal crowd with 8,000 attendees, injecting an estimated $2.4 million into the local economy.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 21,685 | 29,180 | 61,287 |
| Utilities | 1,126 | 1,515 | 3,181 |
| Construction | 5,252 | 7,068 | 14,845 |
| Manufacturing | 4,727 | 6,361 | 13,360 |
| Wholesale and Retail Trade | 6,378 | 8,582 | 18,026 |
| Transportation & Warehousing | 2,101 | 2,827 | 5,938 |
| Finance, Insurance, Real Estate, Rental & Leasing | 1,276 | 1,716 | 3,605 |
| Professional, Scientific & Technical Services | 3,001 | 4,039 | 8,483 |
| Business, Building & other support services | 2,326 | 3,130 | 6,574 |
| Educational services | 5,553 | 7,472 | 15,693 |
| Health care and social assistance | 6,828 | 9,188 | 19,298 |
| Arts, Information, Culture & Recreation | 2,026 | 2,726 | 5,726 |
| Accommodation and food services | 4,202 | 5,654 | 11,876 |
| Other services (excluding public administration) | 2,626 | 3,534 | 7,422 |
| Public administration | 3,302 | 4,443 | 9,331 |
| Households & Consumer Goods (Individual Devices) | 59,309 | 61,137 | 65,161 |
| Visitor Demand (Visitor Devices) | 6,088 | 6,648 | 8,324 |

# 3.
# Future Demand Model Scenarios

**Refer to Appendices:**

5.3.1 Future Demand: Methodology for the Estimation of Future Number of Devices
5.3.2 Future Demand: Methodology and Analysis of Demand based on Sector Characteristics

# Scenario inputs and outputs

# Scenario 1 - Low Demand

Obtain a conservative scenario where the number of devices per capita is lower and assumes a lower population growth rate.

## Low Demand Scenario

### Assumptions

**1 - Average Number of Devices per Capita:**

- **6.58**

**Source**: Cisco IBSG Group

**2 - IoT vs Non-IoT Connections Ratio**

- **56% vs 44%**

**Source:** IoT Analytics

**3 - Industrial Devices vs Individual Devices per inhabitant**

- Industrial Devices: **3.68**
- Individual/Visitor Devices: **2.90**

**4 - Total Population (2023)**

- **1,038,081**

**5 - Total Industrial Devices (2023)**

- **3,815,069** (1,038,081 * 3.68)

**6 - Total Individual Devices (2023)**

- **3,015,504** (1,038,081 * 2.90)

**7 - Annual Growth of Industrial Devices**

- **16%** (**Source**: Ericsson)

**8 - Annual Growth of Individual Devices**

- Follow the annual growth of population (table on the right)

**9 - Annual Growth of Visitor Demand**

- **4.5% per year**

**10 - Total Visitor Devices**

- Visitor Numbers (50% of max. accommodation) * **2.90**

**11 - Population Growth Rate:**

- Population growth for the DSSN Regions based on the lower projection from the ABS for New South Wales.

| Year | Population for New South Wales | Annual Growth |
|---|---|---|
| 2022 | 8,166,525 | - |
| 2023 | 8,308,795 | 1.74% |
| 2024 | 8,426,235 | 1.41% |
| 2025 | 8,538,190 | 1.33% |
| 2026 | 8,644,507 | 1.25% |
| 2027 | 8,746,490 | 1.18% |
| 2028 | 8,841,657 | 1.09% |
| 2029 | 8,931,668 | 1.02% |
| 2030 | 9,015,876 | 0.94% |

**Source:** Population Projections - ABS

| Regions | 2023 | | | | 2025 | | | | 2030 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Industrial Devices | Individual Devices | Visitor Devices | Total | Industrial Devices | Individual Devices | Visitor Devices | Total | Industrial Devices | Individual Devices | Visitor Devices | Total |
| Central Coast | 1,282,359 | 1,013,601 | 19,262 | 2,315,222 | 1,725,542 | 1,041,585 | 21,035 | 2,788,162 | 3,624,227 | 1,099,859 | 26,213 | 4,750,299 |
| Cessnock City | 241,749 | 191,083 | 18,057 | 450,889 | 325,298 | 196,359 | 19,718 | 541,375 | 683,236 | 207,344 | 24,573 | 915,154 |
| Dungog Shire | 35,674 | 28,198 | 2,806 | 66,678 | 48,003 | 28,976 | 3,064 | 80,044 | 100,824 | 30,597 | 3,819 | 135,240 |
| Lake Macquarie | 795,398 | 628,698 | 8,834 | 1,432,930 | 1,070,288 | 646,056 | 9,647 | 1,725,990 | 2,247,970 | 682,200 | 12,022 | 2,942,192 |
| Maitland | 343,612 | 271,598 | 5,528 | 620,738 | 462,365 | 279,096 | 6,037 | 747,498 | 971,124 | 294,711 | 7,523 | 1,273,358 |
| Muswellbrook | 60,698 | 47,977 | 3,271 | 111,946 | 81,676 | 49,302 | 3,572 | 134,549 | 171,547 | 52,060 | 4,451 | 228,058 |
| Newcastle City | 629,606 | 497,653 | 14,722 | 1,141,981 | 847,198 | 511,392 | 16,077 | 1,374,668 | 1,779,406 | 540,003 | 20,035 | 2,339,444 |
| Port Stephens | 281,293 | 222,340 | 20,616 | 524,249 | 378,508 | 228,478 | 22,513 | 629,500 | 794,997 | 241,261 | 28,055 | 1,064,314 |
| Singleton | 92,154 | 72,840 | 6,431 | 171,425 | 124,002 | 74,851 | 7,023 | 205,876 | 260,446 | 79,039 | 8,752 | 348,237 |
| Upper Hunter | 52,525 | 41,517 | 2,841 | 96,882 | 70,677 | 42,663 | 3,102 | 116,443 | 148,447 | 45,050 | 3,866 | 197,362 |
| **DSSN Region** | **3,815,069** | **3,015,504** | **102,368** | **6,932,941** | **5,133,557** | **3,098,758** | **111,788** | **8,344,104** | **10,782,224** | **3,272,124** | **139,309** | **14,193,657** |

# Scenario 2 - Baseline Demand

Obtain a baseline scenario where the number of devices per capita is most likely and assumes a medium population growth rate.

## Baseline Demand Scenario

### Assumptions

**1 - Average Number of Devices per Capita:**

- 9.4

**Source**: Cisco Annual Internet Report

**2 - IoT vs Non-IoT Connections Ratio**

- **56% vs 44%**

**Source:** IoT Analytics

**3 - Industrial Devices vs Individual Devices per inhabitant**

- Industrial Devices: **5.25**
- Individual/Visitor Devices: **4.15**

**4 - Total Population (2023)**

- **1,038,081**

**5 - Total Industrial Devices (2023)**

- **5,450.099** (1,038,081 * 5.25)

**6 - Total Individual Devices (2023)**

- **4,307,863** (1,038,081 * 4.15)

**7 - Annual Growth of Industrial Devices**

- **16%** (**Source**: Ericsson)

**8 - Annual Growth of Individual Devices**

- Follow the annual growth of population (table on the right)

**9 - Annual Growth of Visitor Demand**

- **4.5% per year**

**10 - Total Visitor Devices**

- Visitor Numbers (75% of max. accommodation) * 4.15

**11 - Population Growth Rate:**

- Population growth for the DSSN Regions based on the lower projection from the ABS for New South Wales.

| Year | Population for New South Wales | Annual Growth |
|---|---|---|
| 2022 | 8,166,525 | - |
| 2023 | 8,323,889 | 1.93% |
| 2024 | 8,453,902 | 1.56% |
| 2025 | 8,580,341 | 1.50% |
| 2026 | 8,702,446 | 1.42% |
| 2027 | 8,820,393 | 1.36% |
| 2028 | 8,933,348 | 1.28% |
| 2029 | 9,041,818 | 1.21% |
| 2030 | 9,145,140 | 1.14% |

**Source:** Population Projections - ABS

| Regions | 2023 | | | | 2025 | | | | 2030 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Industrial Devices | Individual Devices | Visitor Devices | Total | Industrial Devices | Individual Devices | Visitor Devices | Total | Industrial Devices | Individual Devices | Visitor Devices | Total |
| Central Coast | 1,831,941 | 1,448,001 | 41,278 | 3,321,220 | 2,465,060 | 1,492,613 | 45,077 | 4,002,749 | 5,177,467 | 1,590,864 | 56,443 | 6,824,775 |
| Cessnock City | 345,356 | 272,976 | 38,320 | 656,652 | 464,711 | 281,386 | 41,846 | 787,943 | 976,052 | 299,908 | 52,398 | 1,328,358 |
| Dungog Shire | 50,963 | 40,282 | 6,013 | 97,259 | 68,576 | 41,523 | 6,566 | 116,666 | 144,034 | 44,257 | 8,222 | 196,513 |
| Lake Macquarie | 1,136,283 | 898,140 | 18,932 | 2,053,355 | 1,528,983 | 925,811 | 20,674 | 2,475,467 | 3,211,386 | 986,752 | 25,887 | 4,224,025 |
| Maitland | 490,875 | 387,997 | 11,844 | 890,715 | 660,521 | 399,951 | 12,934 | 1,073,406 | 1,387,320 | 426,277 | 16,195 | 1,829,793 |
| Muswellbrook | 86,712 | 68,539 | 7,013 | 162,264 | 116,679 | 70,650 | 7,659 | 194,988 | 245,066 | 75,301 | 9,590 | 329,957 |
| Newcastle City | 899,438 | 710,933 | 31,547 | 1,641,917 | 1,210,283 | 732,836 | 34,450 | 1,977,569 | 2,542,008 | 781,075 | 43,137 | 3,366,220 |
| Port Stephens | 401,848 | 317,628 | 44,175 | 763,651 | 540,726 | 327,414 | 48,240 | 916,381 | 1,135,710 | 348,966 | 60,404 | 1,545,080 |
| Singleton | 131,648 | 104,057 | 13,782 | 249,487 | 177,145 | 107,263 | 15,050 | 299,458 | 372,066 | 114,324 | 18,845 | 505,234 |
| Upper Hunter | 75,035 | 59,309 | 6,088 | 140,433 | 100,968 | 61,137 | 6,648 | 168,752 | 212,066 | 65,161 | 8,324 | 285,552 |
| **DSSN Region** | **5,450,099** | **4,307,863** | **218,991** | **9,976,952** | **7,333,653** | **4,440,584** | **239,143** | **12,013,381** | **15,403,177** | **4,732,885** | **299,445** | **20,435,506** |

# Scenario 3- High Demand

Obtain a disruptive scenario where the number of devices per capita is high and assumes a high population growth rate.

## High Demand Scenario

### Assumptions

**1 - Average Number of Devices per Capita:**

- 13.4

**Source**: Cisco Annual Internet Report

**2 - IoT vs Non-IoT Connections Ratio**

- **56% vs 44%**

**Source:** IoT Analytics

**3 - Industrial Devices vs Individual Devices per inhabitant**

- Industrial Devices: **7.48**
- Individual/Visitor Devices: **5.92**

**4 - Total Population (2023)**

- **1,038,081**

**5 - Total Industrial Devices (2023)**

- **7,769,290** (1,038,081 * 7.48)

**6 - Total Individual Devices (2023)**

- **6,140,996** (1,038,081 * 5.92)

**7 - Annual Growth of Industrial Devices**

- **16%** (**Source**: Ericsson)

**8 - Annual Growth of Individual Devices**

- Follow the annual growth of population (table on the right)

**9 - Annual Growth of Visitor Demand**

- **4.5% per year**

**10 - Total Visitor Devices**

- Visitor Numbers (100% of max. accommodation) * 5.92

**11 - Population Growth Rate:**

- Population growth for the DSSN Regions based on the lower projection from the ABS for New South Wales.

| Year | Population for New South Wales | Annual Growth |
|---|---|---|
| 2022 | 8,166,525 | - |
| 2023 | 8,341,073 | 2.14% |
| 2024 | 8,491,447 | 1.80% |
| 2025 | 8,638,413 | 1.73% |
| 2026 | 8,781,199 | 1.65% |
| 2027 | 8,920,424 | 1.59% |
| 2028 | 9,055,666 | 1.52% |
| 2029 | 9,186,911 | 1.45% |
| 2030 | 9,313,449 | 1.38% |

**Source:** Population Projections - ABS

| Regions | 2023 | | | | 2025 | | | | 2030 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Industrial Devices | Individual Devices | Visitor Devices | Total | Industrial Devices | Individual Devices | Visitor Devices | Total | Industrial Devices | Individual Devices | Visitor Devices | Total |
| Central Coast | 2,611,490 | 2,064,172 | 78,460 | 4,754,122 | 3,514,021 | 2,137,755 | 85,680 | 5,737,456 | 7,380,645 | 2,304,807 | 106,773 | 9,792,225 |
| Cessnock City | 492,316 | 389,136 | 73,544 | 954,996 | 662,460 | 403,008 | 80,312 | 1,145,780 | 1,391,393 | 434,500 | 100,084 | 1,925,977 |
| Dungog Shire | 72,650 | 57,424 | 11,429 | 141,503 | 97,758 | 59,471 | 12,481 | 169,710 | 205,325 | 64,118 | 15,554 | 284,996 |
| Lake Macquarie | 1,619,808 | 1,280,327 | 35,979 | 2,936,115 | 2,179,614 | 1,325,968 | 39,290 | 3,544,872 | 4,577,933 | 1,429,584 | 48,963 | 6,056,480 |
| Maitland | 699,758 | 553,102 | 22,509 | 1,275,369 | 941,594 | 572,819 | 24,581 | 1,538,994 | 1,977,669 | 617,581 | 30,632 | 2,625,882 |
| Muswellbrook | 123,610 | 97,704 | 13,328 | 234,643 | 166,330 | 101,187 | 14,555 | 282,072 | 349,350 | 109,094 | 18,138 | 476,582 |
| Newcastle City | 1,282,177 | 1,013,457 | 59,962 | 2,355,596 | 1,725,297 | 1,049,585 | 65,480 | 2,840,362 | 3,623,714 | 1,131,603 | 81,600 | 4,836,917 |
| Port Stephens | 572,847 | 452,789 | 83,968 | 1,109,604 | 770,823 | 468,930 | 91,695 | 1,331,448 | 1,618,991 | 505,574 | 114,268 | 2,238,833 |
| Singleton | 187,668 | 148,337 | 26,195 | 362,200 | 252,527 | 153,625 | 28,605 | 434,756 | 530,392 | 165,629 | 35,648 | 731,669 |
| Upper Hunter | 106,965 | 84,547 | 11,571 | 203,084 | 143,933 | 87,561 | 12,636 | 244,130 | 302,308 | 94,404 | 15,747 | 412,458 |
| **DSSN Region** | 7,769,290 | 6,140,996 | 416,946 | 14,327,231 | 10,454,356 | 6,359,908 | 455,315 | 17,269,580 | 21,957,720 | 6,856,893 | 567,406 | 29,382,019 |

# Wireless infrastructure capacity modelling approach and assumptions

# Wireless - Modelling Approach Overview

The below steps have been undertaken in the wireless modelling to determine new telecommunications infrastructure requirements and the associated cost estimates.

## 1 Assess existing radio mobile site profiles

- Analysis of emission frequencies for the various radio technologies used by the three major Australian mobile operators.
- Define radio mobile site profiles and their technical characteristics.

| Specifications | 3G/4G co-located with 5G | Urban Site | Rural Site |
|---|---|---|---|
| Maximum throughput downlink per site (Mbps) | 630 | 290 | 250 |
| Maximum throughput uplink per site (Mbps) | 120 | 60 | 55 |
| Maximum Simultaneously Active Users per site | 2300 | 1700 | 1400 |

## 2 Model the topology / profile of mobile sites per LGA

- Analysis of the current number of radio sites for the DSSN regions.
- Distribution of the number of sites across the different topologies/profiles defined according to the urban vs rural split by LGA.

| Region | Number of Sites | 3G/4G co-located with 5G | Urban Site | Rural Site |
|---|---|---|---|---|
| Central Coast | 265 | 98 | 165 | 2 |
| Cessnock City | 59 | 17 | 0 | 42 |
| Dungog Shire | 13 | 0 | 0 | 13 |
| Lake Macquarie | 111 | 68 | 39 | 4 |
| Maitland | 50 | 20 | 19 | 11 |
| Muswellbrook | 28 | 2 | 0 | 26 |
| Newcastle City | 114 | 66 | 48 | 0 |
| Port Stephens | 79 | 27 | 9 | 43 |
| Singleton | 39 | 8 | 1 | 30 |
| Upper Hunter | 24 | 4 | 0 | 20 |

## 3 Determine new equipment / infrastructure needed per LGA

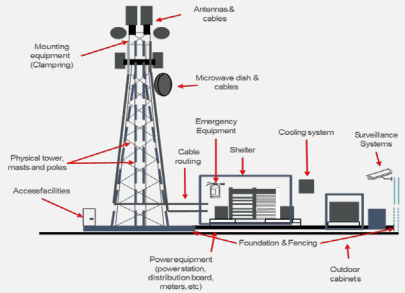
- Execute the wireless model to understand the current state in terms of capacity requirements and new infrastructure that's needed to accommodate the new demand.
- Analysis of capacity in terms of transmission, reception, and simultaneous number of active devices across the different LGAs according to their existing mobile sites and the distribution of the number of devices across the three defined scenarios (Low, Medium, and High).

| Projected Years | Required Mbps - Downlink as % of RAN Capacity | Required Mbps - Uplink as % of RAN Capacity | Required SAUs as % of RAN Capacity |
|---|---|---|---|
| 2023 | 97.6% | 98.6% | 69.6% |
| 2025 | 108.2% | 109.2% | 95.9% |
| 2030 | 141.6% | 142.9% | 162.7% |

| Projected Years | Required Mbps - Downlink as % of RAN Capacity | Required Mbps - Uplink as % of RAN Capacity | Required SAUs as % of RAN Capacity |
|---|---|---|---|
| 2023 | 97.6% | 98.6% | 79.8% |
| 2025 | 96.2% | 97.5% | 76.2% |
| 2030 | 90.8% | 93.0% | 98.5% |

## 4 Cost estimation for the new equipment / infrastructure

- Obtain average costs related to the installation of new macro sites based on tower types and areas. Note that the average cost assumptions in Australia are based on the ACCC regional mobile enquiry report from July 2023.
- Define assumptions to estimate a cost range, area where the macro site will be built, and current mobile site co-location arrangement for the different radio sites.
- Calculate the wireless network costs for each of the three demand scenarios, in line with the number of new macro sites that will need to be added for each region.



# Wireless - Mobile Site Profiles

Understanding the mobile site technologies, frequencies and characteristics across co-located, urban and rural sites is important to establish mobile site throughput assumptions.

## Existing technologies & frequencies in use for radio access

- According to ACCC data for mobile sites for the three main operators, the existing 3G, 4G and 5G technologies and radio frequencies are currently in use.

| Technology | Frequency [Mhz] | Operator | | |
|---|---|---|---|---|
| | | Telstra | OPTUS | TPG |
| 3G | 850 | x | | |
| | 900 | | x | x |
| | 2100 | x | x | x |
| 4G | 700 | x | x | x |
| | 800 | | | x |
| | 900 | x | x | |
| | 1800 | x | x | x |
| | 2100 | x | x | x |
| | 2300 | | x | |
| | 2600 | x | x | |
| 5G | 700 | x | | x |
| | 900 | | x | |
| | 2100 | x | x | x |
| | 2300 | | x | |
| | 2600 | x | | |
| | 3500 | | x | |
| | 3600 | x | | x |
| | 26000 | x | x | x |

Lower frequencies ensure lower capacity but greater coverage.

Higher frequencies ensure greater capacity but lower coverage.

**Sources:** ACCC Mobile Infrastructure Report - Datasets of Mobile Sites for the three operators (2023)

## Mobile sites profiles

- To estimate the current network capacity for different regions, three site profiles were considered:

1) **4G co-located sites with 5G** - sites incorporating all technologies, providing high capacity.
2) **Urban Sites** - 3G/4G standalone sites using high frequencies (e.g., LTE 1800, 2100, 2300, 2600).
3) **Rural Sites** - 3G/4G standalone sites using lower frequencies (e.g., LTE 700, 800, 900).

- The definition of maximum transmission capabilities in terms of transmission, reception, and devices per mobile site depends on many factors, including channel bandwidth, modulation and coding scheme, number of MIMO streams, among others. The values in the table below are average values, considering a starting point of a 4G radio site with a 20MHz bandwidth, modulation at 64-QAM, and the use of multiple 2x2 antennas (MIMO). This type of calculation is theoretical and based on the 3GPP communication standards.

| Specifications | 4G co-located with 5G | Urban Site | Rural Site |
|---|---|---|---|
| Maximum transmission link capacity per site (Mbps) | 510 | 290 | 250 |
| Maximum reception link capacity per site (Mbps) | 105 | 60 | 55 |
| Maximum Simultaneously Active Users per site | 1,800 | 1,400 | 1,200 |

# Wireless - Existing Mobile Sites per LGA

Understanding the existing mobile sites and technologies currently deployed in each LGA, across urban vs rural areas, is an important input assumption for the capacity modelling.

## Existing mobile sites per LGA

| Region | Number of Sites | 3G Radio Access | 4G Radio Access | 5G Radio Access |
|---|---|---|---|---|
| Central Coast | 265 | 234 | 263 | 98 |
| Cessnock City | 59 | 55 | 58 | 17 |
| Dungog Shire | 13 | 10 | 11 | 0 |
| Lake Macquarie | 111 | 98 | 108 | 68 |
| Maitland | 50 | 41 | 49 | 20 |
| Muswellbrook | 28 | 20 | 25 | 2 |
| Newcastle City | 114 | 107 | 114 | 66 |
| Port Stephens | 79 | 69 | 78 | 27 |
| Singleton | 39 | 33 | 35 | 8 |
| Upper Hunter | 24 | 20 | 22 | 4 |

## Urban vs rural population split by LGA

| Region | Urban Population | % Urban Population | Rural Population | % Rural Population |
|---|---|---|---|---|
| Central Coast | 343,631 | 98.8% | 4,236 | 1.2% |
| Cessnock City | 0 | 0.0% | 65,082 | 100.0% |
| Dungog Shire | 0 | 0.0% | 8,770 | 100.0% |
| Lake Macquarie | 80,750 | 91.5% | 7,466 | 8.5% |
| Maitland | 57,646 | 64.0% | 32,358 | 36.0% |
| Muswellbrook | 0 | 0.0% | 18,154 | 100.0% |
| Newcastle City | 172,820 | 100.0% | 0 | 0.0% |
| Port Stephens | 14,376 | 17.4% | 68,161 | 82.6% |
| Singleton | 378 | 1.7% | 22,527 | 98.3% |
| Upper Hunter | 0 | 0.0% | 24,463 | 100.0% |

## Mobile sites per LGA - topology

**Assumptions**

- Given that there are currently no standalone 5G sites at any of the LGAs, it is assumed that any site with 5G access is co-located with an existing 4G site.
- To determine the split of the remaining mobile sites between urban and rural, the ratio between the percentage of urban vs rural population was used as a proxy.

| Region | Number of Sites | 4G co-located with 5G | Urban Site | Rural Site |
|---|---|---|---|---|
| Central Coast | 265 | 98 | 165 | 2 |
| Cessnock City | 59 | 17 | 0 | 42 |
| Dungog Shire | 13 | 0 | 0 | 13 |
| Lake Macquarie | 111 | 68 | 39 | 4 |
| Maitland | 50 | 20 | 19 | 11 |
| Muswellbrook | 28 | 2 | 0 | 26 |
| Newcastle City | 114 | 66 | 48 | 0 |
| Port Stephens | 79 | 27 | 9 | 43 |
| Singleton | 39 | 8 | 1 | 30 |
| Upper Hunter | 24 | 4 | 0 | 20 |

# Wireless - Simulated Capacity Methodology

The below steps have been undertaken in the wireless modelling to identify areas where the existing network capacity does not support the estimated future demand.

## Wireless Model Methodology

### 1 - Model Inputs

To estimate the current state capacity, previously estimated input assumptions feed into the wireless model. These inputs are:

- **1.1 - Total Number of Devices**: Estimated total number of devices for the years 2023, 2025, and 2030, for three scenarios.
- **1.2 - Total Number of Sites:** The existing number of mobile sites in the region categorised as 4G co-located with 5G, Urban Sites (4G with higher frequencies), and Rural Sites (4G with lower frequencies).
- **1.3 - Busy Hour Traffic associated with Mobile Access Technologies**: Traffic associated with the mobile network during the busy hour.
- **1.4 - Split Urban vs Rural:** The population ratio between urban and rural areas used to determine the type of traffic and the respective number of sites allocated to each region.

### 2 - As-Is State

After feeding the model with the inputs mentioned in step 1, it is possible to estimate the current state in terms of RAN (Radio Access Network) capacity across three different variables. In this analysis, it is assumed that the number of sites will remain the same until 2030.

- **Required Transmission Link Capacity as % of RAN Capacity:** This parameter aims to understand the network's capacity to handle data transmissions, information, and other network parameters between the radio site and user equipment.
- **Required Receive Link Capacity as % of RAN Capacity:** This parameter aims to understand the network's capacity to handle the reception of data, information, and other network parameters between user equipment and the base station.
- **Required Simultaneous Active Users/Devices (SAUs) as % of RAN Capacity:** This parameter allows the understanding of network's capacity to handle the number of simultaneous devices/users accessing during the busy hour.

For each of these parameters, the capacity based on the simulated demand is determined as a **percentage** and is represented as:

- <90% - The existing capacity is sufficient to **support the estimated future demand** and **no deployment** of new mobile sites is necessary.
- 90%-100% - The existing capacity is sufficient **to support the estimated future demand**, **without the need to add new radio sites.** However, despite already considering a 20% extra headroom, the network may experience saturation in the case of peak demand or unexpected network congestion
- >100% - The existing capacity **does not support the estimated future demand**, which may lead to **denial of mobile network** service. Installation of **new radio sites** is recommended.

### 3 - Future State

Through the analysis of the current state, the future state of the network is defined, providing the number of sites that need to be implemented \in 2025 and 2030 as necessary to address the simulated connectivity demand by increasing capacity.

| Projected Years | Required Mbps - Downlink as % of RAN Capacity | Required Mbps - Uplink as % of RAN Capacity | Required SAUs as % of RAN Capacity |
|---|---|---|---|
| 2023 | 97.6% | 98.6% | 69.6% |
| 2025 | 108.2% | 109.2% | 95.9% |
| 2030 | 141.6% | 142.9% | 162.7% |

Illustrative Example

# Wireless Infrastructure Modelling – Future Capacity Requirements

# Wireless - Summarisation: Central Coast

For a detailed analysis of the simulated capacity demand for each LGA, refer to **Appendix 5.5: Future Demand: Wireless Simulated Capacity for Each LGA**

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 2,315,222
- **2025:** 2,788,162
- **2030:** 4,750,299

Current Number of Sites: **(265)**

- **4G co-located with 5G**: 98
- **Urban Sites:** 165
- **Rural Sites:** 2

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 61.6% | 57.2% | 43.2% |
| 2025 | 68.3% | 63.4% | 52.1% |
| 2030 | 93.2% | 86.4% | 88.7% |

- Until 2030, the mobile network can ensure the demand

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 61.6% | 57.2% | 43.2% |
| 2025 | 68.3% | 63.4% | 52.1% |
| 2030 | 93.2% | 86.4% | 88.7% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 265

**Projected Costs:** $0

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 3,321,220
- **2025:** 4,002,749
- **2030:** 6,824,775

Current Number of Sites: **(265)**

- **4G co-located with 5G**: 98
- **Urban Sites:** 165
- **Rural Sites:** 2

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 69.8% | 64.7% | 49.0% |
| 2025 | 77.5% | 71.9% | 59.0% |
| 2030 | 105.7% | 98.0% | 100.6% |

- Necessary increase in network capacity in 2030

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 69.8% | 64.7% | 49.0% |
| 2025 | 77.5% | 71.9% | 59.0% |
| 2030 | 99.5% | 92.8% | 95.9% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of 11 new mobile sites
- **Total Radio Sites by 2030**: 276

**Projected Costs:** $4,235,381 - $6,442,062

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 4,754,122
- **2025:** 5,737,456
- **2030:** 9,792,225

Current Number of Sites: **(265)**

- **4G co-located with 5G**: 98
- **Urban Sites:** 165
- **Rural Sites:** 2

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.9% | 92.7% | 70.1% |
| 2025 | 111.0% | 103.0% | 84.6% |
| 2030 | 151.6% | 140.6% | 144.4% |

- Necessary increase in network capacity in 2025

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.9% | 92.7% | 70.1% |
| 2025 | 99.7% | 93.4% | 77.6% |
| 2030 | 97.1% | 93.3% | 99.7% |

- **Until 2025**: Installation of 20 new mobile sites
- **2025-2030**: Installation of 79 new mobile sites
- **Total Radio Sites by 2030**: 364

**Projected Costs:** $38,591,325 - $58,467,640

# Wireless - Summarisation : Cessnock

For a detailed analysis of the simulated capacity demand for each LGA, refer to **Appendix 5.5: Future Demand: Wireless Simulated Capacity for Each LGA**

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 450,889
- **2025:** 541,375
- **2030:** 915,154

Current Number of Sites: **(59)**

- **4G co-located with 5G**: 17
- **Urban Sites:** 0
- **Rural Sites:** 42

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 58.6% | 55.1% | 37.1% |
| 2025 | 64.7% | 60.8% | 44.6% |
| 2030 | 83.6% | 78.6% | 75.4% |

- Until 2030, the mobile network can ensure the demand

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 58.6% | 55.1% | 37.1% |
| 2025 | 64.7% | 60.8% | 44.6% |
| 2030 | 83.6% | 78.6% | 75.4% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 59

**Projected Costs:** $0

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 656,652
- **2025:** 787,943
- **2030:** 1,328,358

Current Number of Sites: **(59)**

- **4G co-located with 5G**: 17
- **Urban Sites:** 0
- **Rural Sites:** 42

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 83.1% | 78.1% | 54.1% |
| 2025 | 91.4% | 85.9% | 64.9% |
| 2030 | 121.4% | 114.1% | 109.4% |

- Necessary increase in network capacity in 2030

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 83.1% | 78.1% | 54.1% |
| 2025 | 91.4% | 85.9% | 64.9% |
| 2030 | 98.0% | 92.7% | 93.7% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of 8 new mobile sites
- **Total Radio Sites by 2030**: 67

**Projected Costs:** $3,343,835 - $4,619,979

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 954,996
- **2025:** 1,145,780
- **2030:** 1,925,977

Current Number of Sites: **(59)**

- **4G co-located with 5G**: 17
- **Urban Sites:** 0
- **Rural Sites:** 42

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 120.8% | 113.6% | 78.6% |
| 2025 | 132.9% | 124.9% | 94.3% |
| 2030 | 176.1% | 165.4% | 158.6% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 89.0% | 84.3% | 62.9% |
| 2025 | 97.8% | 92.7% | 75.4% |
| 2030 | 94.3% | 90.0% | 98.8% |

- **Until 2025**: Installation of 12 new mobile sites
- **2025-2030**: Installation of 17 new mobile sites
- **Total Radio Sites by 2030**: 88

**Projected Costs:** $12,748,370 - $17,613,669

# Wireless - Summarisation : Dungog

For a detailed analysis of the simulated capacity demand for each LGA, refer to **Appendix 5.5: Future Demand: Wireless Simulated Capacity for Each LGA**

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 66,678
- **2025:** 80,044
- **2030:** 135,240

Current Number of Sites: **(13)**

- **4G co-located with 5G**: 0
- **Urban Sites:** 0
- **Rural Sites:** 13

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 58.5% | 53.2% | 32.1% |
| 2025 | 62.8% | 57.1% | 38.5% |
| 2030 | 84.3% | 76.6% | 65.0% |

- Until 2030, the mobile network can ensure the demand

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 58.5% | 53.2% | 32.1% |
| 2025 | 62.8% | 57.1% | 38.5% |
| 2030 | 84.3% | 76.6% | 65.0% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 13

**Projected Costs:** $0

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 97,259
- **2025:** 116,666
- **2030:** 196,513

Current Number of Sites: **(13)**

- **4G co-located with 5G**: 0
- **Urban Sites:** 0
- **Rural Sites:** 13

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 85.3% | 77.5% | 46.8% |
| 2025 | 91.5% | 83.2% | 56.1% |
| 2030 | 122.4% | 111.3% | 94.5% |

- Necessary increase in network capacity in 2030

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 85.3% | 77.5% | 46.8% |
| 2025 | 91.5% | 83.2% | 56.1% |
| 2030 | 87.9% | 81.4% | 76.8% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of 2 new mobile site
- **Total Radio Sites by 2030**: 15

**Projected Costs:** $835,959 - $1,154,995

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 141,503
- **2025:** 169,710
- **2030:** 284,996

Current Number of Sites: **(13)**

- **4G co-located with 5G**: 0
- **Urban Sites:** 0
- **Rural Sites:** 13

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 124.1% | 112.8% | 68.0% |
| 2025 | 137.1% | 124.6% | 81.6% |
| 2030 | 184.2% | 167.4% | 137.0% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 89.1% | 82.5% | 55.3% |
| 2025 | 98.5% | 91.1% | 66.3% |
| 2030 | 93.0% | 87.3% | 86.9% |

- **Until 2025**: Installation of 2 new mobile sites
- **2025-2030**: Installation of 3 new mobile sites
- **Total Radio Sites by 2030**: 18

**Projected Costs:** $2,298,886 - $3,176,235

# Wireless - Summarisation : Lake Macquarie

For a detailed analysis of the simulated capacity demand for each LGA, refer to **Appendix 5.5: Future Demand: Wireless Simulated Capacity for Each LGA**

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 1,432,930
- **2025:** 1,725,990
- **2030:** 2,942,192

Current Number of Sites: **(111)**

- **4G co-located with 5G**: 68
- **Urban Sites:** 39
- **Rural Sites:** 4

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 60.6% | 59.0% | 47.1% |
| 2025 | 67.2% | 65.5% | 56.7% |
| 2030 | 91.7% | 89.3% | 96.7% |

- Until 2030, the mobile network can ensure the demand

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 60.6% | 59.0% | 47.1% |
| 2025 | 67.2% | 65.5% | 56.7% |
| 2030 | 91.7% | 89.3% | 96.7% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 111

**Projected Costs:** $0

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 2,053,355
- **2025:** 2,475,467
- **2030:** 4,224,025

Current Number of Sites: **(111)**

- **4G co-located with 5G**: 68
- **Urban Sites:** 39
- **Rural Sites:** 4

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 86.8% | 84.6% | 67.5% |
| 2025 | 96.4% | 94.0% | 81.3% |
| 2030 | 131.6% | 128.3% | 138.8% |

- Necessary increase in network capacity in 2030

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 86.8% | 84.6% | 67.5% |
| 2025 | 96.4% | 94.0% | 81.3% |
| 2030 | 91.1% | 90.1% | 99.6% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of 39 new mobile sites
- **Total Radio Sites by 2030**: 150

**Projected Costs:** $16,016,413 - $22,749,742

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 2,936,115
- **2025:** 3,544,872
- **2030:** 6,056,480

Current Number of Sites: **(111)**

- **4G co-located with 5G**: 68
- **Urban Sites:** 39
- **Rural Sites:** 4

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 124.1% | 121.0% | 96.5% |
| 2025 | 138.0% | 134.5% | 116.5% |
| 2030 | 188.7% | 183.9% | 199.0% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.2% | 97.7% | 79.0% |
| 2025 | 99.5% | 98.3% | 86.7% |
| 2030 | 88.6% | 88.7% | 99.6% |

- **Until 2025**: Installation of 34 new mobile sites (19 now; 12 in 2025)
- **2025-2030**: Installation of 65 new mobile sites
- **Total Radio Sites by 2030**: 210

**Projected Costs:** $32,794,470 - $57,401,140

# Wireless - Summarisation : Maitland

For a detailed analysis of the simulated capacity demand for each LGA, refer to **Appendix 5.5: Future Demand: Wireless Simulated Capacity for Each LGA**

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 620,738
- **2025:** 747,498
- **2030:** 1,273,358

Current Number of Sites: **(50)**

- **4G co-located with 5G**: 20
- **Urban Sites:** 19
- **Rural Sites:** 11

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 70.7% | 67.2% | 49.7% |
| 2025 | 78.4% | 74.5% | 59.8% |
| 2030 | 103.1% | 97.9% | 101.9% |

- Necessary increase in network capacity in 2030

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 70.7% | 67.2% | 49.7% |
| 2025 | 78.4% | 74.5% | 59.8% |
| 2030 | 97.1% | 92.6% | 97.2% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030:** Installation of 2 new mobile sites
- **Total Radio Sites by 2030**: 52

**Projected Costs:** $907,059 - $1,050,393

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 890,715
- **2025:** 1,073,406
- **2030:** 1,829,793

Current Number of Sites: **(50)**

- **4G co-located with 5G**: 20
- **Urban Sites:** 19
- **Rural Sites:** 11

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 101.5% | 96.4% | 71.3% |
| 2025 | 112.7% | 107.0% | 85.9% |
| 2030 | 148.1% | 140.7% | 146.5% |

- Necessary increase of the network capacity at the moment

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 98.5% | 93.7% | 69.6% |
| 2025 | 97.6% | 93.6% | 76.5% |
| 2030 | 93.5% | 91.3% | 99.9% |

- **Until 2025**: Installation of 5 new mobile sites
- **2025-2030**: Installation of 14 new mobile sites
- **Total Radio Sites by 2030**: 69

**Projected Costs:** $9,119,052 - $10,417,176

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 1,275,369
- **2025:** 1,538,994
- **2030:** 2,625,882

Current Number of Sites: **(50)**

- **4G co-located with 5G**: 20
- **Urban Sites:** 19
- **Rural Sites:** 11

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 145.3% | 138.0% | 102.1% |
| 2025 | 161.5% | 153.4% | 123.2% |
| 2030 | 212.6% | 201.9% | 210.2% |

- Necessary increase of the network capacity at the moment

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.5% | 96.7% | 74.6% |
| 2025 | 98.2% | 96.0% | 81.3% |
| 2030 | 89.2% | 88.5% | 99.9% |

- **Until 2025**: Installation of 21 new mobile sites
- **2025-2030**: Installation of 24 new mobile sites
- **Total Radio Sites by 2030**: 95

**Projected Costs:** $18,656,511 - $24,191,118

# Wireless - Summarisation : Muswellbrook

For a detailed analysis of the simulated capacity demand for each LGA, refer to **Appendix 5.5: Future Demand: Wireless Simulated Capacity for Each LGA**

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 111,946
- **2025:** 134,549
- **2030:** 228,058

Current Number of Sites: **(28)**

- **4G co-located with 5G**: 2
- **Urban Sites:** 0
- **Rural Sites:** 26

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 38.9% | 35.7% | 24.1% |
| 2025 | 42.8% | 39.4% | 29.0% |
| 2030 | 55.0% | 50.5% | 49.2% |

- Until 2030, the mobile network can ensure the demand

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 38.9% | 35.7% | 24.1% |
| 2025 | 42.8% | 39.4% | 29.0% |
| 2030 | 55.0% | 50.5% | 49.2% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 28

**Projected Costs:** $0

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 162,264
- **2025:** 194,988
- **2030:** 329,957

Current Number of Sites: **(28)**

- **4G co-located with 5G**: 2
- **Urban Sites:** 0
- **Rural Sites:** 26

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 56.3% | 51.8% | 35.0% |
| 2025 | 60.2% | 55.3% | 42.0% |
| 2030 | 79.6% | 73.1% | 71.1% |

- Until 2030, the mobile network can ensure the demand

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 56.3% | 51.8% | 35.0% |
| 2025 | 60.2% | 55.3% | 42.0% |
| 2030 | 79.6% | 73.1% | 71.1% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 28

**Projected Costs:** $0

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 234,643
- **2025:** 282,072
- **2030:** 476,582

Current Number of Sites: **(28)**

- **4G co-located with 5G**: 2
- **Urban Sites:** 0
- **Rural Sites:** 26

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 81.5% | 74.9% | 50.6% |
| 2025 | 89.8% | 82.5% | 60.8% |
| 2030 | 114.9% | 105.6% | 102.7% |

- Necessary increase in network capacity in 2030

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 81.5% | 74.9% | 50.6% |
| 2025 | 89.8% | 82.5% | 60.8% |
| 2030 | 98.7% | 91.4% | 93.1% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of new 2 mobile sites
- **Total Radio Sites by 2030**: 30

**Projected Costs:** $835,959 - $1,154,995

# Wireless - Summarisation : Newcastle

For a detailed analysis of the simulated capacity demand for each LGA, refer to **Appendix 5.5: Future Demand: Wireless Simulated Capacity for Each LGA**

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 1,141,981
- **2025:** 1,374,668
- **2030:** 2,339,444

Current Number of Sites: **(114)**

- **4G co-located with 5G**: 66
- **Urban Sites:** 48
- **Rural Sites:** 0

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 54.7% | 53.1% | 43.0% |
| 2025 | 60.7% | 58.9% | 51.8% |
| 2030 | 82.6% | 80.1% | 88.1% |

- Until 2030, the mobile network can ensure the demand.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 54.7% | 53.1% | 43.0% |
| 2025 | 60.7% | 58.9% | 51.8% |
| 2030 | 82.6% | 80.1% | 88.1% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 114

**Projected Costs:** $0

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 1,641,917
- **2025:** 1,977,569
- **2030:** 3,366,220

Current Number of Sites: **(114)**

- **4G co-located with 5G**: 66
- **Urban Sites:** 48
- **Rural Sites:** 0

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 78.7% | 76.3% | 61.8% |
| 2025 | 87.3% | 84.7% | 74.5% |
| 2030 | 118.9% | 115.3% | 126.7% |

- Necessary increase in network capacity in 2030

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 78.7% | 76.3% | 61.8% |
| 2025 | 87.3% | 84.7% | 74.5% |
| 2030 | 92.2% | 89.4% | 99.7% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of 27 new mobile sites
- **Total Radio Sites by 2030**: 141

**Projected Costs:** $10,496,379 - $15,965,111

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 2,324,484
- **2025:** 2,794,682
- **2030:** 4,727,428

Current Number of Sites: **(114)**

- **4G co-located with 5G**: 66
- **Urban Sites:** 48
- **Rural Sites:** 0

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 112.9% | 109.5% | 88.7% |
| 2025 | 125.4% | 121.6% | 106.9% |
| 2030 | 170.8% | 165.7% | 182.1% |

- Necessary increase of the network capacity at the moment

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.1% | 96.1% | 78.5% |
| 2025 | 99.7% | 96.8% | 86.2% |
| 2030 | 90.9% | 88.2% | 99.9% |

- **Until 2025**: Installation of 24 new mobile sites
- **2025-2030**: Installation of 58 new mobile sites
- **Total Radio Sites by 2030**: 196

**Projected Costs:** $25,412,286 - $48,735,602

# Wireless - Summarisation : Port Stephens

For a detailed analysis of the simulated capacity demand for each LGA, refer to **Appendix 5.5: Future Demand: Wireless Simulated Capacity for Each LGA**

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 524,249
- **2025:** 629,500
- **2030:** 1,064,314

Current Number of Sites: **(79)**

- **4G co-located with 5G**: 27
- **Urban Sites:** 9
- **Rural Sites:** 43

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 47.8% | 45.4% | 34.9% |
| 2025 | 52.9% | 50.2% | 41.9% |
| 2030 | 69.0% | 65.5% | 70.8% |

- Until 2030, the mobile network can ensure the demand

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 47.8% | 45.4% | 34.9% |
| 2025 | 52.9% | 50.2% | 41.9% |
| 2030 | 69.0% | 65.5% | 70.8% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 79

**Projected Costs:** $0

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 763,651
- **2025:** 916,381
- **2030:** 1,545,080

Current Number of Sites: **(79)**

- **4G co-located with 5G**: 27
- **Urban Sites:** 9
- **Rural Sites:** 43

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 69.7% | 66.1% | 50.8% |
| 2025 | 77.0% | 73.1% | 60.9% |
| 2030 | 100.2% | 95.0% | 102.7% |

- Necessary increase in network capacity in 2030

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 69.7% | 66.1% | 50.8% |
| 2025 | 77.0% | 73.1% | 60.9% |
| 2030 | 96.3% | 91.4% | 99.6% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of 2 new mobile sites
- **Total Radio Sites by 2030**: 81

**Projected Costs:** $835,959 - $1,154,995

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 1,109,604
- **2025:** 1,331,448
- **2030:** 2,238,833

Current Number of Sites: **(79)**

- **4G co-located with 5G**: 27
- **Urban Sites:** 9
- **Rural Sites:** 43

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 101.3% | 96.1% | 73.8% |
| 2025 | 111.9% | 106.2% | 88.5% |
| 2030 | 150.6% | 142.8% | 148.9% |

- Necessary increase of the network capacity at the moment

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.3% | 94.2% | 72.6% |
| 2025 | 99.7% | 94.8% | 80.8% |
| 2030 | 92.2% | 88.3% | 99.6% |

- **Until 2025**: Installation of 6 new mobile sites
- **2025-2030**: Installation of 25 new mobile sites
- **Total Radio Sites by 2030**: 110

**Projected Costs:** $14,784,408 - $17,827,248

# Wireless - Summarisation : Singleton

For a detailed analysis of the simulated capacity demand for each LGA, refer to **Appendix 5.5: Future Demand: Wireless Simulated Capacity for Each LGA**

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 171,425
- **2025:** 205,876
- **2030:** 348,237

Current Number of Sites: **(39)**

- **4G co-located with 5G**: 8
- **Urban Sites:** 1
- **Rural Sites:** 30

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 35.7% | 33.4% | 24.8% |
| 2025 | 39.3% | 36.7% | 29.8% |
| 2030 | 50.4% | 47.1% | 50.5% |

- Until 2030, the mobile network can ensure the demand

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 35.7% | 33.4% | 24.8% |
| 2025 | 39.3% | 36.7% | 29.8% |
| 2030 | 50.4% | 47.1% | 50.5% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 39

**Projected Costs:** $0

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 249,487
- **2025:** 299,458
- **2030:** 505,234

Current Number of Sites: **(39)**

- **4G co-located with 5G**: 8
- **Urban Sites:** 1
- **Rural Sites:** 30

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 52.0% | 48.5% | 36.1% |
| 2025 | 57.2% | 53.4% | 43.4% |
| 2030 | 73.2% | 68.3% | 73.2% |

- Until 2030, the mobile network can ensure the demand

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 52.0% | 48.5% | 36.1% |
| 2025 | 57.2% | 53.4% | 43.4% |
| 2030 | 73.2% | 68.3% | 73.2% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 39

**Projected Costs:** $0

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 362,200
- **2025:** 434,756
- **2030:** 731,669

Current Number of Sites: **(39)**

- **4G co-located with 5G**: 8
- **Urban Sites:** 1
- **Rural Sites:** 30

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 75.4% | 70.5% | 52.4% |
| 2025 | 83.0% | 77.6% | 62.9% |
| 2030 | 110.1% | 102.8% | 105.9% |

- Necessary increase in network capacity in 2030

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 75.4% | 70.5% | 52.4% |
| 2025 | 83.0% | 77.6% | 62.9% |
| 2030 | 95.9% | 90.1% | 95.9% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of 3 new mobile sites
- **Total Radio Sites by 2030**: 42

**Projected Costs:** $1,462,928 - $2,021,241

# Wireless - Summarisation : Upper Hunter

For a detailed analysis of the simulated capacity demand for each LGA, refer to **Appendix 5.5: Future Demand: Wireless Simulated Capacity for Each LGA**

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 96,882
- **2025:** 116,443
- **2030:** 197,362

Current Number of Sites: **(24)**

- **4G co-located with 5G**: 4
- **Urban Sites:** 0
- **Rural Sites:** 20

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 34.6% | 32.2% | 23.3% |
| 2025 | 38.2% | 35.5% | 28.0% |
| 2030 | 51.0% | 47.4% | 47.4% |

- Until 2030, the mobile network can ensure the demand

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 34.6% | 32.2% | 23.3% |
| 2025 | 38.2% | 35.5% | 28.0% |
| 2030 | 51.0% | 47.4% | 47.4% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 24

**Projected Costs:** $0

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 140,433
- **2025:** 168,752
- **2030:** 285,552

Current Number of Sites: **(24)**

- **4G co-located with 5G**: 4
- **Urban Sites:** 0
- **Rural Sites:** 20

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 50.2% | 46.7% | 33.8% |
| 2025 | 55.3% | 51.4% | 40.6% |
| 2030 | 73.8% | 68.5% | 68.6% |

- Until 2030, the mobile network can ensure the demand

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 50.2% | 46.7% | 33.8% |
| 2025 | 55.3% | 51.4% | 40.6% |
| 2030 | 73.8% | 68.5% | 68.6% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 24

**Projected Costs:** $0

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 203,084
- **2025:** 244,130
- **2030:** 412,458

Current Number of Sites: **(24)**

- **4G co-located with 5G**: 4
- **Urban Sites:** 0
- **Rural Sites:** 20

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 72.6% | 67.5% | 48.8% |
| 2025 | 80.0% | 74.4% | 58.7% |
| 2030 | 106.5% | 99.0% | 99.2% |

- Necessary increase in network capacity in 2030

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 72.6% | 67.5% | 48.8% |
| 2025 | 80.0% | 74.4% | 58.7% |
| 2030 | 98.2% | 91.6% | 93.7% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of one new mobile sites
- **Total Radio Sites by 2030**: 25

**Projected Costs:** $626,969 - $866,246

# 4. Telecommunications Infrastructure Options Analysis

**For a detailed analysis of the Future Demand Scenarios and infrastructure options for each LGA, refer to Appendix:**

5.4 Future Demand: Wireless Simulated Capacity for Each LGA

# Case Studies: Peak Visitor Demand on Telecommunications Infrastructure

# Case Studies 1 & 2: Pokolbin, Cessnock - Region Characterisation

The below tables summarise all the data such as population, demographics, number of devices, visitor peak demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Pokolbin suburb.

## Population and Demographic Aspects

| Total Area |
|---|
| 126.1 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 0.0% |
| Rural | 100.0% |

| Total Population | |
|---|---|
| 2023 | 1,069 |
| 2025 | 1,102 |
| 2030 | 1,175 |

## Visitor Demand

| Major Event | Estimated Number of Visitors |
|---|---|
| Concert at the Hope Estate | 20,000 |
| SuperCars Event | 62,000 |

## Main Assumptions

- Peak visitors of 20,000 is based on the venue capacity at Hope Estate.
- The total number of peak visitors of 62,000 people was based on Newcastle 500 event attendee numbers from 2023.
- In the case of an event at Hope Estate, only the coverage and capacity of the three mobile sites located in that area were considered to ensure more precise results.
- To obtain the total number of devices for industrial sectors, the industry employment rate for the Cessnock region was used.

## Number of Devices (Baseline Scenario)

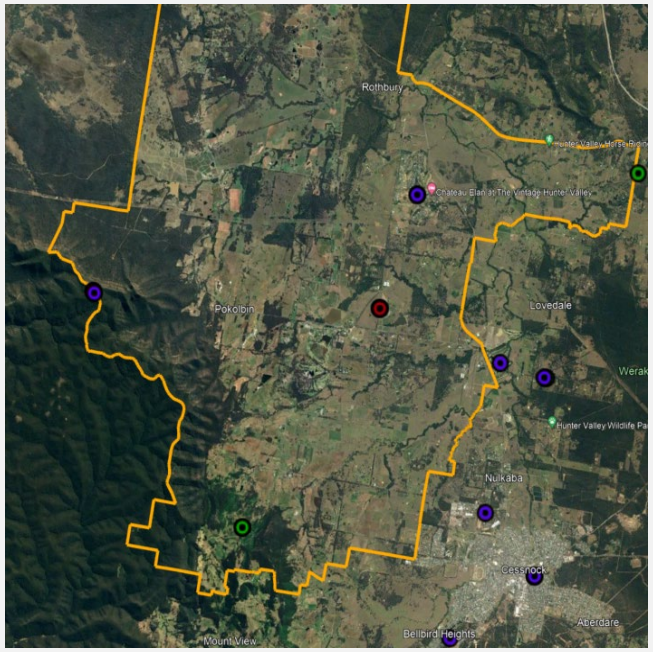
| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 551 | 741 | 1,557 |
| Utilities | 72 | 96 | 202 |
| Construction | 507 | 682 | 1,432 |
| Manufacturing | 413 | 556 | 1,167 |
| Wholesale and Retail Trade | 666 | 897 | 1,883 |
| Transportation & Warehousing | 226 | 304 | 638 |
| Finance, Insurance, Real Estate, Rental & Leasing | 165 | 222 | 467 |
| Professional, Scientific & Technical Services | 198 | 267 | 560 |
| Business, Building & other support services | 259 | 348 | 732 |
| Educational services | 330 | 445 | 934 |
| Health care and social assistance | 788 | 1,060 | 2,226 |
| Arts, Information, Culture & Recreation | 83 | 111 | 233 |
| Accommodation and food services | 485 | 652 | 1,370 |
| Other services (excluding public administration) | 253 | 341 | 716 |
| Public administration | 275 | 371 | 778 |
| Households & Consumer Goods (Individual Devices) | 4,353 | 4,490 | 4,852 |
| Hope Estate - Visitor Demand (Visitor Devices) | 83,000 | 83,000 | 83,000 |
| SuperCars Event - Visitor Demand (Visitor Devices) | 257,290 | 257,290 | 257,290 |

Destination Sydney Surrounds North

# Case Studies 1 & 2: Pokolbin, Cessnock - Technology Review

The detailed analysis of the number of sites, types of radio technology, and the evaluation of the NBN network offer insights into the current telecommunications maturity of a suburb, enabling the identification of potential gaps. This represents the current status for the suburb of Pokolbin, located in the Cessnock region.

## Existing Radio Mobile Sites

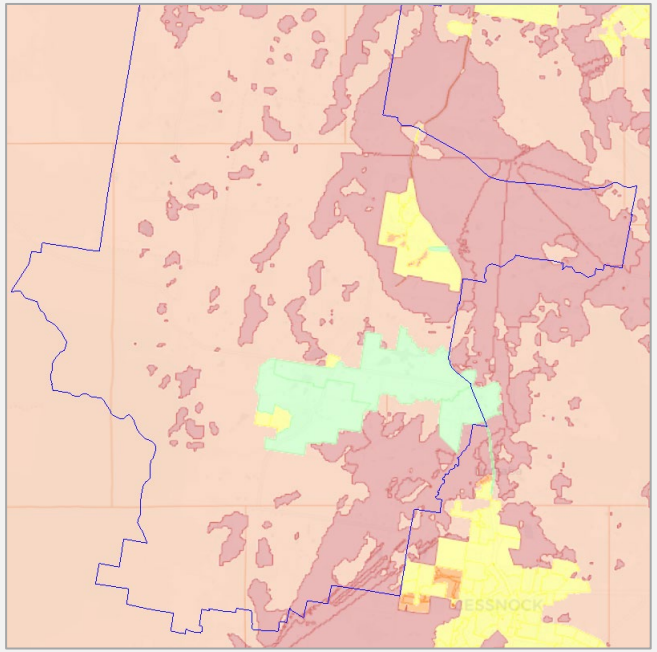



- Pokolbin currently has a total of 10 mobile radio sites deployed in the area (3 from Telstra, 4 from Optus, 3 from TPG). According to coverage maps, the zone does not show connectivity gaps in terms of 3G and 4G, including the more forested area due to the presence of an antenna (with radio sites from all three operators).
- Concerning 5G coverage, this technology is accessible in the residential area due to the presence of 1 Telstra radio site in the region.

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 3 | 3 | 3 | 1 |
| Optus | 4 | 4 | 4 | 0 |
| TPG | 3 | 3 | 3 | 0 |

**Note:** Some radio sites from different operators may be co-located on the same tower and may not be visible in the image above.

## NBN Technology Types



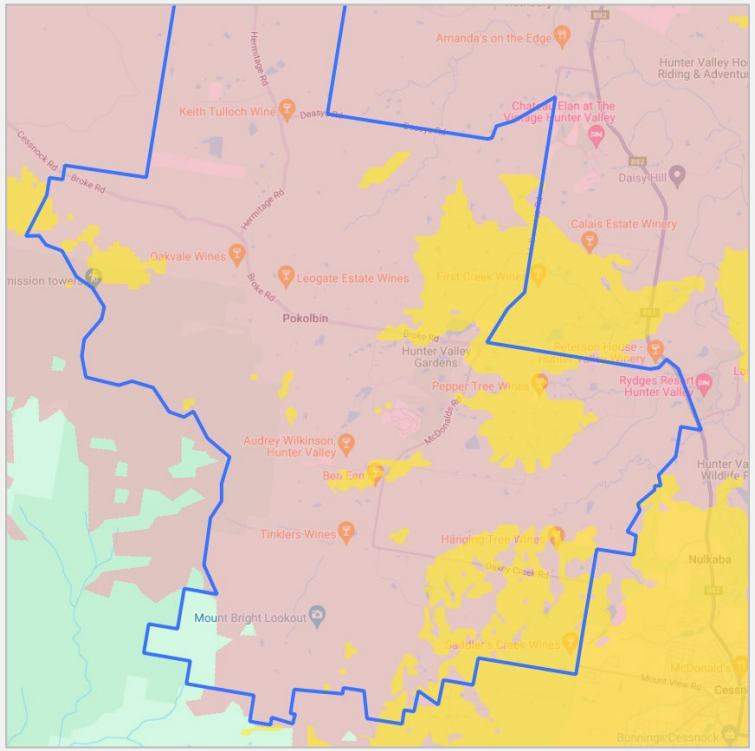

- As illustrated in the image above, Pokolbin has access to NBN services. Fibre to the premises is exclusively available to a limited residential block.
- The remaining densely populated area is connected to NBN services through fibre to the curb or fibre to the node.
- In more remote areas, access is provided through fixed wireless, and satellite serves as the final option in the most remote areas.

# Case Studies 1 & 2: Pokolbin, Cessnock - Technology Review

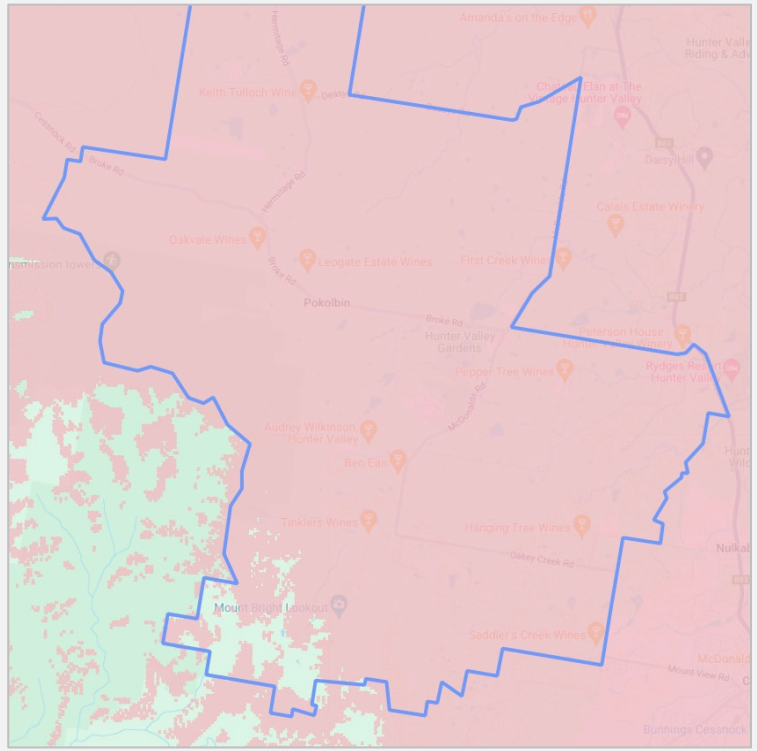
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

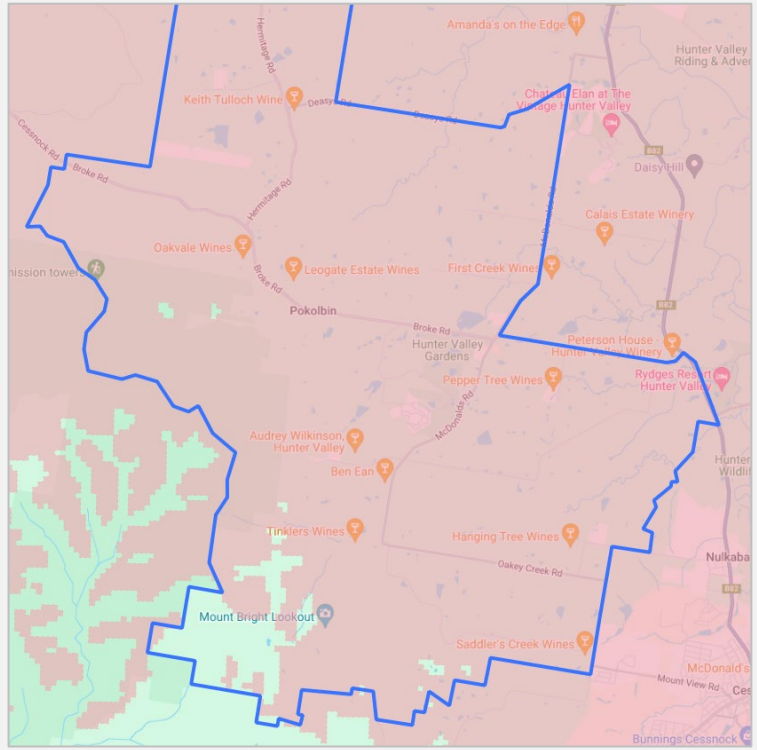
### Telstra Mobile Coverage




### Optus Mobile Coverage




### TPG Mobile Coverage




4G 5G

**Sources:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Case Study 1: Pokolbin, Cessnock - Wireless Summarisation

## (20,000 visitor peak demand at Hope Estate)

Below, the As-Is and Future State in terms of RAN Capacity (Downlink, Uplink, Simultaneous Active Devices) for the different scenarios are represented in a peak demand case of 20,000 visitors at Hope Estate.

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 64,737
- **2025:** 66,096
- **2030:** 71,734

Current Number of Sites: **(3)**

- **4G co-located with 5G**: 1
- **Urban Sites:** 0
- **Rural Sites:** 2

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 70,4% | 67,1% | 105,3% |
| 2025 | 71,9% | 68,6% | 107,5% |
| 2030 | 78,1% | 74,5% | 116,8% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 49,2% | 46,9% | 73,6% |
| 2025 | 50,3% | 47,9% | 75,1% |
| 2030 | 54,6% | 52,0% | 81,5% |

- **Until 2025:** Installation of one new mobile site
- **2025-2030:** No need of installation of new mobile sites
- **Total Radio Sites by 2030:** 4

**Projected Costs:** $626,969 - $866,246

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 92,624
- **2025:** 94,582
- **2030:** 102,748

Current Number of Sites: **(3)**

- **4G co-located with 5G**: 1
- **Urban Sites:** 0
- **Rural Sites:** 2

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 109,9% | 103,7% | 147,8% |
| 2025 | 112,3% | 105,9% | 150,9% |
| 2030 | 121,9% | 115,0% | 164,0% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 51,8% | 49,6% | 81,7% |
| 2025 | 52,9% | 50,7% | 83,5% |
| 2030 | 57,5% | 55,1% | 90,7% |

- **Until 2025**: Installation of two new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 5

**Projected Costs:** $835,958 - $1,154,994

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 132,119
- **2025:** 134,941
- **2030:** 146,667

Current Number of Sites: **(3)**

- **4G co-located with 5G**: 1
- **Urban Sites:** 0
- **Rural Sites:** 2

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 156,8% | 147,9% | 210,9% |
| 2025 | 160,2% | 151,0% | 215,3% |
| 2030 | 174,1% | 164,1% | 234,1% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 58,5% | 56,2% | 95,3% |
| 2025 | 59,7% | 57,4% | 97,3% |
| 2030 | 53,7% | 51,7% | 89,4% |

- **Until 2025**: Installation of three new mobile sites
- **2025-2030**: Installation of one new mobile site
- **Total Radio Sites by 2030**: 7

**Projected Costs:** $1,671,917 - $ 2,309,989

# Case Study 1: Pokolbin, Cessnock - Wireless Simulated Capacity

## (20,000 visitor peak demand at Hope Estate)

In the table below, the capacity status for the Pokolbin suburb under a baseline demand scenario conditions and a peak demand of 20,000 visitors is presented.

### Low Scenario

#### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 64,737
- **2025:** 66,096
- **2030:** 71,734

Visitor Peak Demand: **20,000 Visitors** (Concert Event)

Current Number of Sites: **(3)***

- **4G co-located with 5G:** 1
- **Urban Sites:** 0
- **Rural Sites:** 2

Busy(h) Traffic associated to Mobile Access Technologies:

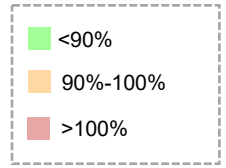
- **30%****

Urban vs Rural Split:

- **Urban** - 0%
- **Rural** - 100%

#### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 70,4% | 67,1% | 105,3% |
| 2025 | 71,9% | 68,6% | 107,5% |
| 2030 | 78,1% | 74,5% | 116,8% |




- After running the model for the Pokolbin suburb in case of a major event with 20,000 visitors, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

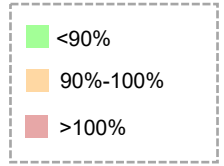
#### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **one new mobile base station until 2025** that will support the demand for Pokolbin region in case of a major event with 20,000 visitors.
- **2030 -** No need to install new mobile sites, **as the one mobile site installed by 2025 support** the demand in **2030**.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 49,2% | 46,9% | 73,6% |
| 2025 | 50,3% | 47,9% | 75,1% |
| 2030 | 54,6% | 52,0% | 81,5% |




*For the analysis of a peak demand of 20,000 visitors at Hope Estate and to obtain more precise results, only the three mobile sites present in the area of Hope Estate were considered to estimate the mobile capacity.
****Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 1: Pokolbin, Cessnock - Wireless Simulated Capacity

## (20,000 visitor peak demand at Hope Estate)

In the table below, the capacity status for the Pokolbin suburb under a low demand scenario conditions and a peak demand of 20,000 visitors is presented.

### Baseline Scenario

#### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 92,624
- **2025:** 94,582
- **2030:** 102,748

Visitor Peak Demand: **20,000 Visitors** (Concert Event)

Current Number of Sites: **(3)***

- **4G co-located with 5G:** 1
- **Urban Sites:** 0
- **Rural Sites:** 2

Busy(h) Traffic associated to Mobile Access Technologies:

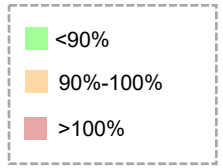
- **30%****

Urban vs Rural Split:

- **Urban** - 0%
- **Rural** - 100%

#### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 109,9% | 103,7% | 147,8% |
| 2025 | 112,3% | 105,9% | 150,9% |
| 2030 | 121,9% | 115,0% | 164,0% |




- After running the model for the Pokolbin suburb in case of a major event with 20,000 visitors, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

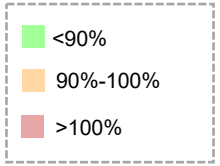
#### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **two new mobile base stations until 2025** that will support the demand for Pokolbin region in case of a major event with 20,000 visitors.
- **2030 -** No need to install new mobile sites, **as the two mobile sites installed by 2025 support** the demand in **2030**.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 51,8% | 49,6% | 81,7% |
| 2025 | 52,9% | 50,7% | 83,5% |
| 2030 | 57,5% | 55,1% | 90,7% |




*For the analysis of a peak demand of 20,000 visitors at Hope Estate and to obtain more precise results, only the three sites present in the area of Hope Estate were considered to estimate the mobile capacity.
****Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 1: Pokolbin, Cessnock - Wireless Simulated Capacity

## (20,000 visitor peak demand at Hope Estate)

In the table below, the capacity status for the Pokolbin suburb under a high demand scenario conditions and a peak demand of 20,000 visitors is presented.

### High Scenario

#### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 132,119
- **2025:** 134,941
- **2030:** 146,667

Visitor Peak Demand: **20,000 Visitors** (Concert Event)

Current Number of Sites: **(3)***

- **4G co-located with 5G:** 1
- **Urban Sites:** 0
- **Rural Sites:** 2

Busy(h) Traffic associated to Mobile Access Technologies:

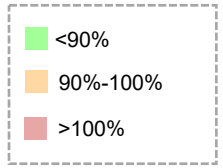
- **30%****

Urban vs Rural Split:

- **Urban** - 0%
- **Rural** - 100%

#### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 156,8% | 147,9% | 210,9% |
| 2025 | 160,2% | 151,0% | 215,3% |
| 2030 | 174,1% | 164,1% | 234,1% |




- After running the model for the Pokolbin suburb in case of a major event with 20,000 visitors, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

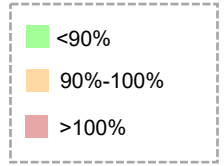
#### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **three new mobile base stations until 2025** that will support the demand for Pokolbin region in case of a major event with 20,000 visitors.
- **2030 -** Installation of **one new mobile base station between 2025 and 2030**, resulting in a total of **7 radio mobile sites** in the Hope Estate area.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 58,5% | 56,2% | 95,3% |
| 2025 | 59,7% | 57,4% | 97,3% |
| 2030 | 53,7% | 51,7% | 89,4% |




*For the analysis of a peak demand of 20,000 visitors at Hope Estate and to obtain more precise results, only the three sites present in the area of Hope Estate were considered to estimate the mobile capacity.
****Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 1: Pokolbin, Cessnock – Other Technology Options

## (20,000 visitor peak demand at Hope Estate)

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for the Pokolbin region in the case of 20,000 visitors.

### Other Technology Options

**1 - Analysis (2030):**

**Low Scenario**
- Total Devices - **71,734**
- Visitor Devices - **58,000**
- As-Is %RAN Capacity - **116.8%**
- No. of Devices exceeding the network capacity - **10,318**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **10,318 * 20% * 30% = 619**

**Baseline Scenario**
- Total Devices - **102,748**
- Visitor Devices - **83,000**
- As-Is %RAN Capacity - **164.0%**
- No. of Devices exceeding the network capacity - **40,097**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **40,097 * 20% * 30% = 2,406**

**High Scenario**
- Total Devices - **146,667**
- Visitor Devices - **118,400**
- As-Is %RAN Capacity - **234.1%**
- No. of Devices exceeding the network capacity - **84,016**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **84,016 * 20% * 30% = 5,041**

| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Cell on Wheels | **Cell on Wheels (CoW) are temporary infrastructures** that provide mobile coverage and capacity, supporting an average of up to **350 devices simultaneously**. Therefore, in each of the following scenarios, and to accommodate exceeding network devices, the required number of CoWs (independent of the operator) are:<br>• **Low Scenario**: 619 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, **2 CoWs are necessary**.<br>• **Baseline Scenario**: 2,406 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, **7 CoWs are necessary**.<br>• **High Scenario**: 5,041 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, **15 CoWs are necessary**.<br>Cell on Wheels can be installed during events, saving annual operational costs in terms of maintaining this infrastructure connected.<br>The deployment of COWs by operators is specific to the respective operator (e.g., a COW implemented by Telstra is only accessible to Telstra mobile network users).<br>The cost of this infrastructure is performed only one time, and the option of renting them is also available:<br>• Acquisition Cost (per unit): **$500,000**<br>• Rental Cost (per unit): **$30,000***<br>* Rental costs is indicative and requires a 3-4 month lead time with the provider | **Low Scenario**<br>Acquisition Cost: **$1,000,000**<br>Rental Cost*: **$60,000**<br>**Baseline Scenario**<br>Acquisition Cost: **$3,500,000**<br>Rental Cost: **$210,000**<br>**High Scenario**<br>Acquisition Cost: **$7,500,000**<br>Rental Cost: **$450,000** | **Low Scenario**<br>✓<br>**Baseline Scenario**<br>✗<br>**High Scenario**<br>✗ |

# Case Study 1: Pokolbin, Cessnock – Other Technology Options

## (20,000 visitor peak demand at Hope Estate)

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for the Pokolbin region in the case of 20,000 visitors.

### Other Technology Options

**1 - Analysis (2030):**

**Low Scenario**
- Total Devices - **71,734**
- Visitor Devices - **58,000**
- As-Is %RAN Capacity - **116.8%**
- No. of Devices exceeding the network capacity - **10,318**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **10,318 * 20% * 30% = 619**

**Baseline Scenario**
- Total Devices - **102,748**
- Visitor Devices - **83,000**
- As-Is %RAN Capacity - **164.0%**
- No. of Devices exceeding the network capacity - **40,097**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **40,097 * 20% * 30% = 2,406**

**High Scenario**
- Total Devices - **146,667**
- Visitor Devices - **118,400**
- As-Is %RAN Capacity - **234.1%**
- No. of Devices exceeding the network capacity - **84,016**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **84,016 * 20% * 30% = 5,041**

| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Cold Mobile Site | The **Cold Mobile Site is a pre-located site** that contains all passive infrastructure components. It is only activated during major events, requiring the installation of antennas and connections to power and backhaul. Therefore, the implementation costs associated with this solution are included in the Wireless Costing, excluding the costs related to **associated infrastructure**.<br><br>For this case study #1 (Pokolbin with a peak demand of 20,000 visitors), the projected need for 2030 is to implement:<br>• **Low Scenario:** 1 new mobile site without active infrastructure<br>• **Baseline Scenario:** 2 new mobile sites without active infrastructure<br>• **High Scenario:** 4 new mobile sites without active infrastructure | **Low Scenario**<br>Min: $560,856<br>Max: $721,351<br><br>**Baseline Scenario**<br>Min: $747,808<br>Max: $961,801<br><br>**High Scenario**<br>Min: $1,495,616<br>Max: $1,923,603 | **Low Scenario**<br>✓<br><br>**Baseline Scenario**<br>✓<br><br>**High Scenario**<br>✓ |
| Private 5G | The deployment of a **private wireless solution based on 5G** is a technology option to adopt in **events and specific zones** where a significant demand is expected. This solution, being **private, allows only selected devices in the region of Pokolbin to access the network**, with **capabilities designed according to the expected demand.**<br><br>The estimation of the number of access points depends on various factors. However, it is reasonable to assume that, given the forecast of the expected demand for the event/region and the dedicated spectrum, each access point (AP) can support an average of 100 devices. Therefore, the following number of access points would be necessary for the three scenarios:<br>• **Low Scenario:** 619 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **7 APs are necessary** (Small Site)<br>• **Baseline Scenario:** 2,406 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **25 APs are necessary**. (Small Site)<br>• **High Scenario:** 5,041 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **51 APs are necessary**. (Medium Site) | **Low Scenario**<br>Min: $976,000<br>Max: $987,000<br><br>**Baseline Scenario**<br>Min: $1,478,000<br>Max: $1,522,000<br><br>**High Scenario**<br>Min: $1,530,000<br>Max: $1,574,000 | **Low Scenario**<br>✓<br><br>**Baseline Scenario**<br>✓<br><br>**High Scenario**<br>✓ |

# Case Study 1: Pokolbin, Cessnock – Other Technology Options

## (20,000 visitor peak demand at Hope Estate)

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for the Pokolbin region in the case of 20,000 visitors.

### Other Technology Options

**1 - Analysis (2030):**

**Low Scenario**

- Total Devices - **71,734**
- Visitor Devices - **58,000**
- As-Is %RAN Capacity - **116.8%**
- No. of Devices exceeding the network capacity - **10,318**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **10,318 * 20% * 30% = 619**

**Baseline Scenario**

- Total Devices - **102,748**
- Visitor Devices - **83,000**
- As-Is %RAN Capacity - **164.0%**
- No. of Devices exceeding the network capacity - **40,097**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **40,097 * 20% * 30% = 2,406**

**High Scenario**

- Total Devices - **146,667**
- Visitor Devices - **118,400**
- As-Is %RAN Capacity - **234.1%**
- No. of Devices exceeding the network capacity - **84,016**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **84,016 * 20% * 30% = 5,041**

| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Private Wi-Fi | The deployment of a **private Wi-Fi-based solution** is another option to consider, especially in **closed/concentrated areas** such as **Cedar Mill Venue in Morisset**. This solution, similar to those used in airports, shopping malls, being private, allows for greater control of usage and definition of **network capabilities** according to expected demand and the number of users accessing the network.<br><br>A Wi-Fi-based solution requires the installation of **Wi-Fi access points or kiosks** throughout the **venue/building**, and in contrast to a private wireless network based on 5G, it does not offer as high speeds but is also a more **easily installed solution** operating on **unlicensed spectrum**. Additionally, since it is Wi-Fi-based, this solution requires **users to register/connect their devices to the respective Wi-Fi network**.<br><br>This solution is only adaptable in situations where a network core is already installed, allowing for the installation of access points and access switches. In the event of an existing network core and the presence of Wi-Fi only, a **simple chip upgrade is required to convert Wi-Fi 5 terminals to Wi-Fi 6, without the need to alter the architectural design.**<br><br>Therefore, the following number of access points would be necessary for the three scenarios<br>• **Low Scenario:** 619 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **7 APs are necessary** (Small Site)<br>• **Baseline Scenario:** 2,406 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **25 APs are necessary**. (Small Site)<br>• **High Scenario:** 5,041 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **51 APs are necessary**. (Medium Site)<br><br>For the costs associated with deploying a private Wi-Fi solution, only the Access Points and Access Switches are considered, as it is assumed that the core already exists. | **Low Scenario**<br>Min: $36,000<br>Max: $47,000<br><br>**Baseline Scenario**<br>Min: $72,000<br>Max: $83,000<br><br>**High Scenario**<br>Min: $190,000<br>Max: $234,000 | **Low Scenario**<br>✓<br><br>**Baseline Scenario**<br>✓<br><br>**High Scenario**<br>✓ |

# Case Study 2: Pokolbin, Cessnock - Wireless Summarisation

## (62,000 visitor peak demand)

Below, the As-Is and Future State in terms of RAN Capacity (Downlink, Uplink, Simultaneous Active Devices) for the different scenarios are represented in a peak demand case of 62,000 visitors at a SuperCars Event in Pokolbin.

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 186,537
- **2025:** 187,896
- **2030:** 193,534

Current Number of Sites: **(10)**

- **4G co-located with 5G**: 1
- **Urban Sites:** 0
- **Rural Sites:** 9

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 82,4% | 76,0% | 96,5% |
| 2025 | 83,0% | 76,5% | 97,2% |
| 2030 | 85,5% | 78,8% | 100,1% |

- Necessary increase of the network capacity in 2030.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 82,4% | 76,0% | 96,5% |
| 2025 | 83,0% | 76,5% | 97,2% |
| 2030 | 70,0% | 65,2% | 88,5% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of one new mobile site
- **Total Radio Sites by 2030**: 11

**Projected Costs:** $626,969 - $866,246

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 266,914
- **2025:** 268,872
- **2030:** 277,038

Current Number of Sites: **(10)**

- **4G co-located with 5G**: 1
- **Urban Sites:** 0
- **Rural Sites:** 9

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 117,9% | 108,7% | 138,1% |
| 2025 | 118,7% | 109,5% | 139,1% |
| 2030 | 122,3% | 112,8% | 143,3% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 70,9% | 66,7% | 99,1% |
| 2025 | 71,4% | 67,2% | 99,8% |
| 2030 | 65,0% | 61,4% | 94,0% |

- **Until 2025**: Installation of three new mobile sites
- **2025-2030**: Installation of one new mobile site
- **Total Radio Sites by 2030**: 14

**Projected Costs:** $1,671,917 - $2,309,989

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 380,759
- **2025:** 383,581
- **2030:** 395,307

Current Number of Sites: **(10)**

- **4G co-located with 5G**: 1
- **Urban Sites:** 0
- **Rural Sites:** 9

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 168,1% | 155,0% | 196,9% |
| 2025 | 169,4% | 156,2% | 198,4% |
| 2030 | 174,6% | 161,0% | 204,5% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 60,8% | 57,9% | 96,2% |
| 2025 | 61,2% | 58,4% | 96,9% |
| 2030 | 63,1% | 60,1% | 99,8% |

- **Until 2025**: Installation of eight new mobile sites
- **2025-2030**: No need of installation of new mobile sites
- **Total Radio Sites by 2030**: 18

**Projected Costs:** $3,343,835 - $4,619,979

# Case Study 2: Pokolbin, Cessnock - Wireless Simulated Capacity

## (62,000 visitor peak demand)

In the table below, the capacity status for the Pokolbin suburb under a low demand scenario conditions and a peak demand of 62,000 visitors is presented.

### Low Scenario

#### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 186,537
- **2025:** 187,896
- **2030:** 193,534

Visitor Peak Demand: **62,000 Visitors** (Supercars Event)

Current Number of Sites: **(10)**

- **4G co-located with 5G:** 1
- **Urban Sites:** 0
- **Rural Sites:** 9

Busy(h) Traffic associated to Mobile Access Technologies:

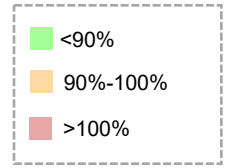
- **30%***

Urban vs Rural Split:

- **Urban** - 0%
- **Rural** - 100%

#### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 82,4% | 76,0% | 96,5% |
| 2025 | 83,0% | 76,5% | 97,2% |
| 2030 | 85,5% | 78,8% | 100,1% |




- After running the model for the Pokolbin suburb in case of a major event with 62,000 visitors it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

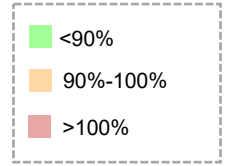
#### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030 -** Installation of **one new mobile base station between 2025 and 2030**, resulting in a total of **11 radio mobile sites** in the Pokolbin.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 82,4% | 76,0% | 96,5% |
| 2025 | 83,0% | 76,5% | 97,2% |
| 2030 | 70,0% | 65,2% | 88,5% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 2: Pokolbin, Cessnock - Wireless Simulated Capacity

## (62,000 visitor peak demand)

In the table below, the capacity status for the Pokolbin suburb under a baseline demand scenario conditions and a peak demand of 62,000 visitors is presented.

### Baseline Scenario

#### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 266,914
- **2025:** 268,872
- **2030:** 277,038

Visitor Peak Demand: **62,000 Visitors** (Supercars Event)

Current Number of Sites: **(10)**

- **4G co-located with 5G:** 1
- **Urban Sites:** 0
- **Rural Sites:** 9

Busy(h) Traffic associated to Mobile Access Technologies:

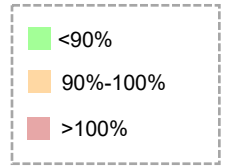
- **30%***

Urban vs Rural Split:

- **Urban** - 0%
- **Rural** - 100%

#### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 117,9% | 108,7% | 138,1% |
| 2025 | 118,7% | 109,5% | 139,1% |
| 2030 | 122,3% | 112,8% | 143,3% |




- After running the model for the Pokolbin suburb in case of a major event with 62,000 visitors, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

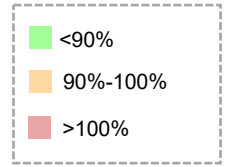
#### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **three new mobile base station until 2025** that will support the demand for Pokolbin region in case of a major event with 62,000 visitors.
- **2030 -** Installation of **one new mobile base station between 2025 and 2030**, resulting in a total of **14 radio mobile sites** in the Pokolbin.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 70,9% | 66,7% | 99,1% |
| 2025 | 71,4% | 67,2% | 99,8% |
| 2030 | 65,0% | 61,4% | 94,0% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 2: Pokolbin, Cessnock - Wireless Simulated Capacity

## (62,000 visitor peak demand)

In the table below, the capacity status for the Pokolbin suburb under an high demand scenario conditions and a peak demand of 62,000 visitors is presented.

### High Scenario

#### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 380,759
- **2025:** 383,581
- **2030:** 395,307

Visitor Peak Demand: **62,000 Visitors** (Supercars Event)

Current Number of Sites: **(10)**

- **4G co-located with 5G:** 1
- **Urban Sites:** 0
- **Rural Sites:** 9

Busy(h) Traffic associated to Mobile Access Technologies:

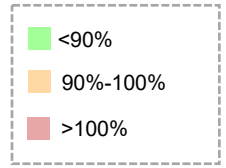
- **30%***

Urban vs Rural Split:

- **Urban** - 0%
- **Rural** - 100%

#### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 168,1% | 155,0% | 196,9% |
| 2025 | 169,4% | 156,2% | 198,4% |
| 2030 | 174,6% | 161,0% | 204,5% |




- After running the model for the Pokolbin suburb in case of a major event with 62,000 visitors, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

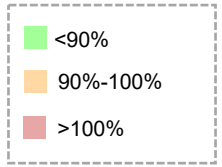
#### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **eight new mobile base station until 2025** that will support the demand for Pokolbin region in case of a major event with 62,000 visitors.
- **2030 -** No need to install new mobile sites, **as the eight mobile sites installed by 2025 support** the demand in **2030**.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 60,8% | 57,9% | 96,2% |
| 2025 | 61,2% | 58,4% | 96,9% |
| 2030 | 63,1% | 60,1% | 99,8% |




*__Important Note:__ While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 2: Pokolbin, Cessnock - Wireless Simulated Capacity

## (62,000 visitor peak demand)

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for the Pokolbin region in the case of 62,000 visitors.

### Other Technology Options

**1 - Analysis (2030):**

**Low Scenario**
- Total Devices - **193,534**
- Visitor Devices - **179,800**
- As-Is %RAN Capacity - **100.1%**
- No. of Devices exceeding the network capacity - **193**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%)**: 193 * 20% * 30% = 11**

**Baseline Scenario**
- Total Devices - **277,038**
- Visitor Devices - **257,290**
- As-Is %RAN Capacity - **143.3%**
- No. of Devices exceeding the network capacity - **83,710**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%)**: 83,710 * 20% * 30% = 5,022**

**High Scenario**
- Total Devices - **395,307**
- Visitor Devices - **367,040**
- As-Is %RAN Capacity - **204.5%**
- No. of Devices exceeding the network capacity - **202,002**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%)**: 202,002 * 20% * 30% = 12,120**

| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Cell on Wheels | **Cell on Wheels (CoW) are temporary infrastructures** that provide mobile coverage and capacity, supporting an average of up to **350 devices simultaneously**. Therefore, in each of the following scenarios, and to accommodate exceeding network devices, the required number of CoWs (independent of the operator) are:<br>• **Low Scenario**: 11 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, 1 **CoWs are necessary**.<br>• **Baseline Scenario**: 5,022 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, 15 **CoWs are necessary**.<br>• **High Scenario**: 12,120 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, 35 **CoWs are necessary**.<br>Cell on Wheels can be installed during events, saving annual operational costs in terms of maintaining this infrastructure connected.<br>The deployment of COWs by operators is specific to the respective operator (e.g., a COW implemented by Telstra is only accessible to Telstra mobile network users).<br>The cost of this infrastructure is performed only one time, and the option of renting them is also available:<br>• Acquisition Cost (per unit): **$500,000**<br>• Rental Cost (per unit): **$30,000***<br>*Rental Costs provided by Telstra | **Low Scenario**<br>Acquisition Cost: **$500,000**<br>Rental Cost: **$30,000**<br>**Baseline Scenario**<br>Acquisition Cost: **$7,500,000**<br>Rental Cost: **$450,000**<br>**High Scenario**<br>Acquisition Cost: **$17,500,000**<br>Rental Cost: **$1,050,000** | **Low Scenario** ✓<br>**Baseline Scenario** ✗<br>**High Scenario** ✗ |

# Case Study 2: Pokolbin, Cessnock - Wireless Simulated Capacity

## (62,000 visitor peak demand)

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for the Pokolbin region in the case of 62,000 visitors.

### Other Technology Options

**1 - Analysis (2030):**

**Low Scenario**
- Total Devices - **193,534**
- Visitor Devices - **179,800**
- As-Is %RAN Capacity - **100.1%**
- No. of Devices exceeding the network capacity - **193**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%)**: 193 * 20% * 30% = 11**

**Baseline Scenario**
- Total Devices - **277,038**
- Visitor Devices - **257,290**
- As-Is %RAN Capacity - **143.3%**
- No. of Devices exceeding the network capacity - **83,710**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%)**: 83,710 * 20% * 30% = 5,022**

**High Scenario**
- Total Devices - **395,307**
- Visitor Devices - **367,040**
- As-Is %RAN Capacity - **204.5%**
- No. of Devices exceeding the network capacity - **202,002**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%)**: 202,002 * 20% * 30% = 12,120**

| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Cold Mobile Site | The **Cold Mobile Site is a pre-located site** that contains all passive infrastructure components. It is only activated during major events, requiring the installation of antennas and connections to power and backhaul. Therefore, the implementation costs associated with this solution are included in the Wireless Costing, excluding the costs related to **associated infrastructure**.<br><br>For this case study #2 (Pokolbin with a peak demand of 62,000 visitors), the projected need for 2030 is to implement:<br>• **Low Scenario:** 1 new mobile site without active infrastructure<br>• **Baseline Scenario:** 4 new mobile sites without active infrastructure<br>• **High Scenario:** 8 new mobile sites without active infrastructure | **Low Scenario**<br>Min: $560,856<br>Max: $721,351<br><br>**Baseline Scenario**<br>Min: $1,495,616<br>Max: $1,923,603<br><br>**High Scenario**<br>Min: $2,991,232<br>Max: $3,847,205 | **Low Scenario**<br>✓<br><br>**Baseline Scenario**<br>✓<br><br>**High Scenario**<br>✓ |
| Private 5G | The deployment of a **private wireless solution based on 5G** is a technology option to adopt in **events and specific zones** where a significant demand is expected. This solution, being **private, allows only selected devices in the region of Pokolbin to access the network**, with **capabilities designed according to the expected demand**<br><br>The estimation of the number of access points depends on various factors. However, it is reasonable to assume that, given the forecast of the expected demand for the event/region and the dedicated spectrum, each access point (AP) can support an average of 100 devices. Therefore, the following number of access points would be necessary for the three scenarios<br>• **Low Scenario:** 193 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **2 APs are necessary** (Small Site)<br>• **Baseline Scenario:** 5,022 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **51 APs are necessary**. (Medium Site)<br>• **High Scenario:** 12,120 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **122 APs are necessary**. (Large Site) | **Low Scenario**<br>Min: $966,000<br>Max: $977,000<br><br>**Baseline Scenario**<br>Min: $1,530,000<br>Max: $1,574,000<br><br>**High Scenario**<br>Min: $2,604,000<br>Max: $2,844,000 | **Low Scenario**<br>✓<br><br>**Baseline Scenario**<br>✓<br><br>**High Scenario**<br>✓ |

# Case Study 3: Cedar Mill (Morisset) - Region Characterisation

The below tables summarise all the data such as population, demographics, number of devices, visitor peak demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Morisset suburb.

## Population and Demographic Aspects

| Total Area |
|---|
| 27.1 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 91.5% |
| Rural | 8.5% |

| Total Population | |
|---|---|
| 2023 | 4,157 |
| 2025 | 4,285 |
| 2030 | 4,567 |

## Visitor Demand

| Major Event | Estimated Number of Visitors |
|---|---|
| Cedar Mill Venue | 30,000 |

## Main Assumptions

- Peak visitors of 30,000 is based on the venue capacity for Cedar Mill.
- To obtain the total number of devices for industrial sectors, the industry employment rate for the Cessnock region was used.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 642 | 864 | 1,815 |
| Utilities | 300 | 403 | 847 |
| Construction | 2,398 | 3,227 | 6,777 |
| Manufacturing | 1,242 | 1,671 | 3,510 |
| Wholesale and Retail Trade | 2,484 | 3,342 | 7,019 |
| Transportation & Warehousing | 814 | 1,095 | 2,299 |
| Finance, Insurance, Real Estate, Rental & Leasing | 963 | 1,296 | 2,723 |
| Professional, Scientific & Technical Services | 1,220 | 1,642 | 3,449 |
| Business, Building & other support services | 664 | 893 | 1,876 |
| Educational services | 1,970 | 2,650 | 5,567 |
| Health care and social assistance | 4,089 | 5,503 | 11,557 |
| Arts, Information, Culture & Recreation | 385 | 519 | 1,089 |
| Accommodation and food services | 1,349 | 1,815 | 3,812 |
| Other services (excluding public administration) | 878 | 1,181 | 2,481 |
| Public administration | 1,199 | 1,613 | 3,389 |
| Households & Consumer Goods (Individual Devices) | 16,923 | 17,456 | 18,862 |
| Cedar Mill - Visitor Demand (Visitor Devices) | 124,500 | 124,500 | 124,500 |

# Case Study 3: Cedar Mill (Morisset) - Technology Review

The detailed analysis of the number of sites, types of radio technology, and the evaluation of the NBN network offer insights into the current telecommunications maturity of a suburb, enabling the identification of potential gaps. This represents the current status for the suburb of Morisset, located in the Lake Macquarie region.

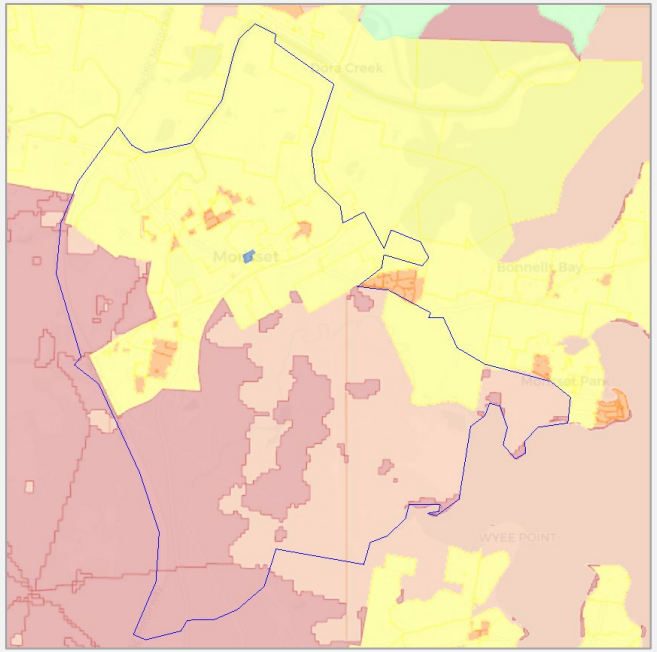
## Existing Radio Mobile Sites


- The suburb of Morisset, where Cedar Mill is planned, currently has a total of 5 mobile radio sites (2 from Telstra, 2 from Optus, and 1 from TPG). Analysing the coverage maps of the three operators, there are no connectivity gaps or coverage issues for this suburb.
- Regarding 5G coverage, it is available throughout the residential and areas with industrial and commercial activity.

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 2 | 2 | 2 | 2 |
| Optus | 2 | 2 | 2 | 1 |
| TPG | 1 | 1 | 1 | 1 |

**Note:** Some radio sites from different operators may be co-located on the same tower and may not be visible in the image above.

## NBN Technology Types



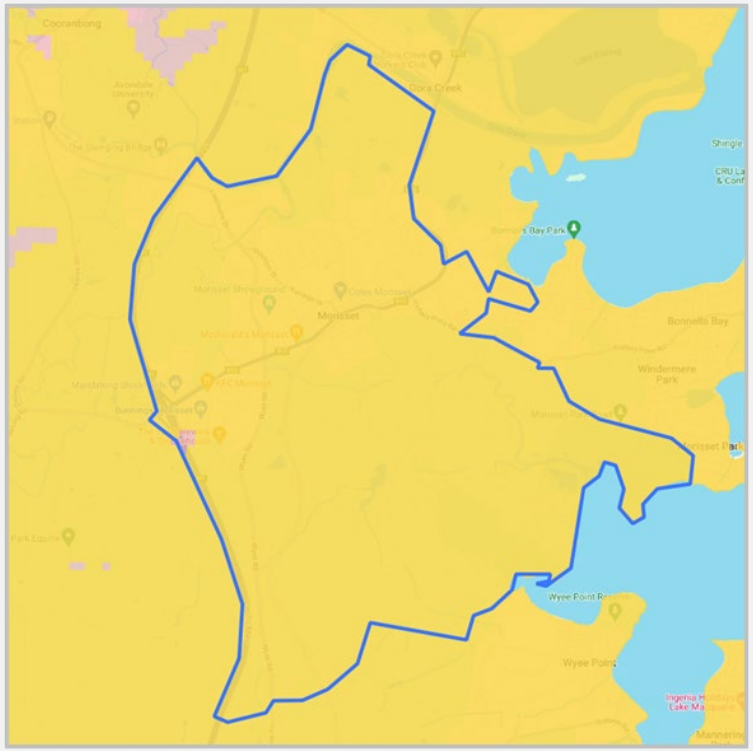

- In the image above, the coverage of NBN services in the Morisset suburb is illustrated. Fibre-to-the-premises is available in residential zones, while other densely populated and industrial areas are served by fibre-to-the-building and fibre-to-the-node. In the more remote, forested zone, coverage is ensured through fixed wireless and satellite technologies

# Case Study 3: Cedar Mill (Morisset) - Technology Review

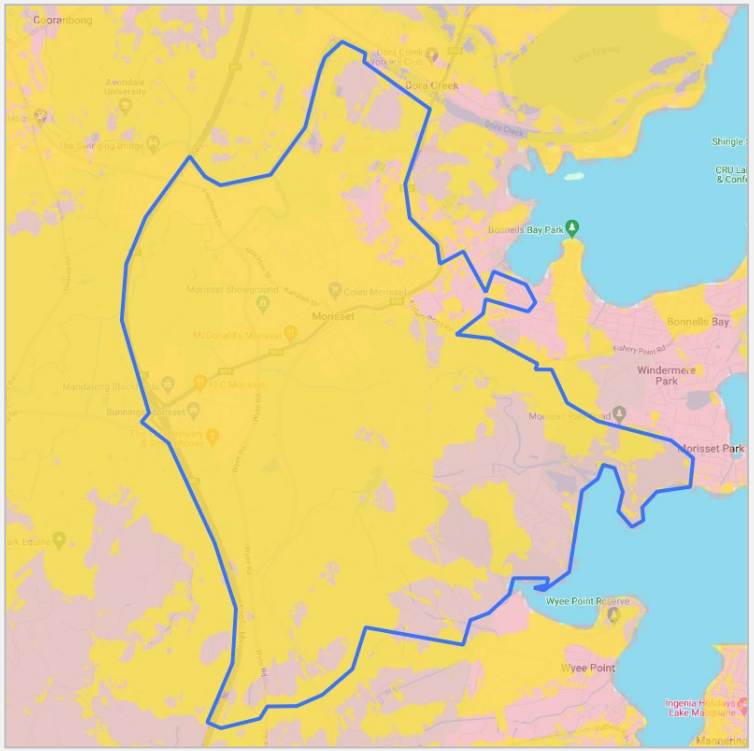
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

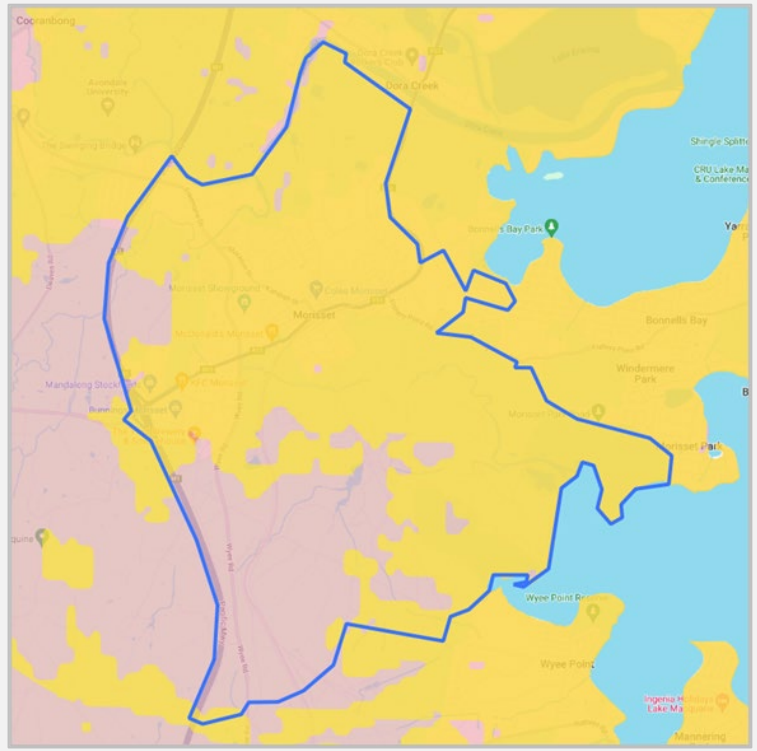
### Telstra Mobile Coverage




### Optus Mobile Coverage




### TPG Mobile Coverage




4G 5G

**Sources:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Case Study 3: Cedar Mill (Morisset) - Wireless Summarisation

Below, the As-Is and Future State in terms of RAN Capacity (Downlink, Uplink, Simultaneous Active Devices) for the different scenarios are represented in a peak demand case of 30,000 visitors event at the Morisset suburb.

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 113,265
- **2025:** 118,584
- **2030:** 140,816

Current Number of Sites: **(5)**

- **4G co-located with 5G**: 4
- **Urban Sites:** 1
- **Rural Sites:** 0

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 57.6% | 57.6% | 86.5% |
| 2025 | 60.3% | 60.3% | 90.6% |
| 2030 | 71.6% | 71.6% | 107.6% |

- Necessary increase of the network capacity in 2030.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 57.6% | 57.6% | 86.5% |
| 2025 | 60.3% | 60.3% | 90.6% |
| 2030 | 58.5% | 58.8% | 88.8% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of one new mobile site
- **Total Radio Sites by 2030**: 6

**Projected Costs:** $552,441 - $840,269

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 162,020
- **2025:** 169,671
- **2030:** 201,573

Current Number of Sites: **(5)**

- **4G co-located with 5G**: 4
- **Urban Sites:** 1
- **Rural Sites:** 0

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 74.2% | 74.2% | 111.5% |
| 2025 | 77.7% | 77.7% | 116.8% |
| 2030 | 92.4% | 92.4% | 138.7% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 60.7% | 60.9% | 92.1% |
| 2025 | 63.5% | 63.8% | 96.4% |
| 2030 | 63.8% | 64.3% | 97.5% |

- **Until 2025**: Installation of one new mobile site
- **2025-2030**: Installation of one new mobile site
- **Total Radio Sites by 2030**: 7

**Projected Costs:** $736,588 - $1,120,359

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 231,085
- **2025:** 242,110
- **2030:** 287,919

Current Number of Sites: **(5)**

- **4G co-located with 5G**: 4
- **Urban Sites:** 1
- **Rural Sites:** 0

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 105.9% | 105.9% | 159.0% |
| 2025 | 110.9% | 110.9% | 166.6% |
| 2030 | 131.9% | 131.9% | 198.1% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 55.9% | 56.5% | 86.2% |
| 2025 | 58.6% | 59.2% | 90.3% |
| 2030 | 62.3% | 63.1% | 96.4% |

- **Until 2025**: Installation of four new mobile sites
- **2025-2030**: Installation of one new mobile site
- **Total Radio Sites by 2030**: 10

**Projected Costs:** $1,657,323 - $3,080,986

# Case Study 3: Cedar Mill (Morisset) - Wireless Simulated Capacity

In the table below, the capacity status for the Morisset suburb under a low demand scenario conditions and a peak demand of 30,000 visitors is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 113,265
- **2025:** 118,584
- **2030:** 140,816

Visitor Peak Demand: **30,000 Visitors** (Cedar Mill Venus)

Current Number of Sites: **(5)**

- **4G co-located with 5G:** 4
- **Urban Sites:** 1
- **Rural Sites:** 0

Busy(h) Traffic associated to Mobile Access Technologies:

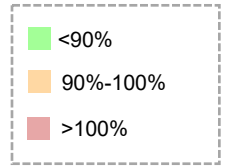
- **30%***

Urban vs Rural Split:

- **Urban** - 91.5%
- **Rural** - 8.5%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 57.6% | 57.6% | 86.5% |
| 2025 | 60.3% | 60.3% | 90.6% |
| 2030 | 71.6% | 71.6% | 107.6% |




- After running the model for the Morisset suburb in case of a major event with 30,000 visitors it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

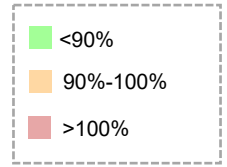
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030 -** Installation of **one new mobile base station between 2025 and 2030**, resulting in a total of **6 radio mobile sites** in the Morisset suburb.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 57.6% | 57.6% | 86.5% |
| 2025 | 60.3% | 60.3% | 90.6% |
| 2030 | 58.5% | 58.8% | 88.8% |




*__Important Note:__ While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 3: Cedar Mill (Morisset) - Wireless Simulated Capacity

In the table below, the capacity status for the Morisset suburb under a baseline demand scenario conditions and a peak demand of 30,000 visitors is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 162,020
- **2025:** 169,671
- **2030:** 201,573

Visitor Peak Demand: **30,000 Visitors** (Cedar Mill Venus)

Current Number of Sites: **(5)**

- **4G co-located with 5G:** 4
- **Urban Sites:** 1
- **Rural Sites:** 0

Busy(h) Traffic associated to Mobile Access Technologies:

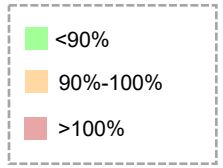
- **30%***

Urban vs Rural Split:

- **Urban** - 91.5%
- **Rural** - 8.5%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 74.2% | 74.2% | 111.5% |
| 2025 | 77.7% | 77.7% | 116.8% |
| 2030 | 92.4% | 92.4% | 138.7% |




- After running the model for the Morisset suburb in case of a major event with 30,000 visitors, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

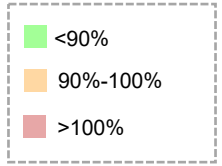
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **one new mobile base station until 2025** that will support the demand for the Morisset suburb in case of a major event with 30,000 visitors.
- **2030 -** Installation of **one new mobile base station between 2025 and 2030**, resulting in a total of **7 radio mobile sites** in the Morisset suburb.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 60.7% | 60.9% | 92.1% |
| 2025 | 63.5% | 63.8% | 96.4% |
| 2030 | 63.8% | 64.3% | 97.5% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 3: Cedar Mill (Morisset) - Wireless Simulated Capacity

In the table below, the capacity status for the Morisset suburb under a high demand scenario conditions and a peak demand of 30,000 visitors is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 231,085
- **2025:** 242,110
- **2030:** 287,919

Visitor Peak Demand: **30,000 Visitors** (Cedar Mill Venus)

Current Number of Sites: **(5)**

- **4G co-located with 5G:** 4
- **Urban Sites:** 1
- **Rural Sites:** 0

Busy(h) Traffic associated to Mobile Access Technologies:

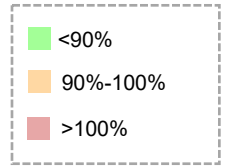
- **30%***

Urban vs Rural Split:

- **Urban** - 91.5%
- **Rural** - 8.5%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 105.9% | 105.9% | 159.0% |
| 2025 | 110.9% | 110.9% | 166.6% |
| 2030 | 131.9% | 131.9% | 198.1% |




- After running the model for the Morisset suburb in case of a major event with 30,000 visitors, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

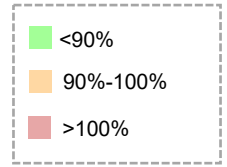
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **four new mobile base station until 2025** that will support the demand for Morisset suburb in case of a major event with 30,000 visitors.
- **2030 -** Installation of **one new mobile base station between 2025 and 2030**, resulting in a total of **10 radio mobile sites** in the Morisset suburb.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 55.9% | 56.5% | 86.2% |
| 2025 | 58.6% | 59.2% | 90.3% |
| 2030 | 62.3% | 63.1% | 96.4% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 3: Cedar Mill (Morisset) - Other Technology Options

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for the Morisset (Cedar Mill) region in the case of 30,000 visitors.

## Other Technology Options

**1 - Analysis (2030):**

**Low Scenario**
- Total Devices - **140,816**
- Visitor Devices - **87,000**
- As-Is %RAN Capacity - **107.6%**
- No. of Devices exceeding the network capacity - **9,946**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **9,946 * 20% * 30% = 596**

**Baseline Scenario**
- Total Devices - **201,573**
- Visitor Devices - **124,500**
- As-Is %RAN Capacity - **138.7%**
- No. of Devices exceeding the network capacity - **56,242**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **56,242 * 20% * 30% =3,374**

**High Scenario**
- Total Devices - **287,919**
- Visitor Devices - **177,600**
- As-Is %RAN Capacity - **198.1%**
- No. of Devices exceeding the network capacity - **142,578**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **142,578 * 20% * 30% = 8,554**

| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Cell on Wheels | **Cell on Wheels (CoW) are temporary infrastructures** that provide mobile coverage and capacity, supporting an average of up to **350 devices simultaneously**. Therefore, in each of the following scenarios, and to accommodate exceeding network devices, the required number of CoWs (independent of the operator) are:<br>• **Low Scenario**: 596 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, **2 CoWs are necessary**.<br>• **Baseline Scenario**: 3,374 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, 10 **CoWs are necessary**.<br>• **High Scenario**: 8,554 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, 2**5 CoWs are necessary**.<br>Cell on Wheels can be installed during events, saving annual operational costs in terms of maintaining this infrastructure connected.<br>The deployment of COWs by operators is specific to the respective operator (e.g., a COW implemented by Telstra is only accessible to Telstra mobile network users).<br>The cost of this infrastructure is performed only one time, and the option of renting them is also available:<br>• Acquisition Cost (per unit): **$500,000**<br>• Rental Cost (per unit): **$30,000***<br>*Rental Costs provided by Telstra | **Low Scenario**<br>Acquisition Cost: **$1,000,000**<br>Rental Cost: **$60,000**<br>**Baseline Scenario**<br>Acquisition Cost: **$5,000,000**<br>Rental Cost: **$300,000**<br>**High Scenario**<br>Acquisition Cost: **$12,500,000**<br>Rental Cost: **$750,000** | **Low Scenario**<br>✓<br>**Baseline Scenario**<br>✗<br>**High Scenario**<br>✗ |

# Case Study 3: Cedar Mill (Morisset) - Other Technology Options

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for the Morisset (Cedar Mill) region in the case of 30,000 visitors.

## Other Technology Options

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| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Cold Mobile Site | The **Cold Mobile Site is a pre-located site** that contains all passive infrastructure components. It is only activated during major events, requiring the installation of antennas and connections to power and backhaul. Therefore, the implementation costs associated with this solution are included in the Wireless Costing, excluding the costs related to **associated infrastructure**.<br><br>For this case study #3 (Cedar Mill in Morisset with a peak demand of 30,000 visitors), the projected need for 2030 is to implement:<br>• **Low Scenario:** 1 new mobile site without active infrastructure<br>• **Baseline Scenario:** 2 new mobile sites without active infrastructure<br>• **High Scenario:** 5 new mobile sites without active infrastructure | **Low Scenario**<br>Min: $286,164<br>Max: $754,999<br><br>**Baseline Scenario**<br>Min: $381,552<br>Max: $1,006,665<br><br>**High Scenario**<br>Min: $858,492<br>Max: $2,768,330 | **Low Scenario**<br><br>**Baseline Scenario**<br><br>**High Scenario** |
| Private 5G | The deployment of a **private wireless solution based on 5G** is a technology option to adopt in **events and specific zones** where a significant demand is expected. This solution, being **private, allows only selected devices in the region of Morisset (Cedar Mill) to access the network**, with **capabilities designed according to the expected demand**<br><br>The estimation of the number of access points depends on various factors. However, it is reasonable to assume that, given the forecast of the expected demand for the event/region and the dedicated spectrum, each access point (AP) can support an average of 100 devices. Therefore, the following number of access points would be necessary for the three scenarios<br>• **Low Scenario:** 596 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **6 APs are necessary** (Small Site)<br>• **Baseline Scenario:** 3,374 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **34 APs are necessary**. (Medium Site)<br>• **High Scenario:** 8,554 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **86 APs are necessary**. (Medium Site) | **Low Scenario**<br>Min: $974,000<br>Max: $985,000<br><br>**Baseline Scenario**<br>Min: $1,496,000<br>Max: $1,540,000<br><br>**High Scenario**<br>Min: $1,600,000<br>Max: $1,644,000 | **Low Scenario**<br><br>**Baseline Scenario**<br><br>**High Scenario** |

# Case Study 3: Cedar Mill (Morisset) - Other Technology Options

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for the Morisset (Cedar Mill) region in the case of 30,000 visitors.

## Other Technology Options

**1 - Analysis (2030):**

**Low Scenario**
- Total Devices - **140,816**
- Visitor Devices - **87,000**
- As-Is %RAN Capacity - **107.6%**
- No. of Devices exceeding the network capacity - **9,946**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **9,946 * 20% * 30% = 596**

**Baseline Scenario**
- Total Devices - **201,573**
- Visitor Devices - **124,500**
- As-Is %RAN Capacity - **138.7%**
- No. of Devices exceeding the network capacity - **56,242**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **56,242 * 20% * 30% =3,374**

**High Scenario**
- Total Devices - **287,919**
- Visitor Devices - **177,600**
- As-Is %RAN Capacity - **198.1%**
- No. of Devices exceeding the network capacity - **142,578**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **142,578 * 20% * 30% = 8,554**

| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Private Wi-Fi | The deployment of a **private Wi-Fi-based solution** is another option to consider, especially in **closed/concentrated areas** such as **Cedar Mill Venue in Morisset**. This solution, similar to those used in airports, shopping malls, being private, allows for greater control of usage and definition of **network capabilities** according to expected demand and the number of users accessing the network.<br><br>A Wi-Fi-based solution requires the installation of **Wi-Fi access points or kiosks** throughout the **venue/building**, and in contrast to a private wireless network based on 5G, it does not offer as high speeds but is also a more **easily installed solution** operating on **unlicensed spectrum**. Additionally, since it is Wi-Fi-based, this solution requires **users to register/connect their devices to the respective Wi-Fi network**.<br><br>This solution is only adaptable in situations where a network core is already installed, allowing for the installation of access points and access switches. In the event of an existing network core and the presence of Wi-Fi only, a **simple chip upgrade is required to convert Wi-Fi 5 terminals to Wi-Fi 6, without the need to alter the architectural design.**<br><br>Therefore, the following number of access points would be necessary for the three scenarios<br>• **Low Scenario:** 596 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **6 APs are necessary** (Small Site)<br>• **Baseline Scenario:** 3,374 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **34 APs are necessary**. (Medium Site)<br>• **High Scenario:** 8,554 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **86 APs are necessary**. (Medium Site)<br><br>For the costs associated with deploying a private Wi-Fi solution, only the Access Points and Access Switches are considered, as it is assumed that the core already exists. | **Low Scenario**<br>Min: $34,000<br>Max: $45,000<br><br>**Baseline Scenario**<br>Min: $156,000<br>Max: $200,000<br><br>**High Scenario**<br>Min: $260,000<br>Max: $304,000 | **Low Scenario**<br><br>**Baseline Scenario**<br><br>**High Scenario** |

# Case Study 4: Nelson Bay/Shoal Bay - Other Technology Options

The below tables summarise all the data such as population, demographics, number of devices, visitor peak demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for the Nelson and Shoal Bay suburbs.

## Population and Demographic Aspects

| Total Area |
|---|
| 19.6 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 17.4% |
| Rural | 82.6% |

| Total Population | |
|---|---|
| 2023 | 8,109 |
| 2025 | 8,359 |
| 2030 | 8,909 |

## Visitor Demand

| Major Event | Estimated Number of Visitors |
|---|---|
| Food Event | 15,000 |

## Main Assumptions

- Peak visitors of 15,000 is based on a previous food event.
- To obtain the total number of devices for industrial sectors, the industry employment rate for the Port Stephens region was used.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 1,337 | 1,799 | 3,778 |
| Utilities | 418 | 562 | 1,181 |
| Construction | 4,511 | 6,070 | 12,750 |
| Manufacturing | 2,590 | 3,485 | 7,319 |
| Wholesale and Retail Trade | 5,012 | 6,745 | 14,166 |
| Transportation & Warehousing | 2,047 | 2,754 | 5,785 |
| Finance, Insurance, Real Estate, Rental & Leasing | 1,420 | 1,911 | 4,014 |
| Professional, Scientific & Technical Services | 2,172 | 2,923 | 6,139 |
| Business, Building & other support services | 1,587 | 2,136 | 4,486 |
| Educational services | 3,091 | 4,159 | 8,736 |
| Health care and social assistance | 6,057 | 8,150 | 17,118 |
| Arts, Information, Culture & Recreation | 710 | 956 | 2,007 |
| Accommodation and food services | 3,801 | 5,115 | 10,743 |
| Other services (excluding public administration) | 1,796 | 2,417 | 5,076 |
| Public administration | 3,509 | 4,721 | 9,916 |
| Households & Consumer Goods (Individual Devices) | 33,016 | 34,055 | 36,799 |
| Cedar Mill - Visitor Demand (Visitor Devices) | 62,250 | 62,250 | 62,250 |

# Case Study 4: Nelson Bay/Shoal Bay - Technology Review

The detailed analysis of the number of sites, types of radio technology, and the evaluation of the NBN network offer insights into the current telecommunications maturity of a suburb, enabling the identification of potential gaps. This represents the current status for the suburb of Nelson and Shoal Bay, located in the Port Stephens region.

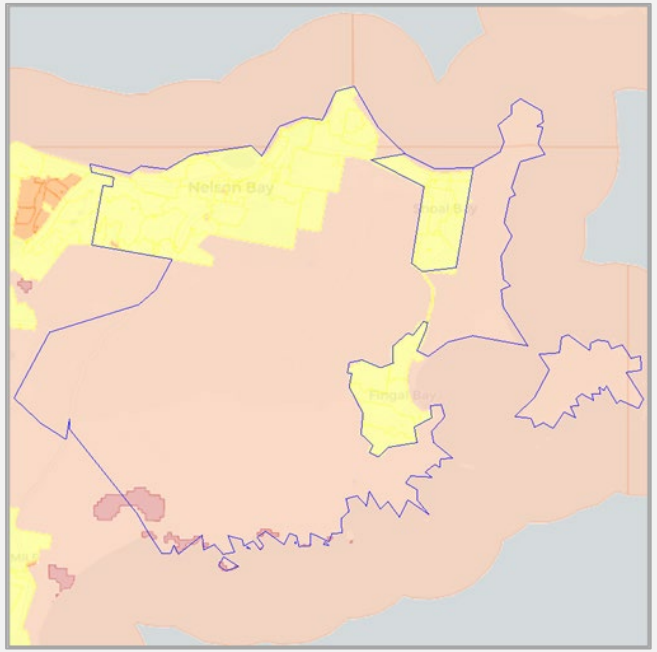
## Existing Radio Mobile Sites

- The Nelson and Shoal Bay area currently has a total of 7 mobile radio sites (2 from Telstra, 3 from Optus, and 2 from TPG). Analysing the coverage maps of the operators, there are no connectivity gaps for 3G and 4G technologies.
- Regarding 5G, out of the 7 sites, 3 provide access to this technology. While Nelson Bay has access to 5G, Shoal Bay is not covered by this technology. There is no base station in the area, and due to the proximity to the water, the radio signal strength may experience some attenuation.

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 2 | 2 | 2 | 1 |
| Optus | 3 | 2 | 3 | 1 |
| TPG | 2 | 2 | 2 | 1 |

**Note:** Some radio sites from different operators may be co-located on the same tower and may not be visible in the image above.

## NBN Technology Types



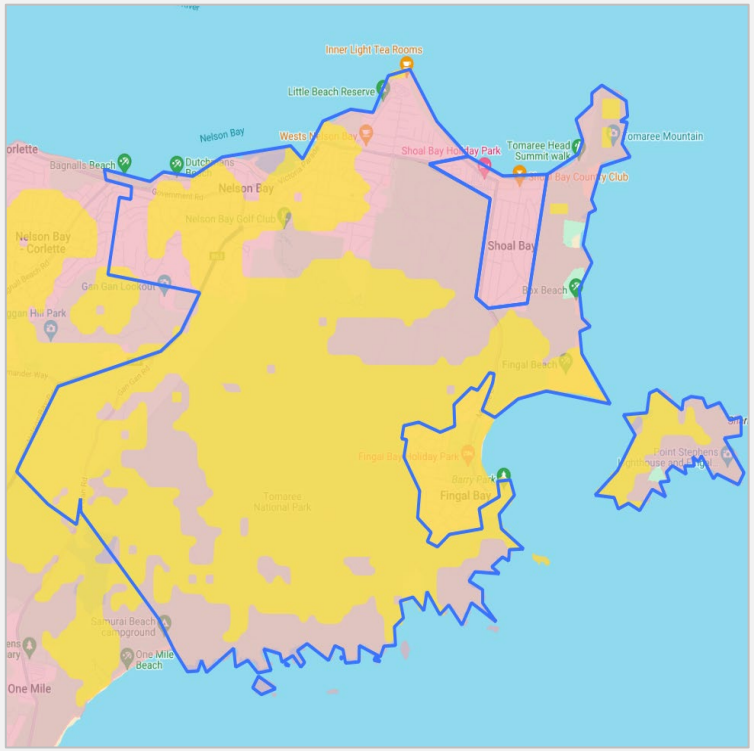

- The Nelson Bay and Shoal Bay area utilises four different types of technology to access NBN services. Fibre to the premises is selectively available in a very limited residential zone, whereas the broader populated region relies on fibre to the node. In remote, uninhabited areas, satellite technology is predominantly utilised for NBN access.

# Case Study 4: Nelson Bay/Shoal Bay - Technology Review

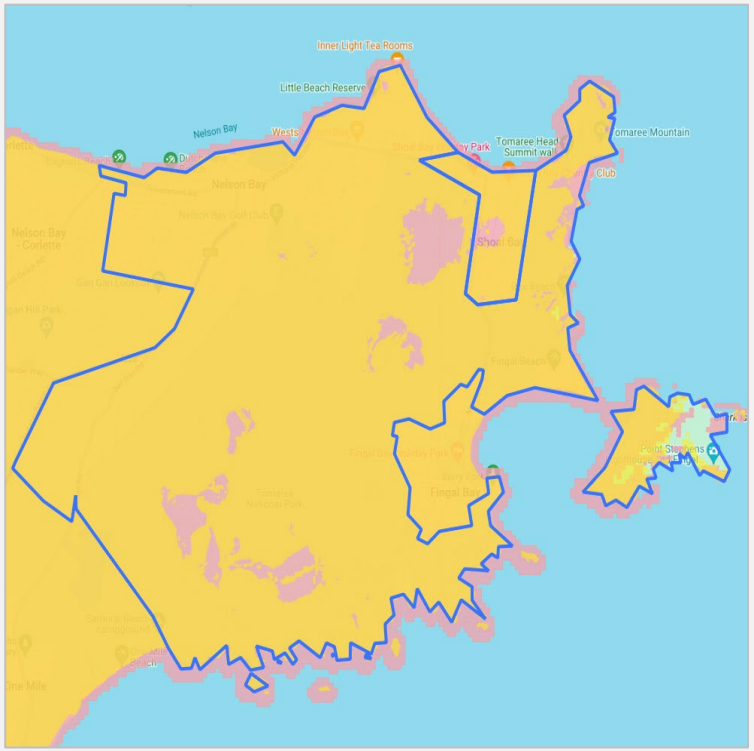
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

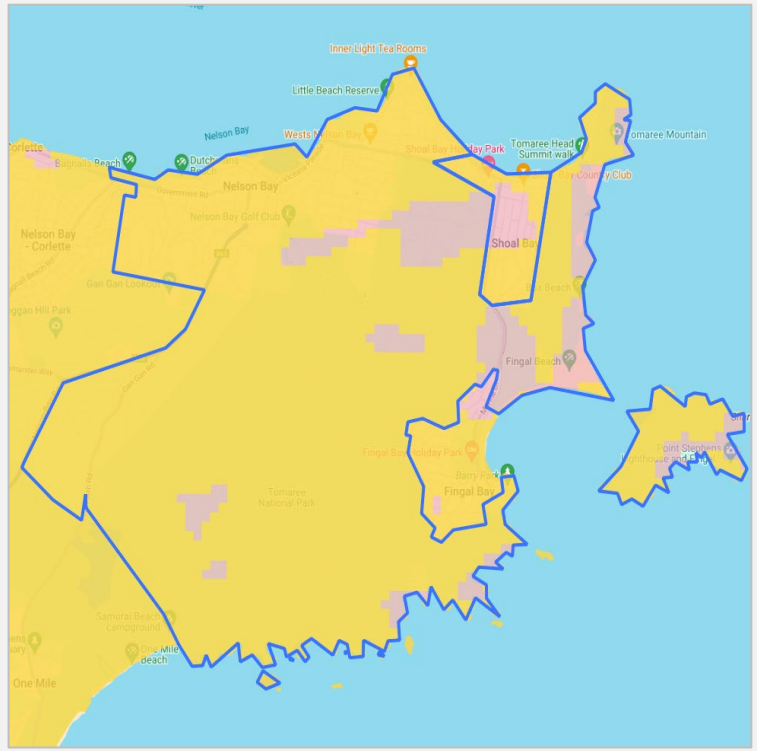
### Telstra Mobile Coverage




### Optus Mobile Coverage




### TPG Mobile Coverage




4G 5G

**Sources:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Case Study 4: Nelson Bay/Shoal Bay - Wireless Summarisation

Below, the As-Is and Future State in terms of RAN Capacity (Downlink, Uplink, Simultaneous Active Devices) for the different scenarios are represented in a peak demand case of 15,000 visitors event at Nelson and Shoal Bay suburbs.

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 94,652
- **2025:** 105,000
- **2030:** 148,246

Current Number of Sites: **(7)**

- **4G co-located with 5G**: 2
- **Urban Sites:** 1
- **Rural Sites:** 4

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 80.0% | 76.3% | 69.6% |
| 2025 | 85.5% | 81.7% | 77.2% |
| 2030 | 107.4% | 102.5% | 109.0% |

- Necessary increase of the network capacity in 2030.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 80.0% | 76.3% | 69.6% |
| 2025 | 85.5% | 81.7% | 77.2% |
| 2030 | 84.9% | 82.2% | 91.4% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of one new mobile site
- **Total Radio Sites by 2030**: 8

**Projected Costs:** $626,969 - $866,246

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 135,324
- **2025:** 150,207
- **2030:** 212,251

Current Number of Sites: **(7)**

- **4G co-located with 5G**: 2
- **Urban Sites:** 1
- **Rural Sites:** 4

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 98.0% | 93.6% | 85.3% |
| 2025 | 104.9% | 100.1% | 94.7% |
| 2030 | 131.7% | 125.8% | 133.8% |

- Necessary increase of the network capacity in 2025.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 98.0% | 93.6% | 85.3% |
| 2025 | 82.9% | 80.3% | 79.3% |
| 2030 | 86.1% | 84.2% | 96.5% |

- **Until 2025**: Installation of one new mobile sites
- **2025-2030**: Installation of one new mobile site
- **Total Radio Sites by 2030**: 9

**Projected Costs:** $835,959 - $1,154,995

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 192,905
- **2025:** 214,352
- **2030:** 303,459

Current Number of Sites: **(7)**

- **4G co-located with 5G**: 2
- **Urban Sites:** 1
- **Rural Sites:** 4

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 139.7% | 133.4% | 121.6% |
| 2025 | 149.7% | 142.9% | 135.1% |
| 2030 | 196.2% | 187.3% | 191.3% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 91.3% | 89.3% | 87.7% |
| 2025 | 97.8% | 95.7% | 97.4% |
| 2030 | 84.4% | 83.8% | 97.3% |

- **Until 2025**: Installation of two new mobile sites
- **2025-2030**: Installation of three new mobile sites
- **Total Radio Sites by 2030**: 12

**Projected Costs:** $2,512,186 - $2,862,430

# Case Study 4: Nelson Bay/Shoal Bay - Wireless Simulated Capacity

In the table below, the capacity status for the Nelson and Shoal Bay suburbs under a low demand scenario conditions and a peak demand of 15,000 visitors is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 94,652
- **2025:** 105,000
- **2030:** 148,246

Visitor Peak Demand: **15,000 Visitors** (Food Event)

Current Number of Sites: **(7)**

- **4G co-located with 5G:** 2
- **Urban Sites:** 1
- **Rural Sites:** 4

Busy(h) Traffic associated to Mobile Access Technologies:

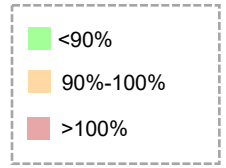
- **30%***

Urban vs Rural Split:

- **Urban** - 17.4%
- **Rural** - 82.6%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 80.0% | 76.3% | 69.6% |
| 2025 | 85.5% | 81.7% | 77.2% |
| 2030 | 107.4% | 102.5% | 109.0% |




- After running the model for the Nelson and Shoal Bay suburbs in case of a major event with 15,000 visitors it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

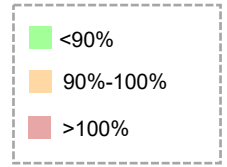
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030 -** Installation of **one new mobile base station between 2025 and 2030**, resulting in a total of **8 radio mobile sites** in the Nelson and Shoal Bay suburbs.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 80.0% | 76.3% | 69.6% |
| 2025 | 85.5% | 81.7% | 77.2% |
| 2030 | 84.9% | 82.2% | 91.4% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 4: Nelson Bay/Shoal Bay - Wireless Simulated Capacity

In the table below, the capacity status for the Nelson and Shoal Bay suburbs under a baseline demand scenario conditions and a peak demand of 15,000 visitors is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 135,324
- **2025:** 150,207
- **2030:** 212,251

Visitor Peak Demand: **15,000 Visitors** (Food Event)

Current Number of Sites: **(7)**

- **4G co-located with 5G:** 2
- **Urban Sites:** 1
- **Rural Sites:** 4

Busy(h) Traffic associated to Mobile Access Technologies:

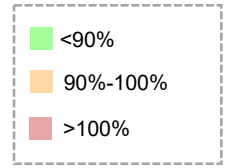
- **30%***

Urban vs Rural Split:

- **Urban** - 17.4%
- **Rural** - 82.6%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 98.0% | 93.6% | 85.3% |
| 2025 | 104.9% | 100.1% | 94.7% |
| 2030 | 131.7% | 125.8% | 133.8% |




- After running the model for the Nelson and Shoal Bay suburbs, it can be observed that for the **year 2023 the current scenario in terms of sites supports the necessary demand**. However, by the year **2025, there is already saturation in terms of network capacity**.

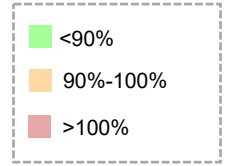
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **one new mobile base station until 2025** that will support the demand for Nelson and Shoal Bay suburbs in case of a major event with 15,000 visitors.
- **2030 -** Installation of **one new mobile base station between 2025 and 2030**, resulting in a total of **9 radio mobile sites** in the Nelson and Shoal Bay suburbs.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 98.0% | 93.6% | 85.3% |
| 2025 | 82.9% | 80.3% | 79.3% |
| 2030 | 86.1% | 84.2% | 96.5% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 4: Nelson Bay/Shoal Bay - Wireless Simulated Capacity

In the table below, the capacity status for the Nelson and Shoal Bay suburbs under a high demand scenario conditions and a peak demand of 15,000 visitors is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 192,905
- **2025:** 214,352
- **2030:** 303,459

Visitor Peak Demand: **15,000 Visitors** (Food Event)

Current Number of Sites: **(7)**

- **4G co-located with 5G:** 2
- **Urban Sites:** 1
- **Rural Sites:** 4

Busy(h) Traffic associated to Mobile Access Technologies:

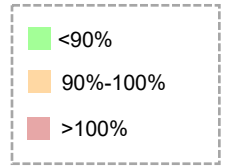
- **30%***

Urban vs Rural Split:

- **Urban** - 17.4%
- **Rural** - 82.6%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 139.7% | 133.4% | 121.6% |
| 2025 | 149.7% | 142.9% | 135.1% |
| 2030 | 196.2% | 187.3% | 191.3% |




- After running the model for the Nelson and Shoal Bay suburbs in case of a major event with 15,000 visitors, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

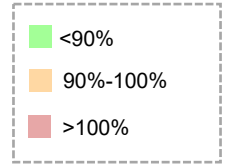
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **two new mobile base station until 2025** that will support the demand for Nelson and Shoal Bay suburbs in case of a major event with 15,000 visitors.
- **2030 -** Installation of **three new mobile base station between 2025 and 2030**, resulting in a total of **12 radio mobile sites** in the Nelson and Shoal Bay suburbs.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 91.3% | 89.3% | 87.7% |
| 2025 | 97.8% | 95.7% | 97.4% |
| 2030 | 84.4% | 83.8% | 97.3% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 4: Nelson Bay/Shoal Bay - Other Technology Options

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for the Nelson and Shoal Bay region in the case of 15,000 visitors.

## Other Technology Options

**1 - Analysis (2030):**

**Low Scenario**
- Total Devices - **148,246**
- Visitor Devices - **43,500**
- As-Is %RAN Capacity - **109.0%**
- No. of Devices exceeding the network capacity - **12,240**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **12,240 * 20% * 30% = 734**

**Baseline Scenario**
- Total Devices - **212,251**
- Visitor Devices - **62,250**
- As-Is %RAN Capacity - **133.8%**
- No. of Devices exceeding the network capacity - **53,617**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **53,617 * 20% * 30% = 3,217**

**High Scenario**
- Total Devices - **303,459**
- Visitor Devices - **88,736**
- As-Is %RAN Capacity - **191.3%**
- No. of Devices exceeding the network capacity - **144,829**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **144,829 * 20% * 30% = 8,689**

| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Cell on Wheels | **Cell on Wheels (CoW) are temporary infrastructures** that provide mobile coverage and capacity, supporting an average of up to **350 devices simultaneously**. Therefore, in each of the following scenarios, and to accommodate exceeding network devices, the required number of CoWs (independent of the operator) are:<br>• **Low Scenario**: 734 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, **2 CoWs are necessary**.<br>• **Baseline Scenario**: 3,217 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, 10 **CoWs are necessary**.<br>• **High Scenario**: 8,689 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, 2**5 CoWs are necessary**.<br>Cell on Wheels can be installed during events, saving annual operational costs in terms of maintaining this infrastructure connected.<br>The deployment of COWs by operators is specific to the respective operator (e.g., a COW implemented by Telstra is only accessible to Telstra mobile network users).<br>The cost of this infrastructure is performed only one time, and the option of renting them is also available:<br>• Acquisition Cost (per unit): **$500,000**<br>• Rental Cost (per unit): **$30,000***<br>*Rental Costs provided by Telstra | **Low Scenario**<br>Acquisition Cost: **$1,000,000**<br>Rental Cost: **$60,000**<br>**Baseline Scenario**<br>Acquisition Cost: **$5,000,000**<br>Rental Cost: **$300,000**<br>**High Scenario**<br>Acquisition Cost: **$12,500,000**<br>Rental Cost: **$750,000** | **Low Scenario**<br>✓<br>**Baseline Scenario**<br>✗<br>**High Scenario**<br>✗ |

# Case Study 4: Nelson Bay/Shoal Bay - Other Technology Options

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for the Nelson and Shoal Bay region in the case of 15,000 visitors.

## Other Technology Options

**1 - Analysis (2030):**

**Low Scenario**
- Total Devices - **148,246**
- Visitor Devices - **43,500**
- As-Is %RAN Capacity - **109.0%**
- No. of Devices exceeding the network capacity - **12,240**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **12,240 * 20% * 30% = 734**

**Baseline Scenario**
- Total Devices - **212,251**
- Visitor Devices - **62,250**
- As-Is %RAN Capacity - **133.8%**
- No. of Devices exceeding the network capacity - **53,617**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **53,617 * 20% * 30% = 3,217**

**High Scenario**
- Total Devices - **303,459**
- Visitor Devices - **88,736**
- As-Is %RAN Capacity - **191.3%**
- No. of Devices exceeding the network capacity - **144,829**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **144,829 * 20% * 30% = 8,689**

| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Cold Mobile Site | The **Cold Mobile Site is a pre-located site** that contains all passive infrastructure components. It is only activated during major events, requiring the installation of antennas and connections to power and backhaul. Therefore, the implementation costs associated with this solution are included in the Wireless Costing, excluding the costs related to **associated infrastructure**.<br><br>For this case study #4 (Nelson/Shoal Bay with a peak demand of 15,000 visitors), the projected need for 2030 is to implement:<br>• **Low Scenario:** 1 new mobile site without active infrastructure<br>• **Baseline Scenario:** 2 new mobile sites without active infrastructure<br>• **High Scenario:** 5 new mobile sites without active infrastructure | **Low Scenario**<br>Min: $560,856<br>Max: $721,351<br><br>**Baseline Scenario**<br>Min: $747,808<br>Max: $961,801<br><br>**High Scenario**<br>Min: $2,209,767<br>Max: $2.250,615 | **Low Scenario**<br>✓<br><br>**Baseline Scenario**<br>✓<br><br>**High Scenario**<br>✓ |
| Private 5G | The deployment of a **private wireless solution based on 5G** is a technology option to adopt in **events and specific zones** where a significant demand is expected. This solution, being **private, allows only selected devices in the region of Nelson/Shoal Bay to access the network**, with **capabilities designed according to the expected demand**<br><br>The estimation of the number of access points depends on various factors. However, it is reasonable to assume that, given the forecast of the expected demand for the event/region and the dedicated spectrum, each access point (AP) can support an average of 100 devices. Therefore, the following number of access points would be necessary for the three scenarios<br>• **Low Scenario:** 734 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **8 APs are necessary** (Small Site)<br>• **Baseline Scenario:** 3,217 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **33 APs are necessary**. (Medium Site)<br>• **High Scenario:** 8,689 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **87 APs are necessary**. (Medium Site) | **Low Scenario**<br>Min: $978,000<br>Max: $989,000<br><br>**Baseline Scenario**<br>Min: $1,494,000<br>Max: $1,538,000<br><br>**High Scenario**<br>Min: $1,602,000<br>Max: $1,646,000 | **Low Scenario**<br>✓<br><br>**Baseline Scenario**<br>✓<br><br>**High Scenario**<br>✓ |

# Case Study 5: The Entrance, Central Coast - Technology Review

The detailed analysis of the number of sites, types of radio technology, and the evaluation of the NBN network offer insights into the current telecommunications maturity of a suburb, enabling the identification of potential gaps. This represents the current status for the suburb of The Entrance, located in the Central Coast region.

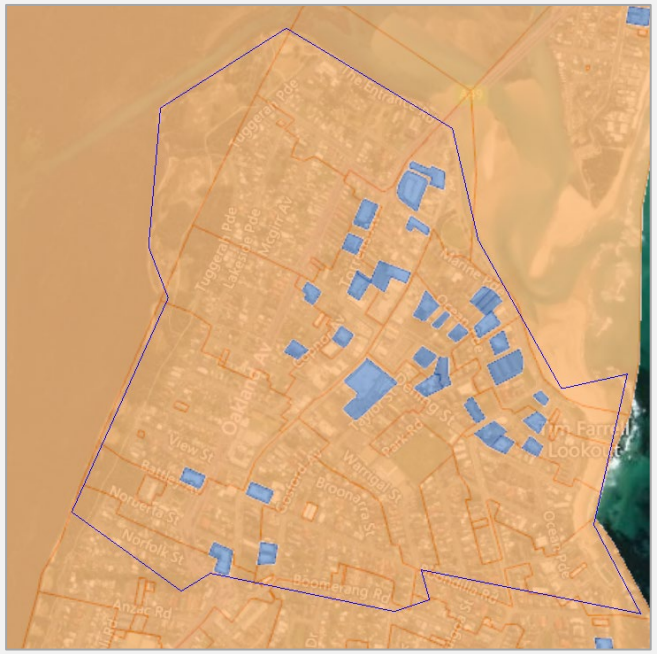
## Existing Radio Mobile Sites


- The suburb of The Entrance currently has a total of 3 mobile radio sites (1 from Telstra, 1 from Optus, and 1 from TPG). Upon analyzing the coverage maps of the operators, there are no connectivity gaps for 3G and 4G technologies.
- Regarding the 5G, all of the mobile sites provide access to this technology.
- Despite there being only 3 sites located in The Entrance suburb, this area benefits from coverage and capacity of sites located in Blue Bay, approximately 1.5 km away."

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 1 | 1 | 1 | 1 |
| Optus | 1 | 1 | 1 | 1 |
| TPG | 1 | 1 | 1 | 1 |

**Note:** Some radio sites from different operators may be co-located on the same tower and may not be visible in the image above.

## NBN Technology Types



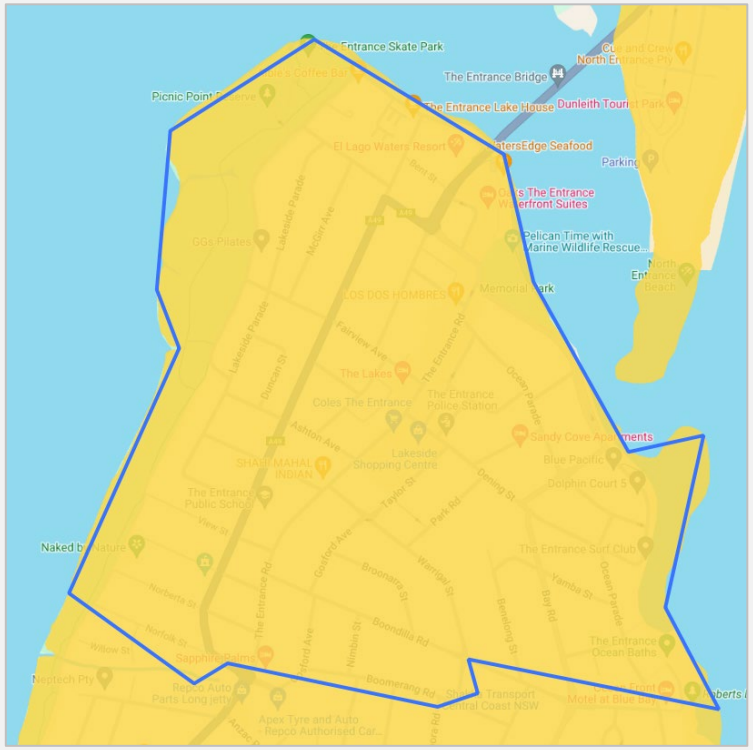

- The suburb of The Entrance, due to being a highly populated area with no rural area, has a high number of dwellings and is located in a central area, mostly having access via Fibre to the Premises (FTTP), with some buildings covered by fibre to the building.

# Case Study 5: The Entrance, Central Coast - Technology Review

The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

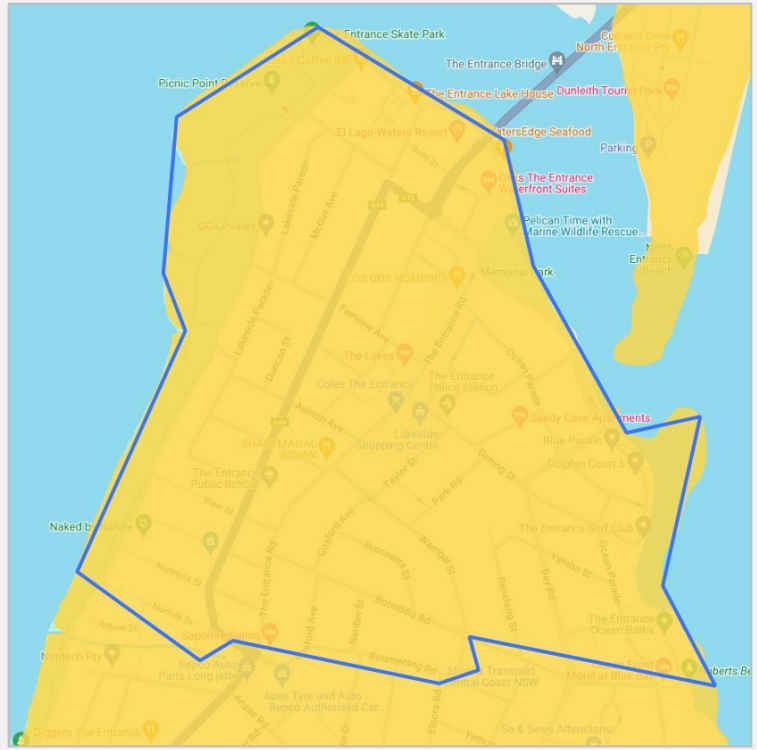
## Current Mobile Coverage

### Telstra Mobile Coverage




### Optus Mobile Coverage


### TPG Mobile Coverage




4G 5G

**Sources:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Case Study 5: The Entrance, Central Coast - Region Characterisation

The below tables summarise all the data such as population, demographics, number of devices, visitor peak demand, and other aspects that characterise a specific region. The steps taken to determine these figures are presented in the Appendix of this report. This is the characterisation for The Entrance suburb.

## Population and Demographic Aspects

| Total Area |
|---|
| 1.4 km$^2$ |

| Urban vs Rural Split | |
|---|---|
| Urban | 100% |
| Rural | 0% |

| Total Population | |
|---|---|
| 2023 | 4,326 |
| 2025 | 4,459 |
| 2030 | 4,753 |

## Visitor Demand

| Major Event | Estimated Number of Visitors |
|---|---|
| ChromeFest Event | 20,000 |

## Main Assumptions

- The peak number of visitors, 20,000, is derived from a previous 3-day event that drew over 50,000 people during the weekend. Saturday marked the highest day of attendance, with 20,000 individuals.
- To obtain the total number of devices for industrial sectors, the industry employment rate for the Central Coast region was used.

## Number of Devices (Baseline Scenario)

| Sectors | 2023 | 2025 | 2030 |
|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 290 | 390 | 819 |
| Utilities | 223 | 300 | 630 |
| Construction | 2,562 | 3,448 | 7,242 |
| Manufacturing | 1,315 | 1,769 | 3,715 |
| Wholesale and Retail Trade | 2,763 | 3,718 | 7,809 |
| Transportation & Warehousing | 824 | 1,109 | 2,330 |
| Finance, Insurance, Real Estate, Rental & Leasing | 1,092 | 1,469 | 3,086 |
| Professional, Scientific & Technical Services | 1,337 | 1,799 | 3,778 |
| Business, Building & other support services | 735 | 989 | 2,078 |
| Educational services | 1,827 | 2,459 | 5,164 |
| Health care and social assistance | 3,966 | 5,337 | 11,209 |
| Arts, Information, Culture & Recreation | 668 | 899 | 1,889 |
| Accommodation and food services | 1,560 | 2,099 | 4,408 |
| Other services (excluding public administration) | 847 | 1,139 | 2,393 |
| Public administration | 1,359 | 1,829 | 3,841 |
| Households & Consumer Goods (Individual Devices) | 17,612 | 18,166 | 19,630 |
| Cedar Mill - Visitor Demand (Visitor Devices) | 83,000 | 83,000 | 83,000 |

# Case Study 5: The Entrance, Central Coast - Wireless Summarisation

Below, the As-Is and Future State in terms of RAN Capacity (Downlink, Uplink, Simultaneous Active Devices) for the different scenarios are represented in a peak demand case of 20,000 visitors event at The Entrance suburb.

## Low Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 85,286
- **2025:** 90.806
- **2030:** 113,875

Current Number of Sites: **(3)**

- **4G co-located with 5G**: 3
- **Urban Sites:** 0
- **Rural Sites:** 0

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 63.8% | 65.4% | 92.7% |
| 2025 | 67.9% | 69.6% | 98.7% |
| 2030 | 81.5% | 83.5% | 123.8% |

- Necessary increase of the network capacity in 2030.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 63.8% | 65.4% | 92.7% |
| 2025 | 67.9% | 69.6% | 98.7% |
| 2030 | 61.1% | 62.6% | 92.8% |

- **Until 2025**: No need of installation of new mobile sites
- **2025-2030**: Installation of one new mobile site
- **Total Radio Sites by 2030**: 4

**Projected Costs:** $552,441 - $840,269

## Baseline Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 121,980
- **2025:** 129,919
- **2030:** 163,021

Current Number of Sites: **(3)**

- **4G co-located with 5G**: 3
- **Urban Sites:** 0
- **Rural Sites:** 0

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 91.2% | 93.5% | 132.6% |
| 2025 | 97.2% | 99.6% | 141.2% |
| 2030 | 116.6% | 119.6% | 177.2% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 54.7% | 56.1% | 79.6% |
| 2025 | 58.3% | 59.8% | 84.7% |
| 2030 | 58.3% | 59.8% | 88.6% |

- **Until 2025**: Installation of two new mobile sites
- **2025-2030**: Installation of one new mobile site
- **Total Radio Sites by 2030**: 6

**Projected Costs:** $1,289,029 - $1,960,628

## High Demand Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 173,967
- **2025:** 185,408
- **2030:** 232,941

Current Number of Sites: **(3)**

- **4G co-located with 5G**: 3
- **Urban Sites:** 0
- **Rural Sites:** 0

### 2 - As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 130.1% | 133.4% | 189.1% |
| 2025 | 138.7% | 142.1% | 201.5% |
| 2030 | 174.2% | 178.6% | 253.2% |

- Necessary increase of the network capacity at the moment.

### 3 - Future State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 55.8% | 57.2% | 81.0% |
| 2025 | 59.4% | 60.9% | 86.4% |
| 2030 | 65.3% | 67.0% | 95.0% |

- **Until 2025**: Installation of four new mobile sites
- **2025-2030**: Installation of one new mobile site
- **Total Radio Sites by 2030**: 8

**Projected Costs:** $1,657,323 - $3,080,986

# Case Study 5: The Entrance, Central Coast - Wireless Simulated Capacity

In the table below, the capacity status for the Entrance suburb under a low demand scenario conditions and a peak demand of 20,000 visitors is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 85,286
- **2025:** 90.806
- **2030:** 113,875

Visitor Peak Demand: **20,000 Visitors** (ChromeFest Event)

Current Number of Sites: **(3)**

- **4G co-located with 5G:** 3
- **Urban Sites:** 0
- **Rural Sites:** 0

Busy(h) Traffic associated to Mobile Access Technologies:

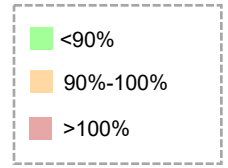
- **30%***

Urban vs Rural Split:

- **Urban** - 100%
- **Rural** - 0%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 63.8% | 65.4% | 92.7% |
| 2025 | 67.9% | 69.6% | 98.7% |
| 2030 | 81.5% | 83.5% | 123.8% |




- After running the model for the The Entrance suburb in case of a major event with 20,000 visitors it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

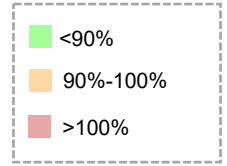
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030 -** Installation of **one new mobile base station between 2025 and 2030**, resulting in a total of **4 radio mobile sites** in the The Entrance suburb.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 63.8% | 65.4% | 92.7% |
| 2025 | 67.9% | 69.6% | 98.7% |
| 2030 | 61.1% | 62.6% | 92.8% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 5: The Entrance, Central Coast - Wireless Simulated Capacity

In the table below, the capacity status for the Entrance suburb under a baseline demand scenario conditions and a peak demand of 20,000 visitors is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 121,980
- **2025:** 129,919
- **2030:** 163,021

Visitor Peak Demand: **20,000 Visitors** (ChromeFest Event)

Current Number of Sites: **(3)**

- **4G co-located with 5G:** 3
- **Urban Sites:** 0
- **Rural Sites:** 0

Busy(h) Traffic associated to Mobile Access Technologies:

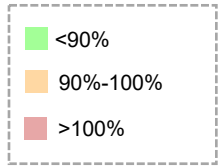
- **30%***

Urban vs Rural Split:

- **Urban** - 100%
- **Rural** - 0%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 91.2% | 93.5% | 132.6% |
| 2025 | 97.2% | 99.6% | 141.2% |
| 2030 | 116.6% | 119.6% | 177.2% |




- After running the model for the Entrance suburb in case of a major event with 20,000 visitors, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

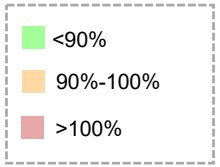
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **two new mobile base station until 2025** that will support the demand for the Entrance suburb in case of a major event with 20,000 visitors.
- **2030 -** Installation of **one new mobile base station between 2025 and 2030**, resulting in a total of **6 radio mobile sites** in the Entrance suburb.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 54.7% | 56.1% | 79.6% |
| 2025 | 58.3% | 59.8% | 84.7% |
| 2030 | 58.3% | 59.8% | 88.6% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 5: The Entrance, Central Coast - Wireless Simulated Capacity

In the table below, the capacity status for the Entrance suburb under a high demand scenario conditions and a peak demand of 20,000 visitors is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 173,967
- **2025:** 185,408
- **2030:** 232,941

Visitor Peak Demand: **20,000 Visitors** (ChromeFest Event)

Current Number of Sites: **(3)**

- **4G co-located with 5G:** 3
- **Urban Sites:** 0
- **Rural Sites:** 0

Busy(h) Traffic associated to Mobile Access Technologies:

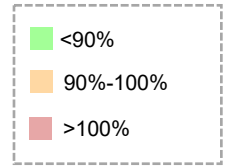
- **30%***

Urban vs Rural Split:

- **Urban** - 100%
- **Rural** - 0%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 130.1% | 133.4% | 189.1% |
| 2025 | 138.7% | 142.1% | 201.5% |
| 2030 | 174.2% | 178.6% | 253.2% |




- After running the model for the Entrance suburb in case of a major event with 20,000 visitors, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

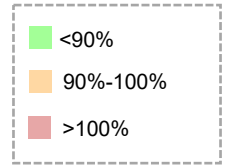
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **four new mobile base station until 2025** that will support the demand for the Entrance suburb in case of a major event with 20,000 visitors.
- **2030 -** Installation of **one new mobile base station between 2025 and 2030**, resulting in a total of **8 radio mobile sites** in the Entrance suburb.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 55.8% | 57.2% | 81.0% |
| 2025 | 59.4% | 60.9% | 86.4% |
| 2030 | 65.3% | 67.0% | 95.0% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Case Study 5: The Entrance, Central Coast - Other Technology Options

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for The Entrance suburb in the case of 20,000 visitors.

## Other Technology Options

**1 - Analysis (2030):**

**Low Scenario**
- Total Devices - **113,875**
- Visitor Devices - **58,000**
- As-Is %RAN Capacity - **123.8%**
- No. of Devices exceeding the network capacity - **21,891**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **21,891 * 20% * 30% = 1,313**

**Baseline Scenario**
- Total Devices - **163,021**
- Visitor Devices - **83,000**
- As-Is %RAN Capacity - **177,2%**
- No. of Devices exceeding the network capacity - **71,022**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **71,022 * 20% * 30% = 4,261**

**High Scenario**
- Total Devices - **232,941**
- Visitor Devices - **118,400**
- As-Is %RAN Capacity - **253.2%**
- No. of Devices exceeding the network capacity - **140,942**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **140,942 * 20% * 30% = 8,456**

| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Cell on Wheels | **Cell on Wheels (CoW) are temporary infrastructures** that provide mobile coverage and capacity, supporting an average of up to **350 devices simultaneously**. Therefore, in each of the following scenarios, and to accommodate exceeding network devices, the required number of CoWs (independent of the operator) are:<br>• **Low Scenario**: 1,313 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, 4 **CoWs are necessary**.<br>• **Baseline Scenario**: 4,261 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, **13 CoWs are necessary**.<br>• **High Scenario**: 8,456 exceeding devices connected during the busy hour via mobile access. Since each CoW supports 350 devices, **25 CoWs are necessary**.<br>Cell on Wheels can be installed during events, saving annual operational costs in terms of maintaining this infrastructure connected.<br>The deployment of COWs by operators is specific to the respective operator (e.g., a COW implemented by Telstra is only accessible to Telstra mobile network users).<br>The cost of this infrastructure is performed only one time, and the option of renting them is also available:<br>• Acquisition Cost (per unit): **$500,000**<br>• Rental Cost (per unit): **$30,000***<br>*Rental Costs provided by Telstra | **Low Scenario**<br>Acquisition Cost: **$2,000,000**<br>Rental Cost: **$120,000**<br>**Baseline Scenario**<br>Acquisition Cost: **$6,500,000**<br>Rental Cost: **$390,000**<br>**High Scenario**<br>Acquisition Cost: **$12,500,000**<br>Rental Cost: **$750,000** | **Low Scenario**<br>**Baseline Scenario**<br>**High Scenario** |

# Case Study 5: The Entrance, Central Coast - Other Technology Options

There are alternative technologies with the potential to accommodate the demand generated by events in defined regions. We have outlined potential technology options available for The Entrance suburb in the case of 20,000 visitors.

## Other Technology Options

**1 - Analysis (2030):**

**Low Scenario**
- Total Devices - **113,875**
- Visitor Devices - **58,000**
- As-Is %RAN Capacity - **123.8%**
- No. of Devices exceeding the network capacity - **21,891**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **21,891 * 20% * 30% = 1,313**

**Baseline Scenario**
- Total Devices - **163,021**
- Visitor Devices - **83,000**
- As-Is %RAN Capacity - **177,2%**
- No. of Devices exceeding the network capacity - **71,022**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **71,022 * 20% * 30% = 4,261**

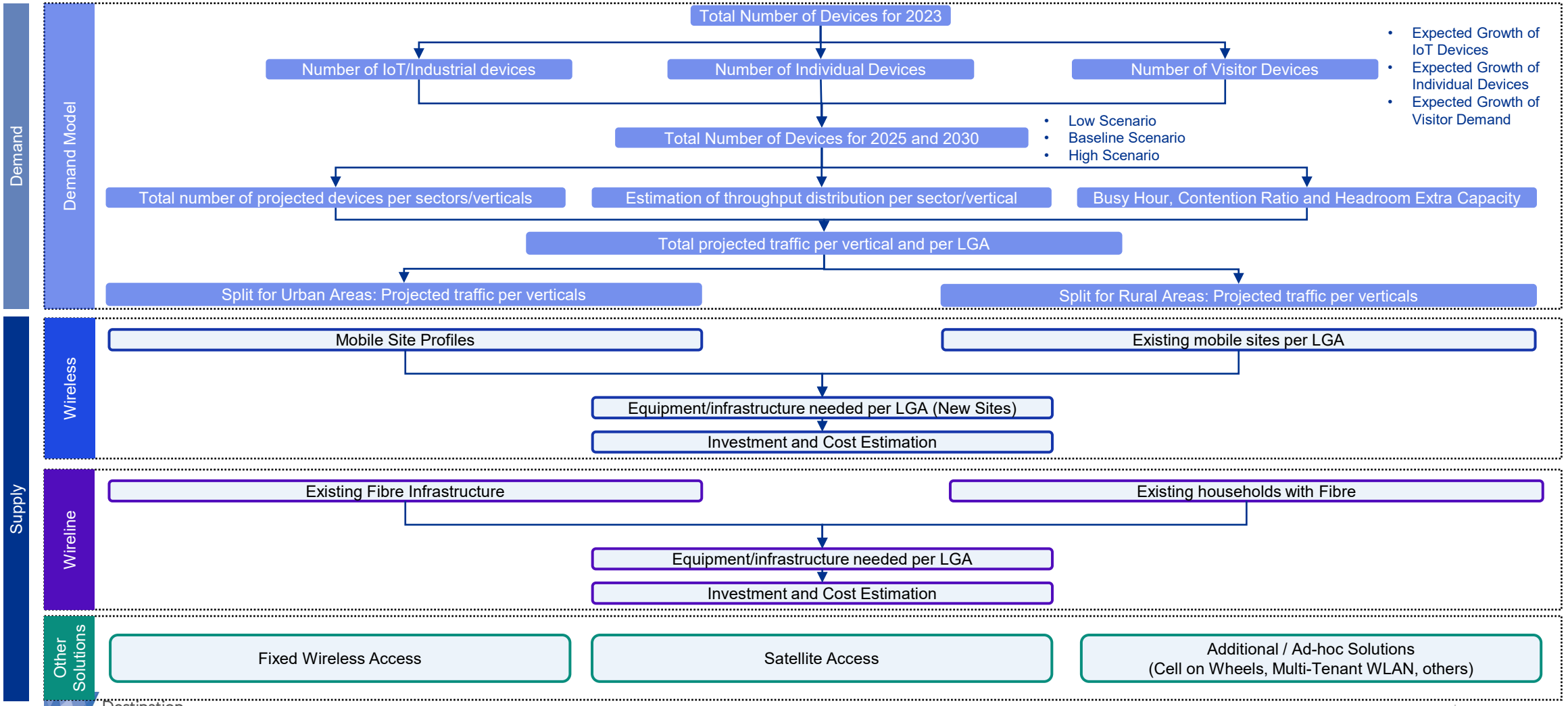
**High Scenario**
- Total Devices - **232,941**
- Visitor Devices - **118,400**
- As-Is %RAN Capacity - **253.2%**
- No. of Devices exceeding the network capacity - **140,942**
- No. of exceeding devices in busy hour (20%) via mobile connection (30%): **140,942 * 20% * 30% = 8,456**

| Technology | Description | Projected Cost | Effectiveness |
|---|---|---|---|
| Cold Mobile Site | The **Cold Mobile Site is a pre-located site** that contains all passive infrastructure components. It is only activated during major events, requiring the installation of antennas and connections to power and backhaul. Therefore, the implementation costs associated with this solution are included in the Wireless Costing, excluding the costs related to **associated infrastructure**.<br><br>For this case study #5 (The Entrance with a peak demand of 20,000 visitors), the projected need for 2030 is to implement:<br>• **Low Scenario:** 1 new mobile site without active infrastructure<br>• **Baseline Scenario: 3** new mobile sites without active infrastructure<br>• **High Scenario: 5** new mobile sites without active infrastructure | **Low Scenario**<br>Min: $286,164<br>Max: $754,999<br><br>**Baseline Scenario**<br>Min: $667,716<br>Max: $1,761,664<br><br>**High Scenario**<br>Min: $858,492<br>Max: $2,768,330 | **Low Scenario** ✓<br><br>**Baseline Scenario** ✓<br><br>**High Scenario** ✓ |
| Private 5G | The deployment of a **private wireless solution based on 5G** is a technology option to adopt in **events and specific zones** where a significant demand is expected. This solution, being **private, allows only selected devices in the region of The Entrance to access the network**, with **capabilities designed according to the expected demand**<br><br>The estimation of the number of access points depends on various factors. However, it is reasonable to assume that, given the forecast of the expected demand for the event/region and the dedicated spectrum, each access point (AP) can support an average of 100 devices. Therefore, the following number of access points would be necessary for the three scenarios<br>• **Low Scenario:** 1,313 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **14 APs are necessary** (Small Site)<br>• **Baseline Scenario:** 4,261 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **43 APs are necessary**. (Medium Site)<br>• **High Scenario:** 8,456 exceeding devices connected during the busy hour via mobile access. Since each AP supports 100 devices, **85 APs are necessary**. (Medium Site) | **Low Scenario**<br>Min: $990,000<br>Max: $1,001,000<br><br>**Baseline Scenario**<br>Min: $1,514,000<br>Max: $1,558,000<br><br>**High Scenario**<br>Min: $1,598,000<br>Max: $1,642,000 | **Low Scenario** ✓<br><br>**Baseline Scenario** ✓<br><br>**High Scenario** ✓ |

# Approach to conducting the Future State Characterisation

# Overview of the Future Characterisation Key Steps

The below chart shows the key steps that our approach includes to model future connectivity demand and the network infrastructure investment needed to fulfil that demand.



# Wireless Characterisation

# Wireless - Existing Mobile Sites and Respective Profiles

Obtaining the count of existing sites for each region and defining their profiles is crucial for estimating the current capacity of the radio access network. These inputs determine whether the existing infrastructure can support both current and future demands.

## Mobile Sites per LGA

To obtain the different existent sites according to their profiles and to perform the wireless capacity simulation for the different regions, the following types of radio sites were defined:

- **4G co-located with 5G Sites** - encompassing all existing sites with access to 5G. 5G sites enable high transmission capacity and can support a high number of devices simultaneously.
- **Urban Sites** - The number of urban sites was derived from the percentage ratio of urban population to the region's current number of 3G/4G sites in each region. These sites operate at higher frequencies to ensure greater transmission capacity.
- **Rural Sites** - In contrast to urban sites, rural sites were obtained through the percentage ratio of rural population to the region's current number of 3G/4G sites in each region. These sites operate at lower frequencies, reflecting lower capacity requirements and aiming to ensure greater coverage distance.

| Region | Number of Sites | 4G co-located with 5G | Urban Site | Rural Site |
|---|---|---|---|---|
| Central Coast | 265 | 98 | 165 | 2 |
| Cessnock City | 59 | 17 | 0 | 42 |
| Dungog Shire | 13 | 0 | 0 | 13 |
| Lake Macquarie | 111 | 68 | 39 | 4 |
| Maitland | 50 | 20 | 19 | 11 |
| Muswellbrook | 28 | 2 | 0 | 26 |
| Newcastle City | 114 | 66 | 48 | 0 |
| Port Stephens | 79 | 27 | 9 | 43 |
| Singleton | 39 | 8 | 1 | 30 |
| Upper Hunter | 24 | 4 | 0 | 20 |

## Mobile Sites Profiles

To estimate the current network capacity for different regions, three site profiles were considered:

1) **4G co-located sites with 5G** - sites incorporating all technologies, providing high capacity.
2) **Urban Sites** - 3G/4G standalone sites using high frequencies (e.g., LTE 1800, 2100, 2300, 2600).
3) **Rural Sites** - 3G/4G standalone sites using lower frequencies (e.g., LTE 700, 800, 900).

The definition of maximum transmission capabilities in terms of transmission, reception, and devices per mobile site depends on many technical telecommunications factors,. The values in the table below are average values, considering a starting point of a common topology 4G radio site user by mobile operators and according to the 3GPP standards.

| Specifications | 4G co-located with 5G | Urban Site | Rural Site |
|---|---|---|---|
| Maximum transmission link capacity per site (Mbps) | 510 | 290 | 250 |
| Maximum reception link capacity per site (Mbps) | 105 | 60 | 55 |
| Maximum Simultaneously Active Users per site | 1,800 | 1,400 | 1,200 |

# Wireless - Simulated Capacity Methodology

The below steps have been undertaken in the wireless modelling to identify areas where the existing network capacity does not support the estimated future demand.

## Wireless Model Methodology

### 1 - Model Inputs

To estimate the current state capacity, previously estimated input assumptions feed into the wireless model. These inputs are:

- **1.1 - Total Number of Devices**: Estimated total number of devices for the years 2023, 2025, and 2030, for three scenarios.
- **1.2 - Total Number of Sites:** The existing number of mobile sites in the region categorised as 4G co-located with 5G, Urban Sites (4G with higher frequencies), and Rural Sites (4G with lower frequencies).
- **1.3 - Busy Hour Traffic associated with Mobile Access Technologies**: Traffic associated with the mobile network during the busy hour.
- **1.4 - Split Urban vs Rural:** The population ratio between urban and rural areas used to determine the type of traffic and the respective number of sites allocated to each region.

### 2 - Present State

After feeding the model with the inputs mentioned in step 1, it is possible to estimate the current state in terms of RAN (Radio Access Network) capacity across three different variables. In this analysis, it is assumed that the number of sites will remain the same until 2030.

- **Required Transmission Link Capacity as % of RAN Capacity:** This parameter aims to understand the network's capacity to handle data transmissions, information, and other network parameters between the radio site and user equipment.
- **Required Receive Link Capacity as % of RAN Capacity:** This parameter aims to understand the network's capacity to handle the reception of data, information, and other network parameters between user equipment and the base station.
- **Required Simultaneous Active Users/Devices (SAUs) as % of RAN Capacity:** This parameter allows the understanding of network's capacity to handle the number of simultaneous users/devices accessing during the busy hour.

For each of these parameters, the capacity based on the simulated demand is determined as a **percentage** and is represented as:

- <90% - The existing capacity is sufficient to **support the estimated future demand** and **no deployment** of new mobile sites is necessary.
- 90%-100% - The existing capacity is sufficient **to support the estimated future demand**, without the need to add new radio sites. However, despite already considering a 20% extra headroom, the network may experience saturation in the case of peak demand or unexpected network congestion
- >100% - The existing capacity **does not support the estimated future demand**, which may lead to **denial of mobile network** service. Installation of **new radio sites** is recommended.

### 3 - Future State

Through the analysis of the current state, the future state of the network is defined, providing the number of sites that need to be implemented \in 2025 and 2030 as necessary to address the simulated connectivity demand by increasing capacity.

| Projected Years | Required Mbps - Downlink as % of RAN Capacity | Required Mbps - Uplink as % of RAN Capacity | Required SAUs as % of RAN Capacity |
|---|---|---|---|
| 2023 | 97.6% | 98.6% | 69.6% |
| 2025 | 108.2% | 109.2% | 95.9% |
| 2030 | 141.6% | 142.9% | 162.7% |

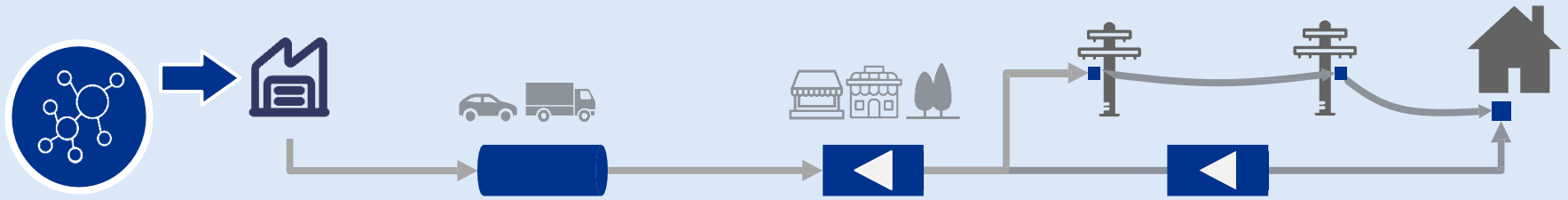
Illustrative Example

# Wireline Characterisation

# Wireline – Components of Existing Fibre Infrastructure

The diagram below illustrates the infrastructure of a fibre access technology that aligns with the architecture and access types provided by the NBN for accessing its services via fibre.

## High-Level Diagram of Fibre Infrastructure

| **Program** Designation | **Fixed Core Network** | | **Aggregation Network** | **Fibre to the Node (FTTN)** | **Fibre to the Curb (FTTC)** | **Fibre to the Premises (FTTP)** |
|---|---|---|---|---|---|---|
| **Graphical Representation** of a Passive Optical Network (PON) |  | | | | | |
| **Network** Designation | **Core Network** | **Local Exchange** | **Aggregation Network** | **Distribution Network** | **Premises Drop / Last Mile** | **Premises** |
| **Core Assets** (Telecommunications) | Access to connectivity backbone | | Optical Line Termination OLT | Multiple level of the application of Splitters | | Optical Network Terminal ONT |
| **Equipment** | • Transport Network - Ducts<br>• Transport Network - Fibre between Core PoPs (Point of Presence)<br>• Transport Network - Fibre between Internet Exchange Points (IXP) connection<br>• Transport Network - Connection to 3rd Parties | | • Switches (MPLS and Ethernet)<br>• Optical Line Terminator(OLT)<br>• Power Systems<br>• HVAC Systems<br>• Optical Transmitters and Amplifiers<br>• Shelter<br>• Security and Monitoring System | • Optical Sub Splitter (OSS)<br>• Optical Splitter (1:64)<br>• Shelter<br>• Joints<br>• Manholes | • Optical Distribution Point (1:6)<br>• Optical Splitter (1:16)<br>• Distribution Point Unit (DPU)<br>• Shelter | • Customer Box<br>• Customer Router<br>• Optical Distribution Box<br>• Interior Wiring<br>• Installation Materials |

# Wireline - Existing dwellings with Fibre

The analysis of the current number of dwellings with fibre access across different LGAs helps understand the current deployment status and estimate the infrastructure and associated costs in an attempt to provide FTTP (fibre to the Premises) to all dwellings by 2030.

## Existing households with Fibre

To understand the maturity and installation status of fibre in different regions, the number of dwellings and their respective types of fixed access to NBN services were examined for each one of the suburbs.

According to the NBN's plan to fiberise **90% of homes and businesses with its fastest service** and with the investment from the Australian government for this transition, it is assumed that by 2030, the DSSN may aim to provide FTTP for all regions and their respective dwellings.

**In summary, based on this assumption the following transition will be completed for the entire region by 2030:**

- Transition of **13,836 private dwellings** from FTTC to FTTP
- Transition of **241,968 private dwellings** from FTTN to FTTP
- **Provision of FTTP to the 26,180 dwellings** currently without fibre.

This assumption does not include the transition from Fibre to the Building to Fibre to the Premises, as it has been observed that existing buildings with fibre are residual and belong to industrial sectors such as universities, hospitals, military areas, etc.

**Current distribution of access types across dwellings for the different regions**

| Region | Total Private Dwellings | # of Dwellings with access to Fibre to the Premises (FTTP) | # of Dwellings with access to Fibre to the Curb (FTTC) | # of Dwellings with access to Fibre to the Node (FTTN) | # of Dwellings without access to Fibre |
|---|---|---|---|---|---|
| Central Coast | 152,699 | 67,578 | 1,994 | 79,448 | 3,679 |
| Cessnock City | 26,304 | 2,441 | 4,286 | 15,693 | 3,884 |
| Dungog Shire | 3,905 | 0 | 0 | 1,863 | 2,042 |
| Lake Macquarie | 37,464 | 3,890 | 3,817 | 29,332 | 425 |
| Maitland | 35,343 | 23,345 | 0 | 10,546 | 1,452 |
| Muswellbrook | 8,193 | 948 | 50 | 6,335 | 860 |
| Newcastle City | 75,771 | 15,218 | 0 | 60,265 | 288 |
| Port Stephens | 37,730 | 3,421 | 3,716 | 27,088 | 3,505 |
| Singleton | 9,348 | 73 | 0 | 5,960 | 3,315 |
| Upper Hunter | 12,168 | 0 | 0 | 5,438 | 6,730 |
| DSSN Region | 398,925 | 116,914 | 13,863 | 241,968 | 26,180 |

# Wireline – Cost Estimation of Wireline Expansion

The following table presents the costs associated with the wireline expansion for the different LGAs.

## Cost Estimation of Wireline Upgrade to FTTP

According to statements provided by the CEO of NBN and following the expansion project currently underway to upgrade the various types of NBN access to FTTP, different costs associated with this expansion have been projected over the years:

- In **2020**, the government projected in their business case that fibre lead-in costs would be **$750 per connection**.
- In **2023**, NBN communicated a **$2,650 capital cost** per connection.
- In **2024**, NBN communicated the lead-in cost as **$1,400 per connection**.

Therefore, in order to calculate the costs associated with the expansion from **FTTN or FTTC to FTTP**, a cost of **$1,400 per dwelling** was used. The costs for each LGA associated with this expansion can be seen on the right side.

Regarding the **costs associated** with providing access **via fibre to dwellings** that currently do not **have access to this type of technology**, the cost of this expansion is inherent to **different factors** and the geographical location/distance of possible fibre cores. To estimate these costs, the following factors must be taken into consideration:

- **Presence of IXPs and POPs in the region -** The more distant these connection points are, the greater the amount of fiber required, consequently escalating costs..
- **Construction of Ducts** - In extremely rural regions with dispersed dwellings, the construction of ducts in various directions is required to provide FTTP.
- **Installation of OLTs** - In terms of fibre network aggregation, in remote areas, the number of necessary OLTs depends on the distance between dwellings and regions.

| Regions | # of Dwellings with access to FTTC or FTTN | | Cost of Expand to FTTP |
|---|---|---|---|
| Central Coast | 81,442 | | $114,018,800 |
| Cessnock | 19,979 | | $27,970,600 |
| Dungog | 1,863 | | $2,608,200 |
| Lake Macquarie | 33,149 | | $46,408,600 |
| Maitland | 10,546 | x$1,400 | $14,764,400 |
| Muswellbrook | 6,385 | | $8,939,000 |
| Newcastle | 60,265 | | $84,371,000 |
| Port Stephens | 30,804 | | $43,125,600 |
| Singleton | 5,960 | | $8,344,000 |
| Upper Hunter | 5,438 | | $7,613,200 |
| DSSN Region | 255,831 | | $358,163,400 |

# Future Characterisation Infrastructure & Costings: Wireless

# Wireless – Components and Cost Estimation of new Mobile Sites

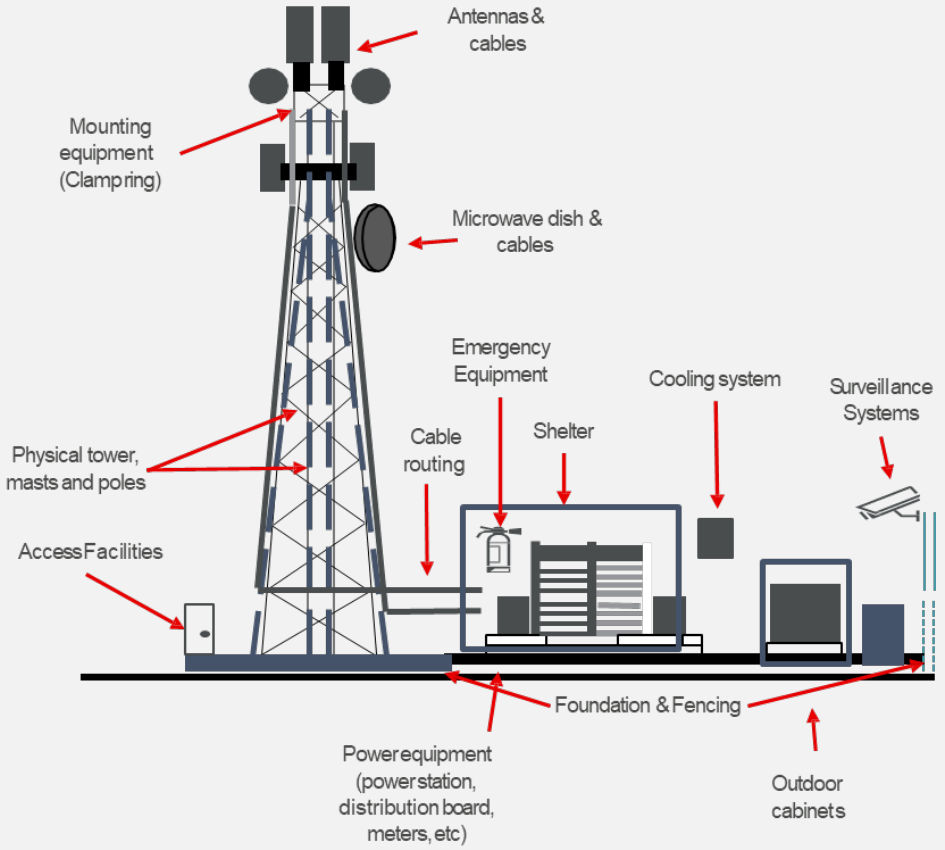
The diagram below illustrates the infrastructure for a radio mobile macro site.

## Mobile Sites - Cost Estimation

- In order to project the costs associated with the necessary expansion to accommodate the future demand, it is necessary to understand the costs of each type of existing macro site. For this analysis, two types of macro sites were considered: Monopoles and Lattice Towers.
- These costs should not be regarded as precise figures, as they depend on site-specific features, such as height, structure type, distance from the power grid, access track, backhaul connection, and the fact that the site in question is co-located.
- For the cost estimation projection, the costs present in the ACCC report 'Regional Mobile Infrastructure Inquiry' were used as a reference.

| Type of Infrastructure | Major Cities | | Inner Regional Areas | |
|---|---|---|---|---|
| | Monopole Tower (25-50m) | Lattice Tower (30-60m) | Monopole Tower (25-50m) | Lattice Tower (30-60m) |
| Tower site selection and planning approvals | $69,885 | $111,260 | $369,563 | $104,967 |
| Tower site construction | $159,271 | $287,866 | $278,038 | $318,456 |
| Access to tower site (if an upgrade is required) | - | $120,387 | - | $23,638 |
| Connection to power | - | $235,486 | $30,199 | $113,795 |
| Connection to backhaul | $57,008 | - | $43,551 | - |
| Associated infrastructure | $266,277 | $85,270 | $144,895 | $65,113 |
| Indicative total build cost | $552,441 | $840,269 | $866,246 | $625,969 |

**Cost of Radio Macro Sites | Source:** ACCC Regional Mobile Infrastructure Inquiry - Sample of tower build costs




**Composition of a Radio Mobile Macro Site**

# Wireless – Cost Estimation of new Mobile Sites

To conduct the study on the cost associated with mobile expansion, different assumptions have been defined and are explained below in terms of the type of mobile tower, location in urban or rural areas, and the existence of co-location among operators.

## Cost Estimation of new Mobile Sites - Assumptions

### Assumptions

To estimate the cost associated with each LGA, the following assumptions were made:

1. A radio site can be classified as either a monopole tower or lattice tower type. This decision depends on factors such as access type, area, space, aesthetic considerations, among others. Therefore, the following cost range was assumed for each radio site:
   - Cost range of a radio site in a Major City: $552,441 - $840,269
   - Cost range of a radio site in an Inner Regional Area: $625,969 - $866,246

2. To determine whether the cost of a site should be considered for a major city or inner regional areas, the urban vs rural split previously presented for each of the regions was taken into account.

3. Since the presence of currently co-located mobile radio sites, it is expected that new macro sites will also share infrastructure among the three operators. The table indicates a minimum co-location value of 44.5% for Telstra in 2023. Therefore, this projection assumes that 44.5% of additional sites will be co-located, requiring the construction of only one tower to accommodate the three different operator.

| Operator | Co-located sites as percentage (%) of total sites |
|---|---|
| Telstra | 44.5% |
| Optus | 69.7% |
| TPG | 88.7% |

**Source:** ACCC Mobile Infrastructure Report 2023 - Co-Located Sites

# Wireless – Cost Estimation of new Mobile Sites

Below, the additional number of mobile sites for each region is presented for the different scenarios.

## Cost Estimation of new Mobile Sites - Number of Additional Mobile Sites

- The table below shows the estimated number of additional radio sites for each region, divided according to the previously explained rationale of Major City Site vs Inner Regional Area Site. In parentheses, the number of co-located radio sites is displayed, indicating radio sites from the three different operators that will share the same tower. Therefore, to calculate the cost of these co-located radio sites, the cost associated with the type of site (Major City vs Inner Regional) is divided by 3 (same tower, with radio sites from all 3 operators).

| Region | Urban vs Rural Split | | Low Scenario | | | Baseline Scenario | | | High Scenario | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Urban | Rural | Additional Radio Sites | Major City Site (Co-Located) | Inner Regional Area Site (Co-Located) | Additional Radio Sites | Major City Site (Co-Located) | Inner Regional Area Site (Co-Located) | Additional Radio Sites | Major City Site (Co-Located) | Inner Regional Area Site (Co-Located) |
| Central Coast | 98.8% | 1.2% | + 0 | 0 (0) | 0 (0) | + 11 | 11 (5) | 0 (0) | + 99 | 98 (43) | 1 (1) |
| Cessnock City | 0.0% | 100.0% | + 0 | 0 (0) | 0 (0) | + 8 | 0 (0) | 8 (4) | + 29 | 0 (0) | 29 (13) |
| Dungog Shire | 0.0% | 100.0% | + 0 | 0 (0) | 0 (0) | + 2 | 0 (0) | 2 (1) | + 5 | 0 (0) | 5 (2) |
| Lake Macquarie | 91.5% | 8.5% | + 0 | 0 (0) | 0 (0) | + 39 | 36 (16) | 3 (1) | + 99 | 91 (40) | 8 (4) |
| Maitland | 64.0% | 36.0% | + 2 | 1 (1) | 1 (0) | + 19 | 12 (5) | 7 (3) | + 45 | 29 (13) | 16 (7) |
| Muswellbrook | 0.0% | 100.0% | + 0 | 0 (0) | 0 (0) | + 0 | 0 (0) | 0 (0) | + 2 | 0 (0) | 2 (1) |
| Newcastle City | 100.0% | 0.0% | + 0 | 0 (0) | 0 (0) | + 27 | 27 (12) | 0 (0) | + 82 | 82 (36) | 0 (0) |
| Port Stephens | 17.4% | 82.6% | + 0 | 0 (0) | 0 (0) | + 2 | 0 (0) | 2 (1) | + 31 | 5 (2) | 26 (11) |
| Singleton | 1.7% | 98.3% | + 0 | 0 (0) | 0 (0) | + 0 | 0 (0) | 0 (0) | + 3 | 0 (0) | 3 (1) |
| Upper Hunter | 0.0% | 100.0% | + 0 | 0 (0) | 0 (0) | + 0 | 0 (0) | 0 (0) | + 1 | 0 (0) | 1 (0) |

# Wireless – Cost Estimation of new Mobile Sites

The following table presents the costs associated with the installation of radio mobile sites for the different LGAs according to the defined scenarios.

### Cost Estimation of new Mobile Sites - Comparison of Total Costs per Scenario

| Regions | Low Scenario | Baseline Scenario | High Scenario |
|---|---|---|---|
| Central Coast | $0 | $4,235,381 - $6,442,062 | $38,591,325 - $58,467,640 |
| Cessnock | $0 | $3,343,835 - $4,619,979 | $12,748,370 - $17,613,669 |
| Dungog | $0 | $835,959 - $1,154,995 | $2,298,886 - $3,176,235 |
| Lake Macquarie | $0 | $16,016,413 - $22,749,742 | $32,794,470 - $57,401,140 |
| Maitland | $907,059 - $1,050,393 | $9,119,052 - $10,417,176 | $18,656,511 - $24,191,118 |
| Muswellbrook | $0 | $0 | $835,959 - $1,154,995 |
| Newcastle | $0 | $10,496,379 - $15,965,111 | $25,412,286 - $48,735,602 |
| Port Stephens | $0 | $835,959 - $1,154,995 | $14,784,408 - $17,827,248 |
| Singleton | $0 | $0 | $1,462,928 - $2,021,241 |
| Upper Hunter | $0 | $0 | $626,969 - $866,246 |
| DSSN Region | $907,059 - $1,050,393 | $46,797,194 - $60,589,844 | $158,114,226 - $221,553,020 |

# 5. Appendices

# Appendix 5.1 Telecommunications Infrastructure Review

**Methodology and findings of the technology review conducted for each LGA in the DSSN region.**

# Telecommunications Infrastructure Review

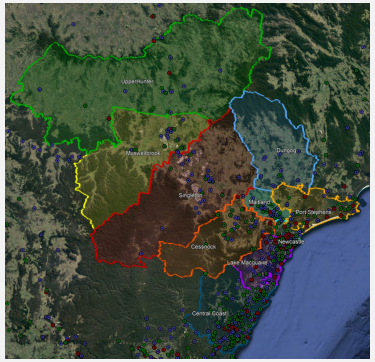
**Methodology and findings of the technology review conducted for each LGA in the DSSN region.**

# Technology Review Approach

To comprehend the impact of demand growth on network infrastructure, it is important to assess the current status of the deployment of various network access types. Specifically, an evaluation was conducted on the deployment status of mobile access, fibre, fixed wireless, and satellite, focusing on the three major operators (Telstra, Optus, and TPG) and the National Broadband Network (nbn).

## Analysis of Current Network Mobile State

- To analyse the **current radio infrastructure**, data concerning the **radio sites operated by Telstra, Optus, and TPG** in the different regions was collected.
- Mapping these sites based on their geographic coordinates, a comprehensive assessment of **coverage was conducted** using **maps provided by the operators**.
- This evaluation included an **examination of 3G, 4G, and 5G technologies**. It's crucial to highlight that the operators are planning to **discontinue 3G** technology in **2024.**



**Existing Number of Mobile Sites for each DSSN Region:**

| Region | Telstra | Optus | TPG | Total |
|---|---|---|---|---|
| Central Coast | 100 | 104 | 61 | 265 |
| Newcastle | 43 | 41 | 30 | 114 |
| Lake Macquarie | 40 | 39 | 32 | 111 |
| Port Stephens | 28 | 31 | 20 | 79 |
| Cessnock | 24 | 22 | 13 | 59 |
| Maitland | 22 | 18 | 10 | 50 |
| Singleton | 25 | 9 | 5 | 39 |
| Muswellbrook | 18 | 7 | 3 | 28 |
| Upper Hunter | 12 | 8 | 4 | 24 |
| Dungog | 10 | 3 | 0 | 13 |

**Sources:** ACCC Mobile Infrastructure Report | Telstra Coverage Maps | Optus Coverage Maps | TPG Coverage Maps

## Analysis of nbn Types of Technology

In order to analyse the **current fixed/fibre network infrastructure** for each region, the deployment status of the **nbn network** was assessed.

**The coverage maps** for each region were examined in terms of **Fibre to the Premises** (FTTP)**, Fibre to the Node** (FTTN), and **Fixed Wireless and Satellite**, as these are the most common types of access. The **types of connections** provided by the NBN are listed below:

**Wired Connections**

**Fibre to the Premises (FTTP)** - used in circumstances where a fibre optic line will be run from the nearest available fibre node, directly to population premises

**Fibre to the Building (FTTB) -** generally used when NBN connects an apartment block or similar types of buildings, running a fibre optic line to the fibre node in the building's communications room, and the using the exiting connection technology in the building.

**Fibre to the Curb (FTTC) -** used in circumstances where fibre is extended close to habitational premises, connecting to a small Distribution Point Unit (DPU), generally located inside a pit on the street.

**Fibre to the Node (FTTN) -** used where the existing copper phone and internet network from a nearby fibre node is used to make the final part of the connection to the NBN network

**Wireless Connections**

**Fixed Wireless -** typically used in circumstances where the distance between premises can be many kilometres.

**Satellite -** used in remote and residential areas that do not have access to the NBN network through wired/fibre connections or fixed wireless

**Source:** NBN National Map Datasets | NBN Australia

# Technology Review - Central Coast

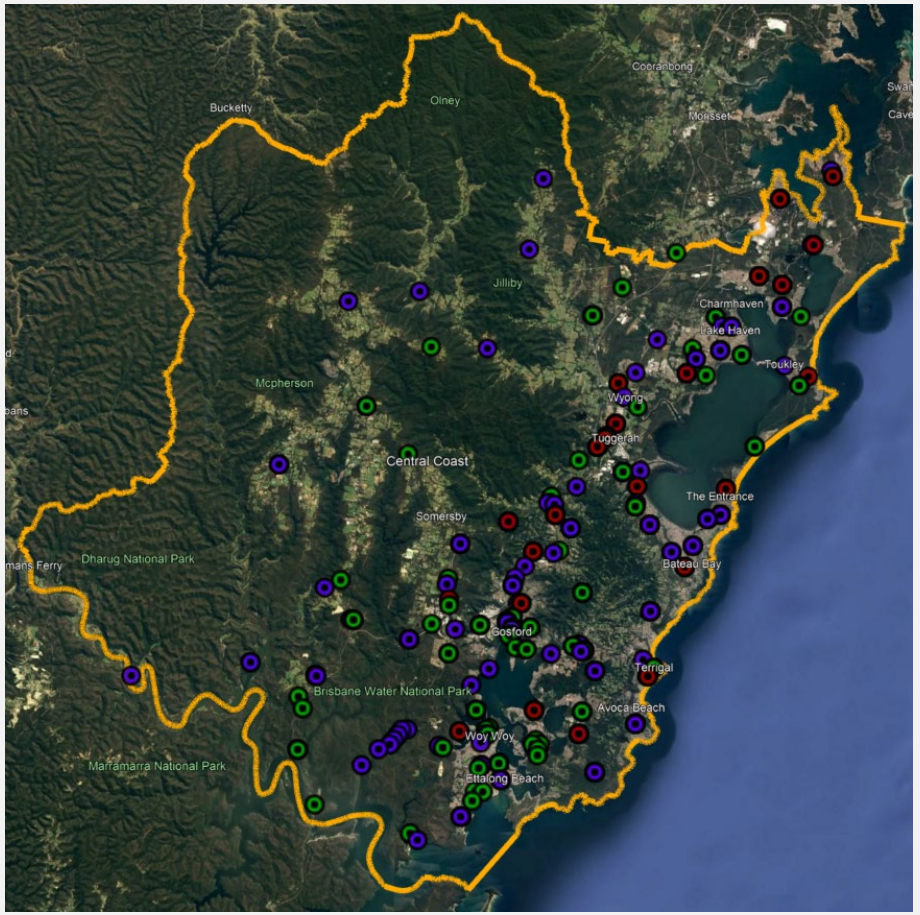
The determination of site numbers and subsequent analysis of coverage maps provides insight into the current state of coverage for various radio technologies (3G, 4G, and 5G), identifying potential connectivity gaps. The following analysis addresses the current mobile network in the region of Central Coast:

## Existing Radio Mobile Sites

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 100 | 90 | 99 | 48 |
| OPTUS | 104 | 83 | 103 | 29 |
| TPG | 61 | 61 | 61 | 21 |

## Analysis of Current State

- **Telstra**: Complete coverage for 3G and 4G technologies across the entire Central Coast region. Regarding 5G, the coverage is extensive, with only a few gaps in suburbs like Wamberal and Matcham. Terrigal is covered with 5G.
- **Optus**: Extensive network coverage for 3G and 4G technologies is available throughout the territory, with potential connectivity gaps in the Dharug National Park area. Concerning the implementation of 5G, it is deployed throughout the main suburbs. Terrigal is covered by 5G.
- **TPG**: Wide coverage for 3G and 4G technologies for the main suburbs. Regarding 5G technology, similar to Optus, it is implemented across the main suburbs, with 5G coverage also available in Terrigal.

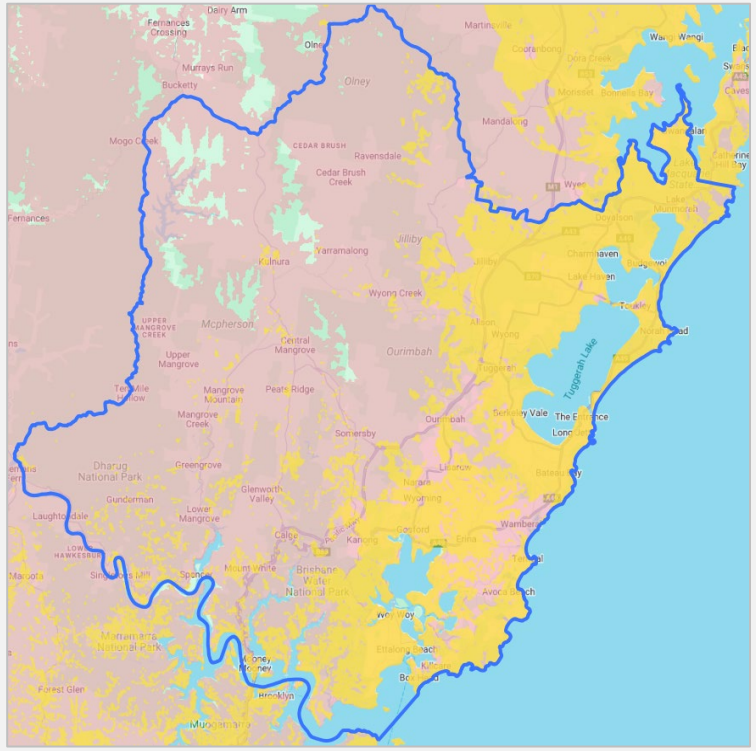


# Technology Review - Central Coast

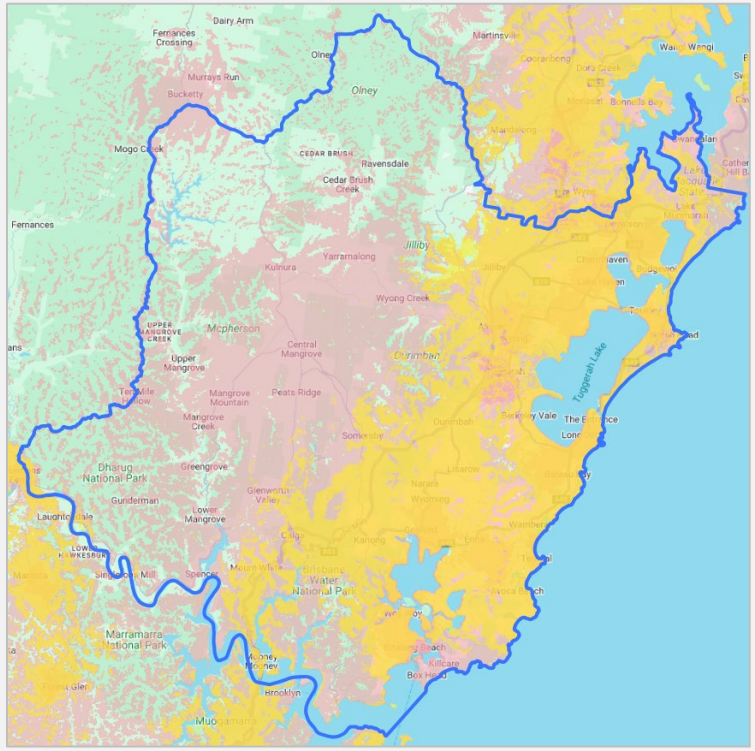
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

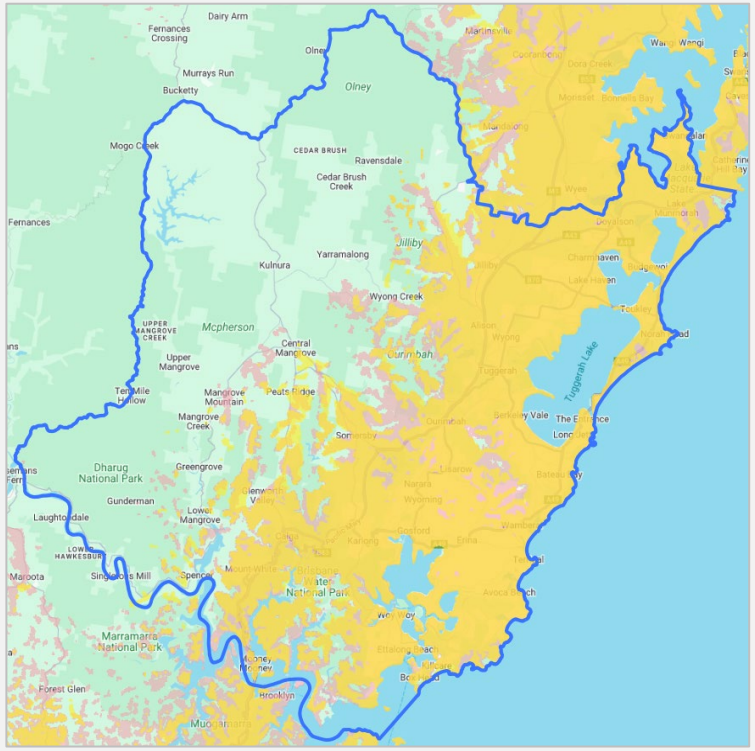
### Telstra Mobile Coverage




### Optus Mobile Coverage




### TPG Mobile Coverage




4G 5G

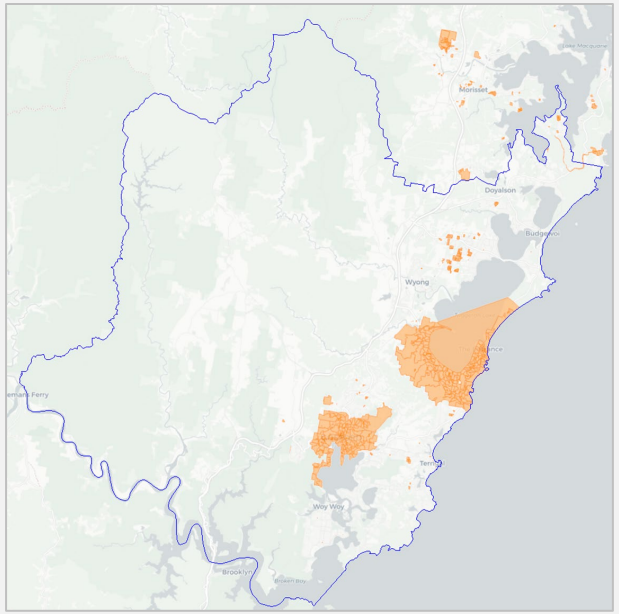
**Sources:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Technology Review - Central Coast

The analysis of coverage maps for the National Broadband Network (NBN) provides insight into the current deployment status, including fixed-line access (Fibre to the Premises and Fibre to the Node), as well as access to the network through fixed wireless and satellite. The following maps represent the current state of the Central Coast region.

## NBN Technology Types

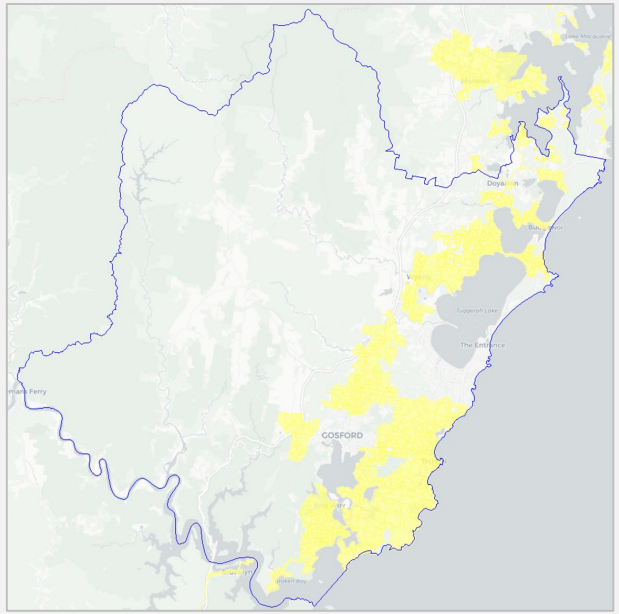
### NBN - Fibre to the Premises




Fibre to the Premises

- The Central Coast region is densely urban in population (98.2 per cent) and, within the DSSN region group, it is one of the highest in terms of FTTP coverage. This access is ensured for the entire suburbs of Gosford and The Entrance.

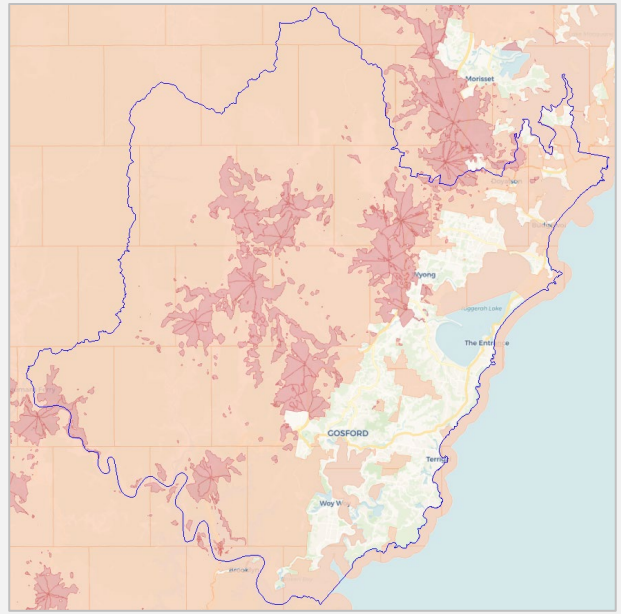
### NBN - Fibre to the Node




Fibre to the Node

- The remaining urban areas, and consequently densely populated areas, of the Central Coast region, such as Woy Woy, Terrigal, or Lisarow, where there is constant network access for various industrial sectors and individuals, have at least one Fibre to the Node connection.

### NBN - Fixed Wireless and Satellite




Satellite Fixed Wireless

- The more rural areas of the Central Coast region, such as Mangrove and Somersby, where there are some residences, points of interest, or industrial zones, have access to fixed wireless, while the entire remaining mountainous area is connected via satellite.

# Technology Review - Cessnock

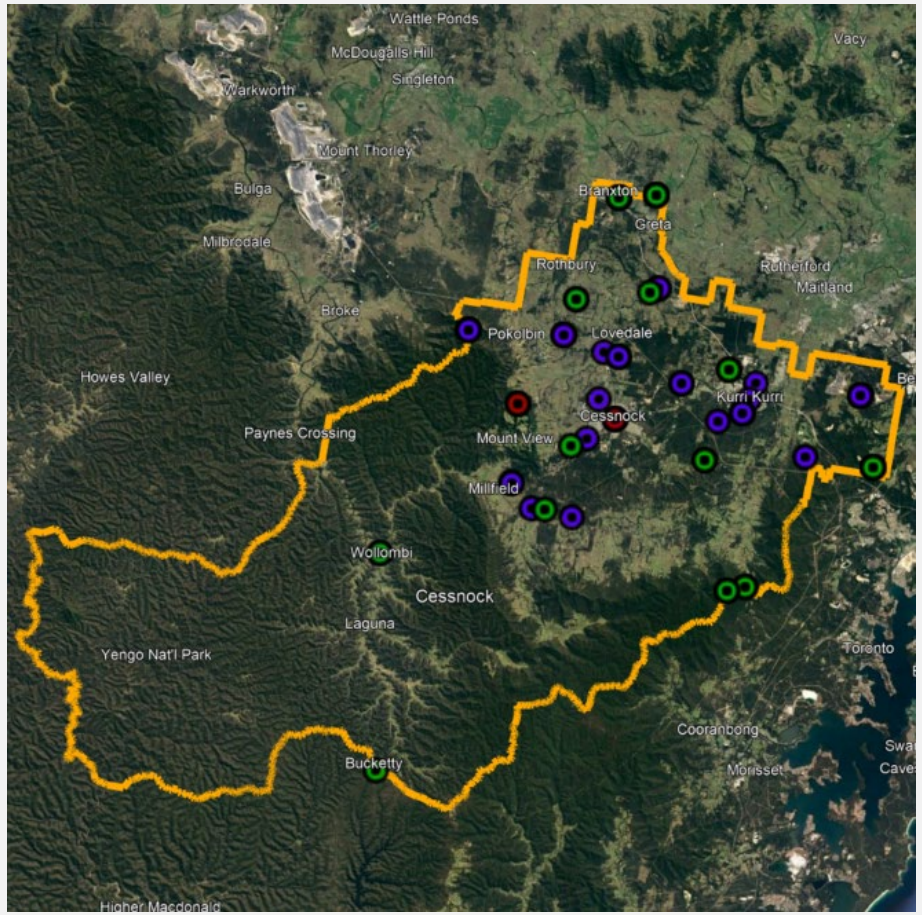
The determination of site numbers and subsequent analysis of coverage maps provides insight into the current state of coverage for various radio technologies (3G, 4G, and 5G), identifying potential connectivity gaps. The following analysis addresses the current mobile network in the region of Cessnock:

## Existing Radio Mobile Sites

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 24 | 20 | 24 | 14 |
| OPTUS | 22 | 22 | 21 | 0 |
| TPG | 13 | 13 | 13 | 3 |

## Analysis of Current State

- **Telstra**: Complete coverage of 3G and 4G in the inhabited and industrially active regions. Remote and forested areas like Pokolbin State Forest and Yengo National Park may have some coverage dead zones. 5G is available in all densely populated areas. The residential area of Pokolbin is covered via 5G by Telstra.
- **Optus**: 3G and 4G are available in central and residential areas of the Cessnock region. Similar to Telstra, there may be coverage dead zones in national parks and, in this case, in areas like Wollombi and Laguna. 5G coverage is not available from Optus in this region.
- **TPG**: Similar to Telstra and Optus, 3G and 4G are present in the more populated areas of the region. However, TPG may have coverage gaps in more peripheral areas of Pokolbin like Cedar Creek and Mount View. 5G coverage is limited east area of Cessnock regions, in suburbs such Kurri Kurri.

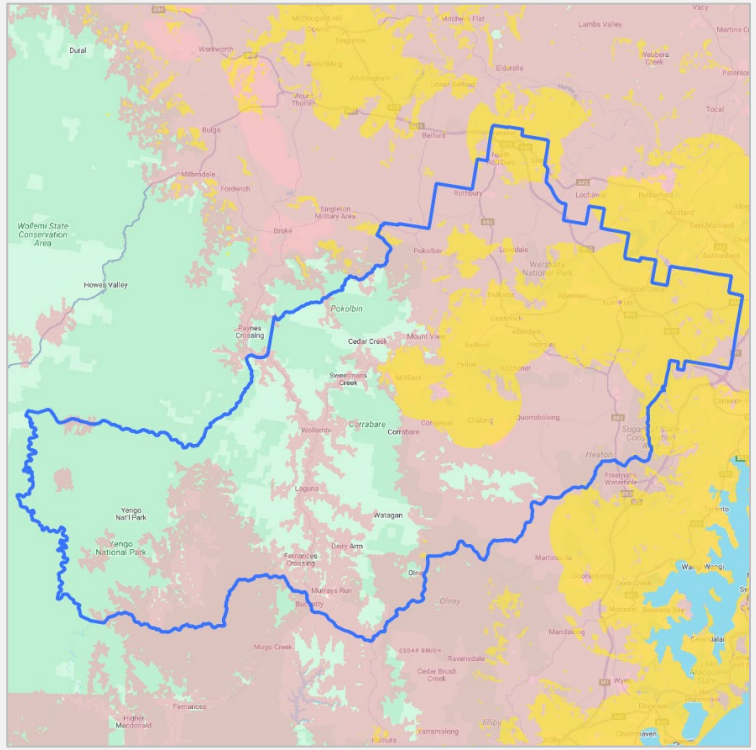


# Technology Review - Cessnock

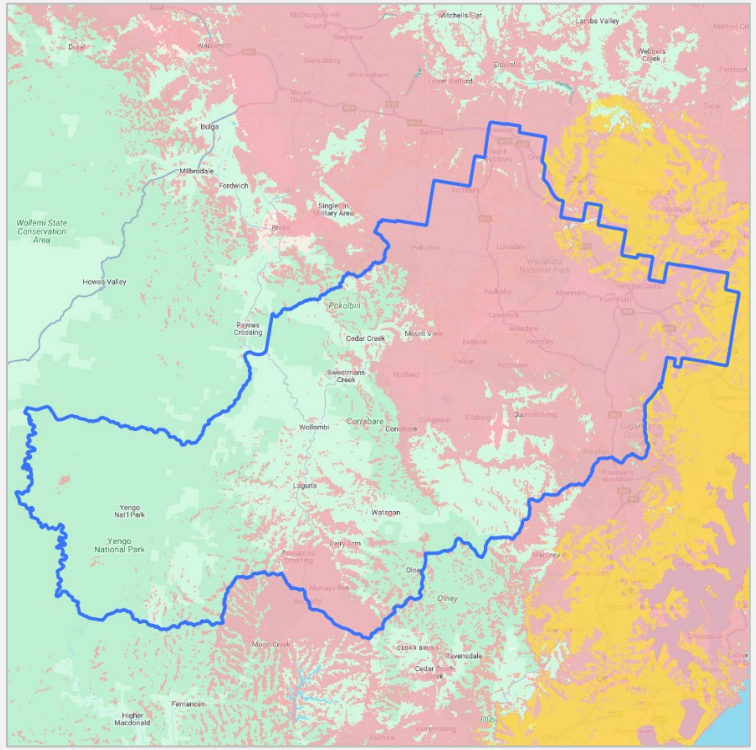
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

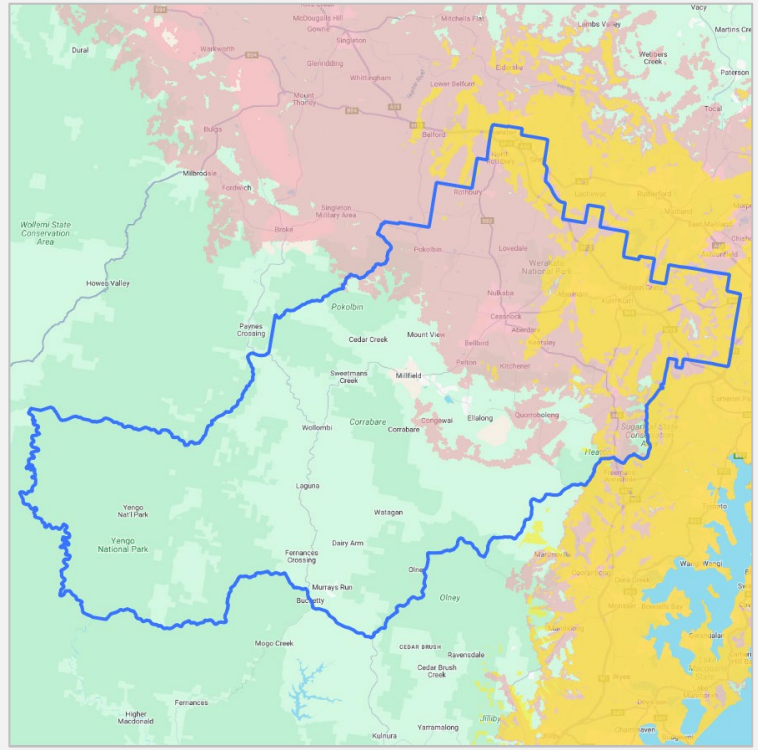
### Telstra Mobile Coverage



### Optus Mobile Coverage



### TPG Mobile Coverage



4G 5G

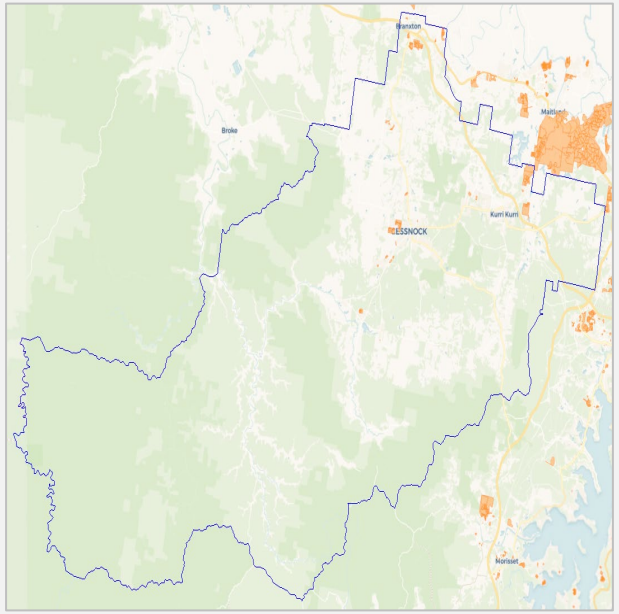
**Source:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Technology Review - Cessnock

The analysis of coverage maps for the National Broadband Network (NBN) provides insight into the current deployment status, including fixed-line access (Fibre to the Premises and Fibre to the Node), as well as access to the network through fixed wireless and satellite. The following maps represent the current state of the Cessnock region.

## NBN Technology Types

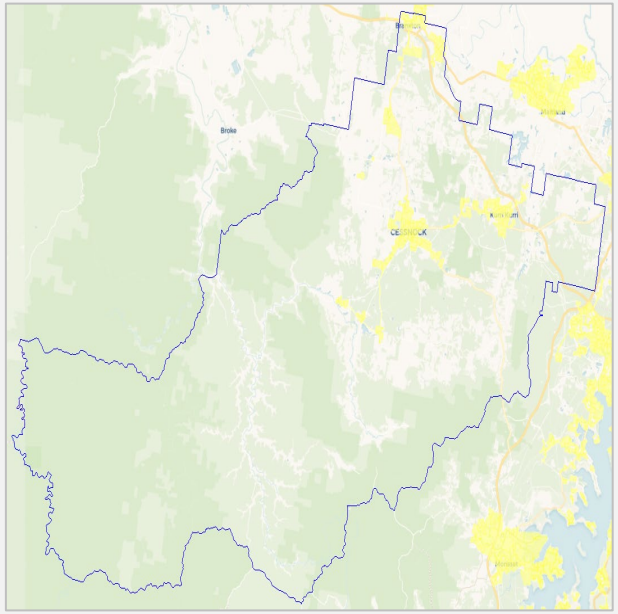
### NBN - Fibre to the Premises



Fibre to the Premises

- The Cessnock region is considered a rural area, and as such, access to Fibre to the Premises is significantly limited throughout the entire region. Only a small central area of Cessnock and North Rothbury has access to this type of technology.

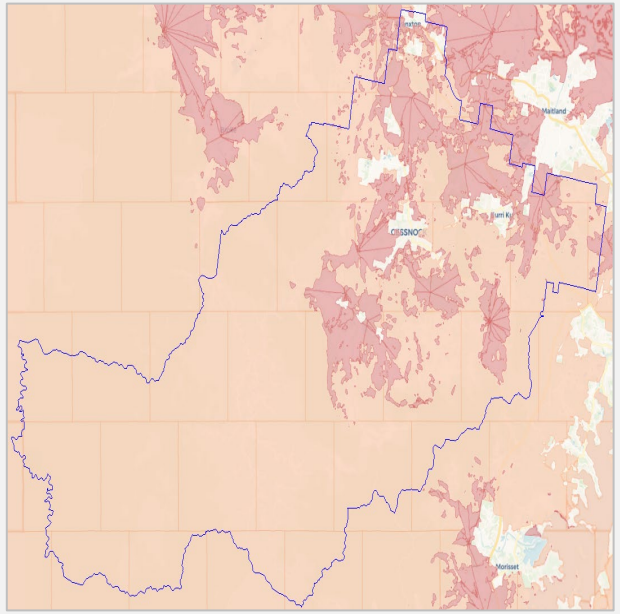
### NBN - Fibre to the Node



Fibre to the Node

- For the remaining areas with some residences and consequently population, access to fibre is guaranteed at least up to a central node. This is the case for most of the suburbs of Cessnock, Kurri Kurri, Branxton, Greta and Pokolbin residential zone.

### NBN - Fixed Wireless and Satellite



Satellite Fixed Wireless

- The LGA of Cessnock is considered 100 per cent rural in terms of population. Consequently, it is natural that the NBN primarily offers network access through fixed wireless or satellite connections for the more remote areas with sparse resident population.

# Technology Review - Dungog

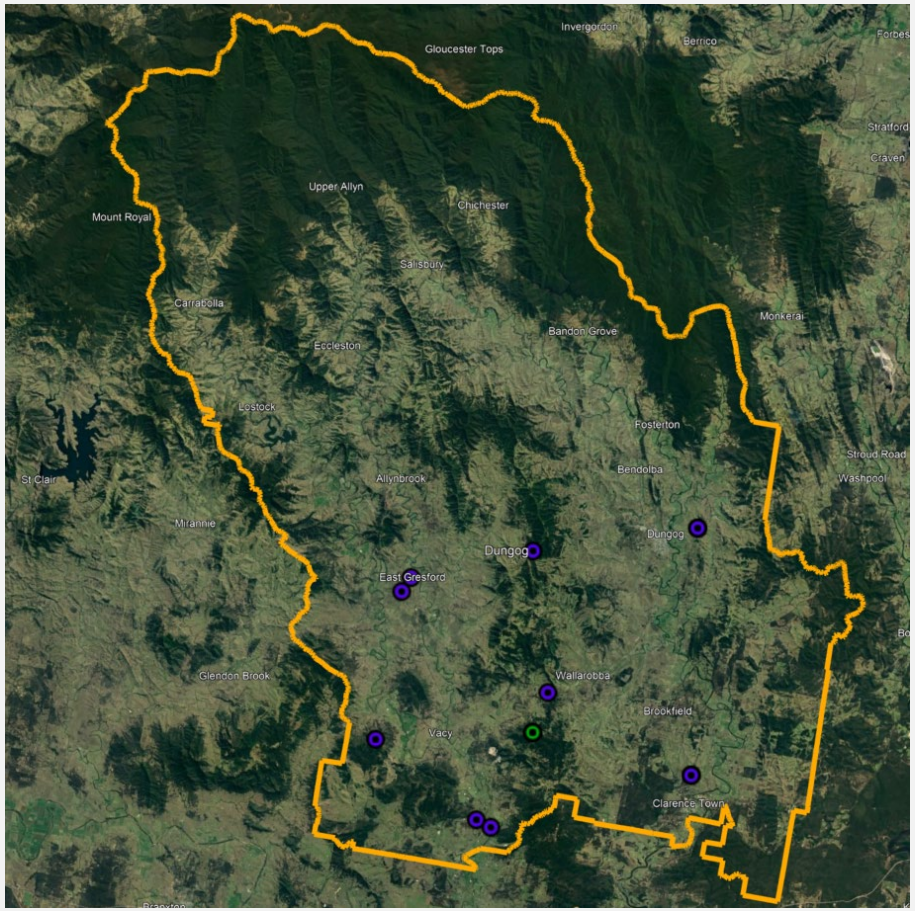
The determination of site numbers and subsequent analysis of coverage maps provides insight into the current state of coverage for various radio technologies (3G, 4G, and 5G), identifying potential connectivity gaps. The following analysis addresses the current mobile network in the region of Dungog:

## Existing Radio Mobile Sites

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 10 | 7 | 8 | 0 |
| OPTUS | 3 | 3 | 3 | 0 |
| TPG | 0 | 0 | 0 | 0 |

## Analysis of Current State

- **Telstra**: 3G and 4G are available in the main residential areas of the Dungog region. There is no 5G coverage for this region.
- **Optus**: 3G and 4G are available in the residential areas of Dungog, Wallarobba, and Clarence Town. The northern area (area with lower population density) of the region has visible coverage gaps. There is no 5G coverage from Optus.
- **TPG**: There is no existence of any type of mobile base station in the Dungog region, and therefore, there is no coverage of 3G, 4G, and 5G from TPG.

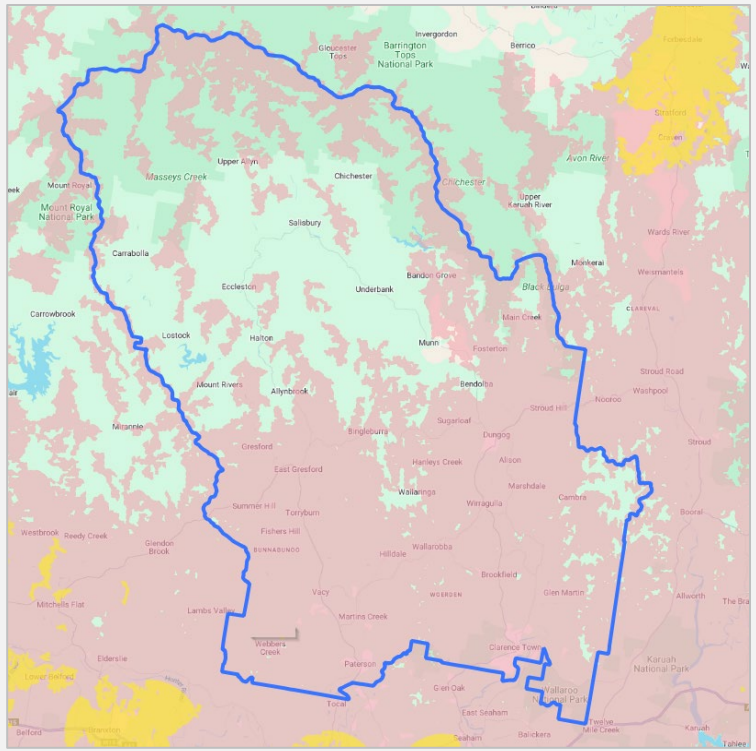


# Technology Review - Dungog

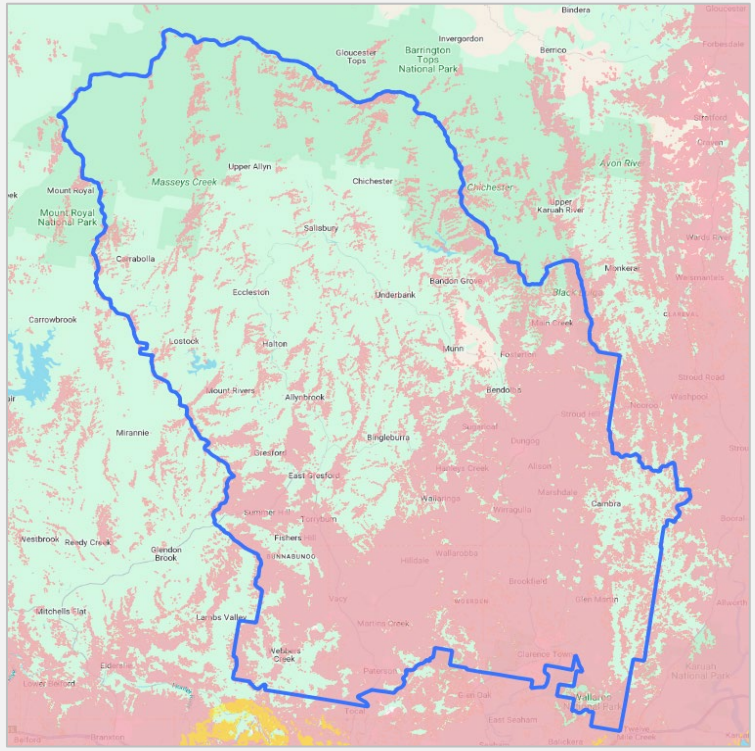
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

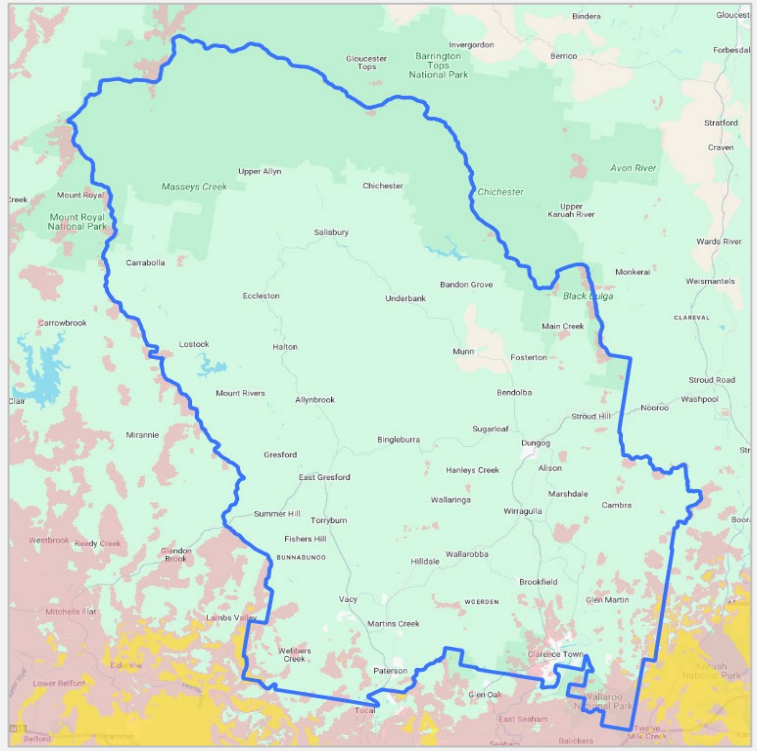
### Telstra Mobile Coverage




### Optus Mobile Coverage




### TPG Mobile Coverage




4G 5G

**Source:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Technology Review - Dungog

The analysis of coverage maps for the National Broadband Network (NBN) provides insight into the current deployment status, including fixed-line access (Fibre to the Premises and Fibre to the Node), as well as access to the network through fixed wireless and satellite. The following maps represent the current state of the Dungog region.

## NBN Technology Types

### NBN - Fibre to the Premises


Fibre to the Premises

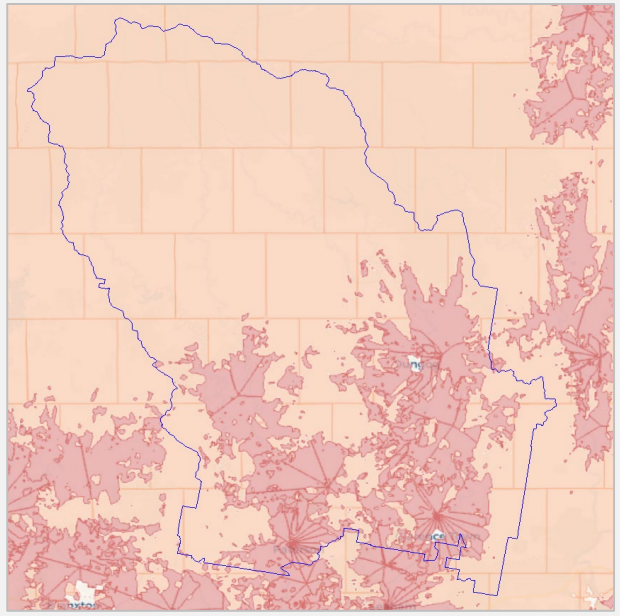
- The Dungog region is considered 100 per cent rural and has a total population of only 9,894 inhabitants. For this region, the NBN does not provide any type of access to its network through Fibre to the Premises.

### NBN - Fibre to the Node


Fibre to the Node

- Fibre to the Node access is ensured in the residential zone of this Local Government Area (LGA), with the population of the suburbs of Dungog and Clarence Town having access to NBN services through this type of connection.

### NBN - Fixed Wireless and Satellite



Satellite Fixed Wireless

- Considering Dungog's status as an LGA with a vast and predominantly rural/remote area, the NBN primarily offers access to its services for Dungog through fixed wireless and satellite connections.

# Technology Review - Lake Macquarie

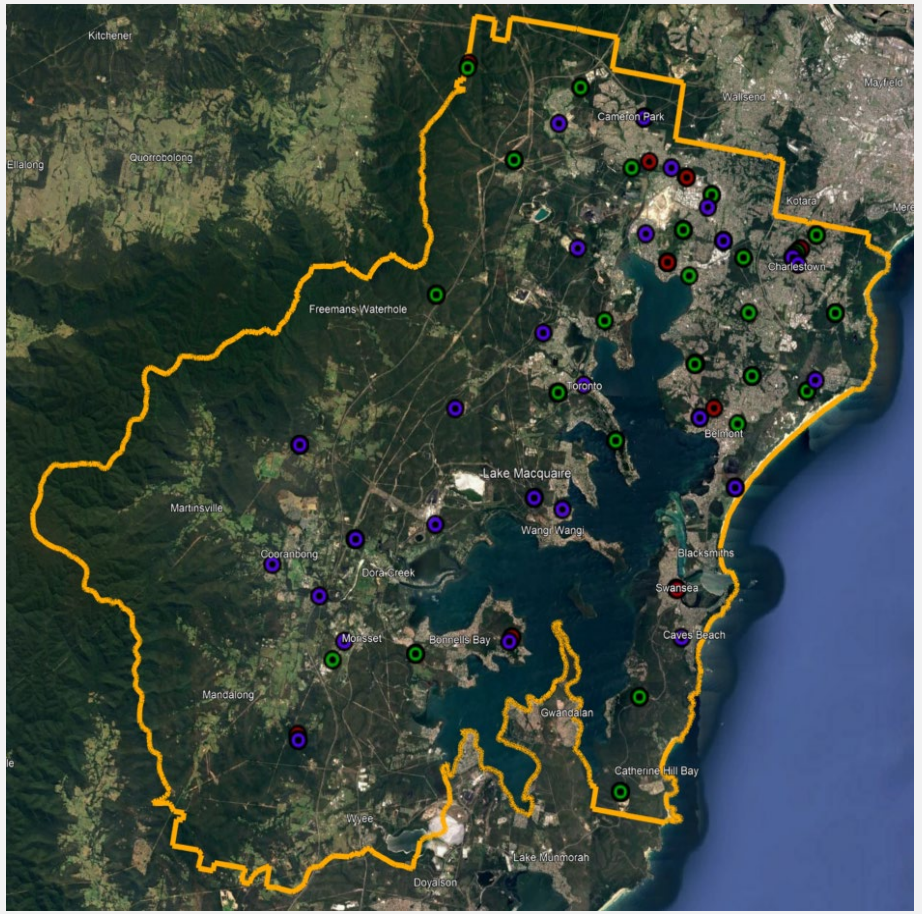
The determination of site numbers and subsequent analysis of coverage maps provides insight into the current state of coverage for various radio technologies (3G, 4G, and 5G), identifying potential connectivity gaps. The following analysis addresses the current mobile network in the region of Lake Macquarie:

## Existing Radio Mobile Sites

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 40 | 33 | 38 | 30 |
| OPTUS | 39 | 34 | 39 | 18 |
| TPG | 32 | 31 | 31 | 20 |

## Analysis of Current State

- **Telstra:** 3G and 4G coverage available for the entire Lake Macquarie region. 5G coverage is well established in this region, including coverage for the Morisset area.
- **Optus:** 3G and 4G coverage available for all densely populated suburbs, including suburbs located in more outer areas like Martinsville. Regarding 5G, coverage is available for populated areas, including the suburbs of Charlestown, Belmont, Toronto, and Morisset.
- **TPG:** 3G and 4G coverage available throughout the Lake Macquarie region. 5G is also available for all suburbs with higher population density, presenting few coverage gaps.

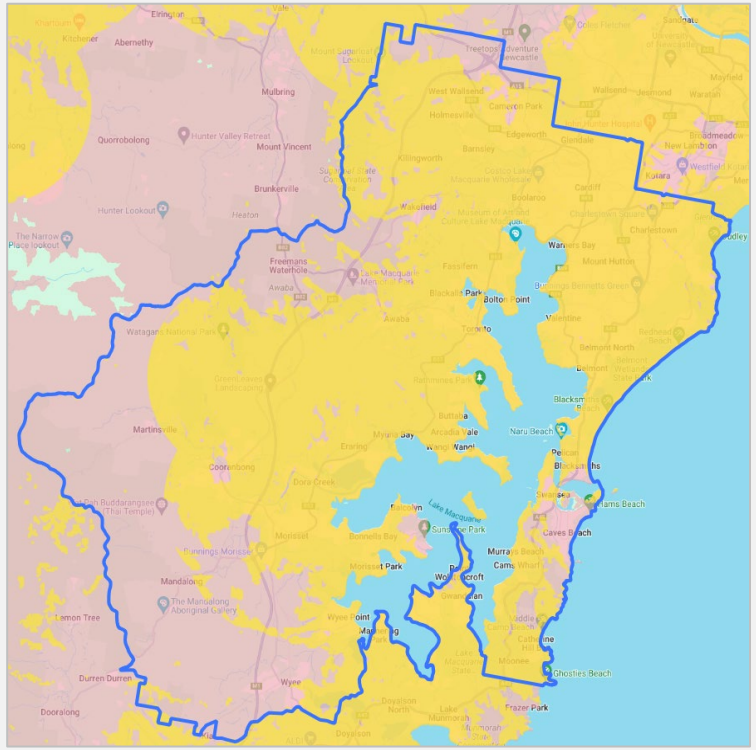


# Technology Review - Lake Macquarie

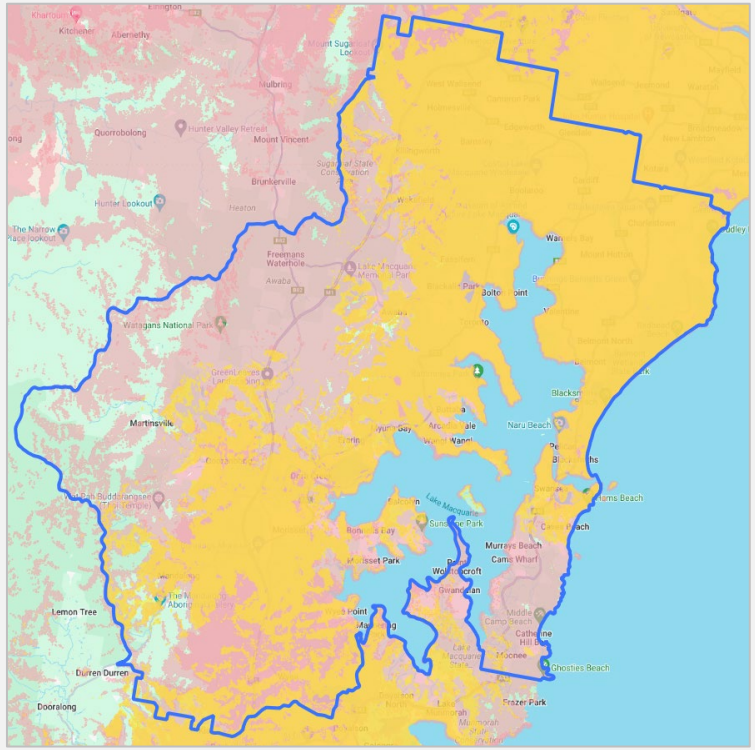
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

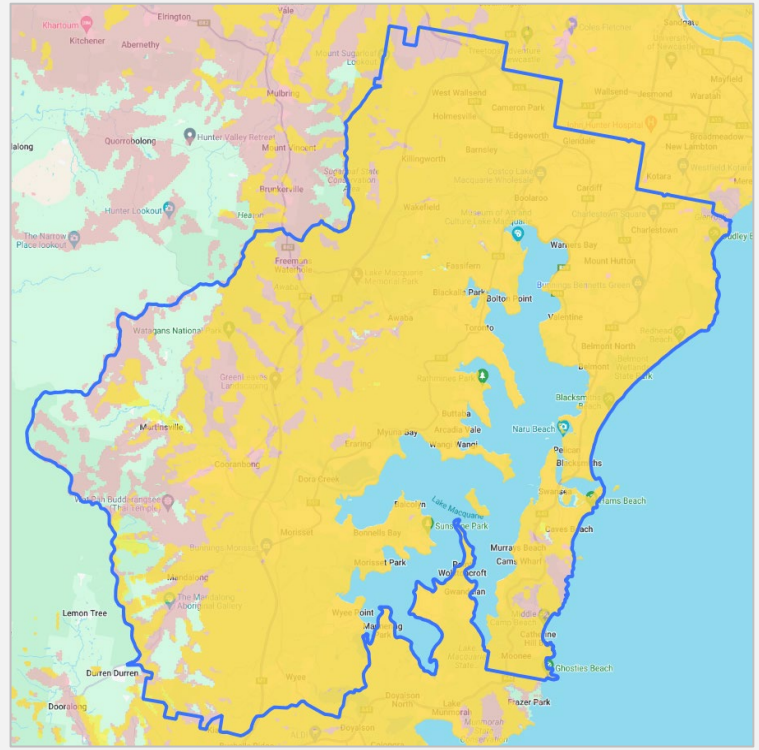
### Telstra Mobile Coverage




### Optus Mobile Coverage




### TPG Mobile Coverage




4G 5G

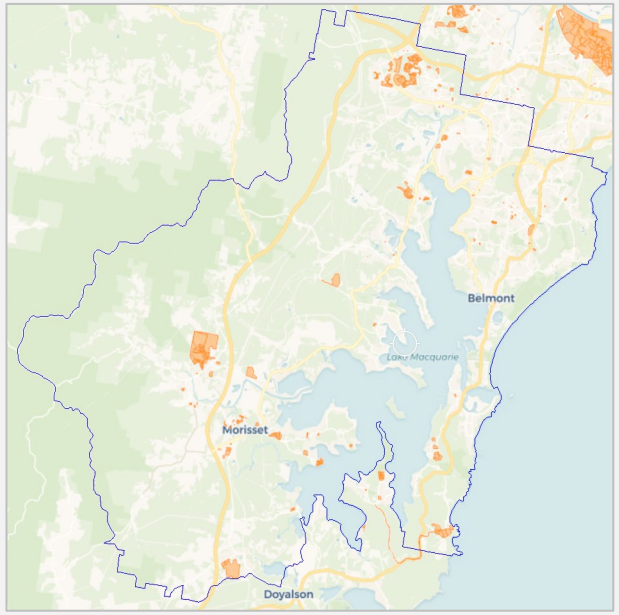
**Source:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Technology Review - Lake Macquarie

The analysis of coverage maps for the National Broadband Network (NBN) provides insight into the current deployment status, including fixed-line access (Fibre to the Premises and Fibre to the Node), as well as access to the network through fixed wireless and satellite. The following maps represent the current state of the Lake Macquarie region.

## NBN Technology Types

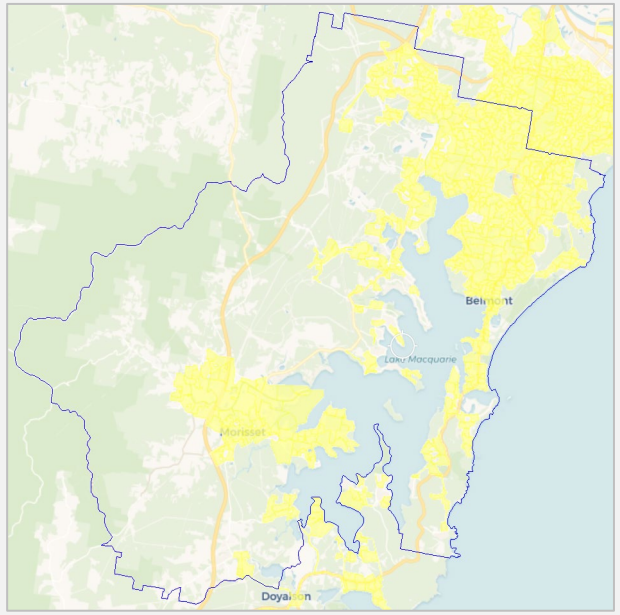
### NBN - Fibre to the Premises




Fibre to the Premises

- Although the Lake Macquarie region has some population and is mostly urban, access to fibre to the premises is available only in certain residential areas of West Wall and North Cooranbong.

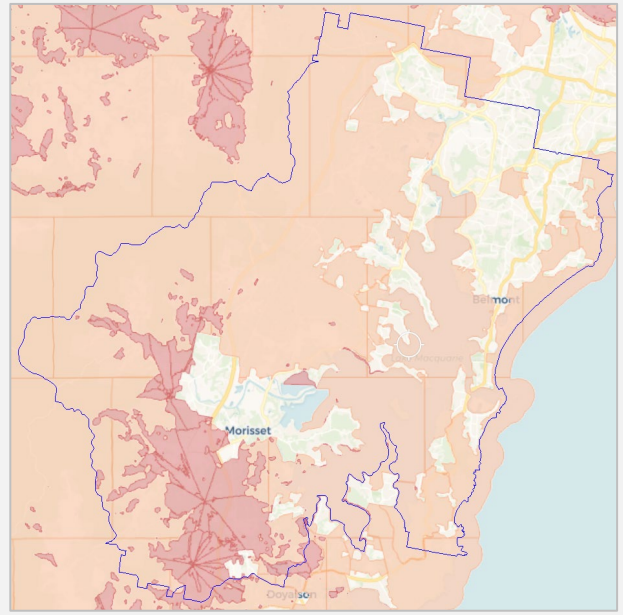
### NBN - Fibre to the Node




Fibre to the Node

- Fibre to the Node access to the NBN network is predominantly available to all areas around the Lake, where the majority of residences and industrial sectors are located. The suburbs of Morisset, Toronto, and Charlestown have this type of access.

### NBN - Fixed Wireless and Satellite




Satellite Fixed Wireless

- The areas farther away from the lake, consequently with lower population density, less tourist attraction, and fewer business opportunities, are more remote and rural. In these areas, access to the NBN network is provided through Fixed Wireless and Satellite connections.

# Technology Review - Maitland

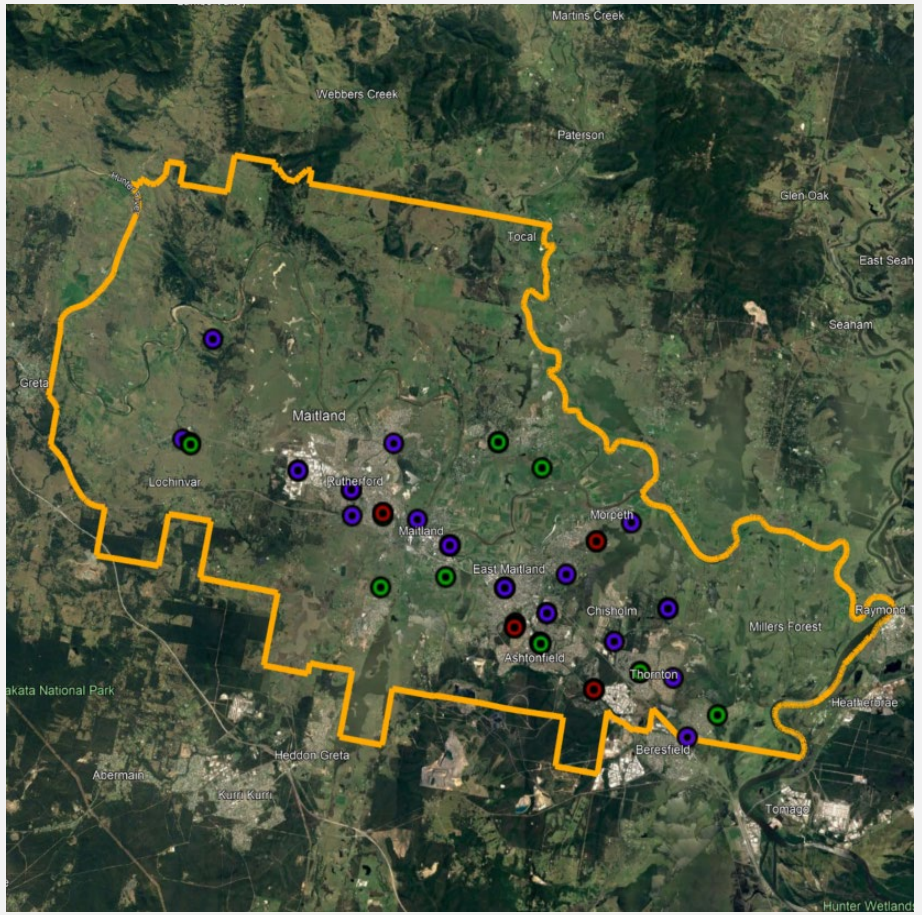
The determination of site numbers and subsequent analysis of coverage maps provides insight into the current state of coverage for various radio technologies (3G, 4G, and 5G), identifying potential connectivity gaps. The following analysis addresses the current mobile network in the region of Maitland:

## Existing Radio Mobile Sites

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 22 | 16 | 21 | 16 |
| OPTUS | 18 | 15 | 18 | 3 |
| TPG | 10 | 10 | 10 | 1 |

## Analysis of Current State

- **Telstra:** Complete coverage via 3G and 4G for the Maitland region. Regarding 5G, Telstra provides extensive coverage, including areas further from the centre such as Windella and the airport zone.
- **Optus:** 3G and 4G coverage available for the entire Maitland region with few gaps in the zone of Hillsborough. Concerning 5G, Optus has coverage southern zone of Maitland (Maitland Park) and East Maitland.
- **TPG:** 3G and 4G technology available for the entire Maitland region. With regard to 5G, despite TPG having only 1 5G radio site in the region (located between Maitland and Rutherford), there are other radio sites near the boundaries of the region (e.g., Greta) that provide 5G coverage, ensuring the existence of this technology throughout the Maitland, Rutherford, and East Maitland area.

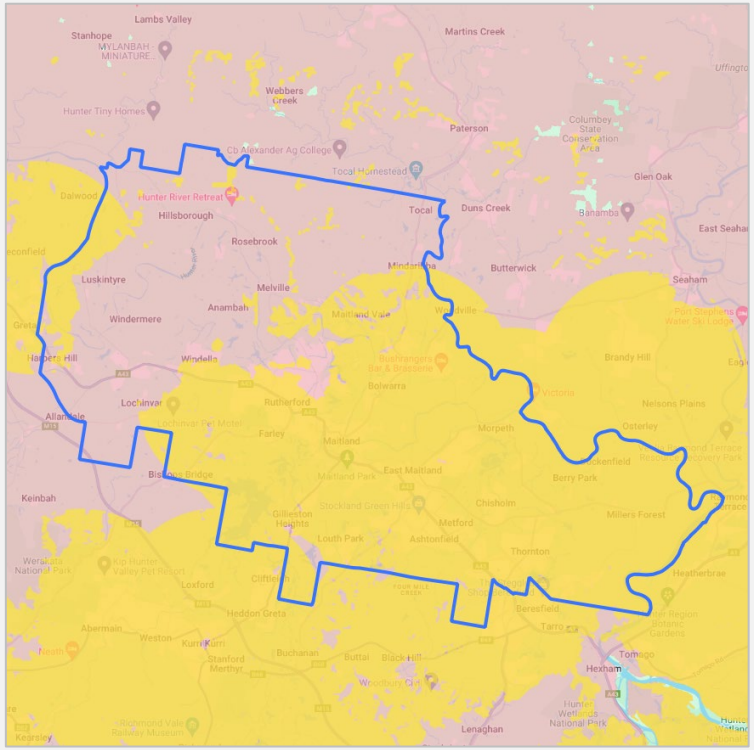


# Technology Review - Maitland

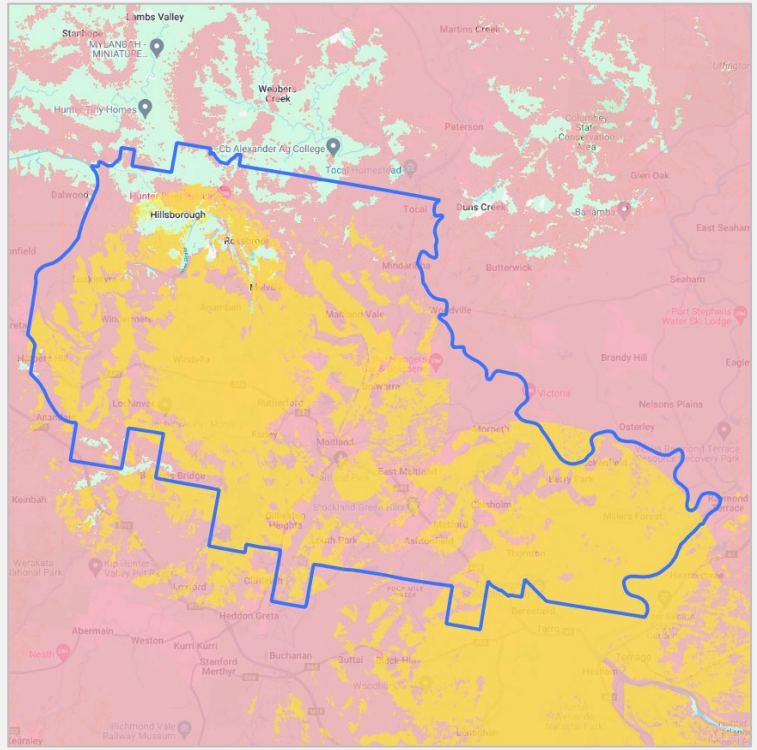
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

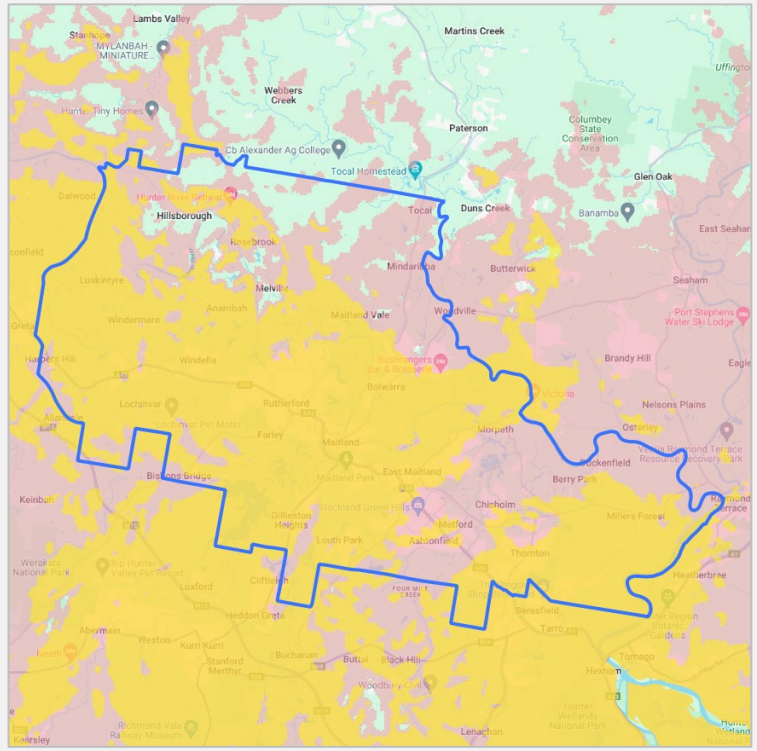
### Telstra Mobile Coverage




### Optus Mobile Coverage




### TPG Mobile Coverage




4G 5G

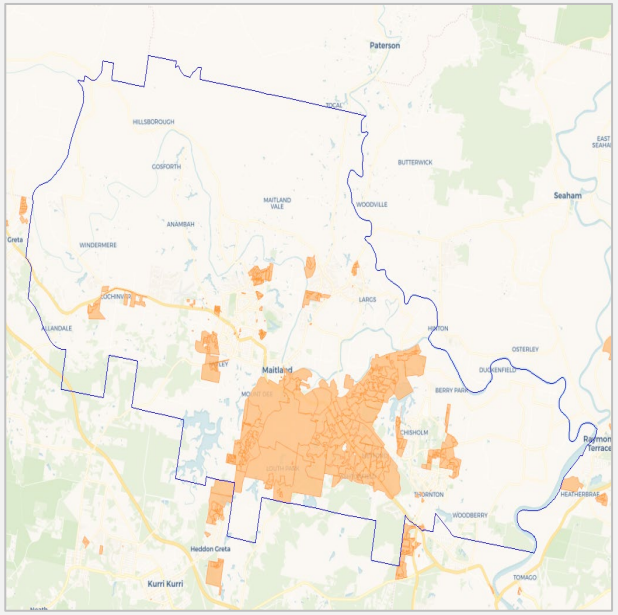
**Source:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Technology Review - Maitland

The analysis of coverage maps for the National Broadband Network (NBN) provides insight into the current deployment status, including fixed-line access (Fibre to the Premises and Fibre to the Node), as well as access to the network through fixed wireless and satellite. The following maps represent the current state of the Maitland region.

## NBN Technology Types

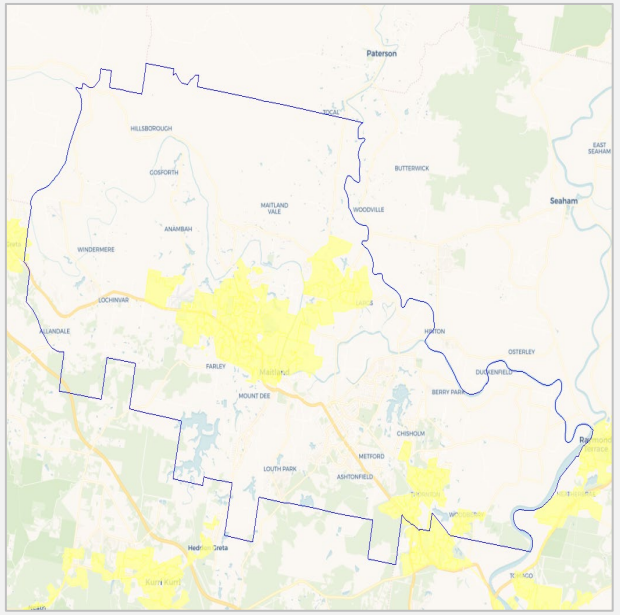
### NBN - Fibre to the Premises




Fibre to the Premises

- In terms of absolute area, the Maitland region is the second smallest among the 10 regions of the DSSN. However, it is one of the largest in terms of population, and therefore, it features an extensive area with access to Fibre to the Premises, predominantly in the South and East Maitland areas.

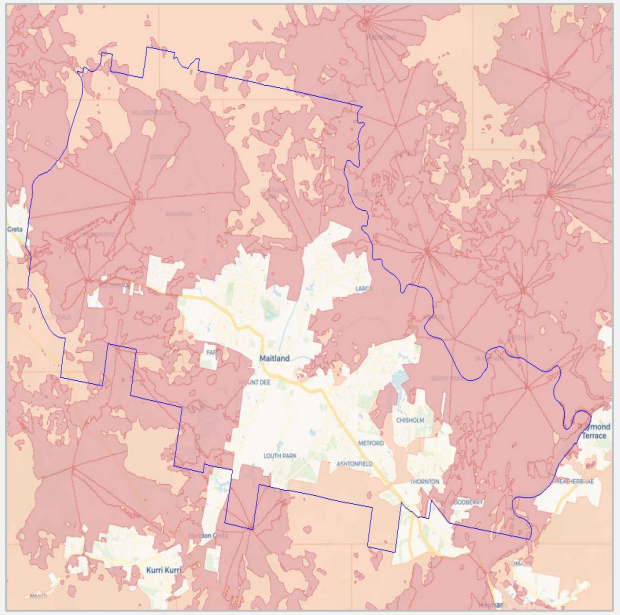
### NBN - Fibre to the Node




Fibre to the Node

- The remaining residential areas of Maitland, including less densely populated neighborhoods such as Rutherford, Thornton, and Woodberry, have access to the NBN network through Fibre to the Node.

### NBN - Fixed Wireless and Satellite




Satellite Fixed Wireless

- The more remote areas of the Maitland region, consequently with less population and economic activity, have access to NBN network services through fixed wireless, and in extremely remote areas, through satellite connections.

# Technology Review - Muswellbrook

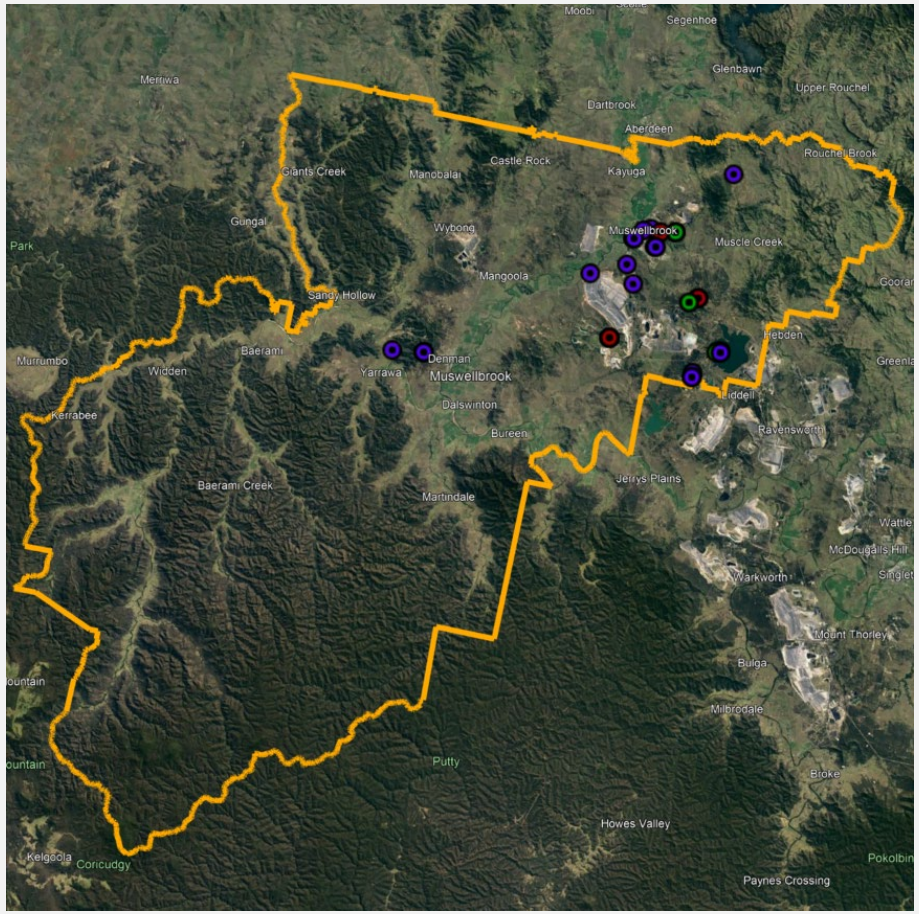
The determination of site numbers and subsequent analysis of coverage maps provides insight into the current state of coverage for various radio technologies (3G, 4G, and 5G), identifying potential connectivity gaps. The following analysis addresses the current mobile network in the region of Muswellbrook:

## Existing Radio Mobile Sites

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 18 | 10 | 16 | 2 |
| OPTUS | 7 | 7 | 7 | 0 |
| TPG | 3 | 3 | 2 | 0 |

## Analysis of Current State

- **Telstra:** 3G and 4G coverage available for all residential and industrial areas. 5G coverage is only available in the central zone of Muswellbrook and Kayuga.
- **Optus**: 3G and 4G coverage available for densely populated areas. Areas further from the centre, such as the suburb of Martindale, may have some connectivity gaps in 3G and 4G. Optus does not have 5G radio sites within the Muswellbrook LGA. However, due to radio sites located in Aberdeen and Liddell, there may be coverage in and around these areas.
- **TPG**: 3G and 4G available for the central zone of Muswellbrook. The peripheral area, including suburbs like Denman and Wybong, may have only 3G connectivity. 5G is not available from TPG for the Muswellbrook region.

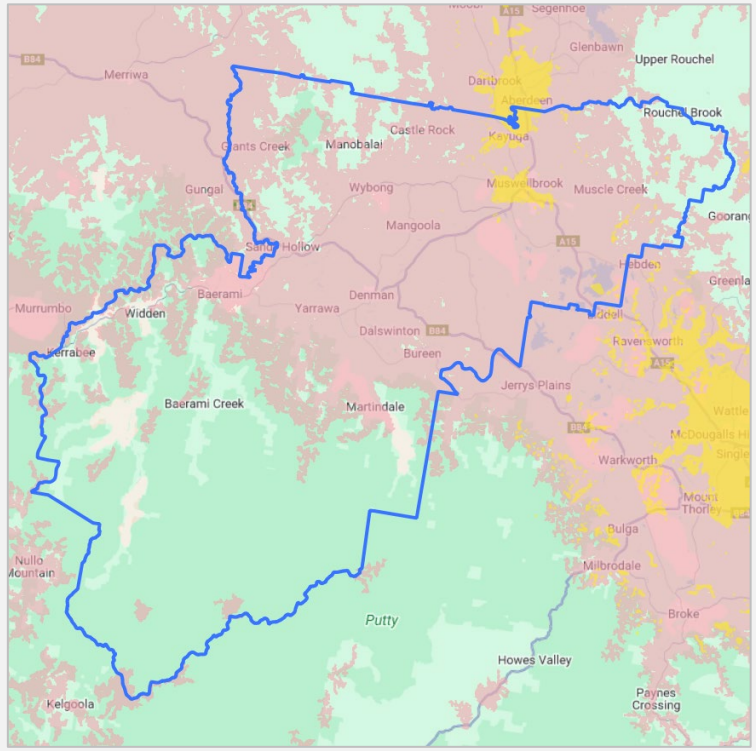


# Technology Review - Muswellbrook

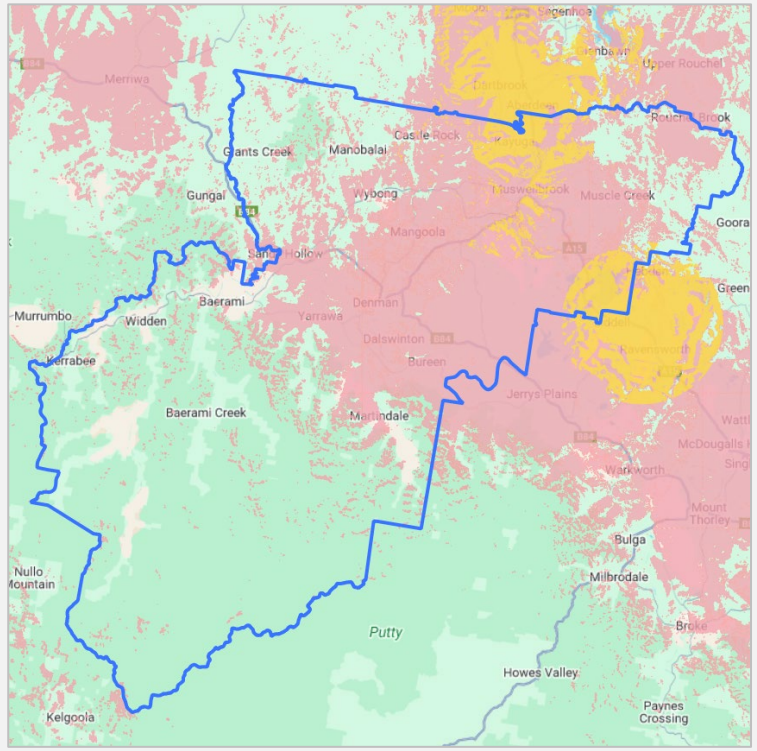
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

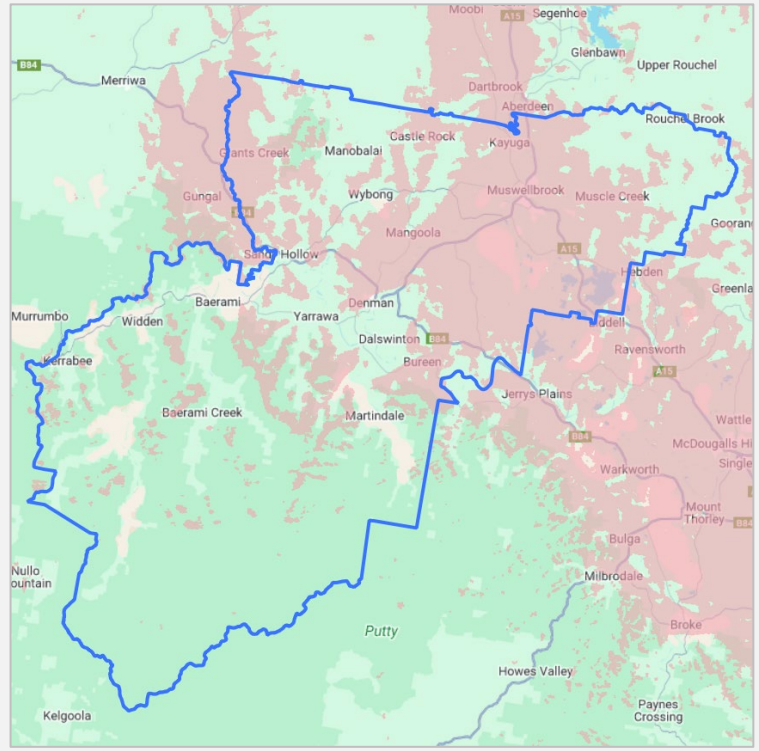
### Telstra Mobile Coverage




### Optus Mobile Coverage




### TPG Mobile Coverage




4G 5G

**Source:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Technology Review - Muswellbrook

The analysis of coverage maps for the National Broadband Network (NBN) provides insight into the current deployment status, including fixed-line access (Fibre to the Premises and Fibre to the Node), as well as access to the network through fixed wireless and satellite. The following maps represent the current state of the Muswellbrook region.

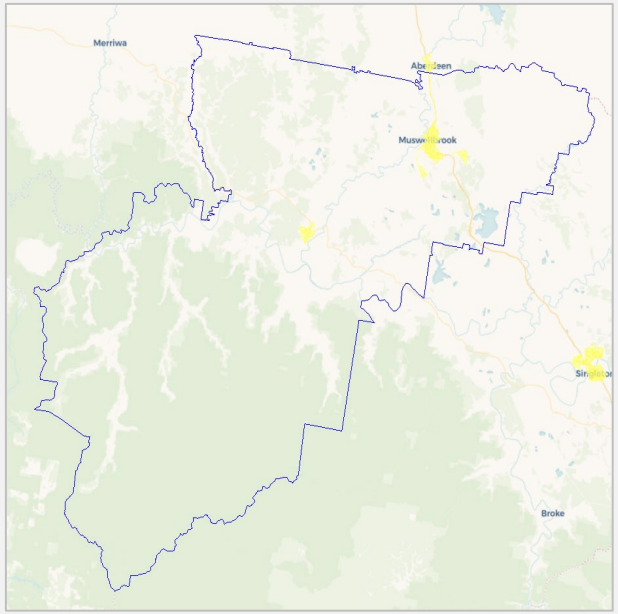
## NBN Technology Types

### NBN - Fibre to the Premises


Fibre to the Premises

- The Muswellbrook region is considered 100 per cent rural in terms of population, and access to the NBN network through Fibre to the Premises is only available in a residential area of the city of Muswellbrook.

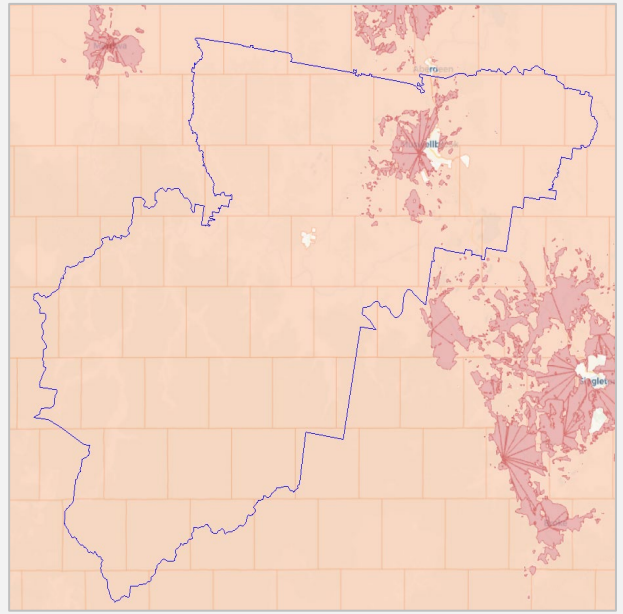
### NBN - Fibre to the Node




Fibre to the Node

- The Muswellbrook region has a total population of only 18,154 inhabitants, all concentrated in the cities of Muswellbrook and Denman. These inhabitants have access to NBN services via Fibre to the Node.

### NBN - Fixed Wireless and Satellite



Satellite Fixed Wireless

- The Muswellbrook region is extremely rural, with a significant portion of its area covered by the Wollemi National Park. In this highly remote and mountainous region, access to the NBN network is only available via satellite.

# Technology Review - Newcastle

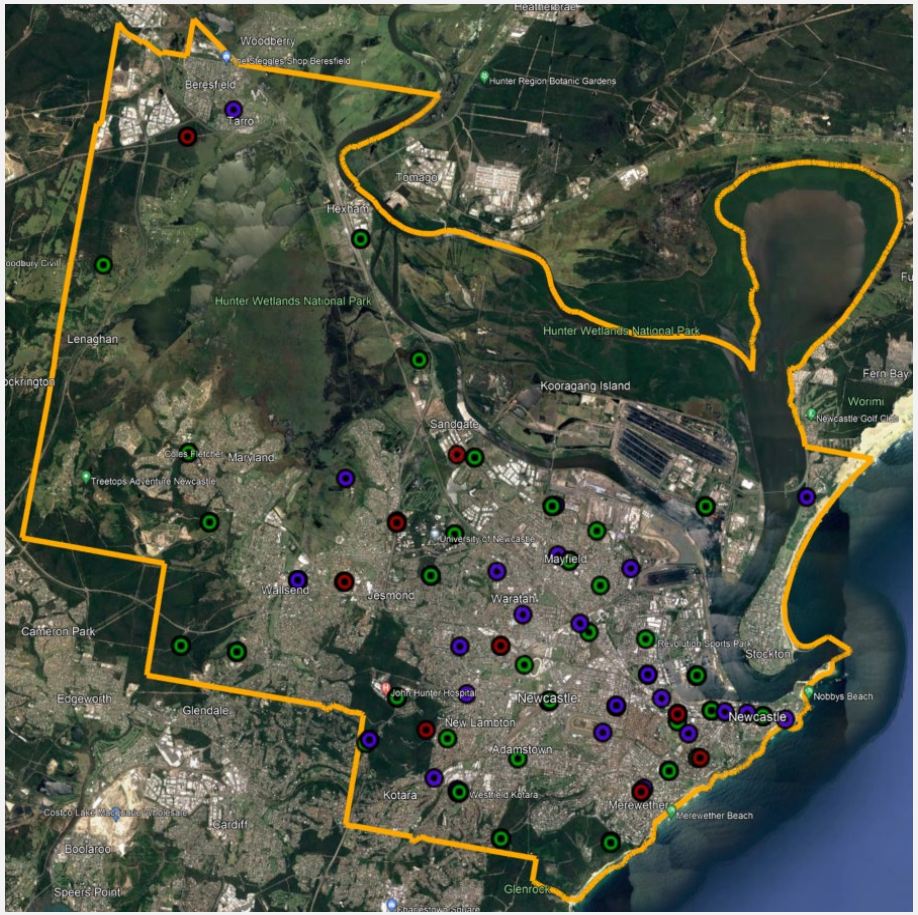
The determination of site numbers and subsequent analysis of coverage maps provides insight into the current state of coverage for various radio technologies (3G, 4G, and 5G), identifying potential connectivity gaps. The following analysis addresses the current mobile network in the region of Newcastle:

## Existing Radio Mobile Sites

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 43 | 40 | 43 | 35 |
| OPTUS | 41 | 37 | 41 | 20 |
| TPG | 30 | 30 | 30 | 11 |

## Analysis of Current State

- **Telstra**: 3G and 4G coverage available for the entire Newcastle region. Regarding 5G, Telstra provides coverage for densely populated areas such as the centre of Newcastle, Mayfield, Adamstown, Wallsend, and New Lambton.
- **Optus**: 3G and 4G coverage available for the entire Newcastle region. Extremely developed 5G coverage for the entire region, including the Hunter Wetland National Park, with few coverage gaps.
- **TPG**: 3G and 4G coverage available throughout the Newcastle region. Concerning 5G coverage, TPG provides coverage for populated areas, with few coverage gaps, only visible in the southern part of the suburb of Merewether.

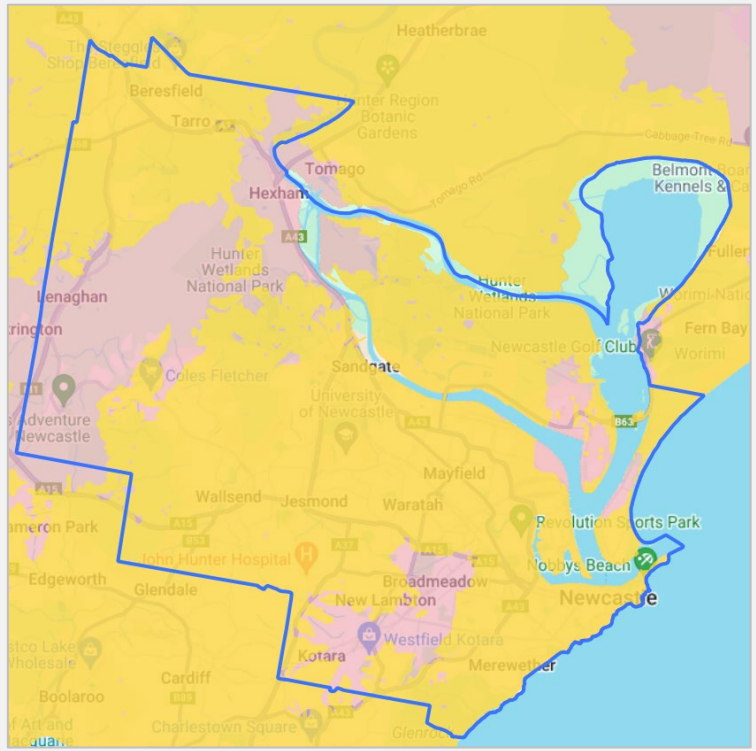


# Technology Review - Newcastle

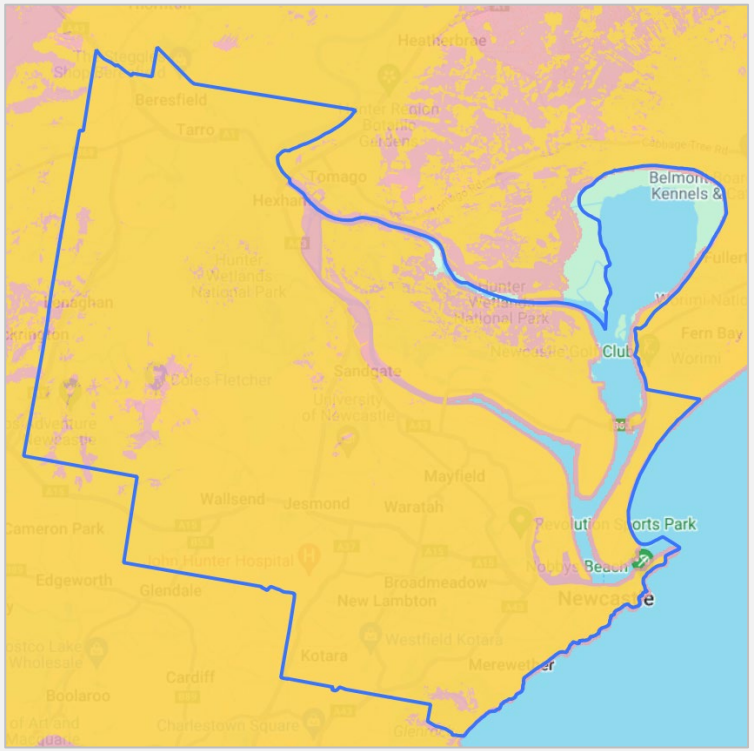
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

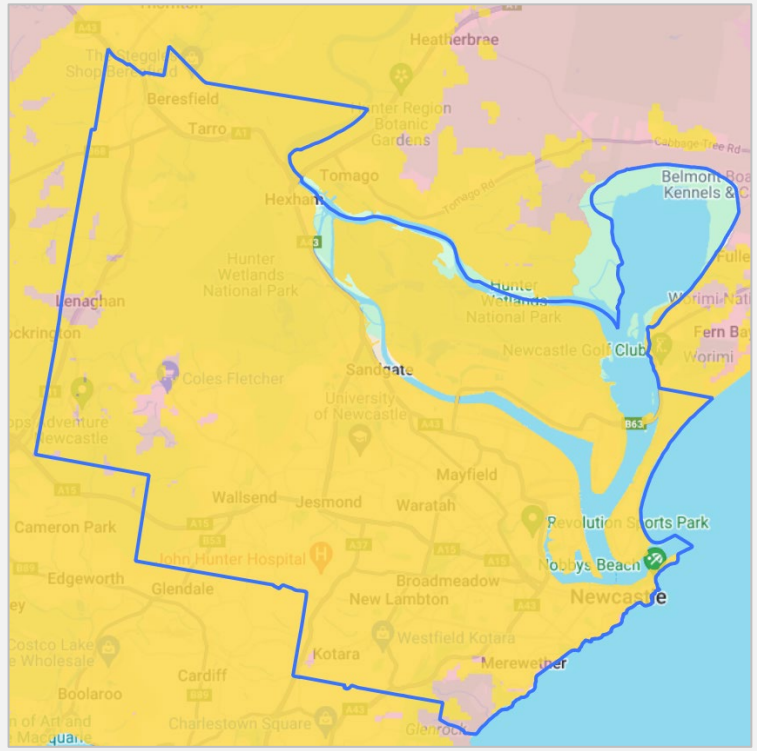
### Telstra Mobile Coverage




### Optus Mobile Coverage




### TPG Mobile Coverage




4G 5G

**Source:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Technology Review - Newcastle

The analysis of coverage maps for the National Broadband Network (NBN) provides insight into the current deployment status, including fixed-line access (Fibre to the Premises and Fibre to the Node), as well as access to the network through fixed wireless and satellite. The following maps represent the current state of the Newcastle region.

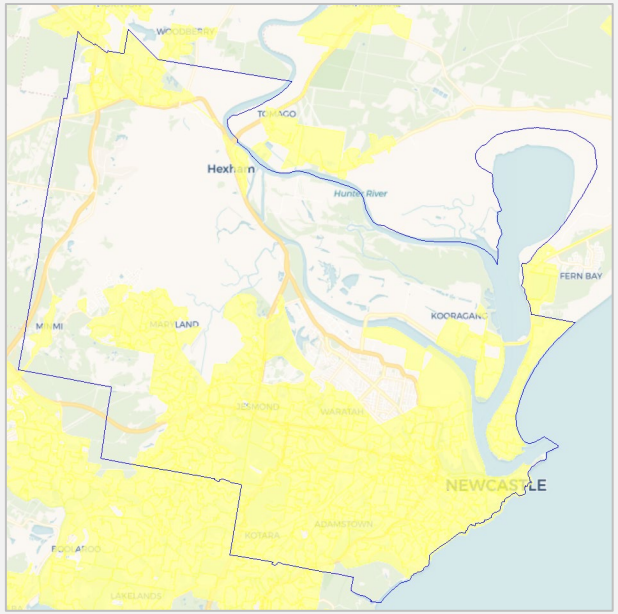
## NBN Technology Types

### NBN - Fibre to the Premises


Fibre to the Premises

- The Newcastle region has the highest population density among all DSSN regions, making it expected that access to NBN network services for residents and industrial sectors is primarily through fibre. The suburbs of Mayfield and Waratah have access to Fibre to the Premises.

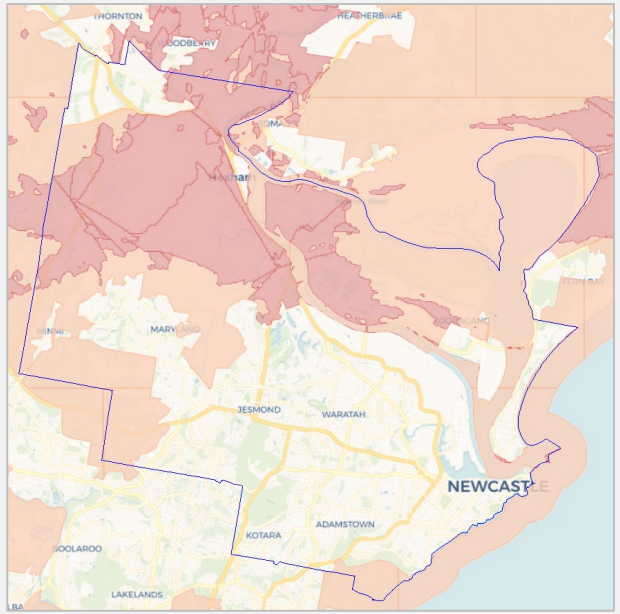
### NBN - Fibre to the Node




Fibre to the Node

- The remaining residential and industrially active economic zones in Newcastle have access to Fibre to the Node for NBN services, ensuring a robust and high-speed network connection for both residential and business sectors in the densely populated Newcastle region.

### NBN - Fixed Wireless and Satellite




Satellite Fixed Wireless

- Due to its high population, the Newcastle region provides access through fibre to the majority of the area. Only the area around the Hunter Wetlands National Park needs to rely on fixed wireless access to the NBN network services.

# Technology Review - Port Stephens

The determination of site numbers and subsequent analysis of coverage maps provides insight into the current state of coverage for various radio technologies (3G, 4G, and 5G), identifying potential connectivity gaps. The following analysis addresses the current mobile network in the region of Port Stephens:

## Existing Radio Mobile Sites

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 28 | 23 | 27 | 13 |
| OPTUS | 31 | 26 | 31 | 10 |
| TPG | 20 | 20 | 20 | 4 |

## Analysis of Current State

- **Telstra**: 3G and 4G coverage available for the entire Port Stephens region. Regarding 5G coverage, Telstra provides coverage for the Medowie and Raymond Terrace regions, Fingal Bay, and Nelson Bay. Shoal Bay currently does not have complete 5G coverage.
- **Optus**: 3G and 4G coverage is available for the entire Port Stephens region. 5G coverage is available for the suburb of Medowie, the bays of Salamander, Anna, Fingal, Nelson and Shoal.
- **TPG**: 3G and 4G coverage available in all residential areas of the Port Stephens region. Regarding 5G technology, TPG provides coverage in the Medowie area and areas of the bays of Salamander, Anna, and Nelson Bay. Shoal Bay and Fingal Bay may have some connectivity gaps in relation to 5G.

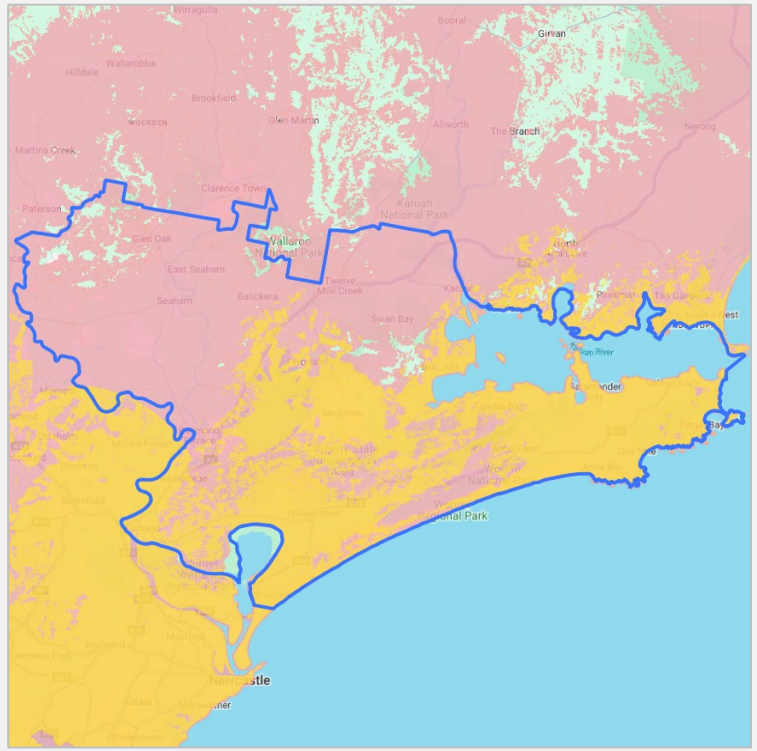
# Technology Review - Port Stephens

The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

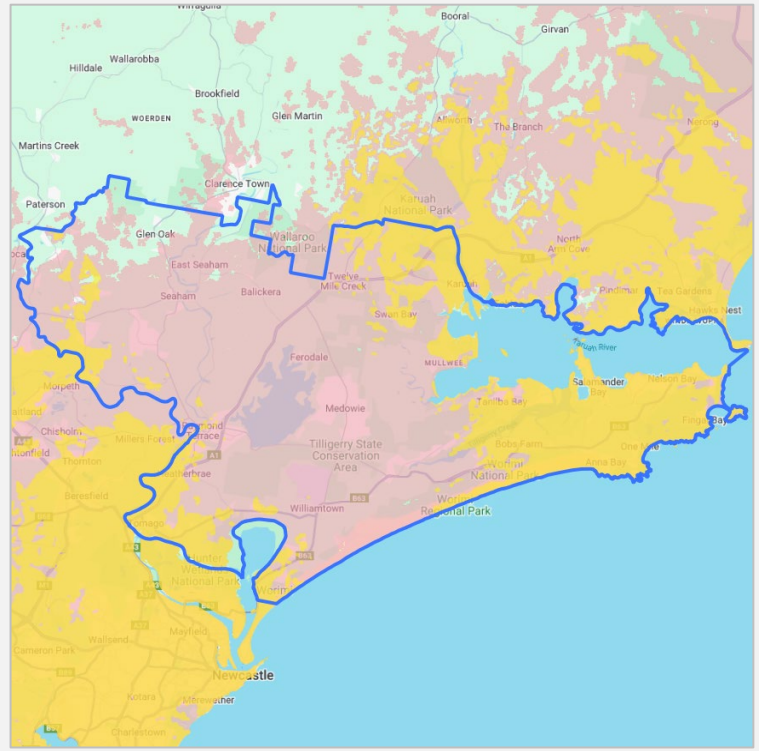
## Current Mobile Coverage

### Telstra Mobile Coverage


### Optus Mobile Coverage




### TPG Mobile Coverage




4G 5G

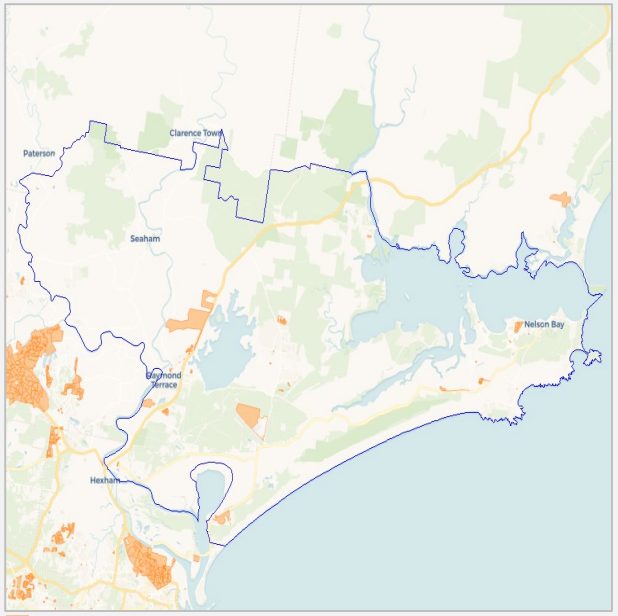
**Source:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Technology Review - Port Stephens

The analysis of coverage maps for the National Broadband Network (NBN) provides insight into the current deployment status, including fixed-line access (Fibre to the Premises and Fibre to the Node), as well as access to the network through fixed wireless and satellite. The following maps represent the current state of the Port Stephens region.

## NBN Technology Types

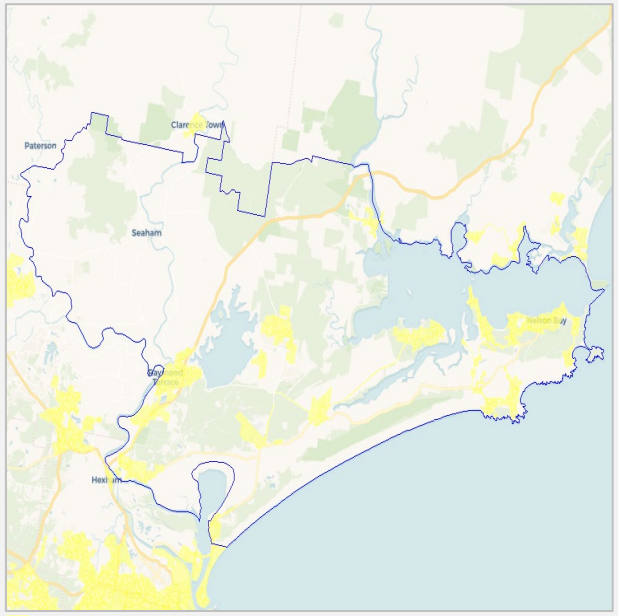
### NBN - Fibre to the Premises




Fibre to the Premises

- The Port Stephens area is mostly rural, naturally lacking an extensive coverage in terms of access to NBN services through Fibre to the Premises. This type of access is available in the suburb of Corlette and on the outskirts of Eagleton.

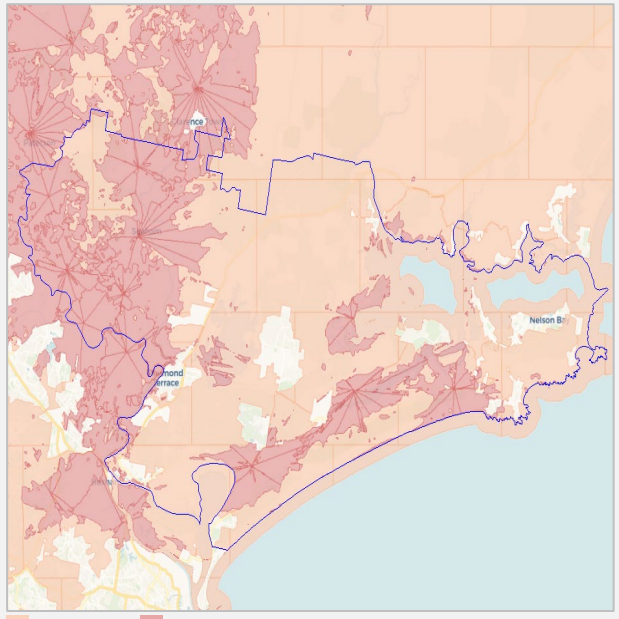
### NBN - Fibre to the Node




Fibre to the Node

- The residential areas of Port Stephens mostly have access to the NBN network through Fibre to the Node. This type of access is available in the more populated suburbs such as Medowie, Nelson Bay, and Shoal Bay.

### NBN - Fixed Wireless and Satellite



Satellite Fixed Wireless

- Due to the Port Stephens region concentrating its population around the Karuah River and its bay, it is natural that the more remote areas are characterised as rural. In places like Wallaroo and Medowie Park, access to the NBN network is provided through fixed wireless or satellite connections.

# Technology Review - Singleton

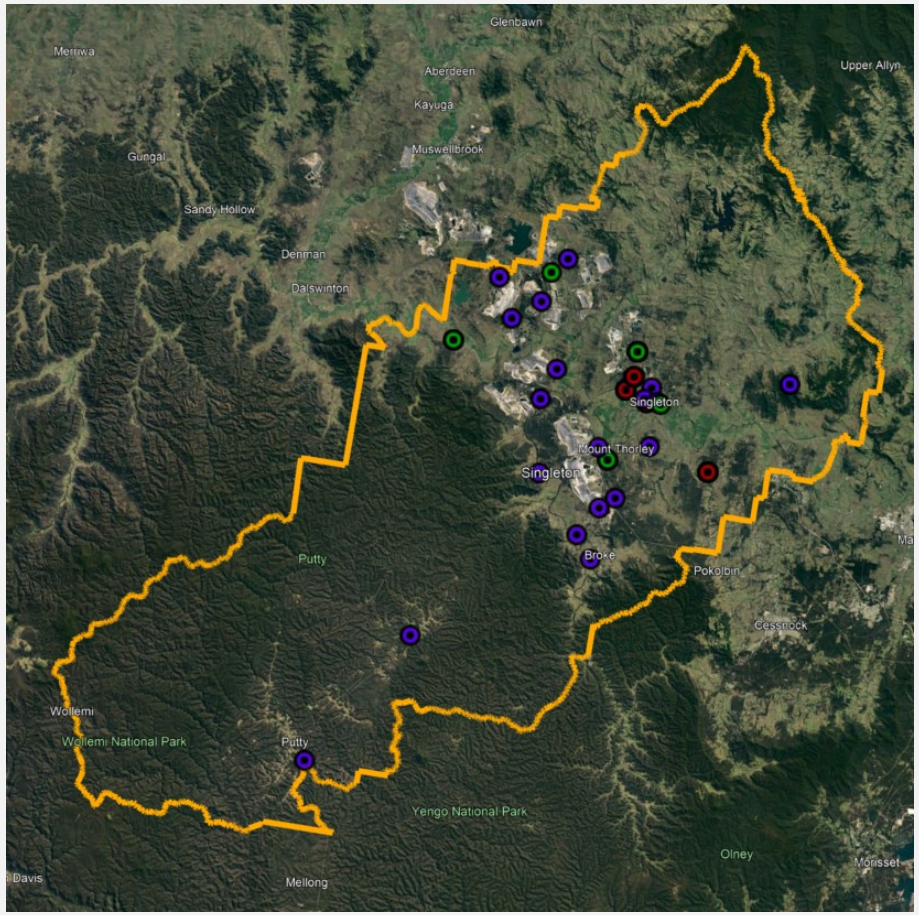
The determination of site numbers and subsequent analysis of coverage maps provides insight into the current state of coverage for various radio technologies (3G, 4G, and 5G), identifying potential connectivity gaps. The following analysis addresses the current mobile network in the region of Singleton:

## Existing Radio Mobile Sites

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 25 | 19 | 21 | 7 |
| OPTUS | 9 | 9 | 9 | 1 |
| TPG | 5 | 5 | 5 | 0 |

## Analysis of Current State

- **Telstra**: 4G coverage for the entire Singleton region. Remote suburbs like Putty and Garland Valley situated in the mountainous zone have access to 3G. Regarding 5G, Telstra provides coverage for the entire populated area of Singleton
- **Optus**: 3G and 4G coverage available for populated and industrial areas of Singleton. Concerning 5G, Optus only has one base station providing 5G coverage, located to the north, and does not guarantee coverage for the populated area of Singleton.
- **TPG**: 3G and 4G coverage available for the densely populated areas of the Singleton region. Regarding 5G technology, TPG does not have any base station in the Singleton region.

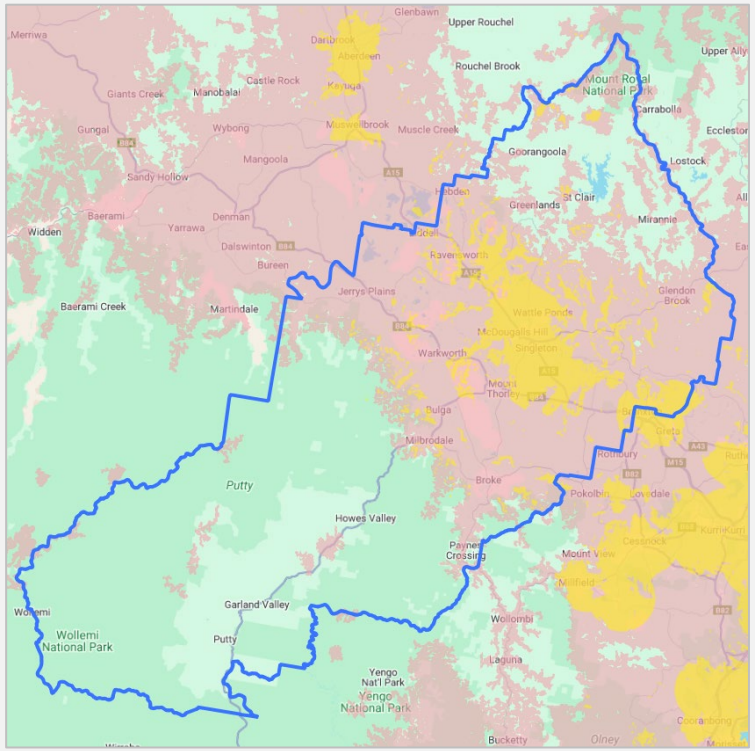


# Technology Review - Singleton

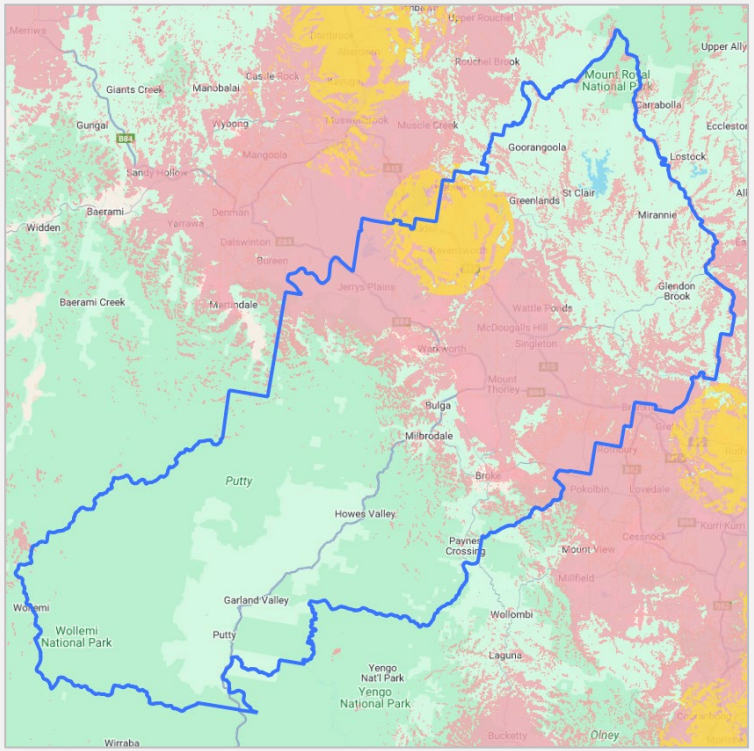
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

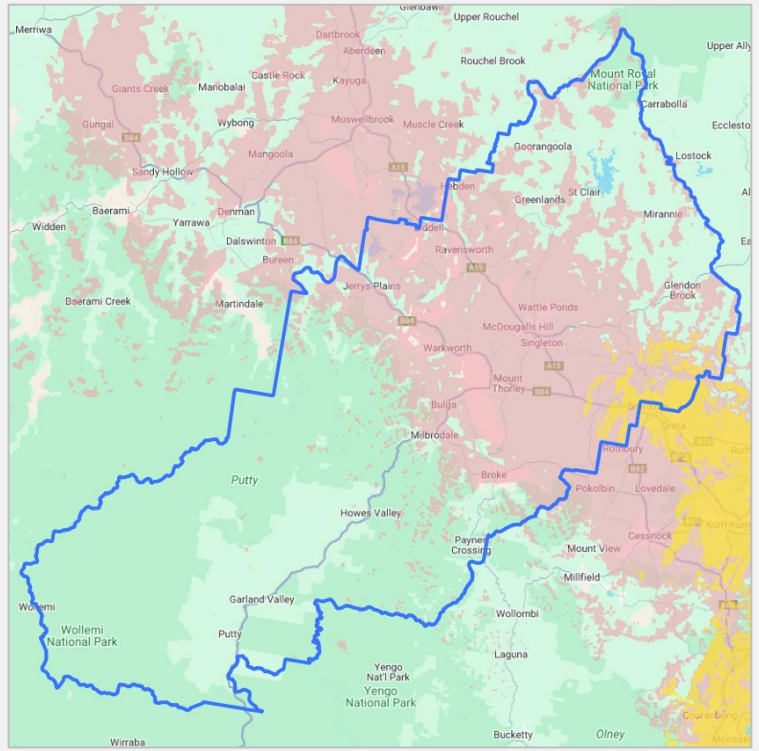
### Telstra Mobile Coverage




### Optus Mobile Coverage




### TPG Mobile Coverage




4G 5G

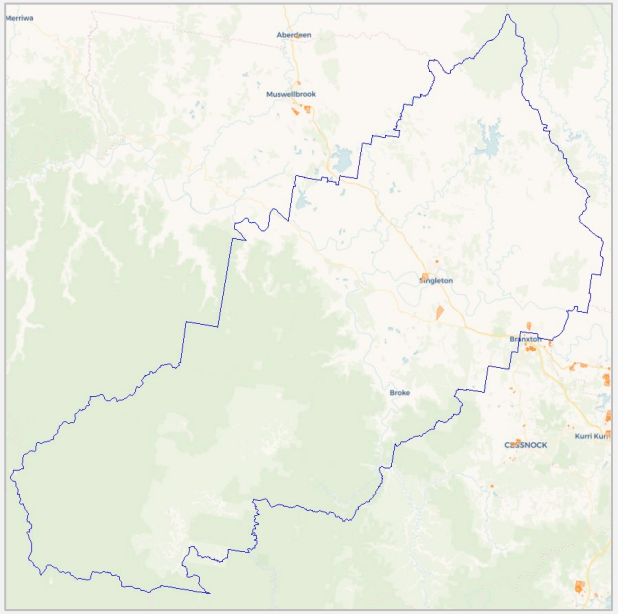
**Source:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Technology Review - Singleton

The analysis of coverage maps for the National Broadband Network (NBN) provides insight into the current deployment status, including fixed-line access (Fibre to the Premises and Fibre to the Node), as well as access to the network through fixed wireless and satellite. The following maps represent the current state of the Singleton region.

## NBN Technology Types

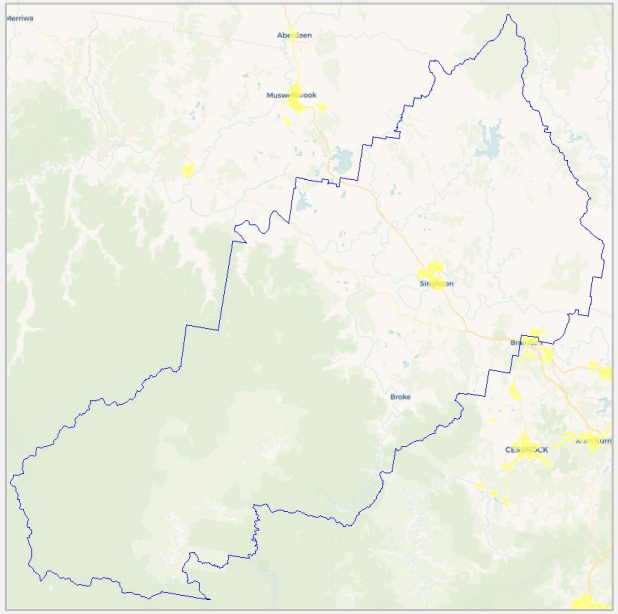
### NBN - Fibre to the Premises




Fibre to the Premises

- The Singleton region is another area considered extremely rural, where access via Fibre to the Premises is only available in a limited part of the city of Singleton.

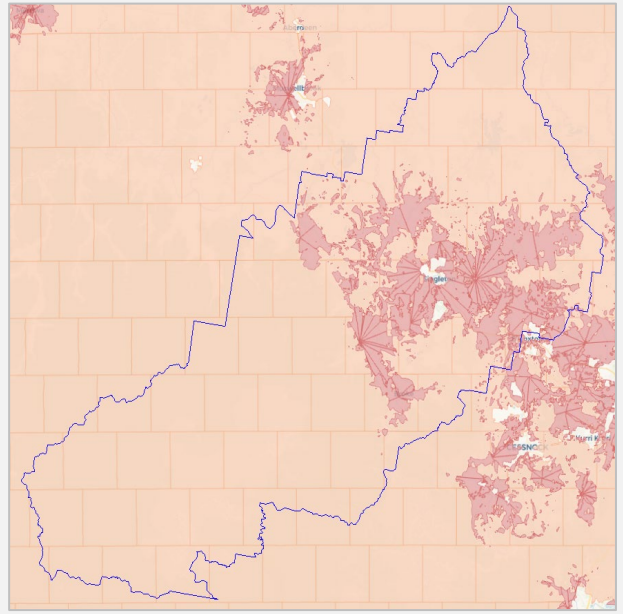
### NBN - Fibre to the Node




Fibre to the Node

- Singleton is a region with a relatively low population of around 23 thousand inhabitants, most of whom reside in the centre of Singleton. For the majority of the populated areas, access to the NBN network is available through Fibre to the Node.

### NBN - Fixed Wireless and Satellite



Satellite Fixed Wireless

- The Singleton region is the second-largest with 4,893 km$^2$, however, a significant portion of this area is covered by the Wollemi National Park, where access to the NBN network is available via satellite. The more dispersed suburbs around Singleton with lower population have access through fixed wireless.

# Technology Review - Upper Hunter

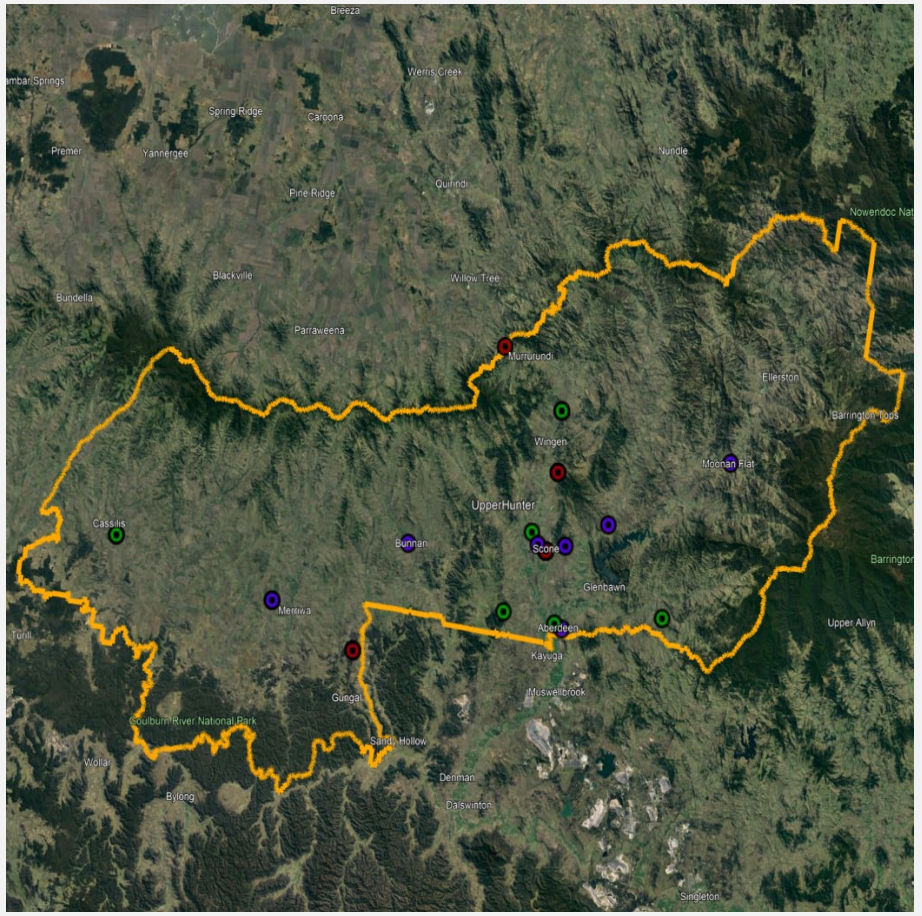
The determination of site numbers and subsequent analysis of coverage maps provides insight into the current state of coverage for various radio technologies (3G, 4G, and 5G), identifying potential connectivity gaps. The following analysis addresses the current mobile network in the region of Upper Hunter:

## Existing Radio Mobile Sites

| Mobile Operator | # of Radio Mobile Sites | # of Sites with 3G Access | # of Sites with 4G Access | # of Sites with 5G Access |
|---|---|---|---|---|
| Telstra | 12 | 9 | 12 | 3 |
| OPTUS | 8 | 7 | 8 | 1 |
| TPG | 4 | 4 | 2 | 0 |

## Analysis of Current State

- **Telstra**: 3G and 4G coverage available for the populated area. Telstra ensures 4G coverage for more remote areas like Cassilis, Merriwa, and Moonan Plat, where it has base stations. Regarding 5G coverage, it exists in the more populated suburbs (Scone and Aberdeen)
- **Optus**: 3G and 4G coverage available for the populated areas of Upper Hunter. Concerning 5G, Optus has installed a base station in Aberdeen, ensuring coverage of this technology in that suburb.
- **TPG**: 3G and 4G coverage for the main populated suburbs of Upper Hunter. In terms of 4G, there may be gaps in coverage in the Wingen and Gundy areas. TPG does not currently have 5G deployed in the Upper Hunter region.

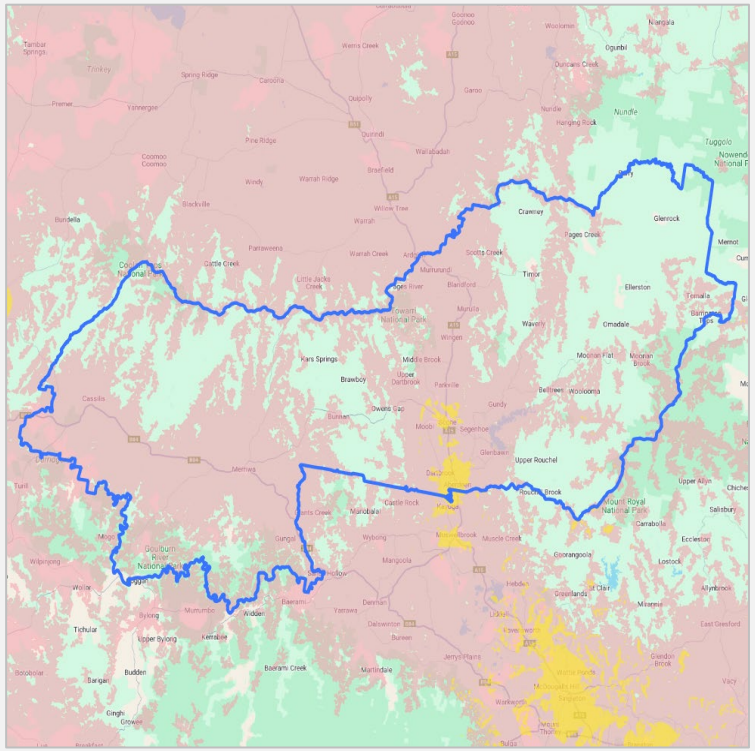


# Technology Review - Upper Hunter

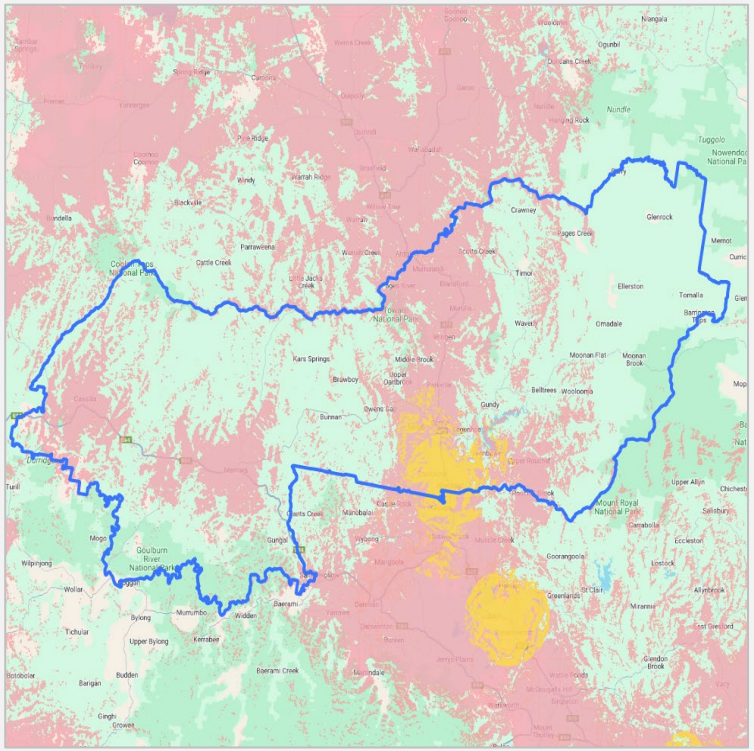
The examination of coverage maps from the three major operators helps to understand the distribution of radio technologies across regions and identify potential connectivity challenges. In these maps, 3G is not separately detailed, as the radio sites are co-located with 4G, and considering that 3G is planned for discontinuation throughout 2024.

## Current Mobile Coverage

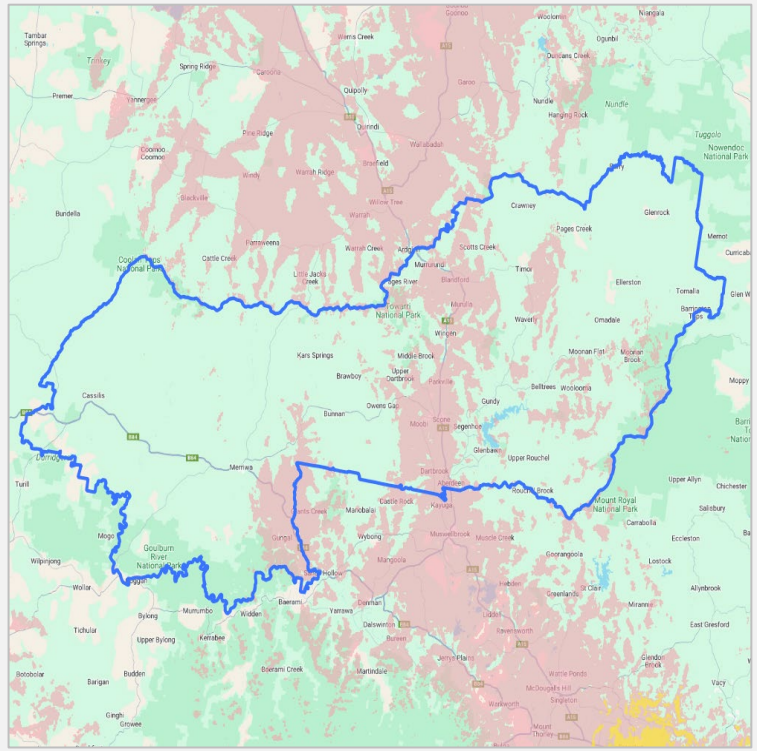
### Telstra Mobile Coverage



### Optus Mobile Coverage



### TPG Mobile Coverage



4G 5G

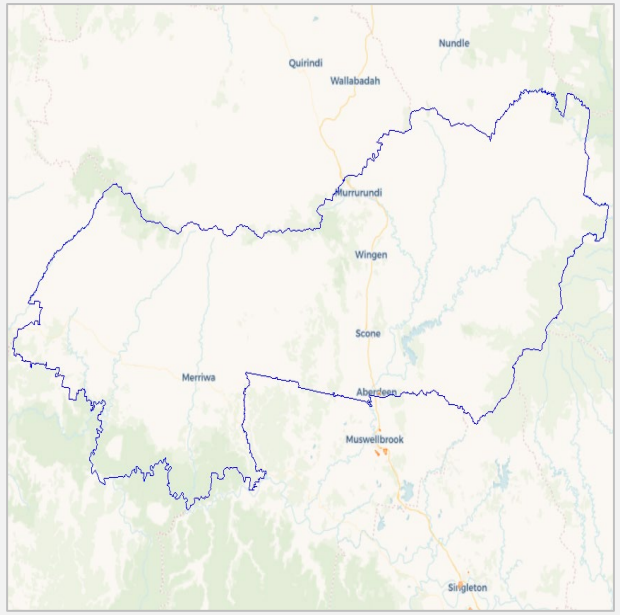
**Source:** ACCC Mobile Infrastructure Report - Coverage Maps 2023 (KML)

# Technology Review - Upper Hunter

The analysis of coverage maps for the National Broadband Network (NBN) provides insight into the current deployment status, including fixed-line access (Fibre to the Premises and Fibre to the Node), as well as access to the network through fixed wireless and satellite. The following maps represent the current state of the Upper Hunter region.

## NBN Technology Types

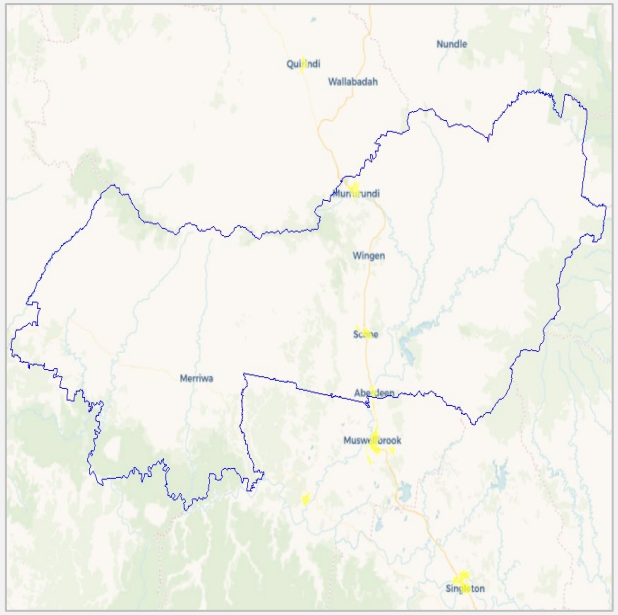
### NBN - Fibre to the Premises




Fibre to the Premises

- The Upper Hunter region is considered 100 per cent rural, and due to its extensive area and low population concentration spread across different zones, it does not have access to the NBN network through Fibre to the Premises.

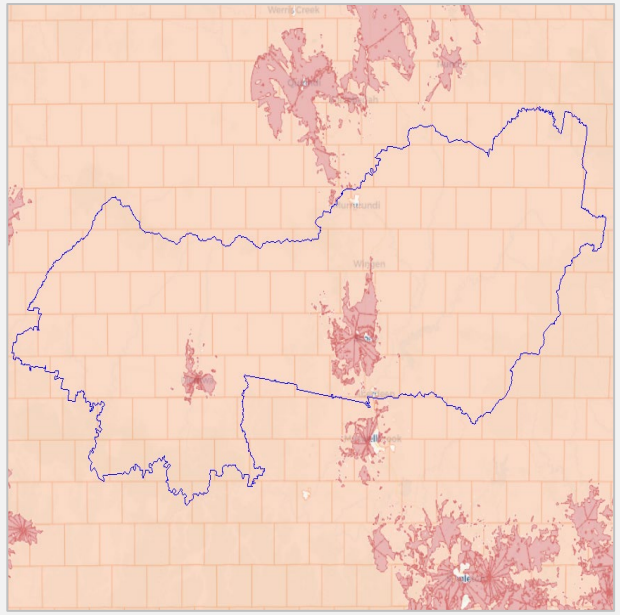
### NBN - Fibre to the Node




Fibre to the Node

- The extensive area of Upper Hunter has its population primarily distributed across three main suburbs: Scone, Murrurundi, and Aberdeen. For these cities, access to the NBN network is ensured through Fibre to the Node.

### NBN - Fixed Wireless and Satellite



Satellite Fixed Wireless

- The Upper Hunter is an area with extensive forested and remote areas where there is no presence of population and associated industrial activity. In these zones, access to the NBN network is exclusively through satellite connection.

# Emerging technologies and trends in telecommunications infrastructure

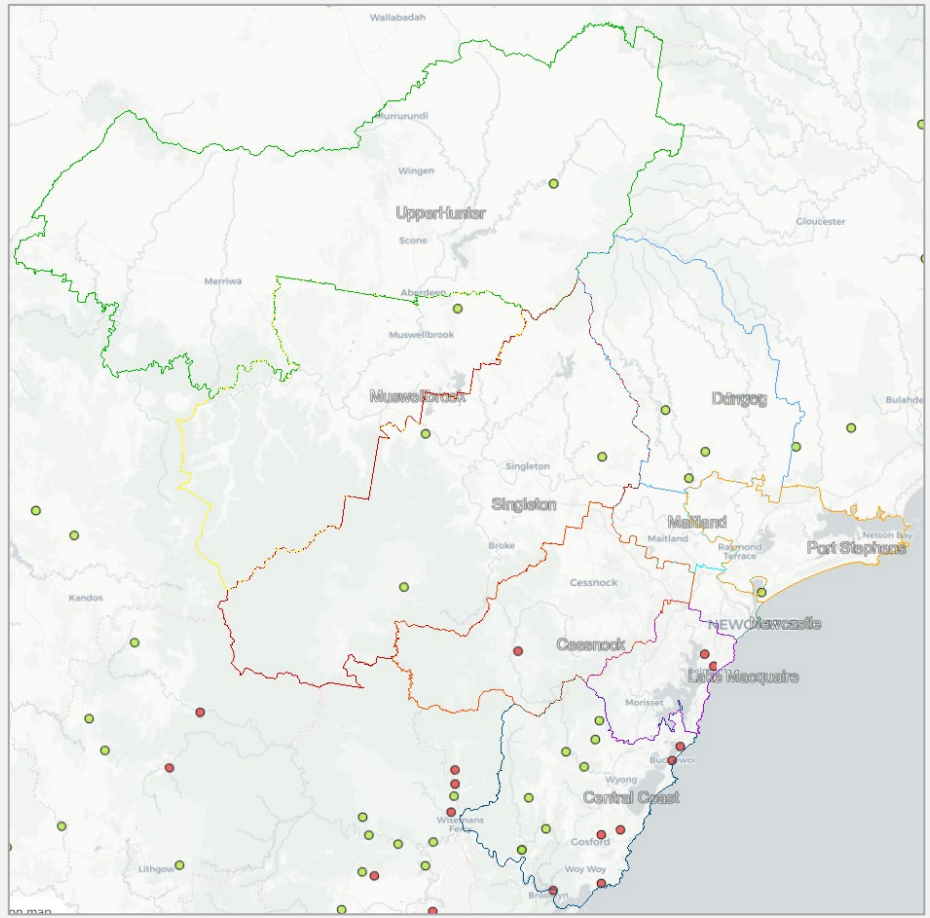
# Technology Review - Mobile Black Spot Program (MBSP)

The Mobile Black Spot Program, launched by the Australian Government, addresses the challenge of limited mobile coverage in rural and remote areas. The initiative focuses on creating and upgrading mobile infrastructure to improve communication and connectivity in underserved regions.

## Mobile Black Spot Program

- The Mobile Black Spot Program, a government initiative, has significantly **improved mobile connectivity across the 10 DSSN regions.** Some of the regions faced **limited mobile coverage, hindering communication and access to essential services**, and the program was designed to overcome these challenges, ensuring residents and businesses have **access to reliable mobile networks**.
- The program was created with the following **objectives**:
    - **Improve Emergency Services**: Enhance emergency communication, providing critical support during disasters and ensuring a timely response from authorities.
    - **Boost Local Economies**: Stimulate economic growth by facilitating communication, online transactions, and business operations.
    - **Enhance Quality of Life**: Residents benefit from improved connectivity for daily activities, education, healthcare, and overall improved well-being.
- The program encompasses a total of **7 rounds of action** and has generated a total investment of more than $1 billion to deliver up to 1,400 new mobile base stations across Australia. **For the 10 DSSN regions, this is the current status of the mobile sites** included in this program:

| Region | # of Mobile Sites (Completed) | # of Mobile Sites (In Progress) | Total |
|---|---|---|---|
| Central Coast | 7 | 5 | 12 |
| Dungog | 3 | 0 | 3 |
| Singleton | 3 | 0 | 3 |
| Lake Macquarie | 0 | 2 | 2 |
| Cessnock | 0 | 1 | 1 |
| Muswellbrook | 1 | 0 | 1 |
| Port Stephens | 1 | 0 | 1 |
| Upper Hunter | 1 | 0 | 1 |
| Maitland | 0 | 0 | 0 |
| Newcastle | 0 | 0 | 0 |



# Additional Technologies and Network Providers – Fixed Wireless Access

The absence of terrestrial connectivity, be it through fixed or mobile access, poses a significant hurdle in remote areas. This is where Fixed Wireless Access (FWA) technology comes into play—an evolving solution with the potential to offer internet access to any isolated zone, fostering communication and connectivity.

## Fixed Wireless Access (FWA) - Definition

FWA technology employs ground-based wireless stations for internet connectivity in remote areas. These stations create a stable link to a nearby wireless base, delivering reliable, high-speed internet without the necessity of traditional wired infrastructure.

**Main Advantages:**

**Remote Accessibility:** FWA extends internet access to remote areas where traditional infrastructure is challenging.

**Quick Deployment:** FWA systems can be rapidly set up, making them efficient for major events, emergency situations or areas undergoing rapid development.

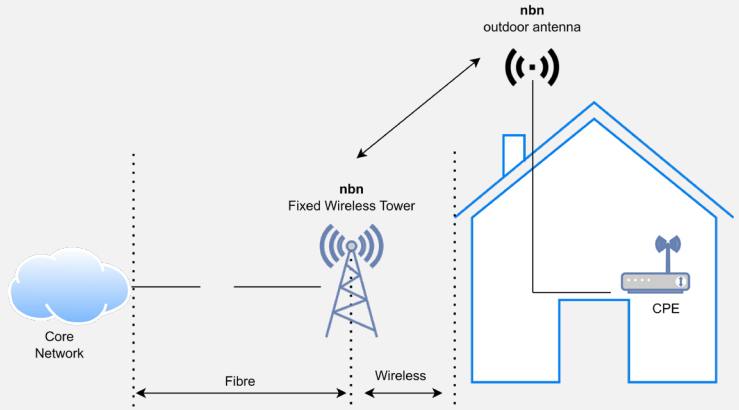
**Scalability:** FWA networks can be easily scaled to accommodate growing demand by adding more base stations or upgrading existing infrastructure, providing flexibility to expand coverage areas as needed.

## Current Initiatives and Deployment in Australia

- The Australian government has invested a total of $480 million in the NBN Fixed Wireless Network, with NBN contributing an additional $270 million to deliver faster wholesale speeds for regional Australia. NBN Co will use the funding to enable 5G on its network of more than 2,200 Fixed Wireless infrastructure sites and more than 22,000 cells in semi-rural areas and across regional and remote Australia.

- Ericsson and NBN Co have established a ten-year partnership aimed at providing fixed wireless access to 120,000 homes currently only served by satellite, joining over 650,000 premises with FWA currently across Australia.

## Fixed Wireless Access (FWA) - Architecture




- **Customer Premises Equipment (CPE):** This is the equipment installed at the user's location, such as a home or business. It includes a wireless transceiver or modem that communicates with the base station.
- **FWA Outdoor Antenna:** The outdoor antenna is located on a fixed infrastructure point, often a tower or tall structure. It communicates with the CPE and serves as the central hub for wireless connectivity in a specific coverage area.
- **FWA Wireless Tower:** A FWA (Fixed Wireless Access) Wireless Tower is a tall structure or infrastructure point designed to transmitting signals to and receiving signals from FWA Outdoor Antennas. These towers are strategically placed to optimize coverage and connectivity within a specific geographic area, providing wireless internet access to users within its range.
- **Core Network:** The core network handles the overall management of the FWA system. It includes components like routers, switches, and servers that route data between the FWA network and the broader internet.

# Additional Technologies and Network Providers - LEO Satellites

The lack of terrestrial connectivity, whether through fixed or mobile access, is often a challenge in remote areas. This is where Low-Earth Orbit Satellites (LEO) technology comes into play - an emerging solution capable of providing internet access to any remote zone and facilitating communication.

## Low Earth Orbit Satellites (LEO) - Definition

LEO satellites function by orbiting the Earth at high velocities, enabling them to complete an orbit in a relatively brief timeframe, usually ranging from 90 to 120 minutes. Their proximity to Earth facilitates accelerated communication and minimised signal latency.

**Main Advantages:**

**Low Latency:** LEO satellites offer low-latency communication due to their proximity to Earth, important for applications requiring real-time data transmission

**High Data Throughput:** The relatively short distance between LEO satellites and user equipment allows for higher data transfer rates enabling faster download and upload speeds.

**Global Coverage:** LEO satellites can provide global coverage, reaching remote and underserved areas where traditional communication infrastructure is challenging to deploy.

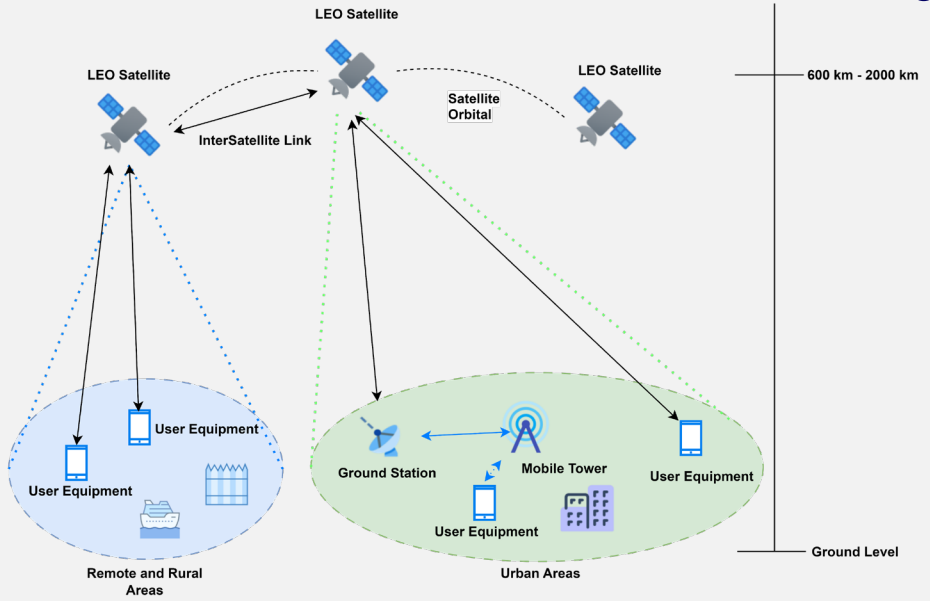
## Current Initiatives and Deployment in Australia

Telstra and OneWeb have reached an agreement with the intention to transition hundreds of existing remote mobile base stations from satellite backhaul to OneWeb's LEO solution. The goal is to deliver up to 25 Gbit/s of LEO capacity, enhancing the mobile experience for Telstra's remote customers.

Optus, in collaboration with Lynk, conducted a live demonstration showcasing satellite direct-to-mobile technology. The demonstration involved connecting a standard mobile phone directly to Lynk's satellite mobile base station in orbit, enabling the sending and receiving of text messages via the Optus network

Starlink is currently available in Australia, providing connectivity in the most rural areas using this type of satellite technology. Future implementations are envisioned, such as the direct-to-cell technology, where a device communicates directly with the satellite.

## Low Earth Orbit Satellites (LEO) - Architecture




- **User Equipment**: Industrial or individual devices or systems used by end-users to communicate with or access services provided by LEO satellites
- **Ground Station**: A terrestrial facility equipped with antennas and communication equipment that communicates with LEO satellites, serving as a point of contact between the satellites and the wider communication network.
- **LEO Satellite:** Satellites that orbit the Earth at altitudes typically ranging from around 600 to 2,000 kilometers, exhibiting short orbital periods and lower latency compared to satellites in higher orbits.

# Additional Technologies and Network Providers - Starlink

Starlink is providing additional options for broadband connectivity at increasingly accessible rates, with new capabilities on the roadmap in 2024 (SMS) and 2025 (voice and data).

## What is Starlink?

- Starlink is a private satellite internet service aimed at delivering high-speed broadband to customers globally who lack access to a reliable internet connection through existing technologies. In Australia, where NBN (National Broadband Network) services utilise fixed wireless and satellite technologies, Starlink is positioned to compete in the satellite access market.
- According to data provided by Optus, a partnering operator with Starlink, Optus asserts a 98.5 per cent mobile coverage guarantee for the Australian population. However, due to Australia's extensive scale and topography, mobile networks can only cover one-third of the country's landmass. In this scenario, Starlink, with its Direct to Cell technology, becomes essential, ensuring complete coverage across the entire Australian territory.

## Technical Characteristics

**Download Speed**
20-100 Mbps

**Latency**
25-50 milliseconds

## Availability

**SMS**
Late 2024

**Voice and Data**
Late 2025

## Coverage

- According to the coverage map provided by Starlink, this technology/service is currently available throughout Australia, including the most remote areas, as it is a satellite-based service.


**Source:** Starlink Coverage Map

# Additional Technologies and Network Providers - Cell on Wheels

The Cell on Wheels (CoW) is a mobile tower that can be deployed and installed in emergency situations or at large events, providing additional coverage and capacity to maintain communications and allow users access to the network.

## Cell on Wheels Characterization

### General Description

Cell on Wheels (COWs) are mobile telecommunications towers designed to provide temporary network coverage and capacity in various situations, including emergency response, special events, and remote locations. Major mobile network operators and NBN deploy COWs to address different communication needs.

While operators primarily use COWs to ensure capacity and coverage during events, NBN's COWs are mainly utilized in emergency situations. They are equipped with an NBN™ Sky Muster™ satellite dish, allowing them to provide emergency workers and evacuated residents with valuable Wi-Fi connections..

### Main Advantages

**Enhanced Capacity:** COWs can help alleviate network congestion by providing additional capacity, ensuring that users have access to reliable and high-speed connectivity, even in densely populated areas or during peak usage periods.

**Rapid Deployment:** COWs can be quickly transported and set up, allowing for rapid deployment in emergency situations or at temporary events where immediate coverage is required.

**Flexibility:** COWs can support various wireless technologies and frequency bands, providing flexibility to adapt to different network requirements and standards.

### Technical Specifications: Antenna Height, Coverage Radius, Capacity, Connectivity*

**Antenna Height: 20 meters**

Maximum height of 20 meters for each antenna, making this solution more adaptable for flat terrain

**Coverage Radius: 5km**

Depending on the terrain's topography, a CoW solution can cover up to 5 km

**Capacity: ~350 simultaneous users**

General capacity to support 350 active users (1750 people) considering a 20% of access in busy hour up to a maximum time of 72 hours

**Connectivity: Access and Backhaul**

**Access**: Mobile Access and Satellite (SatCOLT)
**Backhaul**: Satellite

**Approx. Cost:****

**Regular CoW:** ~ $500,000

**Satellite CoW (SatCOLT): ~** $750,000

*__Note 1__: The technical specifications of COWs may vary depending on the type of access technology and the specific type of COW used by the provider.
**__Note 2:__ The cost approximation is based on average prices from a North American emergency network provider.

# Additional Technologies and Network Providers - Multi-Tenant WLAN

Implementing a multi-tenant WLAN (Wireless Local Area Network) consolidates multiple tenants or users onto a shared wireless infrastructure, enabling optimization and sharing of resources such as network bandwidth, hardware, and management overhead among multiple users or entities.

## Multi-Tenant WLAN

### General Description

- A multi-tenant WLAN (Wireless Local Area Network) is a wireless network infrastructure that serves multiple tenants or users within a certain area. In a multi-tenant WLAN setup, the WLAN infrastructure is designed to efficiently manage and segregate network traffic from different tenants or users to ensure security, performance, and quality of service.

### Main Advantages

**Network Allocation: I**n high-demand scenarios, the WLAN infrastructure can dynamically allocate resources based on the needs of each tenant or user. This can involve prioritizing bandwidth for critical applications or users while ensuring fair access for all tenants.

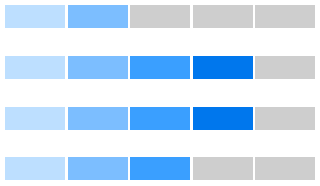
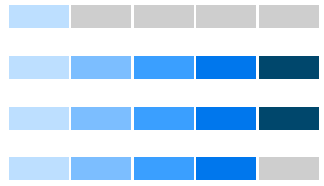
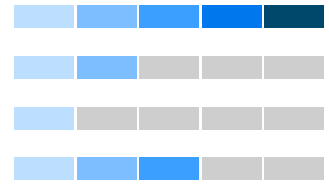
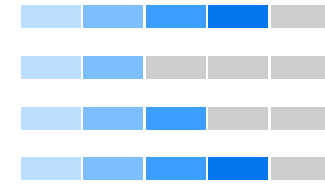
**Scalability**: Multi-tenant WLAN architectures are designed to scale easily to accommodate increasing numbers of users or devices. Additional access points can be deployed as needed to expand coverage and capacity without compromising performance.

### Business Model Comparison

| Standalone | Partnership |
|---|---|
| **Infrastructure** | |
| • In this option a single organisation will provide the all radio access system to support the multi tenant WLAN offer | • Partnership where broadband provider supply the upfront costs to cover regions and areas that still do not have fibre |
| **Distribution Channels** | |
| • Broadband provider has control over distribution strategies and channels, allowing for targeted marketing and sales efforts. | • The Distribution channel is supported by the carriers/ MNO targeting business media |
| **Support** | |
| • Broadband provider has full control over support policies, response times, and service quality.<br>• Pre and post-sale costumer service support | • Client facing supported by partner<br>• Network airtime SLA between parties (Broadband and partner) |
| **Demand & Supply** | |
| • Demand and supply are primarily driven by the broadband provider's own requirements and market dynamics. | • Demand and supply considerations involve coordination among partners to ensure adequate resources and support for shared infrastructure. |

# Additional Technologies and Network Providers - Summarisation

The following summarisation, encompassing various additional technologies, allows for the identification of common patterns, challenges, and opportunities across multiple technologies, leading to more informed strategic planning.

| | Fixed Wireless Access (FWA) | Low-Earth-Orbit (LEO) Satellites | Cell on Wheels (CoW) | Multi-Tenant WLAN |
|---|---|---|---|---|
| |  |  |  |  |
| **Deployment** | Solution already **widely existing in the region**, it can be an alternative with medium effort deployment (through outdoor antennas) in areas that are currently covered by this technology. | Solution **with a high complexity** in terms of deployment. To integrate a solution based on LEO satellites, it is necessary to consider the **coordination of multiple satellites** in low orbit and the respective configurations. | Solution that presents the **lowest complexity in terms of deploy**ment, due to the **simple and rapid installation**, and its ability to be easily adapted to different types of access technology. | Relative accelerated set-up considering the existence of **collocated infrastructure with carriers and by accessing to their competitive position** in the market (current portfolio, and overall brand awareness) |
| **Capabilities** | Offers moderate capabilities in terms of speed, reliability, and coverage. **The NBN is improving speeds up to 250 Mbps** and ensuring at least **50 Mbps** during **busy hours**. | **Provides high-speed internet** access with **low latency**, making it suitable for a wide range of applications and users, **available anywhere** due to its **extensive coverage**. | Assurance of capacity and coverage in pre-selected areas, it can establish **connections in emergency situations or sporadic events** that require a **high** network capacity. | Offers **robust capabilities** in providing wireless connectivity to **multiple tenants** within shared spaces, with features such as security, scalability, and quality of service. |
| **Investment** | **Considerable investment** is required to build and maintain fixed wireless infrastructure, including towers, antennas, and backhaul links, however Australian government and NBN are **investing in this technology ($750,000).** | **High investment** required, due to the complexity of the solution and its specific maintenance, requiring significant resources for both initial implementation and ongoing operation. | **Low investment**, as it is a relatively inexpensive solution compared to others, and does not **incur significant maintenance or partnership** costs. | Technical and **commercial investment quite balanced compared with other solutions**, though being necessary to guarantee the contracted SLAs with the partners |
| **Scalability** | **Medium scalability**, as the solution can be easily adopted, it consistently **depends on the existence of infrastructure** to ensure this access. | **High scalability** to serve a large number of users across vast geographical areas without significant infrastructure expansion. | **Medium scalability**, as despite being a highly mobile solution, it is **dependent on the existing infrastructure** for connection to the network core. | **High scalability**, since there is access to partner's existing customers seeking for **better capacity** and additionally the new businesses that a strong brand as the partner's may bring |

# Private Network Solutions - Private 5G Solution

Private 5G solutions redefine regional connectivity by offering dedicated, high-performance mobile networks tailored to accommodate peak demand scenarios.

## Private 5G Solution

### General Description

- A private 5G solution enhances the opportunity to deploy a dedicated, high-performance mobile network customized to meet specific requirements, empowering organizations to leverage the complete capabilities of 5G technology based on the network demands and expected usage across different regions or areas. This allows for precise adaptation of the network infrastructure to suit varied operational needs and optimize performance across diverse environments

### Main Advantages

**Performance:** A 5G private network solution can efficiently manage network resources to accommodate varying levels of traffic and usage across different times and locations, ensuring optimal performance and user experience even during peak demand periods.

**High-Development Plans:** According to ACMA and the market study conducted in 2023, the market for solutions based on private wireless is growing by about 30% per year, and ACMA is aware of this trend to increase 5G connectivity. Currently, I have 5400 MHz of dedicated spectrum and a plan until 2027 to release additional spectrum to accommodate this solution

### Technical Considerations

1. A subscription fee will be needed, increasing the overall cost of the service when compared to Wi-Fi, however, private networks are **less complex and do not require network cabling**
2. Cellular grade network security provides **increased privacy and data security when compared to Wi-Fi**
3. **Licensed Spectrum** leads to **greater reliability and better performance** in the world if IoT, as well as a dramatic increase in ability to connect to IoT enabled devices
4. **Private 5G networks** support seamless mobility and roaming, allowing **devices to move between cells or access points without losing connectivity**.
5. **Private Networks can be 'sliced' for multiple functions**
   - Creates separate networks or slides
   - Each slice can be configured separately
   - Cater to unique requirements and use cases

# Private Network Solutions - Private 5G Solution

Private 5G solutions redefine regional connectivity by offering dedicated, high-performance mobile networks tailored to accommodate peak demand scenarios.

## Private 5G Solution

### Associated Costs

**Small Site**

| Equipment | Baseline | Throughput | Unit Cost ($) |
|---|---|---|---|
| Access Points | 5-25 | 12,5 ~ 25 Gbps | 2,000 (per AP) |
| Access Switches | 2-3 | 352 ~ 528 Gbps | 11,000 |
| Transport Switches | 0 | - | - |
| Core Switches | 2 | 30 Tbps | 70,000 |
| Network Controllers | 0 | - | - |
| Firewalls | 2 | 340 Gbps | 400,000 |

Total Estimate Cost ($): 972,000 ~ 1,023,000

**Location Types:**
- Offices
- Hotels

**Medium Site**

| Equipment | Baseline | Throughput | Unit Cost ($) |
|---|---|---|---|
| Access Points | 25-100 | 25 – 75 Gbps | 2,000 (per AP) |
| Access Switches | 8-12 | 1,4 – 2,1 Tbps | 11,000 |
| Transport Switches | 2 | 2,88 Tbps | 200,000 |
| Core Switches | 2 | 30 Tbps | 70,000 |
| Network Controllers | 0 | - | - |
| Firewalls | 2 | 340 Gbps | 400,000 |

Total Estimate Cost ($): 1,478,000 ~ 1,672,000

**Location Types:**
- Supermarkets
- Warehouses
- Hospitals

**Large Site**

| Equipment | Baseline | Throughput | Unit Cost ($) |
|---|---|---|---|
| Access Points | 100+ | 75 – 125 + Gbps | 2,000 (per AP) |
| Access Switches | 20 + | 3,5 + Tbps | 11,000 |
| Transport Switches | 6 + | 8,64 + Tbps | 200,000 |
| Core Switches | 2 | 30 Tbps | 70,000 |
| Network Controllers | 0 -2 | 0 - 80 Gbps | 120,000 |
| Firewalls | 2 | 340 Gbps | 400,000 |

Total Estimate Cost ($): 2,560,000 ~ 2,800,000

**Location Types:**
- Stadiums
- Shopping Malls

# Private Network Solutions - Private Wi-Fi Solution

Private network solutions optimize network performance based on fluctuating demand patterns, guaranteeing uninterrupted service and enhanced user experiences.

## Private Wi-Fi Solution

### General Description

- A private Wi-Fi solution provides a dedicated wireless network infrastructure designed to meet the demands of high-traffic scenarios and peak usage periods. Tailored to specific locations, such as public venues, event spaces, or community centers, private Wi-Fi networks ensure reliable and seamless connectivity for users during busy times.

### Main Advantages

**Performance:** Private Wi-Fi networks are designed to provide reliable and consistent wireless connectivity, even in high-density environments or areas with interference. Network performance can be enhanced through strategically deploying access points and optimizing channel utilization.

**Capabilities and Access Control:** A Private Wi-Fi solutions enable full management over the configuration and security of the network, allowing for the tailoring of network settings, allocation of bandwidth, and implementation of security protocols to align with specific requirements and usage policies.

### Technical Considerations

1. Wi-Fi is **cheaper than 5G and LTE per square foot** and due to the fact there are no subscriptions involved in the service.
2. Compared to its Wi-Fi predecessor, **Wi-Fi 6 has implemented WPA3,** which generates a live password with every data transmission, resulting in more secure routers
3. Private Wi-Fi networks operate in **the unlicensed spectrum**, sharing the **frequency band** with other wireless technologies and devices.
4. Wi-Fi networks support QoS mechanisms to prioritize **traffic** and ensure the **timely delivery** of critical applications.
5. The deployment of multiple access points and **wireless mesh networks** extends **coverage** and improves **signal strength** in large or complex environments.

# Private Network Solutions - Summarisation

The following comparison between private 4G/5G networks and private Wi-Fi solutions enables the understanding of different technical capabilities. This allows for the selection of the most suitable wireless technology based on specific use cases, requirements, and constraints.

| Characteristic | Private 4G/5G Network | vs. | Private Wi-Fi |
|---|---|---|---|
| Common Use cases | Longer ranges – smart phones, personal mobile devices, connected cars, smart city deployments, large manufacturing operations, etc. | | Shorter ranges – home and business environments |
| Security | Advanced security with commercial grade network; SIM based; Network slicing isolates different functions and users within separate network environments | | New WPA3 secures routers more than previous Wi-Fi generations, however, still less secure than private networks |
| Latency | 5G: 3 MS; 4G: 50 MS | | 20 MS |
| Speed | 4G: 100 MBPS \| 5G: 10 GBPS | | 9.6 GBPS |
| Session Management | Cellular Networks manage each session in terms of quality of service and built to service simultaneous connections without service degradation | | Signal quality and reliability diminishes as more connections are on the network |
| Cost | Low CAPEX, OPEX compared to operator networks<br>Higher cost relative to Wi-Fi due to infrastructure and licensing fees | | Low CAPEX. however, still requires infrastructure upgrades, OPEX engrained in IT support model;<br>Does not require license fee. |
| Spectrum | Both unlicensed CBRS spectrum and licensed Spectrum (bands can only be used by the company who licenses) | | Unlicensed Spectrum (anyone has the ability to use) |
| Bands | MNO licensed 4G/5G: low, mid and mmWave | | 2.4GHz & 5GHz (mid-band) |

# Appendix 5.2 Estimation of Future Population and Visitor Demand

**Methodology used to assess the current and project future population and visitor numbers across each LGA.**

# Approach to Estimate the Future Population and Visitor Demand

The following steps were undertaken to estimate the current and future population and visitor numbers in each DSSN region.

## Population Demand

**1** Assessment of Current Population for all DSSN Regions

**2** Urban vs Rural Population Ratio

**3** Projected Growth of Population

## Visitor Demand

**4** Assessment of Current Number of Visitors for all DSSN Regions

**5** Future Visitor Demand Growth Until 2030

**6** Obtain the Number of Visitors for the Main Events (ongoing)

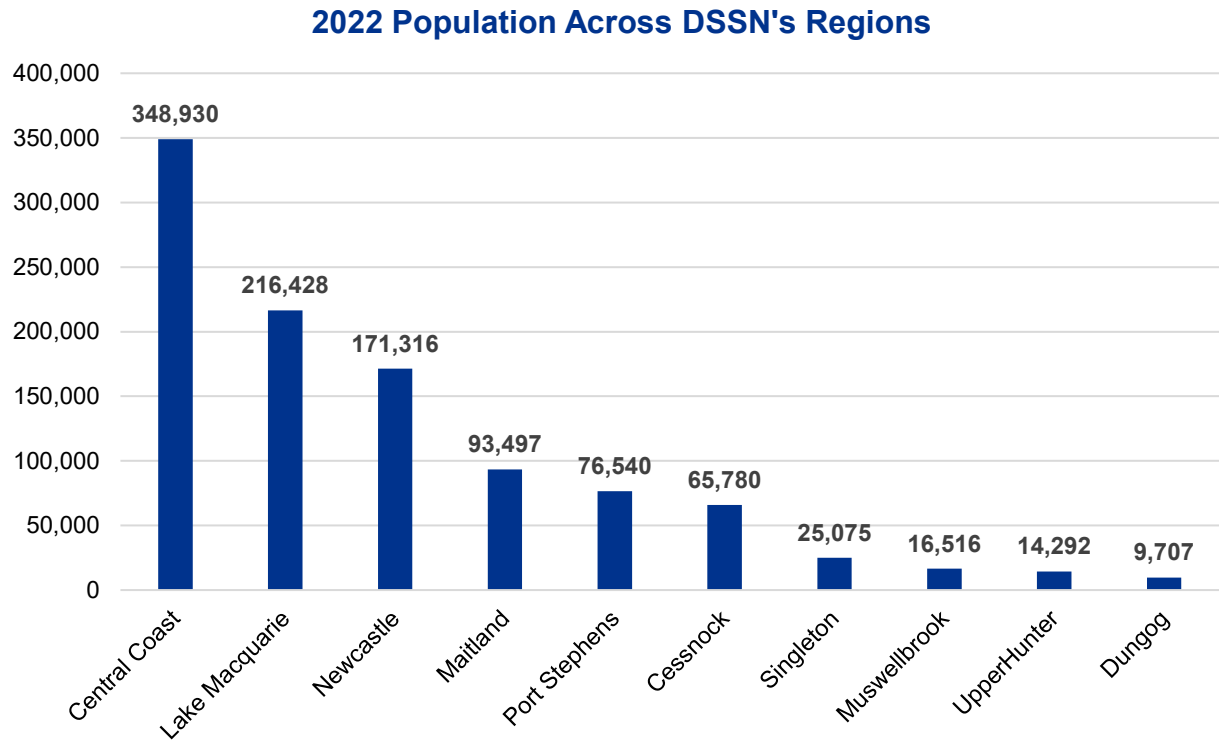
# Population Demand - Assessment of Current Population

To understand current demand of network infrastructure, we need to understand the baseline demographic data across each of the DSSN regions.

**Step 1:** Obtain the population number for the different regions. This information was obtained through the ABS Data/Census and the most recent year provided is 2022.

**Source:** Australian Bureau of Statistics

| Regions | Total Population (2022) | % |
|---|---|---|
| Central Coast | 348,930 | 33.61% |
| Cessnock | 65,780 | 6.34% |
| Dungog | 9,707 | 0.94% |
| Lake Macquarie | 216,428 | 20.85% |
| Maitland | 93,497 | 9.01% |
| Muswellbrook | 16,516 | 1.59% |
| Newcastle | 171,316 | 16.50% |
| Port Stephens | 76,540 | 7.37% |
| Singleton | 25,075 | 2.42% |
| Upper Hunter | 14,292 | 1.38% |
| **DSSN Region** | **1,038,081** | **100%** |



# Population Demand - Urban vs Rural Population Ratio

Urban and rural environments have distinct challenges, preferences, and demographics. Estimating the split between the urban vs rural population enables us to tailor policies and services to the specific network infrastructure needs.

**Step 2:** Obtain the population split between urban and rural to understand the distribution for one of the Local Government Areas.

**Source:** **Population (LGA and Suburb):** ABS 2021 Census

**Suburbs by LGA:** NSW Electorate

**Urban/Rural Population by LGA:** Federal Government - Department of Agriculture, Fisheries & Forestry

- In order to determine the Urban vs Rural split of the different DSSN regions, the population of each **suburb and their respective postcodes in different Local Government Areas (LGA)** were analysed. Subsequently, they were allocated to each type based **on the index (urban or rural)** defined by the Federal Government - Department of Agriculture, Fisheries & Forestry.
- Due to some **suburbs and postcodes being shared by different LGAs**, the following **assumptions** were made:
  a) A **suburb** has been **allocated** to a particular LGA based on **50% or more land area** or estimated **residential population**. For example, if land area mostly sits in LGA 1, but this is mostly State Forest and the residential population looks to be 50% or more located within LGA 2, then the suburb is allocated to LGA 2.

| Region | Total Population | Total Area ($km^2$) | Total Urban Population | % Urban Population | Total Rural Population | % Rural Population |
|---|---|---|---|---|---|---|
| Central Coast | 348,930 | 33.61% | 343,631 | 98.8% | 4,236 | 1.2% |
| Cessnock | 65,780 | 6.34% | 0 | 0.0% | 65,082 | 100.0% |
| Dungog | 9,707 | 0.94% | 0 | 0.0% | 8,770 | 100.0% |
| Lake Macquarie | 216,428 | 20.85% | 80,750 | 91.5% | 7,466 | 8.5% |
| Maitland | 93,497 | 9.01% | 57,646 | 64.0% | 32,358 | 36.0% |
| Muswellbrook | 16,516 | 1.59% | 0 | 0.0% | 18,154 | 100.0% |
| Newcastle | 171,316 | 16.50% | 172,820 | 100.0% | 0 | 0.0% |
| Port Stephens | 76,540 | 7.37% | 14,376 | 17.4% | 68,161 | 82.6% |
| Singleton | 25,075 | 2.42% | 378 | 1.7% | 22,527 | 98.3% |
| Upper Hunter | 14,292 | 1.38% | 0 | 0.0% | 24,463 | 100.0% |
| **DSSN Region** | **1,038,081** | **100%** | **669,601** | **72.7%** | **251,217** | **27.3%** |

# Population Demand - Projected Population Growth

The annual population growth projection in each DSSN region enables the calculation of the number of inhabitants for the upcoming years, providing a more accurate estimate of future network infrastructure demand.

**Step 3:** Project the anticipated population for each DSSN region within the defined scope until 2030, using annual growth rates.

**Source:** Population Projections - Australian Bureau of Statistics

- The annual population growth rate for the New South Wales region was determined. Subsequently, **this annual growth rate** was uniformly applied to **the various DSSN regions**.
- The dataset extracted from the ABS for this projection considers factors such as **life expectancy at birth, mortality, fertility, and migration**.

Population Projections for New South Wales (2022 - 2030)

| Year | Population for New South Wales | Annual Growth |
|---|---|---|
| 2022 | 8,166,525 | - |
| 2023 | 8,323,889 | 1.93% |
| 2024 | 8,453,902 | 1.56% |
| 2025 | 8,580,341 | 1.50% |
| 2026 | 8,702,446 | 1.42% |
| 2027 | 8,820,393 | 1.36% |
| 2028 | 8,933,348 | 1.28% |
| 2029 | 9,041,818 | 1.21% |
| 2030 | 9,145,140 | 1.14% |

**DSSN Population Estimation (2022 - 2030)**

| | Population | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|---|
| DSSN Population (2022 - 2030)tion | Central Coast | 348,930 | 355,654 | 361,209 | 366,611 | 371,828 | 376,868 | 381,694 | 386,329 | 390,743 |
| | Cessnock | 65,780 | 67,048 | 68,095 | 69,113 | 70,097 | 71,047 | 71,957 | 72,830 | 73,663 |
| | Dungog | 9,707 | 9,894 | 10,049 | 10,199 | 10,344 | 10,484 | 10,618 | 10,747 | 10,870 |
| | Lake Macquarie | 216,428 | 220,598 | 224,044 | 227,395 | 230,631 | 233,757 | 236,750 | 239,625 | 242,363 |
| | Maitland | 93,497 | 95,299 | 96,787 | 98,235 | 99,633 | 100,983 | 102,276 | 103,518 | 104,701 |
| | Muswellbrook | 16,516 | 16,834 | 17,097 | 17,353 | 17,600 | 17,838 | 18,067 | 18,286 | 18,495 |
| | Newcastle | 171,316 | 174,617 | 177,345 | 179,997 | 182,558 | 185,033 | 187,402 | 189,678 | 191,845 |
| | Port Stephens | 76,540 | 78,015 | 79,233 | 80,418 | 81,563 | 82,668 | 83,727 | 84,744 | 85,712 |
| | Singleton | 25,075 | 25,558 | 25,957 | 26,346 | 26,721 | 27,083 | 27,430 | 27,763 | 28,080 |
| | Upper Hunter | 14,292 | 14,567 | 14,795 | 15,016 | 15,230 | 15,436 | 15,634 | 15,824 | 16,005 |
| | DSSN Region | 1,038,081 | 1,058,084 | 1,074,611 | 1,090,683 | 1,106,204 | 1,121,197 | 1,135,555 | 1,149,343 | 1,162,477 |
| | | | +1.93% | +1.56% | +1.50% | +1.42% | +1.36% | +1.28% | +1.21% | +1.14% |

# Visitor Demand - Total Visitors Across DSSN Regions

Understanding total visitor numbers across all DSSN regions provides valuable insights. This forms a foundational basis for estimating future visitor demand and determining the requisite or supplementary network infrastructure needed to support tourism in these regions.

**Step 4:** Obtain the available commercial and non-commercial accommodation to estimate the peak visitor numbers for the different LGAs.

**Source:** Visit NSW | Australian Tourism Data Warehouse (ATDW) | LGA/VIC Tourism websites

**DSSN Peak Visitor Numbers according to the accommodation for the different LGAs**

| Region | Total Visitors (Low-50% of max. accommodation) | Total Visitors (Baseline-75% of max. accommodation) | Total Visitors (High-100% of max. accommodation) |
|---|---|---|---|
| Central Coast | 6,631 | 9,947 | 13,263 |
| Cessnock | 6,216 | 9,324 | 12,432 |
| Dungog | 966 | 1,449 | 1,932 |
| Lake Macquarie | 3,041 | 4,562 | 6,082 |
| Maitland | 1,903 | 2,854 | 3,805 |
| Muswellbrook | 1,126 | 1,690 | 2,253 |
| Newcastle | 5,068 | 7,602 | 10,136 |
| Port Stephens | 7,097 | 10,645 | 14,194 |
| Singleton | 2,214 | 3,321 | 4,428 |
| Upper Hunter | 978 | 1,467 | 1,956 |
| **DSSN Region** | **35,240** | **52,861** | **70,481** |

- After conducting a comprehensive analysis of the available data, it becomes evident that **cities with larger populations**, such as Central Coast and Newcastle, **exhibit greater tourism demand, as do regions like Port Stephens and Cessnock.**
- The **total number of visitors**, calculated as a **peak number**, will play a pivotal role in **estimating** the **network demand** projection allocated to **visitor demand** and to calculate the **required network infrastructure.**

# Visitor Demand - Projected Growth

Understanding the anticipated tourism growth across all DSSN regions will enable the estimation of the total approximate number of visitors by 2030. The corresponding demand estimate for network resources can be calculated to consequently estimate the infrastructure requirements to meet the connectivity needs of visitors.

**Step 5:** Estimate the annual growth in terms of the number of visitors for each of the regions.

**Source:** VES 2030 Regional NSW Forecast data

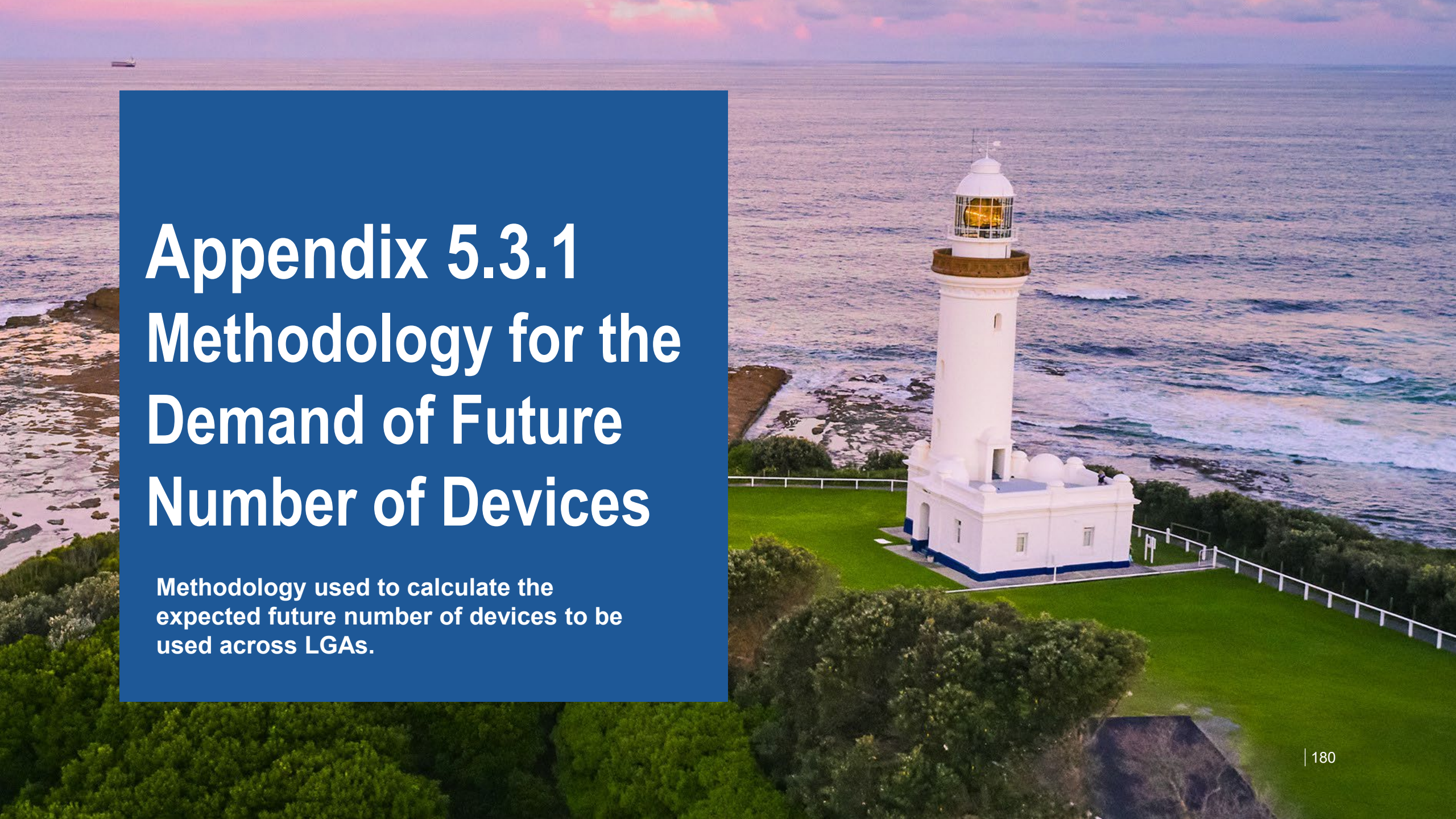
| Annual Growth (%) | |
|---|---|
| From 2019 | |
| To 2025 | To 2030 |
| 4.5% | 4.5% |

- To estimate the growth in the number of visitors for the different regions, a projected annual growth of 4.5% was used.
- These annual growth values were derived from a forecast provided by DSSN, which included both the total growth and annual growth for various Australian regions.

**Total Number of Visitors (2023 - 2030)**

| | Region | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 |
|---|---|---|---|---|---|---|---|---|---|
| Total Number of Visitors (2023-2030) | Central Coast | 9,947 | 10,395 | 10,862 | 11,351 | 11,862 | 12,396 | 12,954 | 13,536 |
| | Cessnock | 9,234 | 9,650 | 10,084 | 10,538 | 11,012 | 11,507 | 12,025 | 12,566 |
| | Dungog | 1,449 | 1,514 | 1,582 | 1,654 | 1,728 | 1,806 | 1,887 | 1,972 |
| | Lake Macquarie | 4,562 | 4,767 | 4,982 | 5,206 | 5,440 | 5,685 | 5,941 | 6,208 |
| | Maitland | 2,854 | 2,982 | 3,117 | 3,257 | 3,403 | 3,557 | 3,717 | 3,884 |
| | Muswellbrook | 1,690 | 1,766 | 1,846 | 1,929 | 2,015 | 2,106 | 2,201 | 2,300 |
| | Newcastle | 7,602 | 7,944 | 8,302 | 8,675 | 9,066 | 9,473 | 9,900 | 10,345 |
| | Port Stephens | 10,645 | 11,124 | 11,625 | 12,148 | 12,694 | 13,266 | 13,863 | 14,486 |
| | Singleton | 3,321 | 3,470 | 3,627 | 3,790 | 3,960 | 4,139 | 4,325 | 4,519 |
| | Upper Hunter | 1,467 | 1,533 | 1,602 | 1,674 | 1,749 | 1,828 | 1,910 | 1,996 |
| | DSSN Region | 52,771 | 55,146 | 57,627 | 60,220 | 62,930 | 65,762 | 68,722 | 71,814 |
| | | | +4.5% | +4.5% | +4.5% | +4.5% | +4.5% | +4.5% | +4.5% |

Destination Sydney Surrounds North



# Appendix 5.3.1 Methodology for the Demand of Future Number of Devices

**Methodology used to calculate the expected future number of devices to be used across LGAs.**

# Approach to Estimate the Number of Devices

The methodology employed comprises the following steps to assess the baseline quantity and distribution of devices in each DSSN region, encompassing various industry sectors and individual user devices.

1. **Determination of Average Number of Devices Per Capita**

2. **Calculation of the Number of Devices Across DSSN Region**

3. **Estimation of the Total Number of Connections (IoT - Non-IoT)**

4. **Obtain the Employment Rate per Industry Sector**

5. **Estimation of Industrial Devices (IoT Devices) per Region and Sector**

6. **Estimation of Individual Devices (Non-IoT Devices) per Region**

7. **Total Number of Devices per Region (Industrial/IoT Devices + Individual/Non-IoT Devices)**

# Average Number of Devices per Capita

The primary objective is to calculate the average number of devices per capita and the corresponding population for all regions, in order to provide an estimate of the total number of devices that exist in the DSSN region.

**Step 1:** Obtain the average number of devices per capita. This value differs depending on the region of the world, and was projected by Cisco through the 2020 Cisco Annual Internet Report, with projections until 2023.

**Source:** Cisco Annual Internet Report

**Note**: In the baseline scenario, it was considered that Australia will be positioned according to Western Europe in terms of Average Devices per Capita (9.4 devices).

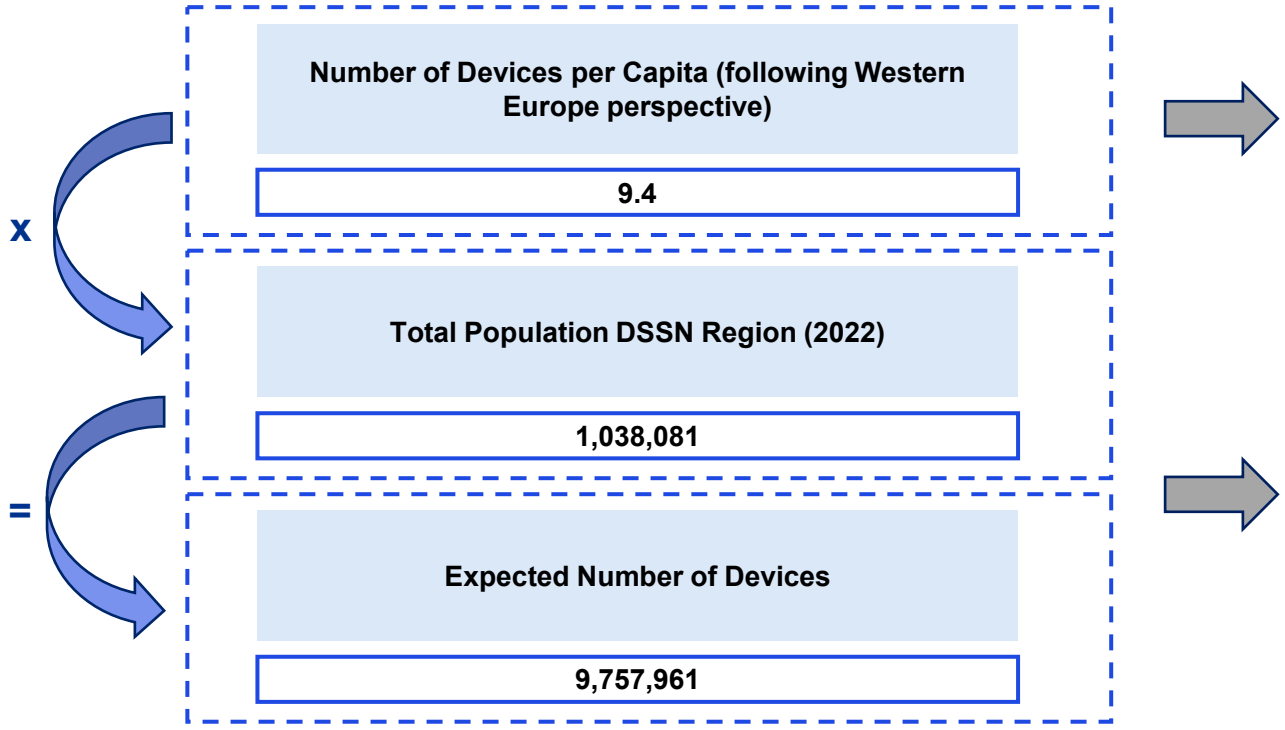
| Worldwide Regions | 2018 | 2023 |
|---|---|---|
| Global | 2.4 | 3.6 |
| Asia Pacific | 2.1 | 3.1 |
| Central and Eastern Europe | 2.5 | 4 |
| Latin America | 2.2 | 3.1 |
| Middle East and Africa | 1.1 | 1.5 |
| North America | 8.2 | 13.4 |
| Western Europe | 5.6 | 9.4 |

Table 1 - Average Number of Devices per Capita

# Estimation of the Number of Devices for the DSSN Region

Estimating the total number of devices is a key input towards the telecommunications infrastructure requirements and planning within the DSSN Region.

**Step 2:** Calculate the total expected number of devices for the entire DSSN region.




The calculation utilises the projection of **9.4** devices per capita, a figure aligned with Cisco's projection for **Western Europe**.

Multiplying the **average number of devices per capita** by the **total population** of the DSSN Region in 2022 (obtained in the previous chapter) gives the expected **total number of devices** for the DSSN Region.

Number of Devices per Capita * Total Population of DSSN Region = Total Number of Devices for DSSN Region

**9.4 * 1,038,081 = 9,757,961 devices**

# Estimation of the Total Number of Connections

To estimate the existing traffic in the DSSN region, understanding the types of connections is crucial. This involves distinguishing between IoT connections, which are linked to industry devices and respective sectors, and non-IoT connections, which are more closely associated with private connections established by individual user devices.

**Step 3:** Obtain the division between the type of device connected to the network. For this projection, a distinction was made between an IoT connection and a non-IoT connection.

| Total Number of Connections (billions) | = | IoT Connections - Industrial devices (billions) | + | Non-IoT Connections - Individual Devices (billions) |
|---|---|---|---|---|
| 29.9 | | 16.7 | | 13.2 |
| The IoT Analytics study projects that in 2023, there are a total number of 29.9 billion connections to the Internet performed by IoT (16.7 billions) and Non-IoT Connections (13.2 billions). | | An IoT connection is generally associated with internet connections by sensors, access points, modems, and may be associated with a more industrial aspect. | | A non-IoT connection is associated with a private connection of a user, such as a resident's mobile phone to an antenna or a personal computer at internet home. |

| Ratio IoT / Non-IoT | |
|---|---|
| IoT | 56% |
| Non - IoT | 44% |

| Number of Devices (Total: 9,757,961) | |
|---|---|
| Industrial Devices (56%) | 5,450,099 |
| Individual Devices (44%) | 4,307,863 |

| Individual Non-IoT Devices per Inhabitant | | |
|---|---|---|
| | Individual Devices | 4,307,863 |
| | DSSN Total Population | 1,038,081 |
| | 4.15 individual/non-IoT devices per inhabitant | |

From the total number of IoT connections (29.9 billion by 2023) and based on the projections for IoT connections (16.7 billion) vs non-IoT connections (13.2 billion), it is possible to calculate the IoT/non-IoT ratio (56% vs 44%) and estimate the associated number of devices.

This value aligns with the projection in the Australian Competition & Consumer Commission (ACCC) in the Regional Mobile Infrastructure Inquiry of July 2023.

**Sources:** IoT Analytics - Total Number of Device Connections | IoT Analytics - Global IoT Market Forecast

# DSSN'S Business Sectors to be Considered

In terms of connectivity requirements, the DSSN regions have specificities not only related to demography and tourism, but also related to the different industry sectors.

**Step 4a:** Understand the business/industrial sectors to project the distribution of IoT/industrial devices.

01 Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas

02 Utilities

03 Construction

04 Manufacturing

05 Wholesale and Retail Trade

06 Transportation & Warehousing

07 Finance, Insurance, Real Estate, Rental & Leasing

08 Professional, Scientific & Technical Services

09 Business, Building & other support services

10 Educational Services

11 Healthcare & Social Assistance

12 Arts, Information, Culture & Recreation

13 Accommodation & Food Services

14 Other Services (except Public Administration

15 Public Administration

# Calculation of Employment Rate per Industry Sector

In this section, the goal is to obtain data on employment distribution across various industrial sectors in each region and understand which sectors have greater influence on connectivity demand in each respective DSSN region.

**Step 4b:** Obtain data on the employment distribution across various industrial sectors in each region to understand which sectors have greater influence in each respective area.

| Sectors/Verticals | DSSN Region | Central Coast | Cessnock | Dungog | Lake Macquarie | Maitland | Muswellbrook | Newcastle | Port Stephens | Singleton | Upper Hunter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 12.4% | 1.3% | 10.0% | 13.7% | 3.0% | 7.3% | 28.6% | 2.3% | 3.2% | 25.4% | 28.9% |
| Utilities | 1.7% | 1.0% | 1.3% | 1.5% | 1.4% | 1.4% | 3.8% | 1.2% | 1.0% | 2.4% | 1.5% |
| Construction | 9.2% | 11.5% | 9.2% | 12.3% | 11.2% | 9.0% | 5.7% | 7.8% | 10.8% | 7.2% | 7.0% |
| Manufacturing | 5.7% | 5.9% | 7.5% | 5.9% | 5.8% | 6.7% | 3.8% | 4.8% | 6.2% | 4.2% | 6.3% |
| Wholesale and Retail Trade | 11.2% | 12.4% | 12.1% | 10.6% | 11.6% | 12.7% | 10.5% | 10.4% | 12.0% | 10.7% | 8.5% |
| Transportation and Warehousing | 3.8% | 3.7% | 4.1% | 4.7% | 3.8% | 4.3% | 2.9% | 3.5% | 4.9% | 2.9% | 2.8% |
| Finance, Insurance, Real Estate, Rental & Leasing | 3.3% | 4.9% | 3.0% | 3.1% | 4.5% | 3.5% | 2.0% | 4.6% | 3.4% | 2.0% | 1.7% |
| Professional, Scientific, and Technical services | 4.8% | 6.0% | 3.6% | 5.2% | 5.7% | 4.7% | 2.5% | 7.7% | 5.2% | 3.0% | 4.0% |
| Management of Business, Building & other support services | 3.7% | 3.3% | 4.7% | 3.2% | 3.1% | 3.7% | 5.0% | 2.9% | 3.8% | 4.5% | 3.1% |
| Educational Services | 7.7% | 8.2% | 6.0% | 8.3% | 9.2% | 7.8% | 6.3% | 10.2% | 7.4% | 5.8% | 7.4% |
| Healthcare and Social Assistance | 14.2% | 17.8% | 14.3% | 12.2% | 19.1% | 16.2% | 9.0% | 20.6% | 14.5% | 8.8% | 9.1% |
| Arts, Information, Culture & Recreation | 1.8% | 3.0% | 1.5% | 1.3% | 1.8% | 1.4% | 1.4% | 2.4% | 1.7% | 1.1% | 2.7% |
| Accommodation and Food Services | 7.0% | 7.0% | 8.8% | 4.4% | 6.3% | 6.8% | 6.8% | 8.3% | 9.1% | 6.8% | 5.6% |
| Other Services (excluding Public Administration) | 4.1% | 3.8% | 4.6% | 4.6% | 4.1% | 4.3% | 4.1% | 3.3% | 4.3% | 4.4% | 3.5% |
| Public Administration | 5.8% | 6.1% | 5.0% | 4.8% | 5.6% | 6.5% | 3.9% | 6.4% | 8.4% | 7.0% | 4.4% |
| Industry of Employment Not Stated | 3.9% | 4.1% | 4.3% | 4.2% | 3.8% | 3.7% | 3.7% | 3.6% | 4.1% | 3.8% | 3.5% |

**Note:** Some of the sectors/verticals were combined due to their identical network demand in terms of throughputs and traffic patterns.

**Source:** Australian Bureau of Statistics

# Estimation of the Total Number of Connections (IoT)

In this section, the goal is to estimate the number of industrial devices by analysing the distribution of the employed population in each industry sector.

**Step 5:** From the distribution of the employed population in each sector, the estimation of the number of industrial devices is carried out through the following calculation:

**Number of Industrial Devices per Sector/Region = Total Number of Industrial Devices for DSSN * Percentage of Population for the Region * Industry Employment Distribution for the Region**

| Sectors/Verticals | DSSN Region | Central Coast | Cessnock | Dungog | Lake Macquarie | Maitland | Muswellbrook | Newcastle | Port Stephens | Singleton | Upper Hunter |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 248,725 | 23,815 | 34,536 | 6,982 | 34,088 | 35,834 | 24,800 | 20,687 | 12,859 | 33,439 | 21,685 |
| Utilities | 68,746 | 18,319 | 4,490 | 764 | 15,908 | 6,872 | 3,295 | 10,793 | 4,018 | 3,160 | 1,126 |
| Construction | 553,386 | 210,673 | 31,773 | 6,268 | 127,264 | 44,179 | 4,943 | 70,156 | 43,400 | 9,479 | 5,252 |
| Manufacturing | 317,425 | 108,085 | 25,902 | 3,007 | 65,904 | 32,889 | 3,295 | 43,173 | 24,915 | 5,529 | 4,727 |
| Wholesale and Retail Trade | 639,833 | 227,161 | 41,788 | 5,402 | 131,809 | 62,341 | 9,105 | 93,542 | 48,222 | 14,086 | 6,378 |
| Transportation and Warehousing | 208,227 | 67,782 | 14,160 | 2,395 | 43,179 | 21,108 | 2,515 | 31,480 | 19,691 | 3,818 | 2,101 |
| Finance, Insurance, Real Estate, Rental & Leasing | 230,699 | 89,765 | 10,361 | 1,580 | 51,133 | 17,181 | 1,734 | 41,374 | 13,663 | 2,633 | 1,276 |
| Professional, Scientific, and Technical Services | 312,110 | 109,916 | 12,433 | 2,650 | 64,768 | 23,071 | 2,168 | 69,257 | 20,896 | 3,949 | 3,001 |
| Management of Business, Building & other support services | 185,644 | 60,454 | 16,232 | 1,631 | 35,225 | 18,162 | 4,336 | 26,084 | 15,270 | 5,924 | 2,326 |
| Educational Services | 458,127 | 150,219 | 20,721 | 4,230 | 104,538 | 38,288 | 5,463 | 91,743 | 29,737 | 7,636 | 5,553 |
| Healthcare and Social Assistance | 948,010 | 326,085 | 49,386 | 6,218 | 217,030 | 79,522 | 7,804 | 185,284 | 58,268 | 11,585 | 6,828 |
| Arts, Information, Culture & Recreation | 121,232 | 54,958 | 5,180 | 663 | 20,453 | 6,872 | 1,214 | 21,587 | 6,831 | 1,448 | 2,026 |
| Accommodation and Food Services | 396,107 | 128,236 | 30,391 | 2,242 | 71,586 | 33,379 | 5,896 | 74,653 | 36,568 | 8,952 | 4,202 |
| Other Services (excluding Public Administration) | 214,475 | 69,614 | 15,886 | 2,344 | 46,588 | 21,108 | 3,555 | 29,681 | 17,279 | 5,793 | 2,626 |
| Public Administration | 334,219 | 111,748 | 17,268 | 2,446 | 63,632 | 31,907 | 3,382 | 57,564 | 33,755 | 9,215 | 3,302 |
| Industry of Employment Not Stated | 213,134 | 75,110 | 14,850 | 2,140 | 43,179 | 18,162 | 3,208 | 32,380 | 16,476 | 5,003 | 2,626 |
| Total | 5,450,099 | 1,831,941 | 345,356 | 50,963 | 1,136,283 | 490,875 | 86,712 | 899,438 | 401,848 | 131,648 | 75,035 |

# Estimation of the Total Number of Connections (Non-IoT)

In this section, the goal is to obtain the number of individual devices (e.g. computers, mobile phones, smartwatches) and the number of visitor devices for each DSSN region.

**Step 6a:** Obtain the number of **individual devices** (computers, mobile phones, smartwatches) for each region. This estimation is obtained through the following calculation:

**Number of Individual Devices per Region = Total Number of Individual Devices for DSSN * Percentage of Population for the Region**

| Regions | Number of Individual Devices |
|---|---|
| Central Coast | 1,448,001 |
| Cessnock | 272,976 |
| Dungog | 40,282 |
| Lake Macquarie | 898,140 |
| Maitland | 387,997 |
| Muswellbrook | 68,539 |
| Newcastle | 710,993 |
| Port Stephens | 317,628 |
| Singleton | 104,057 |
| Upper Hunter | 59,309 |
| DSSN Region | 4,307,863 |

**Step 6b:** Obtain the expected **number of devices allocated for visitors**. For the calculation of this projection, it is assumed that each visitor, on average, will have **4.15 connected devices** to the network, similar to inhabitants.

**Number of Total Devices per Region Used by Visitors = Total Number of Individual Devices per Visitor * Average Visitors per Day**

| Regions | Number of Visitor Devices |
|---|---|
| Central Coast | 41,278 |
| Cessnock | 38,320 |
| Dungog | 6,013 |
| Lake Macquarie | 18,932 |
| Maitland | 11,844 |
| Muswellbrook | 7,013 |
| Newcastle | 31,547 |
| Port Stephens | 44,175 |
| Singleton | 13,782 |
| Upper Hunter | 6,088 |
| DSSN Region | 218,991 |

# Total Number of Connections per Region (Non-IoT & IoT)

In this section, the goal is to obtain the total number of devices for each region for Industrial/IoT devices & Individual/Non-IoT devices.

**Step 7:** Obtain the total number of devices for each region.

| Regions | Number of IoT Devices | Number of Non-IoT Individual Devices | Number of Non-IoT Visitor Devices | Total |
|---|---|---|---|---|
| Central Coast | 1,831,941 | 1,448,001 | 41,278 | 3,321,220 |
| Cessnock | 345,356 | 272,976 | 38,320 | 656,652 |
| Dungog | 50,963 | 40,282 | 6,013 | 97,259 |
| Lake Macquarie | 1,136,283 | 898,140 | 18,932 | 2,053,355 |
| Maitland | 490,875 | 387,997 | 11,844 | 890,715 |
| Muswellbrook | 86,712 | 68,539 | 7,013 | 162,264 |
| Newcastle | 899,438 | 710,993 | 31,547 | 1,641,917 |
| Port Stephens | 401,848 | 317,628 | 44,175 | 763,651 |
| Singleton | 131,648 | 104,057 | 13,782 | 249,487 |
| Upper Hunter | 75,035 | 59,309 | 6,088 | 140,433 |
| DSSN Region | 5,450,099 | 4,307,863 | 218,991 | 9,976,952 |

# Appendix 5.3.2 Methodology and Analysis of Demand

**Methodology and Analysis of Future Demand based on Sector Characteristics and Future Traffic**

# Methodology: Connectivity Demand Model

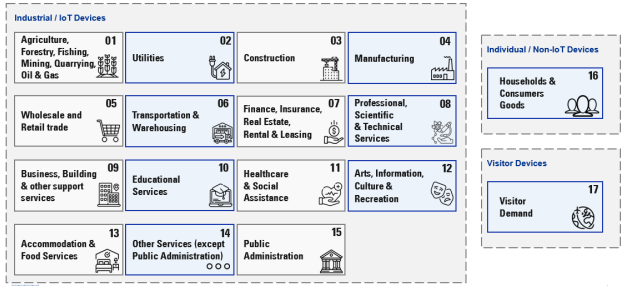
# Connectivity Demand Model Approach

To understand DSSN's future needs, the steps below identify the demand that requires the network investment:

## Universal Definition

- DSSN data analysis and information research

| Region | Total Population | Total Area (Km²) | Total Urban Population | % Urban Population | Total Rural Population | % Rural Population |
|---|---|---|---|---|---|---|
| | | | URBAN | | RURAL | |
| Central Coast | 348 930 | 33,61% | 343 631 | 98.8% | 4 236 | 1.2% |
| Cessnock | 65 780 | 6,34% | 0 | 0.0% | 65 082 | 100.0% |
| Dungog | 9 707 | 0,94% | 0 | 0.0% | 8 770 | 100.0% |
| Lake Macquarie | 216 428 | 20,85% | 80 750 | 91.5% | 7 466 | 8.5% |
| Maitland | 93 497 | 9,01% | 57 646 | 64.0% | 32 358 | 36.0% |
| Muswellbrook | 16 516 | 1,59% | 0 | 0.0% | 18 154 | 100.0% |
| Newcastle | 171 316 | 16,50% | 172 820 | 100.0% | 0 | 0.0% |
| Port Stephens | 76 540 | 7,37% | 14 376 | 17.4% | 68 161 | 82.6% |
| Singleton | 25 075 | 2,42% | 378 | 1.7% | 22 527 | 98.3% |
| Upper Hunter | | | | | | |
| **DSSN Region** | | | | | | |



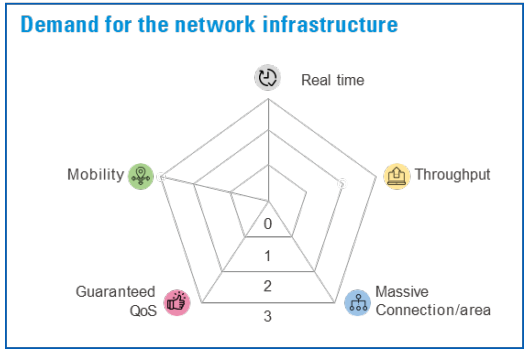

## Demand Model

- Definition of number of devices to be connected per sector and area

| Total Devices | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023 | 248,725 | 68,746 | 553,386 | 317,425 | 639,833 | 208,227 | 230,699 | 312,110 | 185,644 | 458,127 | 948,010 | 121,232 | 396,107 | 214,475 | 334,219 | 4,307,863 | 181,888 |
| 2025 | 334,684 | 92,504 | 744,637 | 427,127 | 860,959 | 280,191 | 310,428 | 419,975 | 249,802 | 616,456 | 1,275,642 | 163,130 | 533,001 | 288,597 | 449,725 | 4,440,584 | 198,634 |
| 2030 | 702,951 | 194,290 | 1,563,991 | 897,113 | 1,808,309 | 588,496 | 652,005 | 882,092 | 524,669 | 1,294,768 | 2,679,285 | 342,629 | 1,119,485 | 606,152 | 944,576 | 4,732,885 | 248,721 |

Industrial (IoT) Devices | Individual (non-IoT) Devices | Visitor Devices

- Definition of technical requirements to serve the volume of devices




[1]period during which occurs the maximum total traffic load in a given 24−hour period, [2]ratio of the potential maximum demand to the actual bandwidth, [3],extra capacity to assure consistency of network modelling

# Demand Model: DSSN's Population To Be Served

Analysing DSSN's demographics enables a targeted approach to connectivity planning, acknowledging the variation in demand across regions. By considering Urban and Rural personas, infrastructure investments can be tailored to meet the specific needs of each area.

- The first variable to consider is the DSSN's demographics, as demand for connectivity will not be equal across DSSN's regions.

- In the Telco industry, traditionally two types of personas are considered, **Urban** and **Rural**, especially because for carriers, infrastructure investment relies on the potential revenue generated. Therefore, Rural areas, with higher area to be covered and significantly lower population density, are not as attractive as Urban areas. This also means that the starting point in terms of already deployed technology will differ significantly.

URBAN RURAL

| Region | Total Population | Total Area ($km^2$) | Total Urban Population | % Urban Population | Total Rural Population | % Rural Population |
|---|---|---|---|---|---|---|
| Central Coast | 348,930 | 33.61% | 343,631 | 98.8% | 4,236 | 1.2% |
| Cessnock | 65,780 | 6.34% | 0 | 0.0% | 65,082 | 100.0% |
| Dungog | 9,707 | 0.94% | 0 | 0.0% | 8,770 | 100.0% |
| Lake Macquarie | 216,428 | 20.85% | 80,750 | 91.5% | 7,466 | 8.5% |
| Maitland | 93,497 | 9.01% | 57,646 | 64.0% | 32,358 | 36.0% |
| Muswellbrook | 16,516 | 1.59% | 0 | 0.0% | 18,154 | 100.0% |
| Newcastle | 171,316 | 16.50% | 172,820 | 100.0% | 0 | 0.0% |
| Port Stephens | 76,540 | 7.37% | 14,376 | 17.4% | 68,161 | 82.6% |
| Singleton | 25,075 | 2.42% | 378 | 1.7% | 22,527 | 98.3% |
| Upper Hunter | 14,292 | 1.38% | 0 | 0.0% | 24,463 | 100.0% |
| **DSSN Region** | **1,038,081** | **100%** | **669,601** | **72.7%** | **251,217** | **27.3%** |

**These personas will also serve as blueprints for the needs estimation in the following years.**

# Demand Model: DSSN Sector Segmentation

In terms of business requirements, the 10 DSSN regions under analysis have specificities not only related to population demography in each region, but also related to the different business sector needs. Therefore, regardless of the deployment mode retained, the model will consider 17 vectors of modeling and perform sensitivity analyses and develop the demand growth scenarios.

## Industrial / IoT Devices

- 01 Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas
- 02 Utilities
- 03 Construction
- 04 Manufacturing
- 05 Wholesale and Retail Trade
- 06 Transportation & Warehousing
- 07 Finance, Insurance, Real Estate, Rental & Leasing
- 08 Professional, Scientific & Technical Services
- 09 Business, Building & other support services
- 10 Educational Services
- 11 Healthcare & Social Assistance
- 12 Arts, Information, Culture & Recreation
- 13 Accommodation & Food Services
- 14 Other Services (except Public Administration)
- 15 Public Administration

## Individual / Non-IoT Devices

- 16 Households & Consumers Goods

## Visitor Devices

- 17 Visitor Demand

# Demand Model: Number of Connected Devices per Sector

Each vector will have specific connectivity needs for their users/devices independently if connected through mobile or fixed technology, which will be stressing the network differently. Therefore, it is necessary to understand the expected demand required by each vector. The table below shows the number of devices for all regions per business sector in 2023.

## Number of Connected Devices per Sector and Region

| | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Central Coast | 23,815 | 18,319 | 210,673 | 108,085 | 227,161 | 67,782 | 89,765 | 109,916 | 60,454 | 150,219 | 326,085 | 54,958 | 128,236 | 69,614 | 111,748 | 1,448,001 | 41,278 |
| Cessnock | 34,536 | 4,490 | 31,773 | 25,902 | 41,788 | 14,160 | 10,361 | 12,433 | 16,232 | 20,721 | 49,386 | 5,180 | 30,391 | 15,886 | 17,268 | 272,976 | 38,320 |
| Dungog | 6,982 | 764 | 6,268 | 3,007 | 5,402 | 2,395 | 1,580 | 2,650 | 1,631 | 4,230 | 6,218 | 663 | 2,242 | 2,344 | 2,446 | 40,282 | 6,013 |
| Lake Macquarie | 34,088 | 15,908 | 127,264 | 65,904 | 131,809 | 43,179 | 51,133 | 64,768 | 35,225 | 104,538 | 217,030 | 20,453 | 71,586 | 46,588 | 63,632 | 898,140 | 18,932 |
| Maitland | 35,834 | 6,872 | 44,179 | 32,889 | 62,341 | 21,108 | 17,181 | 23,071 | 18,162 | 38,288 | 79,522 | 6,872 | 33,379 | 21,108 | 31,907 | 387,997 | 11,844 |
| Muswellbrook | 24,800 | 3,295 | 4,943 | 3,295 | 9,105 | 2,515 | 1,734 | 2,168 | 4,336 | 5,463 | 7,804 | 1,214 | 5,896 | 3,555 | 3,382 | 68,539 | 7,013 |
| Newcastle | 20,687 | 10,793 | 70,156 | 43,173 | 93,542 | 31,480 | 41,374 | 69,257 | 26,084 | 91,743 | 185,284 | 21,587 | 74,653 | 29,681 | 57,564 | 710,933 | 31,547 |
| Port Stephen | 12,859 | 4,018 | 43,400 | 24,915 | 48,222 | 19,691 | 13,633 | 20,896 | 15,270 | 29,737 | 58,268 | 6,831 | 36568 | 17,279 | 33,755 | 317,628 | 44,175 |
| Singleton | 33,439 | 3,160 | 9,479 | 5,529 | 14,086 | 3,818 | 2,633 | 3,949 | 5,924 | 7,636 | 11,585 | 1,448 | 8,952 | 5,793 | 9,215 | 104,057 | 13,782 |
| Upper Hunter | 21,685 | 1,126 | 5,252 | 4,727 | 6,378 | 2,101 | 1,276 | 3,001 | 2,326 | 5,553 | 6,828 | 2,026 | 4,202 | 2,626 | 3,302 | 59,309 | 6,088 |
| Total Devices (2023) | 248,725 | 68,746 | 553,386 | 317,425 | 639,833 | 208,227 | 230,699 | 312,110 | 185,644 | 458,127 | 948,010 | 121,232 | 396,107 | 214,475 | 334,219 | 4,307,863 | 218,991 |

# Demand Model: Number of Connected Devices per Sector

In order to anticipate future demand across various sectors, it is crucial to estimate the growth in the number of devices. Below, the estimation and the underlying assumptions used to derive the final device count are outlined.

| Total Devices | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023 | 248,725 | 68,746 | 553,386 | 317,425 | 639,833 | 208,227 | 230,699 | 312,110 | 185,644 | 458,127 | 948,010 | 121,232 | 396,107 | 214,475 | 334,219 | 4,307,863 | 218,991 |
| 2025 | 334,684 | 92,504 | 744,637 | 427,127 | 860,959 | 280,191 | 310,428 | 419,975 | 249,802 | 616,456 | 1,275,642 | 163,130 | 533,001 | 288,597 | 449,725 | 4,440,584 | 239,143 |
| 2030 | 702,951 | 194,290 | 1,563,991 | 897,113 | 1,808,309 | 588,496 | 652,005 | 882,092 | 524,669 | 1,294,768 | 2,679,285 | 342,629 | 1,119,485 | 606,152 | 944,576 | 4,732,885 | 299,445 |
| | Industrial (IoT) Devices | | | | | | | | | | | | | | | Individual (non-IoT) Devices | Visitor Devices |

## ASSUMPTIONS

- To estimate the growth in **the number of IoT/Industrial** devices between 2023 and 2030 for different regions, the projection by IoT Analytics and Ericsson was considered, indicating **an annual growth of 16%**.
- For non-IoT/individual devices, an **annual growth rate** aligned with the **population growth** in the respective regions was assumed .

| | |
|---|---|
| **Expected Annual Growth of IoT Devices** | **16%** |
| **Expected Annual Growth of Non-IoT Devices** | **Follows the Population Growth** |
| **Expected Annual Growth of Visitor Devices** | **Follows the Visitor Demand Growth** |

**Sources:** IoT Analytics | Ericsson

# Demand Model: Technical Requirements

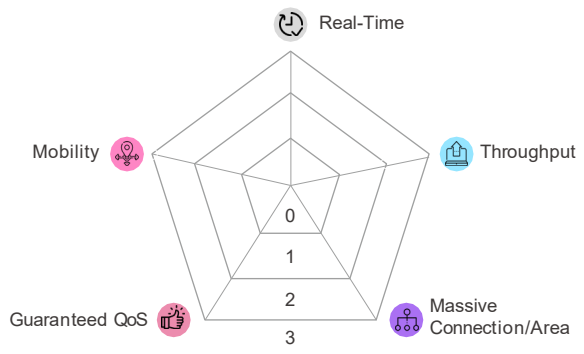
The data collection and information research facilitated the acquisition and analysis of network parameters (e.g., number of sites, location, technologies). Subsequently, the initial phase of the demand model generated an estimate of the number of devices and their growth for the target years, accounting for various geographic factors (e.g., current and future number of devices, projected required throughput). In order to establish the technical requirements derived from the demand model and facilitate the definition of current and future capacity, certain assumptions were considered:

**Assumptions**

| Use Cases Definition | Throughput Estimations | Throughput Calculation | Cross Network Factors Consideration (e.g., Busy Hour, Extra Capacity, others) |
|---|---|---|---|
| For each vertical (sector), several use cases were selected to best represent the future and current implementations in each sector. | Three throughput scales were defined, based on the use case studies from GSMA, Kearney Article and Wireless Labs Study.<br>1. Lowest interval [0,5;1;2] Mbps < 20 Mbps<br>2. Medium interval [2;5;10] Mbps < 50 Mbps<br>3. Highest interval [10;50;100] Mbps >50 Mbps | Throughput distribution per vertical and calculation of average throughput per sector. | After estimating the average throughput per sector, a **Busy Hour**[1] factor of 20% and a **Contention Ratio**[2] of 1/50 were considered. A **Headroom extra capacity**[3] of 20% was also included for consistency of the network modeling. |

[1]period during which occurs the maximum total traffic load in a given 24−hour period, [2]ratio of the potential maximum demand to the actual bandwidth, [3]extra capacity to assure consistency of network modelling

**Demand for the network infrastructure**




For the evaluation of network requirements per type of device used in each sector, a radar chart was used, divided into **four** levels: Level 0, 1, 2 and 3, where level 0 represents the lowest level and level 3 the highest.

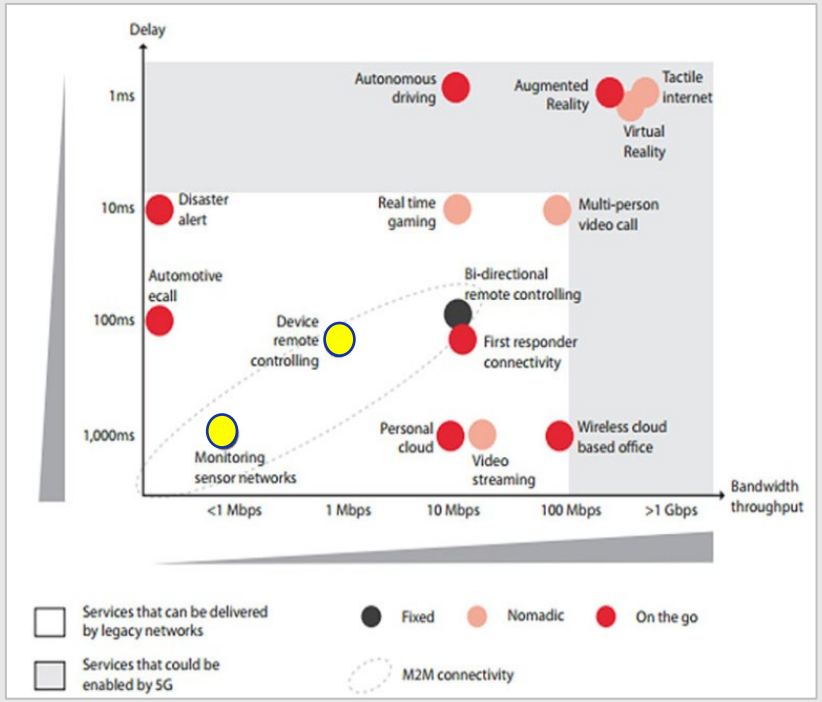
Each vertex of the radar chart has the following requirement meaning:

- **Mobility**: relates to the ability of a device to be mobile, meaning a connection starts in one access point (AP), and device can switch between APs without losing connection (e.g., drones).
- **Real Time**: relates to the ability of exchanging data instantly or with negligible latency of transmission (e.g., live video streaming).
- **Throughput**: relates to the volume of data that can be processed each instant (e.g., sensors; AR/VR).
- **Massive Connection/Area**: relates to number of devices connected to the network at the same time (e.g., Wireless Robot Control).
- **Guaranteed Quality of Service (QoS)**: relates to the quality of data exchanged (e.g., VR/AR).

# Demand Model : Example of Use Case Used

These use cases already implemented and future test-proved use case studies help identify the throughput requirements for a standard device for each of the use cases, based on the specific region and vertical/sector characteristics to determine the number of devices and their contribution to the sector. The objective was to obtain the final average traffic per device.

For example, in Sector 1 - **Agriculture + Forestry, Fishing, Mining, Quarrying, Oil and Gas**, which is one of the sectors that will have a greater impact in rural areas, most 5G use cases are sensor-based to control and improve efficiency in production. Some of the applications are monitoring sensor networks and device remote controlling. According to Wireless Labs and GSMA studies, the picture below, in yellow, represents use case applications that will require an average throughput per device between 0.5 and 1 Mbps.




The presented use cases require real-time data, which will ultimately increase production efficiency. The ability to monitor, track and automate systems will allow producers to measure things on a day-to-day basis.

In Aggrotech, devices will allow farmers to control production by using sensors to communicate moisture, fertilisation and nutrition levels, etc., and to report on current and predicted weather patterns to allow improved management and analysis.

| | Throughput calculation [Mbps] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Mbps | 0.5 | 1 | 2 | 5 | 10 | 50 | 100 | 1000 |
| % of devices that use the specific throughput in this sector | 30% | 30% | 25% | 5% | 5% | 2% | 2% | 1% |

The average traffic per device determined for this sector is 14.7 Mbps. In Singleton, as an example, considering its population as 100 per cent rural, there is an estimated 33,439 devices in 2023 in this sector. After taking into consideration a busy hour factor of 20 per cent, a concentration ratio of 1:50, as well as a headroom extra capacity of 20 per cent, the estimated required throughput for all devices would be 3,237 Mbps.

# Connectivity Demand Model – Overview of Sector Demand Characteristics

# Demand for Agric., Forestry, Fishing, Mining, Quarrying, Oil & Gas

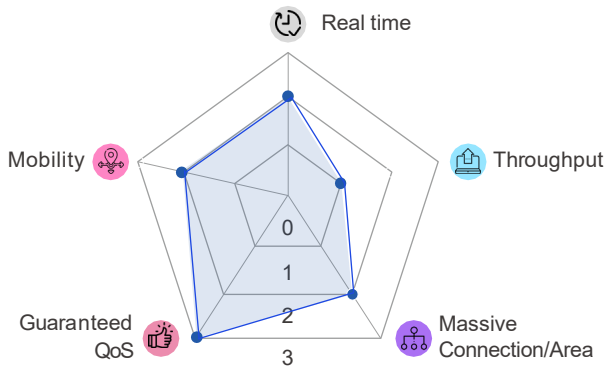
The use cases per sector help to understand the expected requirements for the network, considering type and number of devices required for the applications identified and the throughput necessary.

**Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas** 01

## APPLICATIONS

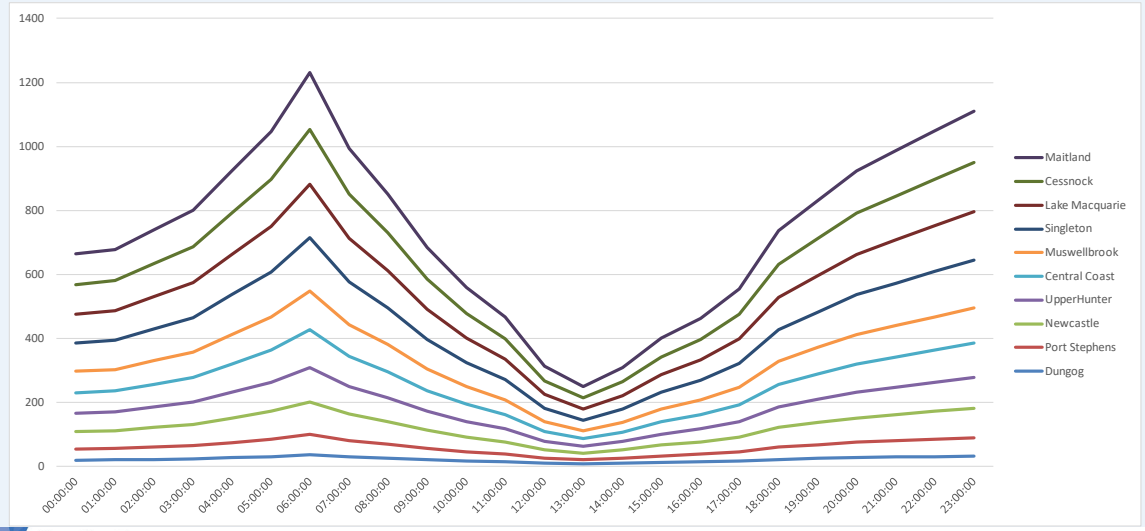
- Remote monitoring of farm conditions and infrastructure, saving time and labour on routine farm checks
- Faster insights from real-time data across the value-chain and higher data analytics capacity, which will improve producers' decision-making and time to market
- High-definition cameras transmit real-time video and robot/drone inspection
- AR/VR applications

## Demand for the network infrastructure




Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## ASSUMPTIONS

- Demand during early morning (12-6am) and late afternoon (6-11pm), e.g., irrigation system
- Less demand during warm hours (11am-6pm)
- Medium demand in the morning (8-11am)
- Most prevalent in rural regions

# Demand for Utilities

The same approach was followed for the following vectors. The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

**02**

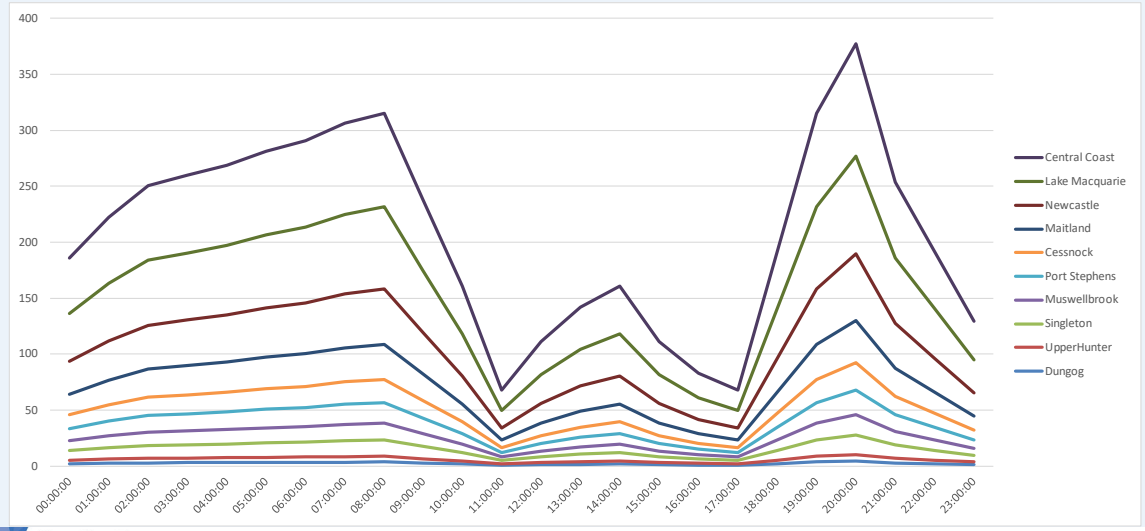
**Utilities**

## APPLICATIONS

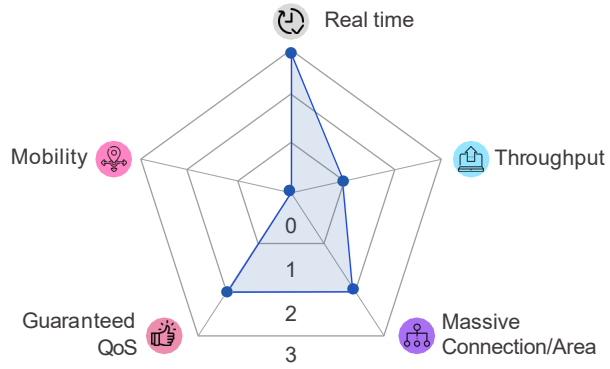
- Smart meters not only for consumers with higher levels of detail
- Remote monitoring of electrical grids
- Smart street lighting (through integrated sensors) to enable efficiency in public areas and provide lighting accordingly

Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## Demand for the network infrastructure




## ASSUMPTIONS

- Highest demand between 6-10pm, e.g., when people return home
- Between 12-8am is off-peak time with less demand
- Between 12-2pm is average demand, e.g., people go home for lunch, machines, household appliances
- Lower demand between 9-11am, 3-6pm and 10-12pm
- If we consider teleworking, there is a peak between 9-12am and 2-6pm, with the demand becoming more constant throughout the day and higher in absolute terms
- More prevalent in urban regions

# Demand for Construction

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

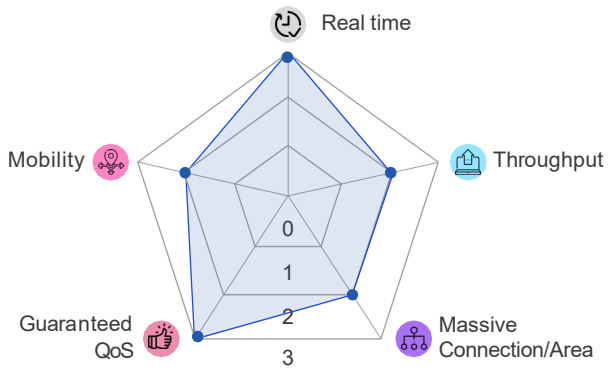
03

**Construction**

## APPLICATIONS

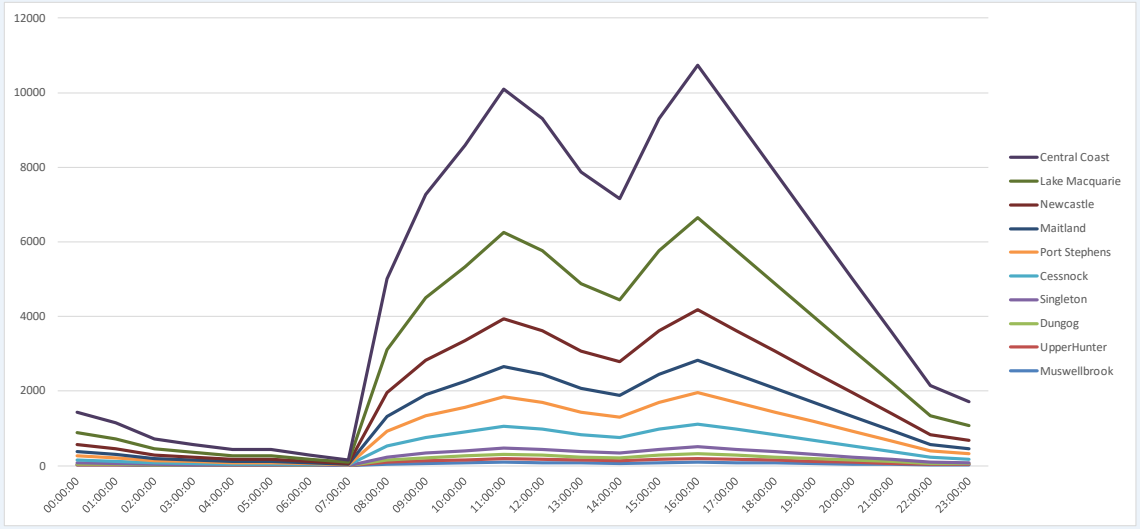
- Holographic Building Visualisation
- 360-degree 8K streaming and QR code scanning from wireless video cameras
- Internet of Things (IoT) structural sensing
- Real-time design displays

## Demand for the network infrastructure




Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## ASSUMPTIONS

- Highest demand between 8am-12pm and 2-6pm
- Lower demand between 12-2pm and 6pm-8am
- Most prevalent in urban areas

# Demand for Manufacturing

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

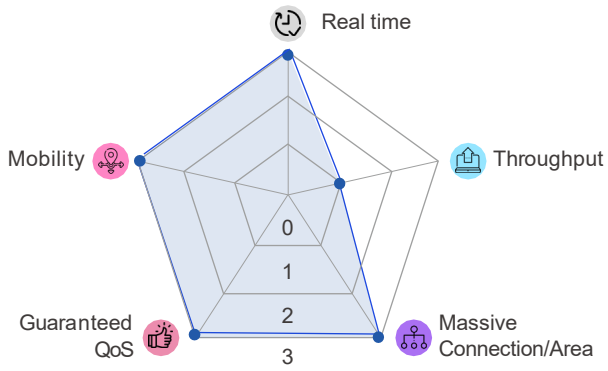
**04**

**Manufacturing**

## APPLICATIONS

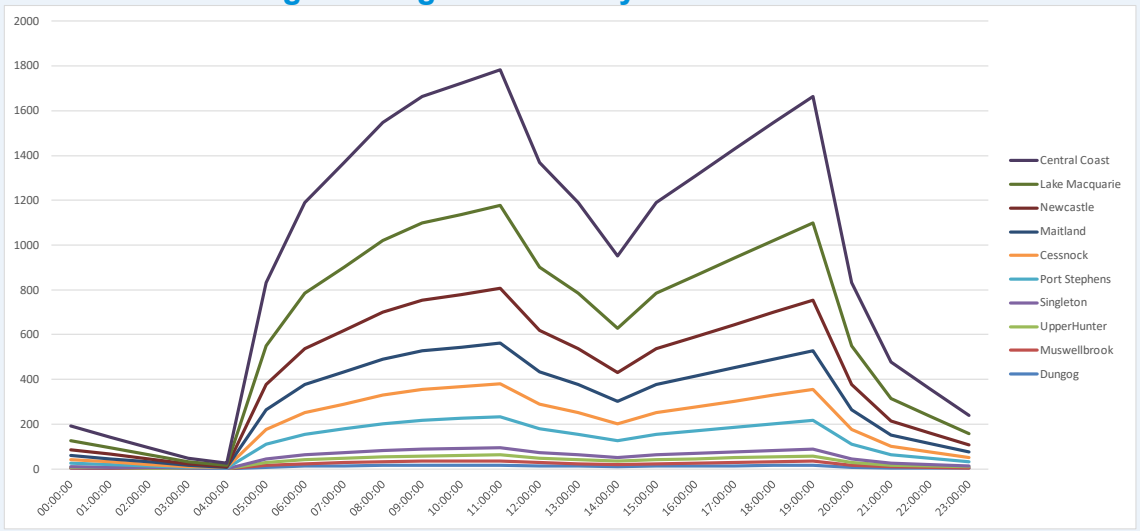
- VR/AR equipment to assist in assembling lines
- Real-time control
- Connecting equipment (sensors, etc.)
- Synchronised robots, control by AI-based detection

## Demand for the network infrastructure




Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## ASSUMPTIONS

- Relatively constant demand
- Peak starting earlier (5am-12pm)
- Decrease in demand between 12-2pm
- Peak between 2-7pm
- Demand almost constant but never zero between 8pm-5am,
- Most prevalent in urban regions

# Demand Wholesale and Retail Trade

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

**05**

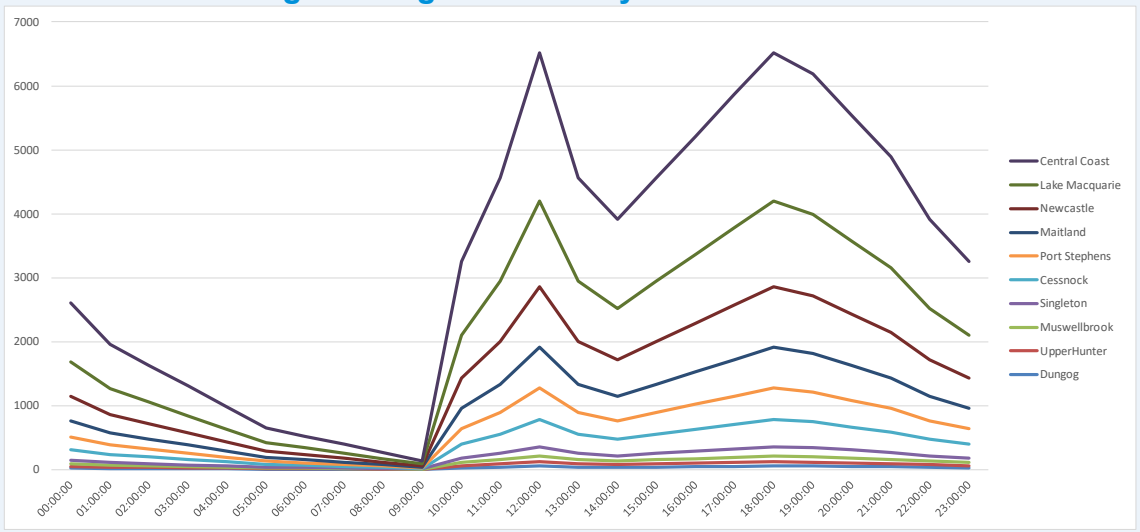
**Wholesale and Retail Trade**

## APPLICATIONS

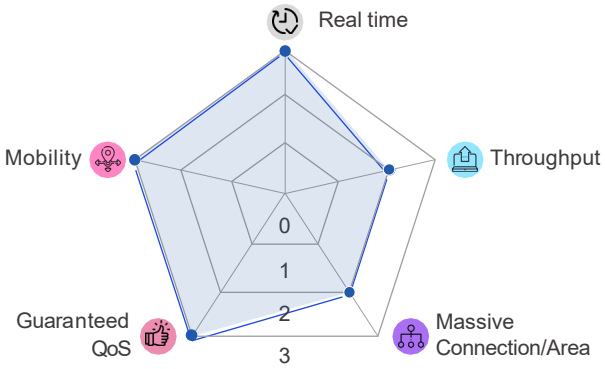
- Sensors to provide real-time inventory visibility
- Immersive experiences (e.g. shoppers are able to immediately check product materials or ingredients through the use of smart glasses or smartphones)
- Personalisation (with lower latency, retailers will also be able to respond to purchasing patterns and behaviours with immersive, tailored content in real time)

Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## Demand for the network infrastructure




## ASSUMPTIONS

- Highest demand between 12-2pm and 6-10pm
- Low demand between 10-12am and 2-4pm
- Average demand 4-6pm
- Demand near zero between 10pm-10am
- Most prevalent in urban regions

# Demand for Transportation and Warehousing

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

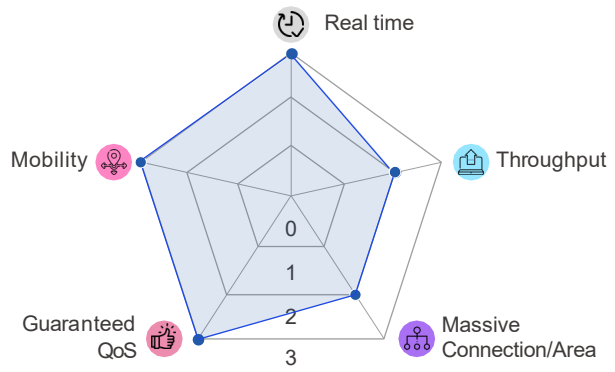
**06**

**Transportation & Warehousing**

## APPLICATIONS

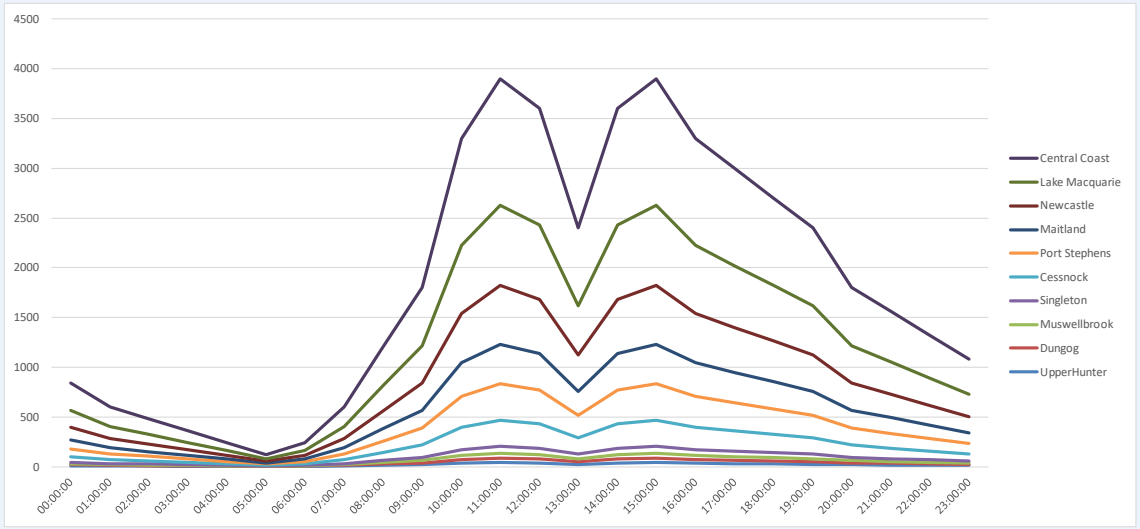
- End-to-end connectivity
- Vehicle-to-vehicle (V2V): Vehicles relay signals directly to each other
- Vehicle-to-infrastructure (V2I): Vehicles communicate with sensors on bridges, roads and traffic lights

## Demand for the network infrastructure




Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## ASSUMPTIONS

- Highest demand between 10am-12pm and 2-4pm
- Demand close to zero between 7pm-7am
- Low demand between 8-9am and 4-7pm
- Most prevalent in urban regions

# Demand for Finance, Insurance, Real Estate and Leasing

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

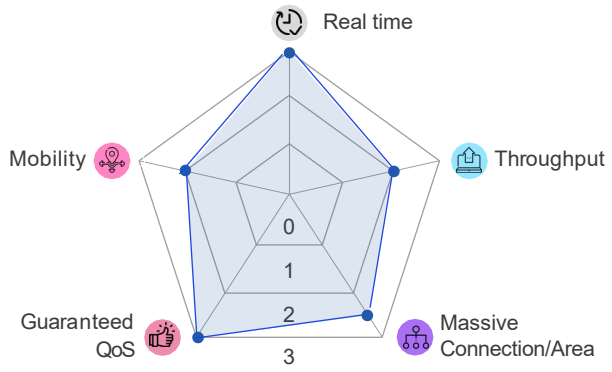
**07**

**Finance, Insurance, Real Estate, Rental Leasing**

## APPLICATIONS

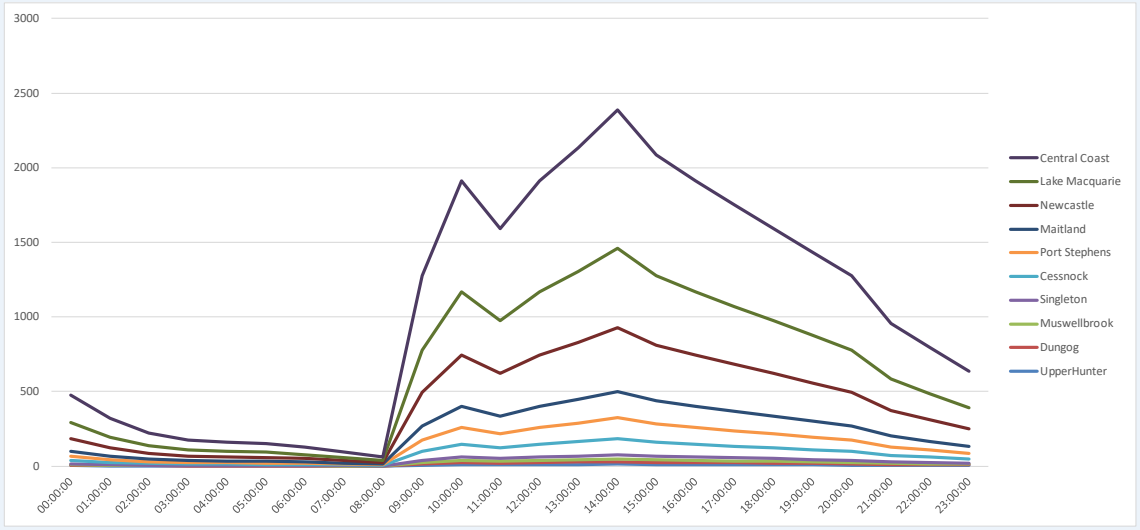
- Financial advice from AI robots
- Increased security and personalised banking
- Blockchain and trade finance
- Faster insurance analysis
- Wearable technology and banking
- Pop-up branches and ATMs
- Finance apps will move to the cloud

## Demand for the network infrastructure




Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## ASSUMPTIONS

- Highest demand between 9am-3pm
- Low demand between 3-9pm
- Peak demand 12-3pm
- Most prevalent in urban regions

# Demand for Professional Scientific and Technical Services

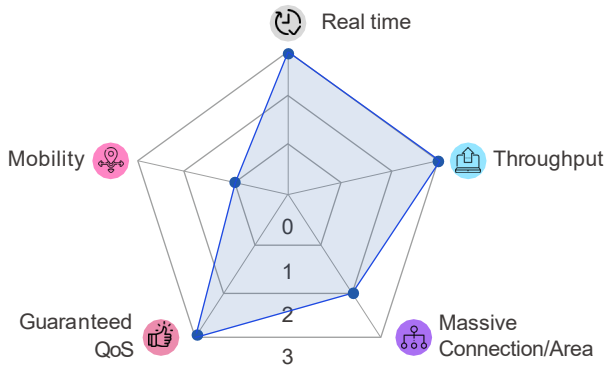
The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

**08 Professional, Scientific & Technical Services**

## APPLICATIONS

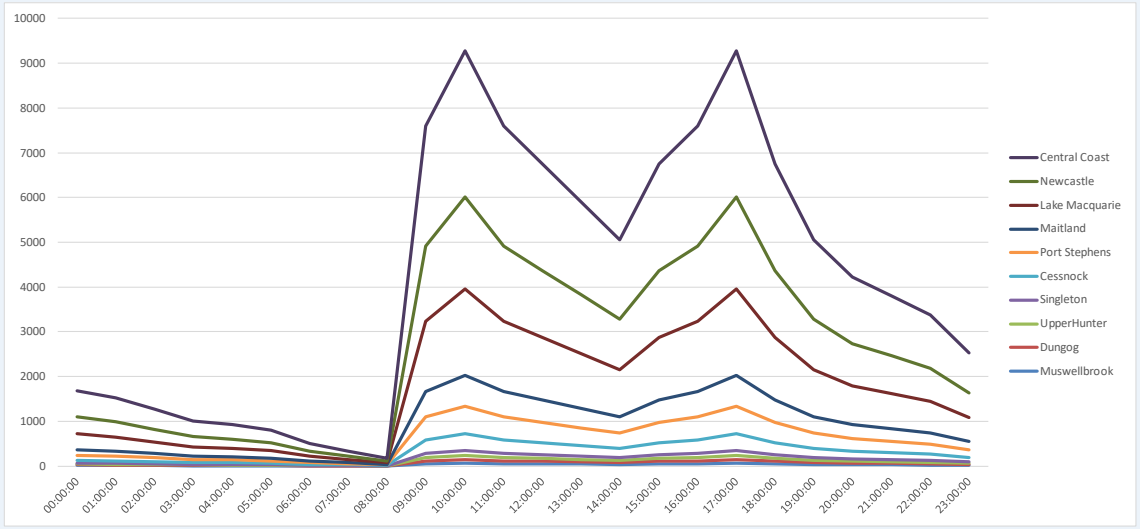
- 5G IoT via nanosatellite
- Real-time and predictive analytics trough sensors
- Robotisation and Science Experimental Automation

## Demand for the network infrastructure




Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## ASSUMPTIONS

- Highest demand between 9am-6pm
- Peak between 9am-12pm and 3-6pm
- Low demand between 6-11pm
- Close to zero between 11pm-9am
- Most prevalent in urban regions

# Demand Business, Building, and other support services

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

**09**

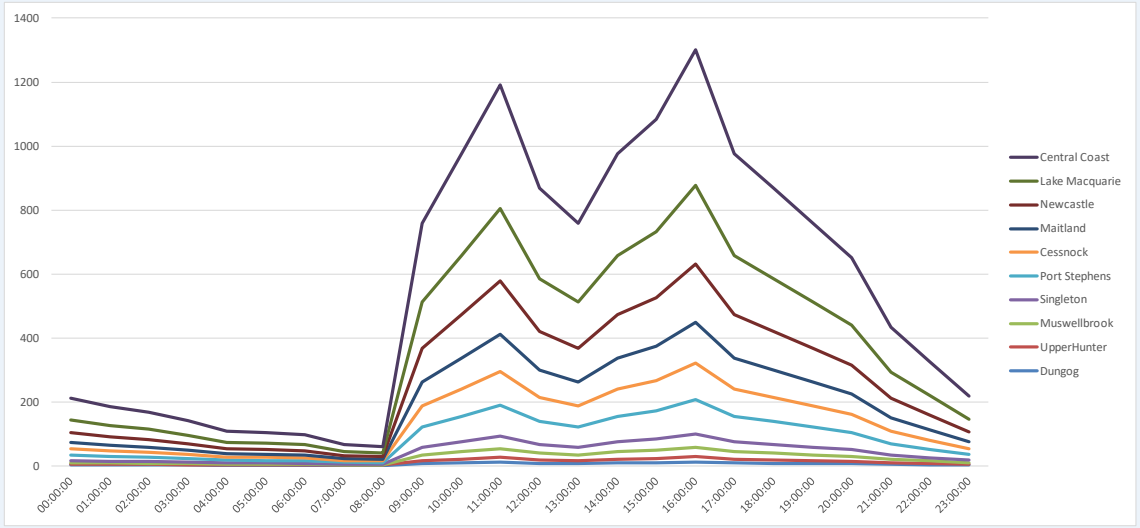
**Business, Building and other support services**

## APPLICATIONS

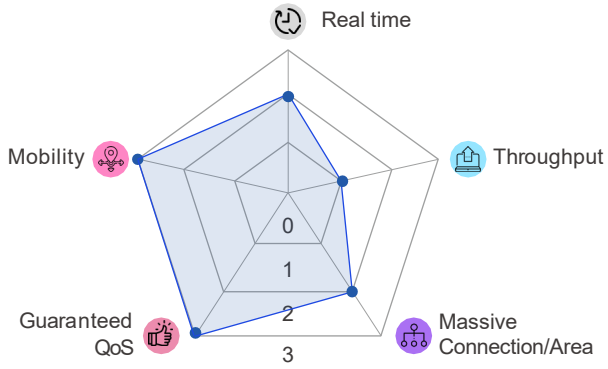
- Harmonise building use and equipment utilisation (orchestrating heating, air conditioning, and ventilation systems)
- Better utilisation of space
- Automated systems to monitor and regulate air quality and IT-assisted booking options for parking spaces or desks

Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## Demand for the network infrastructure




## ASSUMPTIONS

- Peak between 10am-12pm and 2-6pm
- Demand never zero
- Average demand between 8-10am, 12-2pm and 6-10pm
- Demand close to zero between 10pm-8am
- Most prevalent in urban regions

# Demand for Educational Services

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

**10**

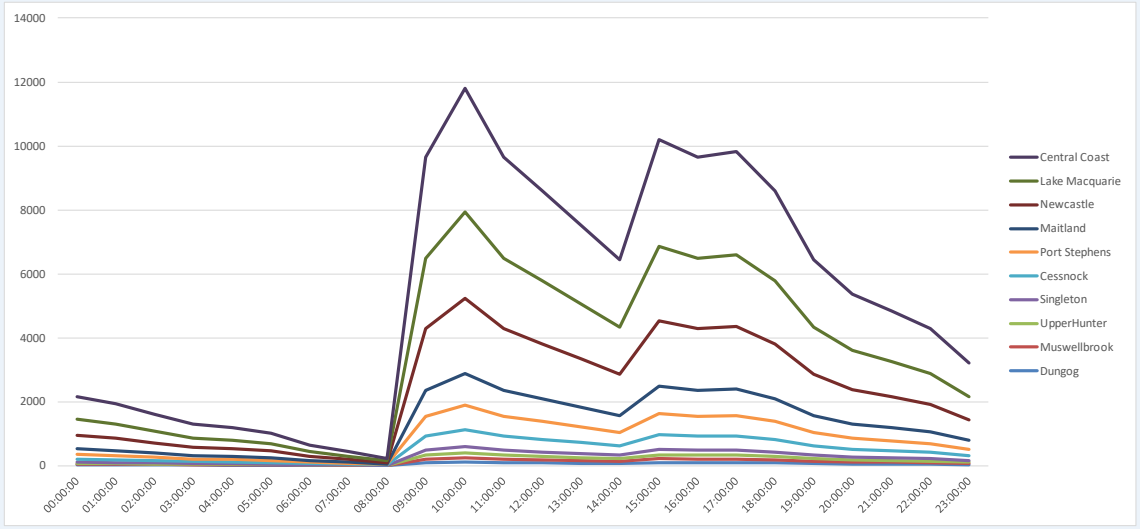
**Educational Services**

## APPLICATIONS

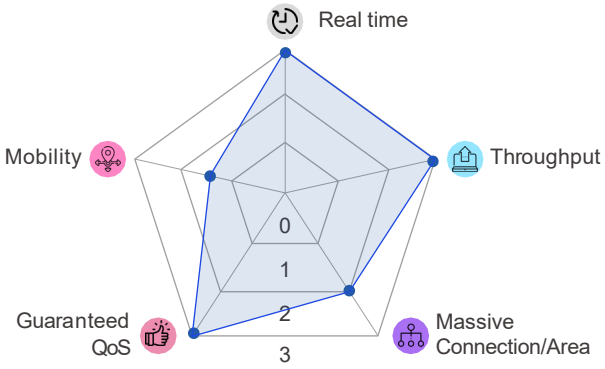
- VR/AR-enhanced education
- IoT offerings
- Remote learning

Demand will differ by region depending on the impact that the sector has on each region

### Evaluation of usage throughout the day




### Demand for the network infrastructure




## ASSUMPTIONS

- Highest demand between 8am-1pm and 2-5/6pm
- Average demand between 12-2pm
- Low demand between 6pm-8am
- Predominant in urban and rural but more in urban regions

# Demand for Healthcare and Social Assistance

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

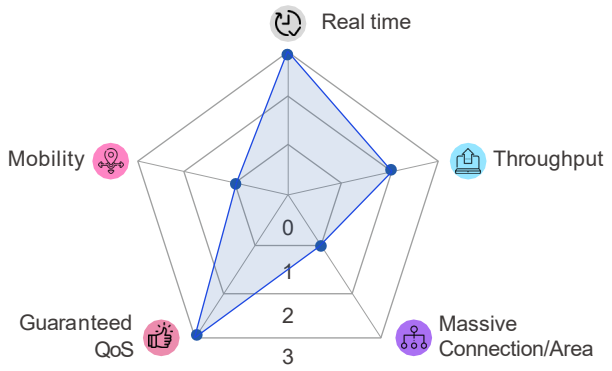
**11**

**Healthcare & Social Assistance**

## APPLICATIONS

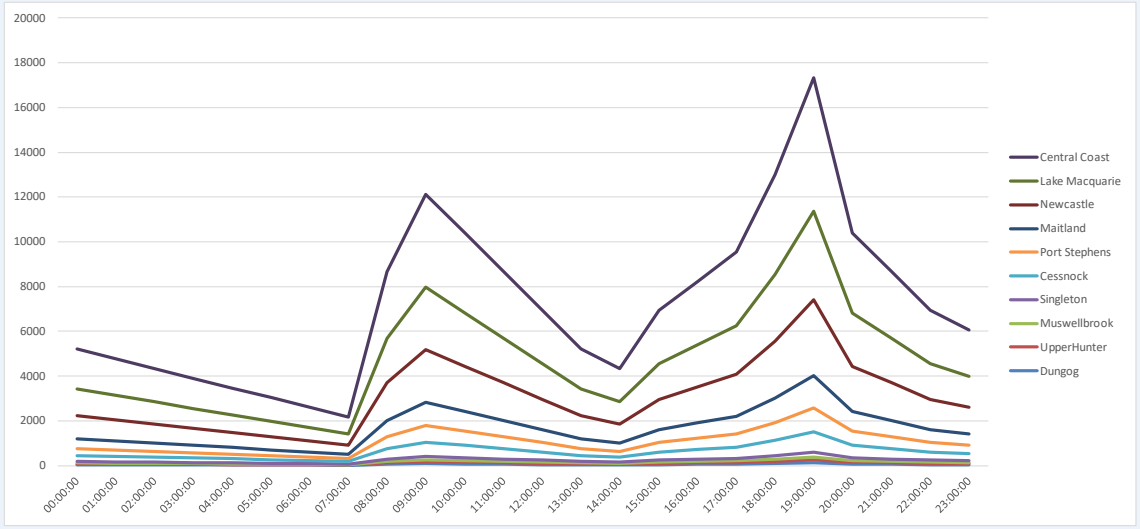
- Remote patient monitoring
- Connected ambulance
- HD virtual consultations
- Video-enabled prescription management
- AR/VR assistance for the blind
- Distraction and rehabilitation therapy
- Remote expert for collaboration in surgery
- AR/VR training and education
- Real-time, high-throughput computational processing
- Video analytics for behavioural recognition

## Demand for the network infrastructure




Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## ASSUMPTIONS

- Vertical with higher values because it has more devices
- Lowest demand between 12-7am
- High demand between 9am-12pm and 4-8pm
- Average demand between 7-9am, 8pm-12am
- Never zero
- More prevalent in urban regions

# Demand for Arts, Information, Culture and Recreation

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

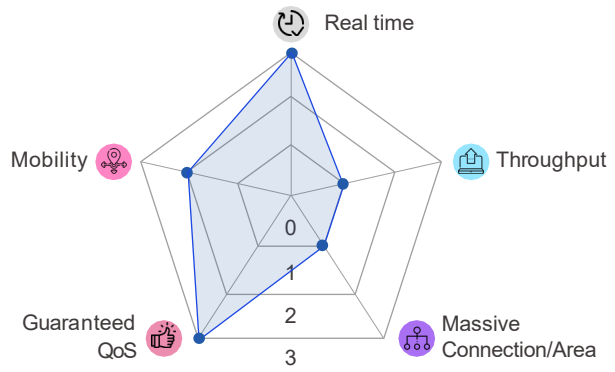
**12**

**Arts, Information, Culture and Recreation**

## APPLICATIONS

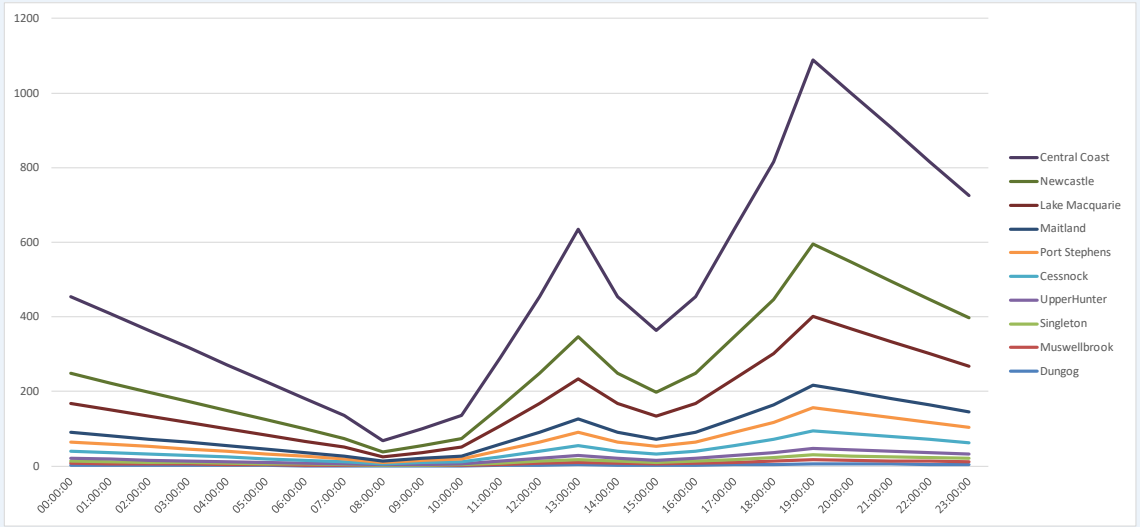
- Ultra-high-resolution scan capture technology
- Immersive experiences
- Real-time rendering and interactive AI

## Demand for the network infrastructure




Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## ASSUMPTIONS

- Highest demand between 6pm-12am
- Average demand between 12-2pm
- Almost zero demand between 12-9am
- Low demand between 9am-12pm and 2-6pm

# Demand for Accommodation & Food Services

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

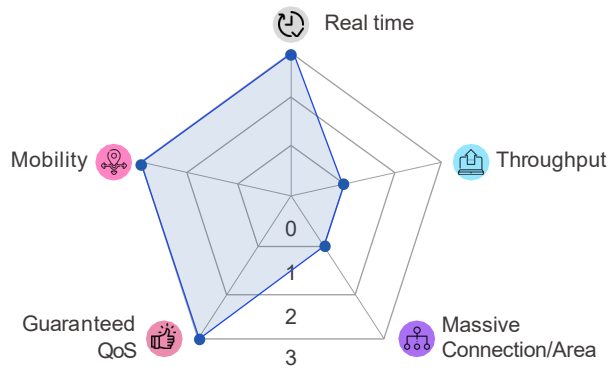
**13**

**Accommodation & Food Services**

## APPLICATIONS

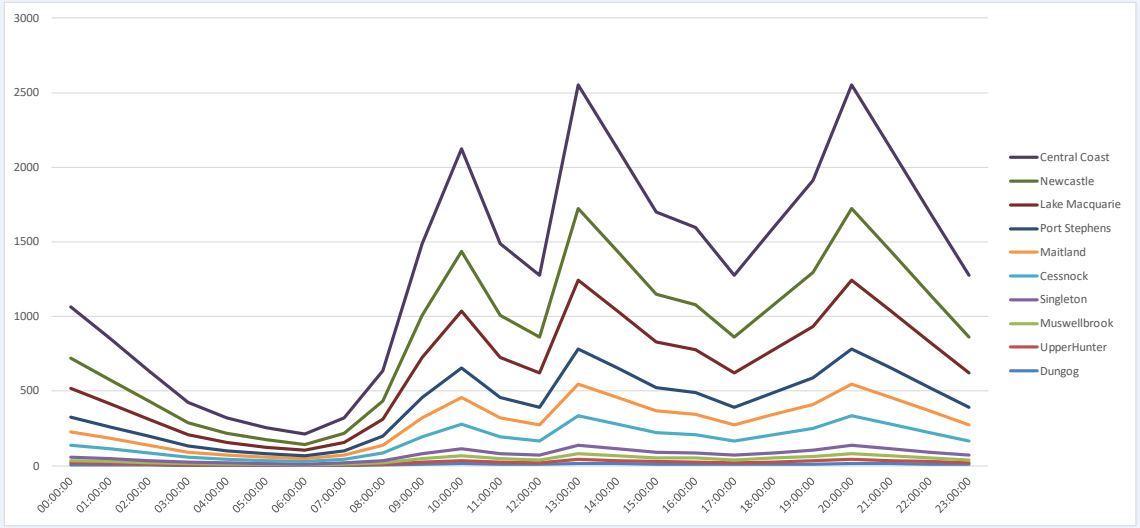
- Enhanced guest experiences with VR
- Drones
- Blockchain, IoT and AI for food end-to-end traceability

## Demand for the network infrastructure




Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## ASSUMPTIONS

- Highest demand between 9-11am, 12-2pm, 7-9pm
- Average demand between 11am-12pm, 5-7pm, 9-11pm
- Low demand between 2-5pm and 11pm-9am

# Demand for Other Services (Non-Public Administration)

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

**14**

**Other Services (Non-Public Administration)**

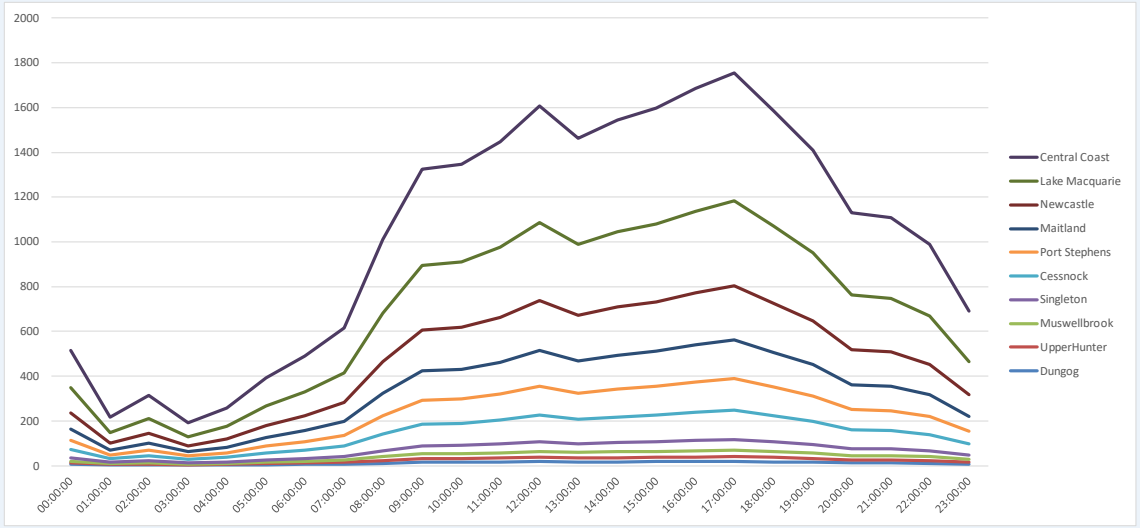
○○○

## APPLICATIONS

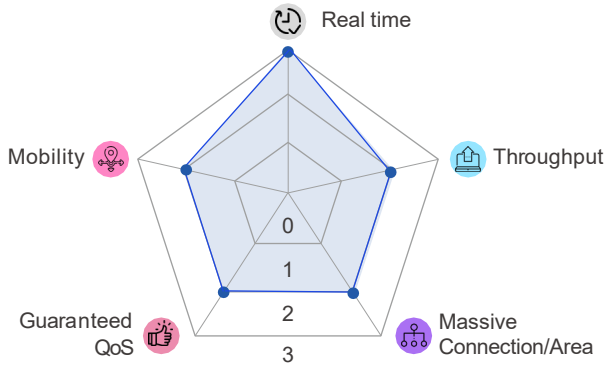
- Connected Field Services
- Immersive Customer Experiences
- Advanced Fleet Management

Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## Demand for the network infrastructure




## ASSUMPTIONS

- Highest demand between 10am-12pm, 2-4pm, 7-9pm
- Average demand between 12-2pm and 4-7pm
- Low demand between 9pm-10am

# Demand for Public Administration

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

**15**

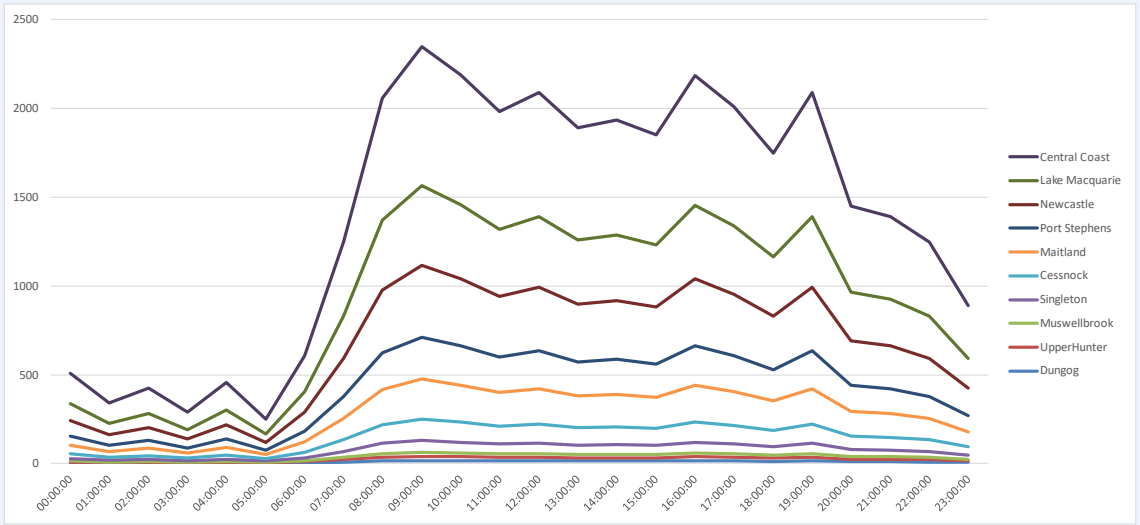
**Public Administration**

## APPLICATIONS

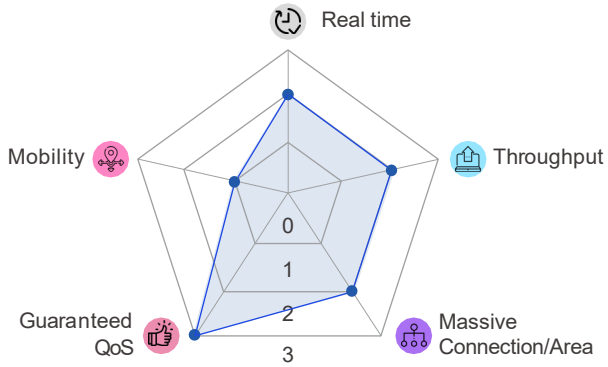
- Smart city management
- Augmented Reality (AR) for public services
- Secure telecommuting

Demand will differ by region depending on the impact that the sector has on each region

### Evaluation of usage throughout the day




### Demand for the network infrastructure




## ASSUMPTIONS

- Highest demand between 9-11am, 3-4pm, 6-7pm
- Average demand between 11am-2pm and 5-6pm
- Low demand between 8pm-9am

# Demand for Households and Consumer Goods

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

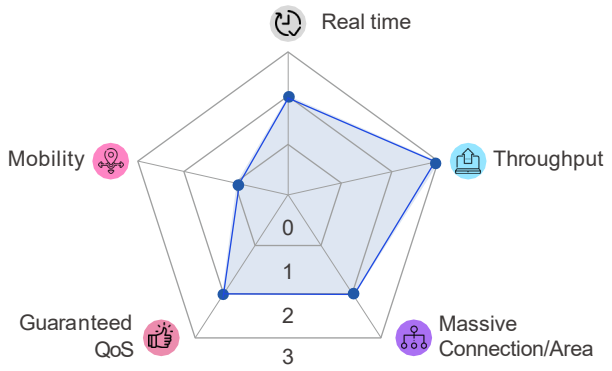
**16**

**Households and Consumer Goods**

## APPLICATIONS

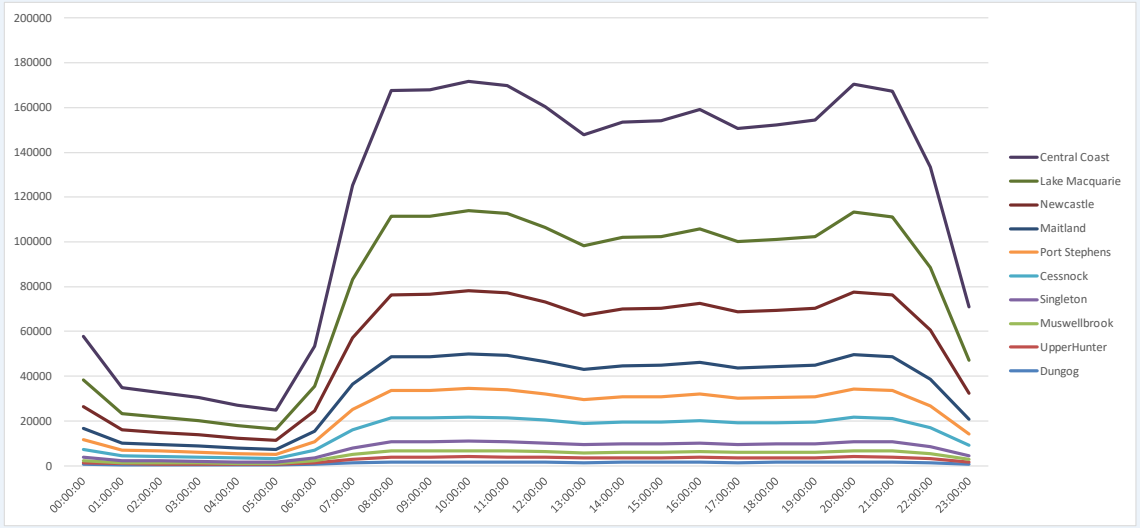
- Smart home automation
- Connected appliances
- Teleworking

## Demand for the network infrastructure




Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day




## ASSUMPTIONS

- Highest demand between 8-10am, 4-5pm, 8-9pm
- Average demand between 11am-3pm, 6-7pm
- Low demand between 10pm-6am

# Demand for Visitors/Tourism

The expected demand for each sector considers the type and number of devices required for the applications identified and the throughput necessary.

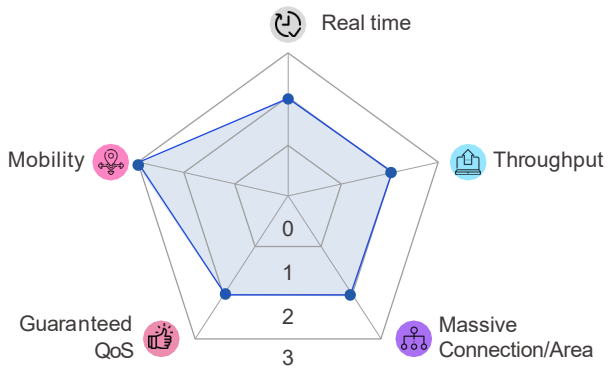
17

**Visitors/ Tourism**

## APPLICATIONS

- Augmented Reality (AR) tourism guides
- Virtual Reality travel experiences
- Real-time language translation

## Demand for the network infrastructure

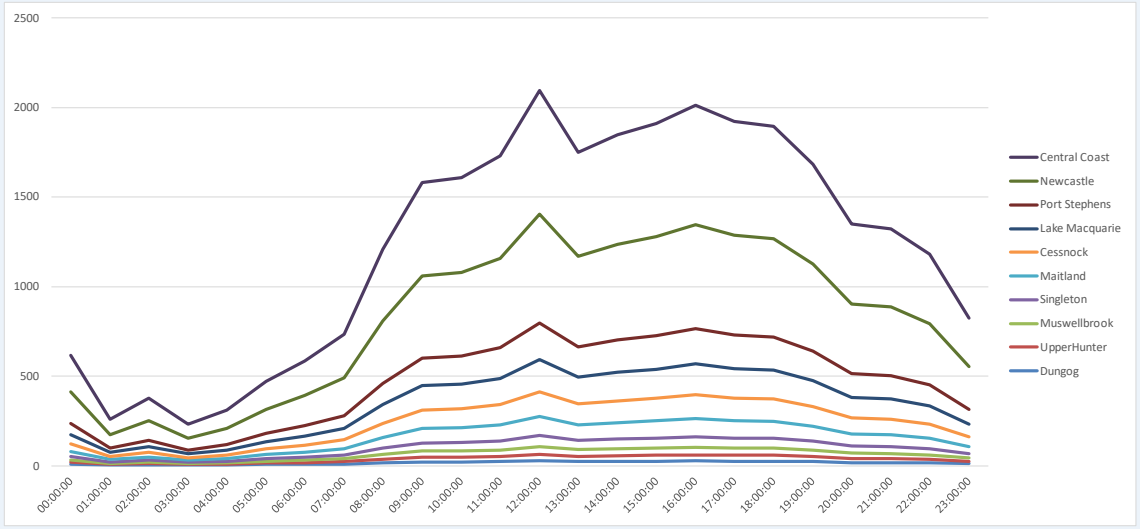



## ASSUMPTIONS

- Highest demand between 10am-12pm and 3-7pm
- Average demand between 1-3pm and 7-9pm
- Low demand between 9pm-10am

Demand will differ by region depending on the impact that the sector has on each region

## Evaluation of usage throughout the day



# Connectivity Demand Model – Estimating network traffic

# Demand Model - Approach to Estimate the Traffic for Each Region

There are six steps in our approach to develop the future connectivity and capacity model in the DSSN region, across the 17 sectors and 10 LGAs.

1. **Throughput distribution estimation per industry sector / vertical**

2. **Estimation of average traffic per device, per vertical**

3. **Calculate busy hour peak traffic / network usage**

4. **Calculate the busy hour contention ratio**

5. **Calculate the headroom extra capacity**

# Demand Model - Throughput Distribution

Tailoring throughput estimates to specific industry sectors ensures a more accurate representation of their unique demands, allowing for targeted infrastructure planning and network resources allocation.

**Step 1:** Estimation of the throughput distribution per industry sector.

**Throughput Definition:** Speed at which data is successfully transmitted or processed through a system or network.

| Verticals / Indsutry Sectors | Throughput [Mbps] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1 | 2 | 5 | 10 | 50 | 100 | 1000 |
| Agriculture, Forestry, Fishing, and Hunting + Mining, Quarrying, and Oil and Gas Extraction | 30% | 30% | 25% | 5% | 5% | 2% | 2% | 1.0% |
| Utilities | 30% | 30% | 20% | 5% | 10% | 2% | 2% | 1.0% |
| Construction | 5% | 15% | 15% | 25% | 22% | 10% | 5% | 3.0% |
| Manufacturing | 20% | 25% | 30% | 15% | 5% | 2% | 2% | 1.0% |
| Wholesale Trade + Retail Trade | 5% | 15% | 20% | 24% | 15% | 15% | 5% | 1.0% |
| Transportation and Warehousing | 12% | 10% | 10% | 20% | 30% | 10% | 5% | 3.0% |
| Finance and Insurance + Real Estate and Rental and Leasing Services | 5% | 20% | 30% | 15% | 14% | 10% | 5% | 1.0% |

**1a**

To define throughput, a range spanning from **0.5 Mbps** to **1000 Mbps** (1 Gbps) has been established.

**2**

For each industry sector, a percentage distribution is allocated to each throughput value, taking into account the aforementioned scale.

For example, the manufacturing sector falls within the **'lowest'** scale, indicating that the maximum throughput percentages will be up to **20 Mbps**.

# Demand Model - Average Traffic per Device

Understanding the average traffic per device and vertical enables precise capacity planning, ensuring that the network is equipped to handle the typical usage patterns of different sectors.

**Step 2:** Estimation of average traffic per device and vertical.

**Average Traffic per Device Definition:** Estimated traffic that each device in the respective sector consumes on the network per second.

| Verticals / Industry Sectors | Throughput [Mbps] | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0.5 | 1 | 2 | 5 | 10 | 50 | 100 | 1000 |
| Agriculture, Forestry, Fishing, and Hunting + Mining, Quarrying, and Oil and Gas Extraction | 30% | 30% | 25% | 5% | 5% | 2% | 2% | 1.0% |
| Utilities | 30% | 30% | 20% | 5% | 10% | 2% | 2% | 1.0% |
| Construction | 5% | 15% | 15% | 25% | 22% | 10% | 5% | 3.0% |
| Manufacturing | 20% | 25% | 30% | 15% | 5% | 2% | 2% | 1.0% |
| Wholesale Trade + Retail Trade | 5% | 15% | 20% | 24% | 15% | 15% | 5% | 1.0% |
| Transportation and Warehousing | 12% | 10% | 10% | 20% | 30% | 10% | 5% | 3.0% |
| Finance and Insurance + Real Estate and Rental and Leasing Services | 5% | 20% | 30% | 15% | 14% | 10% | 5% | 1.0% |

1

| Average Throughput per Device [Mbps] |
|---|
| 14.7 |
| 15.1 |
| 43.9 |
| 15.2 |
| 25.8 |
| 44.4 |
| 22.9 |

1

The estimation of average traffic per device for each industry sector is determined by **multiplying the allocated percentages by their respective throughput values.**

Example of calculation:

**Average Traffic per Device for the Manufacturing Sector** = (20% x 0.5Mbps) + (25% x 1Mbps) + (30% x 2Mbps) + (15% x 5Mbps) + (5% x 10Mbps) + (2% x 50Mbps) + (2% x 100Mbps) + (1% x 1000Mbps) = **15.2 Mbps**

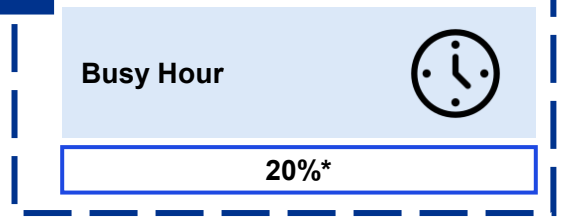
# Demand Model - Busy Hour

Determining peak traffic during busy hours provides insights into the maximum load that the network might experience. This information aids in dimensioning the network infrastructure to accommodate peak demand without performance degradation.

**Step 3:** Calculate Busy Hour peak traffic / network usage

**Busy Hour Definition:** Period during the day when **network usage or traffic is at its highest level**. It is a specific one-hour time frame within a 24-hour day when the demand for network resources, such as bandwidth and connectivity, is most intensive.

**1**




**2**

| Verticals/ Sectors | Devices in 2023 | Traffic [Mbps] | Busy Hour 20% |
|---|---|---|---|
| Agriculture, forestry, fishing, and hunting + Mining, quarrying, and oil and gas extraction | 45277 | 14,7 | 133114,4829 |

**1**

**The busy hour value** is set at 20% based on industry standards, meaning that during the peak demand hour, it is expected that **20% of the devices** allocated to the region will be **connected to the network**.

**2**

For each of the verticals, as indicated in the preceding slide 'Traffic Estimation per Vertical,' the average throughput consumed by each device is estimated. In the specific case of **Cessnock**, **45,277 devices** are connected to the **agriculture, fishing, and mining sector**. Multiplying this by the average throughput per device (**14.7 Mbps**) provides the total throughput value. However, given the assumption that **the maximum number of devices connected to the network** during the **peak demand hour** is **20%**, the result is **133,144 Mbps**.

**Traffic in busy hour** = **Average Traffic for the sector** x **Total Number of Devices** x **Percentage of Devices in the Busy Hour** 133,114 = 14.7 x 45,277 x 20%

***Source:** Traffic Analysis - Cisco - "In the standard business environment, the busy hour of any given day accounts for approximately 15 to 20 percent of the traffic for that day"

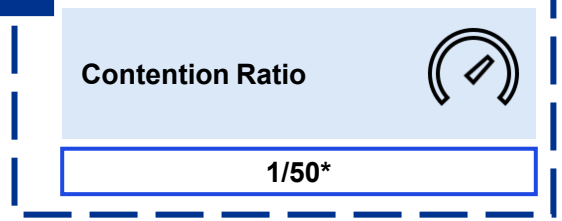
# Demand Model - Contention Ratio

The busy hour contention ratio helps evaluate the network's ability to handle concurrent demands. By calculating this ratio, it is possible to identify potential bottlenecks and optimise the network for improved performance during peak periods.

**Step 4:** Calculate the busy hour contention ratio

**Contention Ratio Definition:** Insight into the relationship between the resources available in the network and the level of demand placed on it. In this case, if the contention ratio is 1/50, it means that the available network capacity is 1 unit for every 50 units of demand or usage.

**1**




**2**

| Verticals/ Sectors | Devices in 2023 | Traffic [Mbps] | Busy Hour 20% | Busy Hour/Contention Ratio [Mbps] 50 |
|---|---|---|---|---|
| Agriculture, forestry, fishing, and hunting + Mining, quarrying, and oil and gas extraction | 45277 | 14,7 | 133114,4829 | 2662,289657 |

**1**

**The contention ratio** value is set at 1/50 based on industry standards. It is used in situations of **peak demand** to **enable service providers to manage bandwidth for different devices**. For example, an access point with **1 Gbps of access speed during peak demand** may see its traffic **contained to up to 50 times** (20 Mbps) **to prevent network saturation** and consequently availability of the service.

**2**

After calculating the busy hour throughput in the previous slide, with a value of **133,114 Mbps**, a contention ratio of 1/50 is then applied, resulting in a value of **2,662 Mbps**.

This value (2,662 Mbps) represents the **portion of the total available bandwidth that is allocated to users during the busy hour**.

**Traffic in busy hour with contention ratio applied = Traffic in busy hour / 50**

2,662 = 133,114 / 50

***Source:** Truespeed - Contention Ratio - "Most residential broadband customers would normally be hovering at around a 1:50 contention ratio."

# Demand Model - Headroom Extra Capacity

Computing headroom extra capacity ensures that the network has a buffer to handle unexpected surges in demand or future growth. This proactive approach minimises the risk of congestion and service degradation, providing a more robust and resilient network infrastructure.

**Step 5:** Calculate the headroom extra capacity

**Headroom Extra Capacity Definition:** The additional capacity intentionally built into a network infrastructure beyond the expected peak demand during the busy hour. This extra capacity serves as a buffer or safety margin to accommodate unforeseen increases in network traffic or unexpected spikes in demand.

**1**

**Headroom Extra Capacity**

**20%**

**2**

| Verticals/ Sectors | Devices in 2023 | Traffic [Mbps] | Busy Hour 20% | Busy Hour/Contention Ratio [Mbps] 50 | + Headroom Extra Capacity 20% |
|---|---|---|---|---|---|
| Agriculture, forestry, fishing, and hunting + Mining, quarrying, and oil and gas extraction | 45277 | 14,7 | 133114,4829 | 2662,289657 | 3194,747589 |

**1**

**The headroom extra capacity value is set at** 20% based on industry standards, meaning that during the **peak demand hour**, the service provider has allocated an **additional 20% buffer of network capacity**.

Why is it important to define extra capacity?
1 - **Buffer for specific peaks**, such as special events.
2 - **Optimising user experience,** ensuring that during peak demand situations, users do not experience constraints in accessing the network.
3 - **Future growth,** considering future capacity planning reducing the need for frequent updates.
4 - **Redundancy,** ensuring that backup resources are available in case of a failure.

**2**

After calculating the estimated traffic during the busy hour and accounting for the contention factor, it is necessary to **allocate an additional portion of network capacity** for situations where there is a **peak demand higher than estimated**, such as during **special events.** This ensures **the best quality of service to users** in **case of possible network failures and issues**.

To calculate the estimated traffic with the headroom extra capacity (**3,194 Mbps**), a **20% increase** was added to the estimated traffic during the busy hour with the contention factor applied (**2,662 Mbps**).

**Traffic considering headroom extra capacity = Traffic in the busy hour with contention ratio applied + Additional headroom capacity**

3,194 = 2,662 + (2,662 x 20%)

# Demand Model Output Example (Central Coast Region, 2023)

Following the execution of the connectivity demand model with the inputs provided, a comprehensive overview of network traffic, encompassing factors such as contention ratio and headroom. This data feeds into models for projecting and estimating the current and future network requirements.

**2023**

**Central Coast**

| Verticals/ Sectors | Devices in 2023 | Throughput [Mbps] | | | | | | | | Use Cases | Average Throughput per Device [Mbps] | Busy Hour | Busy Hour/Contention Ratio [Mbps] | + Headroom Extra Capacity [Mbps] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 0,5 | 1 | 2 | 5 | 10 | 50 | 100 | 1000 | | | 20% | 50 | 20% |
| Agriculture, Forestry, Fishing, Mining, Quarrying, Oil & Gas | 23,815 | 30% | 30% | 25% | 5% | 5% | 2% | 2% | 1% | Monitoring Sensor Networks / Device Remote Controlling | 14.7 | 70,017 | 1,400 | 1,680 |
| Utilities | 18,319 | 30% | 30% | 20% | 5% | 10% | 2% | 2% | 1% | Monitoring Sensor Networks / Device Remote Controlling / Wireless Cloud-based office | 15.1 | 55,325 | 1,106 | 1,328 |
| Construction | 210,673 | 5% | 15% | 15% | 25% | 22% | 10% | 5% | 3% | Monitoring Sensor Networks / Device Remote Controlling / Bi-directional remote controlling / Virtual Reality / Real time 3D modelling / GPS tracking and tools / IoT sensor structuring | 43.9 | 1,850,764 | 37,015 | 44,418 |
| Manufacturing | 108,085 | 20% | 25% | 30% | 15% | 5% | 2% | 2% | 1% | Device Remote Controlling / Bi-directional remote controlling | 15.2 | 328,577 | 6,572 | 7,886 |
| Wholesale and Retail Trade | 227,161 | 5% | 15% | 20% | 24% | 15% | 15% | 5% | 1% | Monitoring Sensor Networks / Device Remote Controlling / Wireless Cloud-based office | 25.8 | 1,171,013 | 23,420 | 28,104 |
| Transportation and Warehousing | 67,782 | 12% | 10% | 10% | 20% | 30% | 10% | 5% | 3% | Autonomous Driving, Automotive ecall, Monitoring Sensor Networks/Device Remote Controlling, First responder connectivity | 44.4 | 601,360 | 12,027 | 14,433 |
| Finance, Insurance, Real Estate, Rental & Leasing | 89,765 | 5% | 20% | 30% | 15% | 14% | 10% | 5% | 1% | Wireless Cloud-based office, Online Banking, Mobile Banking, Blockchain, Trade Finance, Wearable devices (Digital Payment) | 23.0 | 412,471 | 8,249 | 9,899 |
| Professional, Scientific, and Technical Services | 109,916 | 5% | 10% | 10% | 15% | 25% | 16% | 15% | 4% | Virtual Reality / Tactile Internet / AR/VR, Nanosatellites | 66.6 | 1,463,538 | 29,271 | 35,125 |
| Management of Business, Building & Other Support Services | 60,454 | 30% | 25% | 25% | 10% | 5% | 2% | 2% | 1% | Monitoring Sensor Networks/Device Remote Controlling / Disaster alert | 14.9 | 180,153 | 3,603 | 4,324 |
| Educational Services | 150,219 | 10% | 12% | 12% | 10% | 18% | 20% | 15% | 3% | Multi-Person Video Call / Video Streaming/ AR/VR / Remote Learning | 57.7 | 1,733,829 | 34,677 | 41,612 |
| Healthcare and Social Assistance | 326,085 | 10% | 15% | 20% | 18% | 15% | 10% | 10% | 2% | Monitoring Sensor Networks / Device Remote Controlling / Connected Ambulances / Augmented Reality / Virtual Reality / Multi-person video call | 38.0 | 2,478,250 | 49,565 | 59,478 |
| Arts, Information, Culture & Recreation | 54,958 | 25% | 20% | 17% | 15% | 10% | 10% | 2% | 1% | Video streaming / Personal cloud / Real time gaming / Device Remote Controlling / VR | 19.4 | 213,403 | 4,268 | 5,122 |
| Accommodation and Food Services | 128,236 | 30% | 27% | 20% | 5% | 10% | 5% | 2% | 1% | Monitoring Sensor Networks / Device Remote Controlling / Disaster alert / First responder connectivity | 16.6 | 424,974 | 8,499 | 10,199 |
| Other Services (Excluding Public Administration) | 69,614 | 10% | 14% | 15% | 20% | 25% | 10% | 5% | 1% | Monitoring Sensor Networks / Device Remote Controlling / Bi-directional remote controlling/ Wireless cloud-based office | 24.0 | 334,007 | 6,680 | 8,016 |
| Public Administration | 111,748 | 10% | 15% | 20% | 22% | 20% | 10% | 2% | 1% | Multi-Person Video Call / Video Streaming / Monitoring Sensor Networks / Bi-directional remote controlling | 20.7 | 462,638 | 9,253 | 11,103 |
| Households & Consumer Goods | 1,448,001 | 5% | 5% | 10% | 10% | 15% | 20% | 25% | 10% | Videostreaming / Real time gaming / First responder connectivity / VR / Multi-person video call / Personal Cloud / Device remote controlling / Monitoring sensor networks | 137.3 | 39,754,872 | 795,097 | 954,117 |
| Visitor Demand | 41,278 | 5% | 13% | 20% | 25% | 20% | 10% | 5% | 2% | Video Streaming / Multi-Person Video Call / Personal Cloud | 33.8 | 279,083 | 5,582 | 6,698 |

# Appendix 5.4 Telecommunications Infrastructure Options

**Analysis of the simulated capacity demand for each LGA based on the three scenarios, and infrastructure needed to meet the simulated demand.**

# Wireless Simulated Capacity for each LGA

# Wireless - Simulated Capacity: Central Coast

Below, the capacity status for the Central Coast region under low demand scenario conditions is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023**: 2,315,222
- **2025**: 2,788,162
- **2030**: 4,750,299

Current Number of Sites: **(265)**

- **4G co-located with 5G**: 98
- **Urban Sites:** 165
- **Rural Sites:** 2

Busy(h) Traffic associated to Mobile Access Technologies:

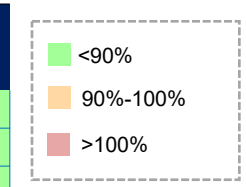
- **30%***

Urban vs Rural Split:

- **Urban** – 98.8%
- **Rural –** 1.2%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 61.6% | 57.2% | 43.2% |
| 2025 | 68.3% | 63.4% | 52.1% |
| 2030 | 93.2% | 86.4% | 88.7% |



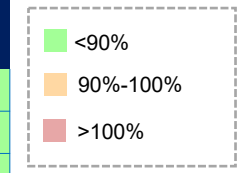

- After running the model for the Central Coast region, it can be observed that for the **year 2023, 2025, and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for **the Central Coast** region in the Wireless component, it is possible to conclude that in a **Low Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **93.2% capacity** in terms of utilization for downlink/transmission communication from the base station to the respective devices.

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 61.6% | 57.2% | 43.2% |
| 2025 | 68.3% | 63.4% | 52.1% |
| 2030 | 93.2% | 86.4% | 88.7% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Central Coast

Below, the capacity status for the Central Coast region under baseline demand scenario conditions is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023**: 3,321,220
- **2025**: 4,002,749
- **2030**: 6,824,775

Current Number of Sites: **(265)**

- **4G co-located with 5G**: 98
- **Urban Sites:** 165
- **Rural Sites:** 2

Busy(h) Traffic associated to Mobile Access Technologies:

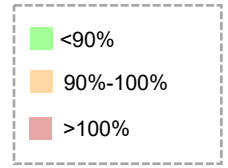
- **30%***

Urban vs Rural Split:

- **Urban** – 98.8%
- **Rural –** 1.2%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 69.8% | 64.7% | 49.0% |
| 2025 | 77.5% | 71.9% | 59.0% |
| 2030 | 105.7% | 98.0% | 100.6% |




- After running the model for the Central Coast region, it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

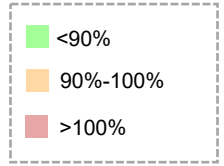
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030** - Installation of **11 new base stations between 2025 and 2030**, resulting in a total of **276 sites** in the Central Coast region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 69.8% | 64.7% | 49.0% |
| 2025 | 77.5% | 71.9% | 59.0% |
| 2030 | 99.5% | 92.8% | 95.9% |




*__Important Note:__ While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Central Coast

Below, the capacity status for the Central Coast region under high demand scenario conditions is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023**: 4,754,122
- **2025**: 5,737,456
- **2030**: 9,792,225

Current Number of Sites: **(265)**

- **4G co-located with 5G**: 98
- **Urban Sites:** 165
- **Rural Sites:** 2

Busy(h) Traffic associated to Mobile Access Technologies:

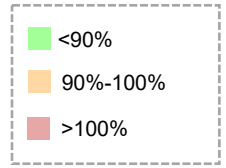
- **30%***

Urban vs Rural Split:

- **Urban** – 98.8%
- **Rural –** 1.2%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.9% | 92.7% | 70.1% |
| 2025 | 111.0% | 103.0% | 84.6% |
| 2030 | 151.6% | 140.6% | 144.4% |




- After running the model for the Central Coast region, it can be observed that for the **year 2023 the current scenario in terms of sites supports the necessary demand**. However, by the year **2025, there is already saturation in terms of network capacity**.

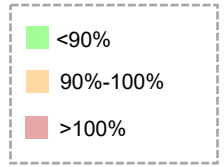
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **20 new mobile base stations until 2025.**
- **2030 -** Installation of **79 new mobile base stations between 2025 and 2030**, resulting in a total of **364 radio mobile sites** in the Central Coast region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.9% | 92.7% | 70.1% |
| 2025 | 99.7% | 93.4% | 77.6% |
| 2030 | 97.1% | 93.3% | 99.7% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Cessnock

Below, the capacity status for the Cessnock region under low demand scenario conditions is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 450,889
- **2025:** 541,375
- **2030:** 915,154

Current Number of Sites: **(59)**

- **4G co-located with 5G**: 17
- **Urban Sites:** 0
- **Rural Sites:** 42

Busy(h) Traffic associated to Mobile Access Technologies:

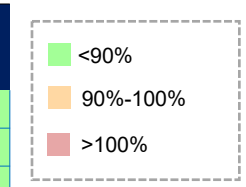
- **30%***

Urban vs Rural Split:

- **Urban -** 0%
- **Rural -** 100%

### 2 - Present State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 58.6% | 55.1% | 37.1% |
| 2025 | 64.7% | 60.8% | 44.6% |
| 2030 | 83.6% | 78.6% | 75.4% |



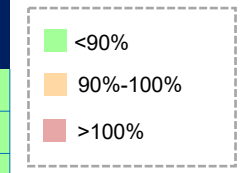

- After running the model for the Cessnock region, it can be observed that for the **year 2023 2025 and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for **the Cessnock** region in the Wireless component, it is possible to conclude that in a **Low Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **83.6% capacity** in terms of utilization for downlink/transmission communication from the base station to the respective devices.

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 58.6% | 55.1% | 37.1% |
| 2025 | 64.7% | 60.8% | 44.6% |
| 2030 | 83.6% | 78.6% | 75.4% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Cessnock

Below, the capacity status for the Cessnock region under baseline demand scenario conditions is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 656,652
- **2025:** 787,943
- **2030:** 1,328,358

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(59)**

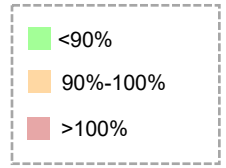
- **4G co-located with 5G**: 17
- **Urban Sites:** 0
- **Rural Sites:** 42

Urban vs Rural Split:

- **Urban -** 0%
- **Rural -** 100%

### 2 - Present State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 83.1% | 78.1% | 54.1% |
| 2025 | 91.4% | 85.9% | 64.9% |
| 2030 | 121.4% | 114.1% | 109.4% |




- After running the model for the Cessnock region, it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

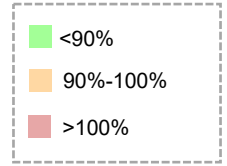
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030** - Installation of **8 new base stations between 2025 and 2030**, resulting in a total of **67 radio mobile sites** in the Cessnock region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 83.1% | 78.1% | 54.1% |
| 2025 | 91.4% | 85.9% | 64.9% |
| 2030 | 98.0% | 92.7% | 93.7% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Cessnock

Below, the capacity status for the Cessnock region under high demand scenario conditions is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 954,996
- **2025:** 1,145,780
- **2030:** 1,925,977

Current Number of Sites: **(59)**

- **4G co-located with 5G**: 17
- **Urban Sites:** 0
- **Rural Sites:** 42

Busy(h) Traffic associated to Mobile Access Technologies:

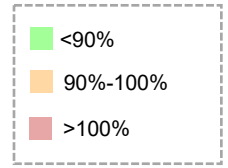
- **30%***

Urban vs Rural Split:

- **Urban -** 0%
- **Rural -** 100%

### 2 - Present State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 120.8% | 113.6% | 78.6% |
| 2025 | 132.9% | 124.9% | 94.3% |
| 2030 | 176.1% | 165.4% | 158.6% |




- After running the model for the Cessnock region, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

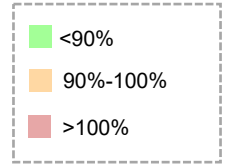
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **12 new mobile base stations until 2025.**
- **2030 -** Installation of **17 new mobile base stations between 2025 and 2030**, resulting in a total of **88 radio mobile sites** in the Cessnock region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 89.0% | 84.3% | 62.9% |
| 2025 | 97.8% | 92.7% | 75.4% |
| 2030 | 94.3% | 90.0% | 98.8% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Dungog

Below, the capacity status for the Dungog region under low demand scenario conditions is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 66,678
- **2025:** 80,044
- **2030:** 135,240

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(13)**

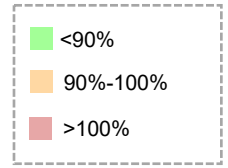
- **4G co-located with 5G:** 0
- **Urban Sites:** 0
- **Rural Sites:** 13

Urban vs Rural Split:

- **Urban -** 0%
- **Rural -** 100%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 58.5% | 53.2% | 32.1% |
| 2025 | 62.8% | 57.1% | 38.5% |
| 2030 | 84.3% | 76.6% | 65.0% |



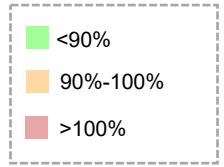

- After running the model for the Dungog region, it can be observed that for the **year 2023, 2025, and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for **the Dungog** region in the Wireless component, it is possible to conclude that in a **Low Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **84.3% capacity** in terms of utilization for downlink/transmission communication from the base station to the respective devices.

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 58.5% | 53.2% | 32.1% |
| 2025 | 62.8% | 57.1% | 38.5% |
| 2030 | 84.3% | 76.6% | 65.0% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Dungog

Below, the capacity status for the Dungog region under baseline demand scenario conditions is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 97,259
- **2025:** 116,666
- **2030:** 196,513

Current Number of Sites: **(13)**

- **4G co-located with 5G:** 0
- **Urban Sites:** 0
- **Rural Sites:** 13

Busy(h) Traffic associated to Mobile Access Technologies:

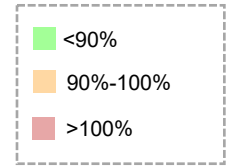
- **30%***

Urban vs Rural Split:

- **Urban -** 0%
- **Rural -** 100%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 85.3% | 77.5% | 46.8% |
| 2025 | 91.5% | 83.2% | 56.1% |
| 2030 | 122.4% | 111.3% | 94.5% |




- After running the model for the Dungog region, it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

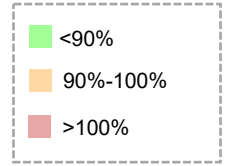
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030** - Installation of **2 new base station between 2025 and 2030**, resulting in a total of **15 radio mobile sites** in the Dungog region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 85.3% | 77.5% | 46.8% |
| 2025 | 91.5% | 83.2% | 56.1% |
| 2030 | 87.9% | 81.4% | 76.8% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Dungog

Below, the capacity status for the Dungog region under baseline demand scenario conditions is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 141,503
- **2025:** 169,710
- **2030:** 284,996

Current Number of Sites: **(13)**

- **4G co-located with 5G:** 0
- **Urban Sites:** 0
- **Rural Sites:** 13

Busy(h) Traffic associated to Mobile Access Technologies:

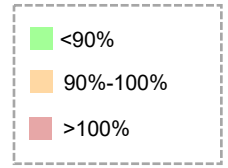
- **30%***

Urban vs Rural Split:

- **Urban -** 0%
- **Rural -** 100%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 124.1% | 112.8% | 68.0% |
| 2025 | 137.1% | 124.6% | 81.6% |
| 2030 | 184.2% | 167.4% | 137.0% |




- After running the model for the Dungog region, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

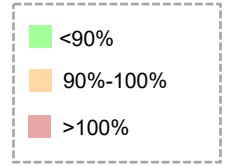
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **2 new mobile base stations until 2025.**
- **2030 -** Installation of **3 new mobile base stations between 2025 and 2030**, resulting in a total of **18 radio mobile sites** in the Dungog region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 89.1% | 82.5% | 55.3% |
| 2025 | 98.5% | 91.1% | 66.3% |
| 2030 | 93.0% | 87.3% | 86.9% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Lake Macquarie

Below, the capacity status for the Lake Macquarie region under low demand scenario conditions is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 1,432,930
- **2025:** 1,725,990
- **2030:** 2,942,192

Current Number of Sites: **(111)**

- **4G co-located with 5G:** 68
- **Urban Sites:** 39
- **Rural Sites:** 4

Busy(h) Traffic associated to Mobile Access Technologies:

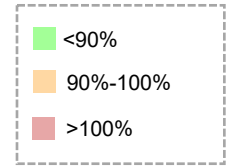
- **30%***

Urban vs Rural Split:

- **Urban** – 91.5%
- **Rural –** 8.5%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 60.6% | 59.0% | 47.1% |
| 2025 | 67.2% | 65.5% | 56.7% |
| 2030 | 91.7% | 89.3% | 96.7% |



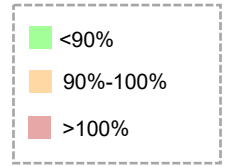

- After running the model for the Lake Macquarie region, it can be observed that for the **year 2023, 2025, and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for **the Lake Macquarie** region in the Wireless component, it is possible to conclude that in a **Low Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **96.7% capacity** in terms of simultaneous number of devices accessing the network via mobile access

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 60.6% | 59.0% | 47.1% |
| 2025 | 67.2% | 65.5% | 56.7% |
| 2030 | 91.7% | 89.3% | 96.7% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Lake Macquarie

Below, the capacity status for the Lake Macquarie region under baseline demand scenario conditions is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 2,053,355
- **2025:** 2,475,467
- **2030:** 4,224,025

Current Number of Sites: **(111)**

- **4G co-located with 5G:** 68
- **Urban Sites:** 39
- **Rural Sites:** 4

Busy(h) Traffic associated to Mobile Access Technologies:

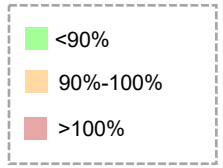
- **30%***

Urban vs Rural Split:

- **Urban** – 91.5%
- **Rural –** 8.5%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 86.8% | 84.6% | 67.5% |
| 2025 | 96.4% | 94.0% | 81.3% |
| 2030 | 131.6% | 128.3% | 138.8% |




- After running the model for the Lake Macquarie region, it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

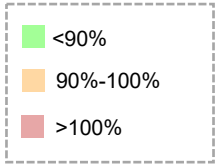
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030** - Installation of **39 new base station between 2025 and 2030**, resulting in a total of **150 radio mobile sites** in the Lake Macquarie region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 86.8% | 84.6% | 67.5% |
| 2025 | 96.4% | 94.0% | 81.3% |
| 2030 | 91.1% | 90.1% | 99.6% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Lake Macquarie

Below, the capacity status for the Lake Macquarie region under high demand scenario conditions is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 2,936,115
- **2025:** 3,544,872
- **2030:** 6,056,480

Current Number of Sites: **(111)**

- **4G co-located with 5G:** 68
- **Urban Sites:** 39
- **Rural Sites:** 4

Busy(h) Traffic associated to Mobile Access Technologies:

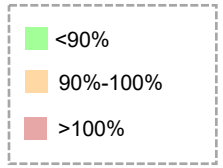
- **30%***

Urban vs Rural Split:

- **Urban** – 91.5%
- **Rural –** 8.5%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 124.1% | 121.0% | 96.5% |
| 2025 | 138.0% | 134.5% | 116.5% |
| 2030 | 188.7% | 183.9% | 199.0% |




- After running the model for the Lake Macquarie region, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

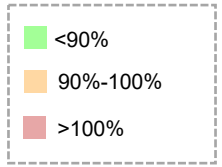
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **34 new mobile base stations until 2025.**
- **2030 -** Installation of **65 new mobile base stations between 2025 and 2030**, resulting in a total of **210 radio mobile sites** in the Lake Macquarie region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.2% | 97.7% | 79.0% |
| 2025 | 99.5% | 98.3% | 86.7% |
| 2030 | 88.6% | 88.7% | 99.6% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Maitland

Below, the capacity status for the Maitland region under low demand scenario conditions is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 620,738
- **2025:** 747,498
- **2030:** 1,273,358

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(50)**

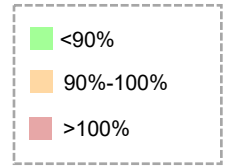
- **4G co-located with 5G:** 20
- **Urban Sites:** 19
- **Rural Sites:** 11

Urban vs Rural Split:

- **Urban** - 64%
- **Rural** - 36%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 70.7% | 67.2% | 49.7% |
| 2025 | 78.4% | 74.5% | 59.8% |
| 2030 | 103.1% | 97.9% | 101.9% |




- After running the model for the Maitland region, it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

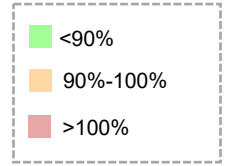
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030** - Installation of **2 new base station between 2025 and 2030**, resulting in a total of **52 radio mobile sites** in the Maitland region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 70.7% | 67.2% | 49.7% |
| 2025 | 78.4% | 74.5% | 59.8% |
| 2030 | 97.1% | 92.6% | 97.2% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Maitland

Below, the capacity status for the Maitland region under baseline demand scenario conditions is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 890,715
- **2025:** 1,073,406
- **2030:** 1,829,793

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(50)**

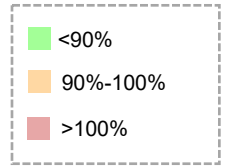
- **4G co-located with 5G:** 20
- **Urban Sites:** 19
- **Rural Sites:** 11

Urban vs Rural Split:

- **Urban** - 64%
- **Rural** - 36%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 101.5% | 96.4% | 71.3% |
| 2025 | 112.7% | 107.0% | 85.9% |
| 2030 | 148.1% | 140.7% | 146.5% |




- After running the model for the Maitland region, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

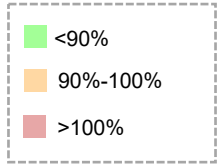
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **5 new mobile base stations until 2025.**
- **2030 -** Installation of **14 new mobile base stations between 2025 and 2030**, resulting in a total of **69 radio mobile sites** in the Maitland region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 98.5% | 93.7% | 69.6% |
| 2025 | 97.6% | 93.6% | 76.5% |
| 2030 | 93.5% | 91.3% | 99.9% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Maitland

Below, the capacity status for the Maitland region under high demand scenario conditions is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 1,275,369
- **2025:** 1,538,994
- **2030:** 2,625,882

Current Number of Sites: **(50)**

- **4G co-located with 5G:** 20
- **Urban Sites:** 19
- **Rural Sites:** 11

Busy(h) Traffic associated to Mobile Access Technologies:

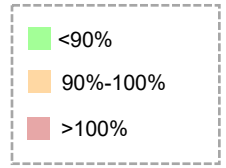
- **30%***

Urban vs Rural Split:

- **Urban** - 64%
- **Rural** - 36%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 145.3% | 138.0% | 102.1% |
| 2025 | 161.5% | 153.4% | 123.2% |
| 2030 | 212.6% | 201.9% | 210.2% |




- After running the model for the Maitland region, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

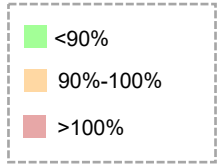
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **21 new mobile base stations until 2025.**
- **2030 -** Installation of **24 new mobile base stations between 2025 and 2030**, resulting in a total of **95 radio mobile sites** in the Maitland region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.5% | 96.7% | 74.6% |
| 2025 | 98.2% | 96.0% | 81.3% |
| 2030 | 89.2% | 88.5% | 99.9% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Muswellbrook

Below, the capacity status for the Muswellbrook region under low demand scenario conditions is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 111,946
- **2025:** 134,549
- **2030:** 228,058

Current Number of Sites: **(28)**

- **4G co-located with 5G:** 2
- **Urban Sites:** 0
- **Rural Sites:** 26

Busy(h) Traffic associated to Mobile Access Technologies:

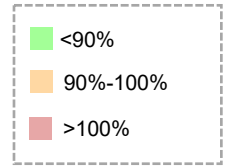
- **30%***

Urban vs Rural Split:

- **Urban** - 0%
- **Rural -** 100%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 38.9% | 35.7% | 24.1% |
| 2025 | 42.8% | 39.4% | 29.0% |
| 2030 | 55.0% | 50.5% | 49.2% |



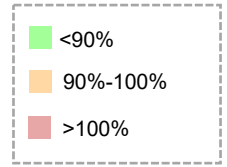

- After running the model for the Muswellbrook region, it can be observed that for the **year 2023, 2025, and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for the **Muswellbrook** region in the Wireless component, it is possible to conclude that in a **Low Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **55% capacity** in terms of utilization for downlink/transmission communication from the base station to the respective devices.

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 38.9% | 35.7% | 24.1% |
| 2025 | 42.8% | 39.4% | 29.0% |
| 2030 | 55.0% | 50.5% | 49.2% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Muswellbrook

Below, the capacity status for the Muswellbrook region under baseline demand scenario conditions is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 162,264
- **2025:** 194,988
- **2030:** 329,957

Current Number of Sites: **(28)**

- **4G co-located with 5G:** 2
- **Urban Sites:** 0
- **Rural Sites:** 26

Busy(h) Traffic associated to Mobile Access Technologies:

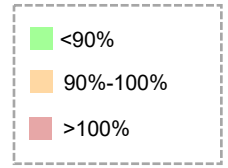
- **30%***

Urban vs Rural Split:

- **Urban** - 0%
- **Rural** - 100%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 56.3% | 51.8% | 35.0% |
| 2025 | 60.2% | 55.3% | 42.0% |
| 2030 | 79.6% | 73.1% | 71.1% |



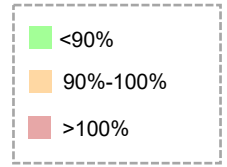

- After running the model for the Muswellbrook region, it can be observed that for the **year 2023, 2025, and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for the **Muswellbrook** region in the Wireless component, it is possible to conclude that in a **Baseline Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **79.6% capacity** in terms of utilization for downlink/transmission communication from the base station to the respective devices.

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 56.3% | 51.8% | 35.0% |
| 2025 | 60.2% | 55.3% | 42.0% |
| 2030 | 79.6% | 73.1% | 71.1% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Muswellbrook

Below, the capacity status for the Muswellbrook region under high demand scenario conditions is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 234,643
- **2025:** 282,072
- **2030:** 476,582

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(28)**

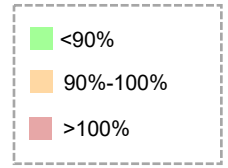
- **4G co-located with 5G:** 2
- **Urban Sites:** 0
- **Rural Sites:** 26

Urban vs Rural Split:

- **Urban** - 0%
- **Rural -** 100%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 81.5% | 74.9% | 50.6% |
| 2025 | 89.8% | 82.5% | 60.8% |
| 2030 | 114.9% | 105.6% | 102.7% |




- After running the model for the Muswellbrook region, it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

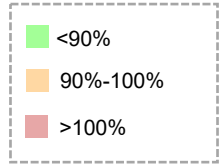
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030** - Installation of **2 new base station between 2025 and 2030**, resulting in a total of **30 radio mobile sites** in the Muswellbrook region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 81.5% | 74.9% | 50.6% |
| 2025 | 89.8% | 82.5% | 60.8% |
| 2030 | 98.7% | 91.4% | 93.1% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Newcastle

Below, the capacity status for the Newcastle region under low demand scenario conditions is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 1,141,981
- **2025:** 1,374,668
- **2030:** 2,339,444

Current Number of Sites: **(114)**

- **4G co-located with 5G:** 66
- **Urban Sites:** 48
- **Rural Sites:** 0

Busy(h) Traffic associated to Mobile Access Technologies:

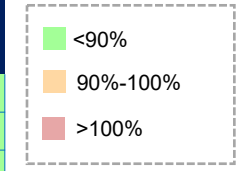
- **30%***

Urban vs Rural Split:

- **Urban** - 100%
- **Rural** - 0%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 54.7% | 53.1% | 43.0% |
| 2025 | 60.7% | 58.9% | 51.8% |
| 2030 | 82.6% | 80.1% | 88.1% |



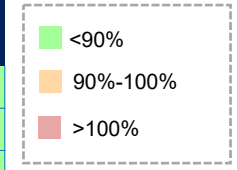

- After running the model for the Newcastle region, it can be observed that for the **year 2023, 2025, and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for **the Newcastle** region in the Wireless component, it is possible to conclude that in a **Low Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **88.1% capacity** in terms of simultaneous number of devices accessing the network via mobile access

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 54.7% | 53.1% | 43.0% |
| 2025 | 60.7% | 58.9% | 51.8% |
| 2030 | 82.6% | 80.1% | 88.1% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Newcastle

Below, the capacity status for the Newcastle region under baseline demand scenario conditions is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 1,641,917
- **2025:** 1,977,569
- **2030:** 3,366,220

Current Number of Sites: **(114)**

- **4G co-located with 5G:** 66
- **Urban Sites:** 48
- **Rural Sites:** 0

Busy(h) Traffic associated to Mobile Access Technologies:

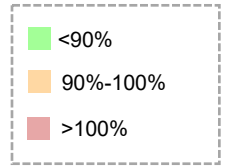
- **30%***

Urban vs Rural Split:

- **Urban** - 100%
- **Rural -** 0%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 78.7% | 76.3% | 61.8% |
| 2025 | 87.3% | 84.7% | 74.5% |
| 2030 | 118.9% | 115.3% | 126.7% |




- After running the model for the Newcastle region, it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

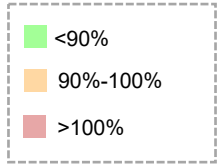
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030** - Installation of **27 new base station between 2025 and 2030**, resulting in a total of **141 radio mobile sites** in the Newcastle region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 78.7% | 76.3% | 61.8% |
| 2025 | 87.3% | 84.7% | 74.5% |
| 2030 | 92.2% | 89.4% | 99.7% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Newcastle

Below, the capacity status for the Newcastle region under high demand scenario conditions is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 2,355,596
- **2025:** 2,840,362
- **2030:** 4,836,917

Current Number of Sites: **(114)**

- **4G co-located with 5G:** 66
- **Urban Sites:** 48
- **Rural Sites:** 0

Busy(h) Traffic associated to Mobile Access Technologies:

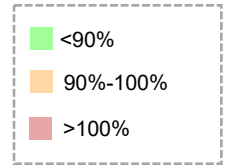
- **30%***

Urban vs Rural Split:

- **Urban** - 100%
- **Rural -** 0%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 112.9% | 109.5% | 88.7% |
| 2025 | 125.4% | 121.6% | 106.9% |
| 2030 | 170.8% | 165.7% | 182.1% |




- After running the model for the Newcastle region, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

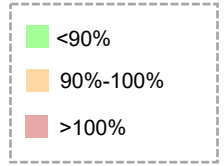
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **24 new mobile base stations until 2025.**
- **2030 -** Installation of **58 new mobile base stations between 2025 and 2030**, resulting in a total of **196 radio mobile sites** in the Newcastle region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.1% | 96.1% | 78.5% |
| 2025 | 99.7% | 96.8% | 86.2% |
| 2030 | 90.9% | 88.2% | 99.9% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Port Stephens

Below, the capacity status for the Port Stephens region under low demand scenario conditions is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 524,249
- **2025:** 629,500
- **2030:** 1,064,314

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(79)**

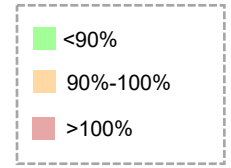
- **4G co-located with 5G:** 27
- **Urban Sites:** 9
- **Rural Sites:** 43

Urban vs Rural Split:

- **Urban** – 17.4%
- **Rural –** 82.6%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 47.8% | 45.4% | 34.9% |
| 2025 | 52.9% | 50.2% | 41.9% |
| 2030 | 69.0% | 65.5% | 70.8% |



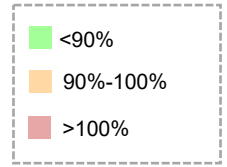

- After running the model for the Port Stephens region, it can be observed that for the **year 2023, 2025, and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for the **Port Stephens** region in the Wireless component, it is possible to conclude that in a **Low Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **70.8% capacity** in terms of simultaneous number of devices accessing the network via mobile access

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 47.8% | 45.4% | 34.9% |
| 2025 | 52.9% | 50.2% | 41.9% |
| 2030 | 69.0% | 65.5% | 70.8% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Port Stephens

Below, the capacity status for the Port Stephens region under baseline demand scenario conditions is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 763,651
- **2025:** 916,381
- **2030:** 1,545,080

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(79)**

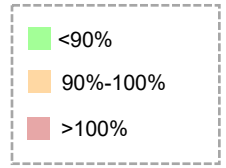
- **4G co-located with 5G:** 27
- **Urban Sites:** 9
- **Rural Sites:** 43

Urban vs Rural Split:

- **Urban** – 17.4%
- **Rural –** 82.6%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 69.7% | 66.1% | 50.8% |
| 2025 | 77.0% | 73.1% | 60.9% |
| 2030 | 100.2% | 95.0% | 102.7% |




- After running the model for the Port Stephens region, it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

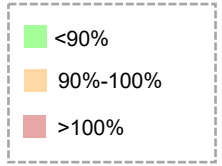
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030 -** Installation of **2 new mobile base stations between 2025 and 2030**, resulting in a total of **81 radio mobile sites** in the Port Stephens region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 69.7% | 66.1% | 50.8% |
| 2025 | 77.0% | 73.1% | 60.9% |
| 2030 | 96.3% | 91.4% | 99.6% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Port Stephens

Below, the capacity status for the Port Stephens region under high demand scenario conditions is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 1,109,604
- **2025:** 1,331,448
- **2030:** 2,238,833

Current Number of Sites: **(79)**

- **4G co-located with 5G:** 27
- **Urban Sites:** 9
- **Rural Sites:** 43

Busy(h) Traffic associated to Mobile Access Technologies:

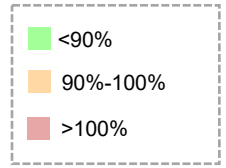
- **30%***

Urban vs Rural Split:

- **Urban** – 17.4%
- **Rural –** 82.6%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 101.3% | 96.1% | 73.8% |
| 2025 | 111.9% | 106.2% | 88.5% |
| 2030 | 150.6% | 142.8% | 148.9% |




- After running the model for the Port Stephens region, it can be observed that there is **currently saturation** in terms of **mobile network capacity**, requiring the **deployment of new radio sites**.

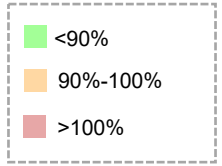
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2025 -** Installation of **6 new mobile base stations until 2025.**
- **2030 -** Installation of **25 new mobile base stations between 2025 and 2030**, resulting in a total of **110 radio mobile sites** in the Port Stephens region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 99.3% | 94.2% | 72.6% |
| 2025 | 99.7% | 94.8% | 80.8% |
| 2030 | 92.2% | 88.3% | 99.6% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Singleton

Below, the capacity status for the Singleton region under low demand scenario conditions is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 171,425
- **2025:** 205,876
- **2030:** 348,237

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(39)**

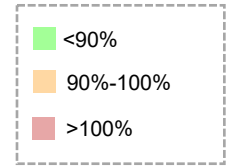
- **4G co-located with 5G:** 8
- **Urban Sites:** 1
- **Rural Sites:** 30

Urban vs Rural Split:

- **Urban** – 1.7%
- **Rural –** 98.3%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 35.7% | 33.4% | 24.8% |
| 2025 | 39.3% | 36.7% | 29.8% |
| 2030 | 50.4% | 47.1% | 50.5% |



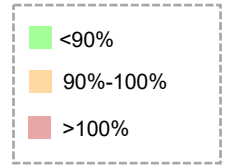

- After running the model for the Singleton region, it can be observed that for the **year 2023, 2025, and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for the **Singleton** region in the Wireless component, it is possible to conclude that in a **Low Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **50.5% capacity** in terms of simultaneous number of devices accessing the network via mobile access

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 35.7% | 33.4% | 24.8% |
| 2025 | 39.3% | 36.7% | 29.8% |
| 2030 | 50.4% | 47.1% | 50.5% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Singleton

Below, the capacity status for the Singleton region under baseline demand scenario conditions is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 249,487
- **2025:** 299,458
- **2030:** 505,234

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(39)**

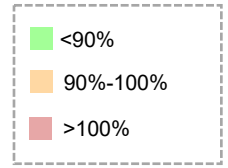
- **4G co-located with 5G:** 8
- **Urban Sites:** 1
- **Rural Sites:** 30

Urban vs Rural Split:

- **Urban** – 1.7%
- **Rural –** 98.3%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 52.0% | 48.5% | 36.1% |
| 2025 | 57.2% | 53.4% | 43.4% |
| 2030 | 73.2% | 68.3% | 73.2% |



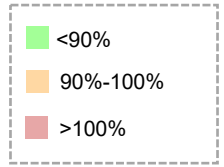

- After running the model for the Singleton region, it can be observed that for the **year 2023, 2025, and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for the **Singleton** region in the Wireless component, it is possible to conclude that in a **Baseline Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **73.2% capacity** in terms of utilization for downlink/transmission communication from the base station to the respective devices, and in the simultaneous number of devices accessing the network via mobile access

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 52.0% | 48.5% | 36.1% |
| 2025 | 57.2% | 53.4% | 43.4% |
| 2030 | 73.2% | 68.3% | 73.2% |




***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Singleton

Below, the capacity status for the Singleton region under high demand scenario conditions is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 362,200
- **2025:** 434,756
- **2030:** 731,669

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(39)**

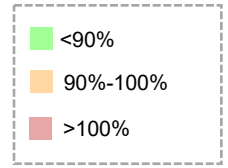
- **4G co-located with 5G:** 8
- **Urban Sites:** 1
- **Rural Sites:** 30

Urban vs Rural Split:

- **Urban** – 1.7%
- **Rural –** 98.3%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 75.4% | 70.5% | 52.4% |
| 2025 | 83.0% | 77.6% | 62.9% |
| 2030 | 110.1% | 102.8% | 105.9% |




- After running the model for the Singleton region, it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

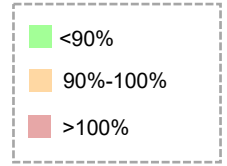
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030** - Installation of **3 new base station between 2025 and 2030**, resulting in a total of **42 radio mobile sites** in the Singleton region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 75.4% | 70.5% | 52.4% |
| 2025 | 83.0% | 77.6% | 62.9% |
| 2030 | 95.9% | 90.1% | 95.9% |




*__Important Note:__ While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Upper Hunter

Below, the capacity status for the Upper Hunter region under low demand scenario conditions is presented.

## Low Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 96,882
- **2025:** 116,443
- **2030:** 197,362

Current Number of Sites: **(24)**

- **4G co-located with 5G:** 4
- **Urban Sites:** 0
- **Rural Sites:** 20

Busy(h) Traffic associated to Mobile Access Technologies:

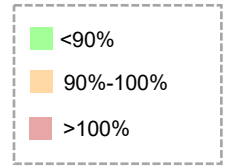
- **30%***

Urban vs Rural Split:

- **Urban** - 0%
- **Rural** - 100%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 34.6% | 32.2% | 23.3% |
| 2025 | 38.2% | 35.5% | 28.0% |
| 2030 | 51.0% | 47.4% | 47.4% |



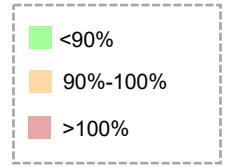

- After running the model for the Upper Hunter region, it can be observed that for the **year 2023, 2025, and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for the **Upper Hunter** region in the Wireless component, it is possible to conclude that in a **Low Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **51% capacity** in terms of utilization for downlink/transmission communication from the base station to the respective devices.

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 34.6% | 32.2% | 23.3% |
| 2025 | 38.2% | 35.5% | 28.0% |
| 2030 | 51.0% | 47.4% | 47.4% |




*__Important Note:__ While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Upper Hunter

Below, the capacity status for the Upper Hunter region under baseline demand scenario conditions is presented.

## Baseline Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 140,433
- **2025:** 168,752
- **2030:** 285,552

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(24)**

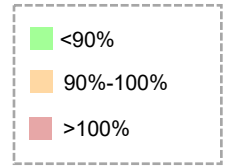
- **4G co-located with 5G:** 4
- **Urban Sites:** 0
- **Rural Sites:** 20

Urban vs Rural Split:

- **Urban** - 0%
- **Rural** - 100%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 50.2% | 46.7% | 33.8% |
| 2025 | 55.3% | 51.4% | 40.6% |
| 2030 | 73.8% | 68.5% | 68.6% |



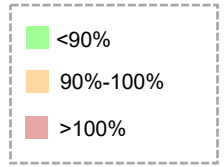

- After running the model for the Upper Hunter region, it can be observed that for the **year 2023, 2025, and 2030, the current scenario in terms of sites supports the necessary demand**.

### 3 - Future State

Conducting traffic projections associated with devices for the **Upper Hunter** region in the Wireless component, it is possible to conclude that in a **Baseline Scenario** regarding the number of devices, **the current network infrastructure** will **sustain the projected demand** until the year **2030**, with the highest value being **73.8% capacity** in terms of utilization for downlink/transmission communication from the base station to the respective devices.

The installation/deployment of new radio mobile sites is not necessarily required.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 50.2% | 46.7% | 33.8% |
| 2025 | 55.3% | 51.4% | 40.6% |
| 2030 | 73.8% | 68.5% | 68.6% |




*__Important Note:__ While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireless - Simulated Capacity: Upper Hunter

Below, the capacity status for the Upper Hunter region under high demand scenario conditions is presented.

## High Scenario

### 1 - Model Inputs:

Total Number of Devices:

- **2023:** 203,084
- **2025:** 244,130
- **2030:** 412,458

Busy(h) Traffic associated to Mobile Access Technologies:

- **30%***

Current Number of Sites: **(24)**

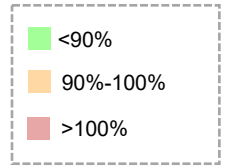
- **4G co-located with 5G:** 4
- **Urban Sites:** 0
- **Rural Sites:** 20

Urban vs Rural Split:

- **Urban** - 0%
- **Rural -** 100%

### 2- As-Is State

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 72.6% | 67.5% | 48.8% |
| 2025 | 80.0% | 74.4% | 58.7% |
| 2030 | 106.5% | 99.0% | 99.2% |




- After running the model for the Upper Hunter region, it can be observed that for the **year 2023 and 2025, the current scenario in terms of sites supports the necessary demand**. However, by the year **2030, there is already saturation in terms of network capacity**.

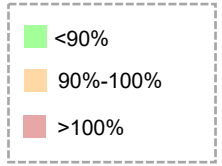
### 3 - Future State

To address the As-Is saturation, and considering only mobile infrastructure, the following number of base stations needs to be installed:

- **2030** - Installation of **1 new base station between 2025 and 2030**, resulting in a total of **25 radio mobile sites** in the Upper Hunter region.

It was assumed that all sites deployed will include 5G technology.

| Projected Years | % RAN Capacity (Downlink) | % RAN Capacity (Uplink) | % RAN Capacity (Active Devices) |
|---|---|---|---|
| 2023 | 72.6% | 67.5% | 48.8% |
| 2025 | 80.0% | 74.4% | 58.7% |
| 2030 | 98.2% | 91.6% | 93.7% |



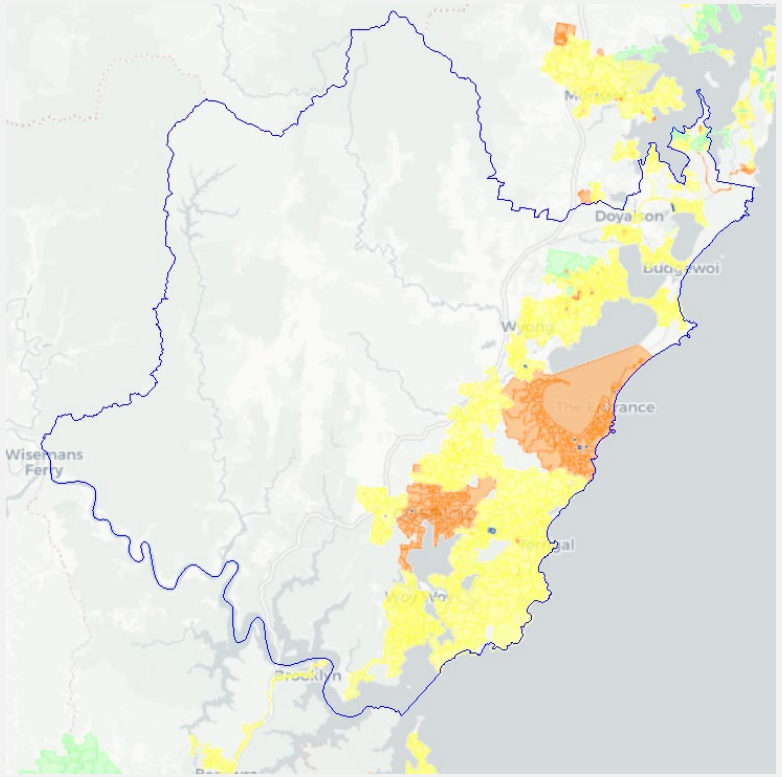

***Important Note:** While performing the forward looking scenario simulation, the model adds +20% of headroom traffic capacity on top of this value.

# Wireline Capacity for each LGA: Existing Households with Fibre

# Wireline - Existing households with Fibre: Central Coast

The analysis below enables the understanding of the current state in terms of development of the different types of fibre access provided by the NBN and comprehending the number of existing homes covered by each of these technologies. The analysis below relates to the Central Coast region.

## Existing households with Fibre



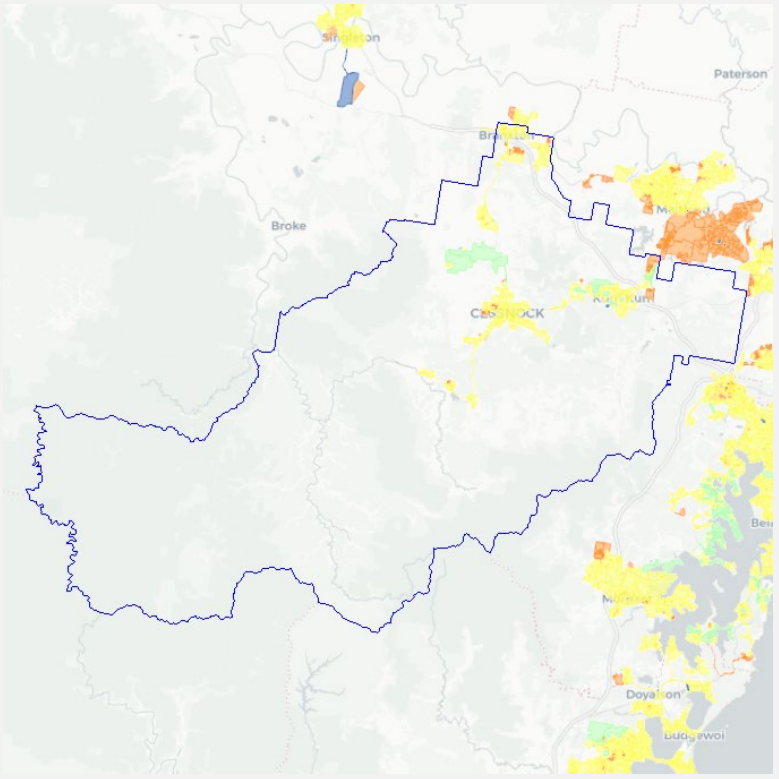

To understand the infrastructure required to fibre a certain region, it is necessary to obtain and comprehend the current deployed infrastructure and the existing number of houses with fibre access at the moment. In this case, for the Central Coast region, it is possible to draw the following conclusions

- Total Number of private Dwellings for Central Coast Region: **152,699**
- Current Percentage of private dwellings with fibre access: **97.59%**
- Existing Types of Fibre Access:
  - **Fibre to the Premises:** Present in around **44%** of the dwellings
  - **Fibre to the Building:** Deployed in private buildings such Bateau Bay Square and Erina Fair Shopping Centre
  - **Fibre to the Curb:** Present in around **1%** of the dwellings
  - **Fibre to the Node:** Present in around **52%** of total dwellings
- Current suburbs without any type of fibre access (top 3):
  - Jilliby **531 dwellings**
  - Somersby **387 dwellings**
  - Mangrove Mountain **280 dwellings**

# Wireline - Existing households with Fibre: Cessnock

The analysis below enables the understanding of the current state in terms of development of the different types of fibre access provided by the NBN and comprehending the number of existing homes covered by each of these technologies. The analysis below relates to the Cessnock region.

## Existing households with Fibre




To understand the infrastructure required to fibre a certain region, it is necessary to obtain and comprehend the current deployed infrastructure and the existing number of houses with fibre access at the moment. In this case, for the Cessnock region, it is possible to draw the following conclusions

- Total Number of private Dwellings for Cessnock Region: **26,304**
- Current Percentage of private dwellings with fibre access: **85.23%**
- Existing Types of Fibre Access:

**Fibre to the Premises:** Present in around **9%** of the dwellings

**Fibre to the Curb:** Present in around **16%** of total dwellings

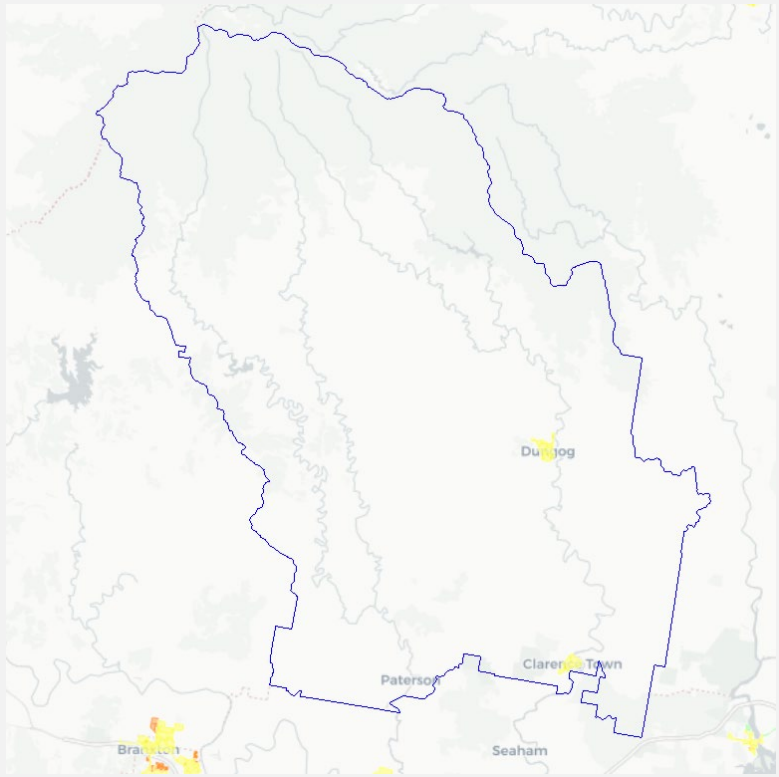
**Fibre to the Node:** Present in around **60%** of total dwellings

- Current suburbs without any type of fibre access (top 3):
  - Ellalong **492 dwellings**
  - Millfield **492 dwellings**
  - Mulbring **255 dwellings**

# Wireline - Existing households with Fibre: Dungog

The analysis below enables the understanding of the current state in terms of development of the different types of fibre access provided by the NBN and comprehending the number of existing homes covered by each of these technologies. The analysis below relates to the Dungog region

## Existing households with Fibre




Fibre to the Node

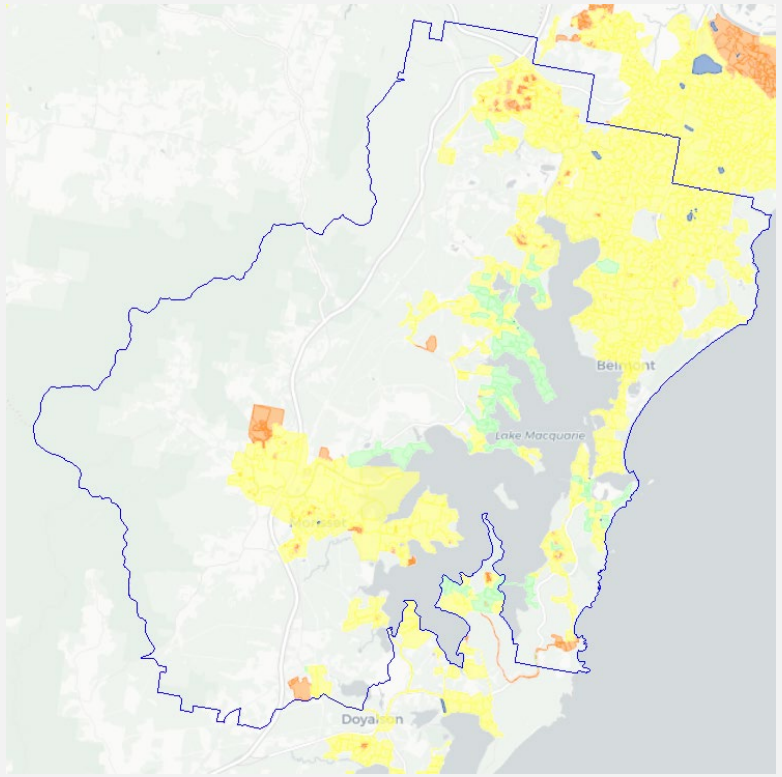
To understand the infrastructure required to fibre a certain region, it is necessary to obtain and comprehend the current deployed infrastructure and the existing number of houses with fibre access at the moment. In this case, for the Dungog region, it is possible to draw the following conclusions

- Total Number of private Dwellings for Dungog Region: **3,905**
- Current Percentage of private dwellings with fibre access: **47.71%**
- Existing Types of Fibre Access:
  - **Fibre to the Node:** Present in around 47% of total dwellings
- Current suburbs without any type of fibre access (top 3):
  - Paterson **374 dwellings**
  - East Gresford **159 dwellings**
  - Martins Creek **149 dwellings**

# Wireline - Existing households with Fibre: Lake Macquarie

The analysis below enables the understanding of the current state in terms of development of the different types of fibre access provided by the NBN and comprehending the number of existing homes covered by each of these technologies. The analysis below relates to the Lake Macquarie region

## Existing households with Fibre



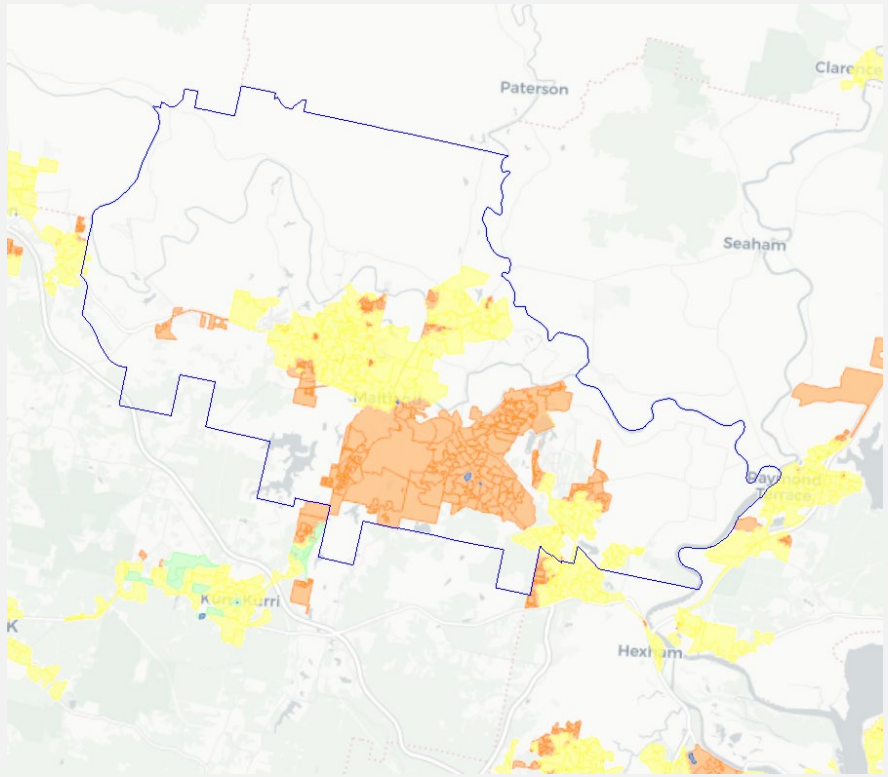

To understand the infrastructure required to fibre a certain region, it is necessary to obtain and comprehend the current deployed infrastructure and the existing number of houses with fibre access at the moment. In this case, for the Lake Macquarie region, it is possible to draw the following conclusions

- Total Number of private Dwellings for Lake Macquarie region: **37,464**
- Current Percentage of private dwellings with fibre access: **98.87%**
- Existing Types of Fibre Access:
  - **Fibre to the Premises:** Present in around **10%** of the dwellings
  - **Fibre to the Building:** Deployed in private buildings such Stockland Glendale and Charlestown Square
  - **Fibre to the Curb:** Present in around **10%** of the dwellings
  - **Fibre to the Node:** Present in around **78%** of total dwellings
- Current suburbs without any type of fibre access (top 3):
  - Mandalong **169 dwellings**
  - Martinsville **150 dwellings**
  - Freemans Waterhole **49 dwellings**

# Wireline - Existing households with Fibre: Maitland

The analysis below enables the understanding of the current state in terms of development of the different types of fibre access provided by the NBN and comprehending the number of existing homes covered by each of these technologies. The analysis below relates to the Maitland region.

## Existing households with Fibre




To understand the infrastructure required to fibre a certain region, it is necessary to obtain and comprehend the current deployed infrastructure and the existing number of houses with fibre access at the moment. In this case, for the Maitland region, it is possible to draw the following conclusions

- Total Number of private Dwellings for Maitland Region: **35,343**
- Current Percentage of private dwellings with fibre access: **95.89%**
- Existing Types of Fibre Access:

  **Fibre to the Premises:** Present in around 66% of the dwellings

  **Fibre to the Building:** Deployed in private buildings such Maitland Private Hospital and Stockland Green Hills.

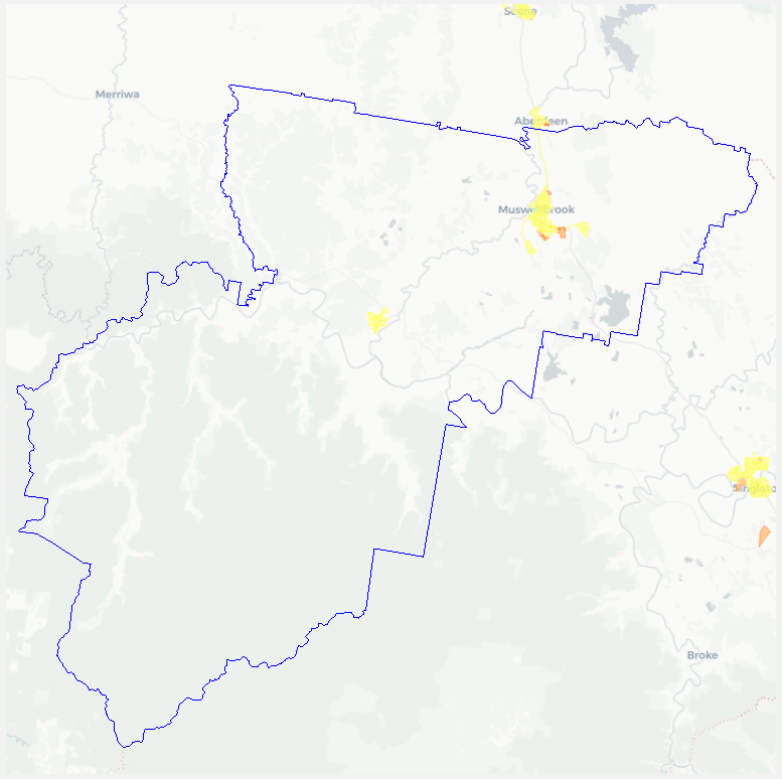
  **Fibre to the Node:** Present in around 30% of total dwellings

- Current suburbs without any type of fibre access (top 3):
  - Lochinvar **439 dwellings**
  - Millers Forest **128 dwellings**
  - Maitland Vale **90 dwellings**

# Wireline - Existing households with Fibre: Muswellbrook

The analysis below enables the understanding of the current state in terms of development of the different types of fibre access provided by the NBN and comprehending the number of existing homes covered by each of these technologies. The analysis below relates to the Muswellbrook region.

## Existing households with Fibre



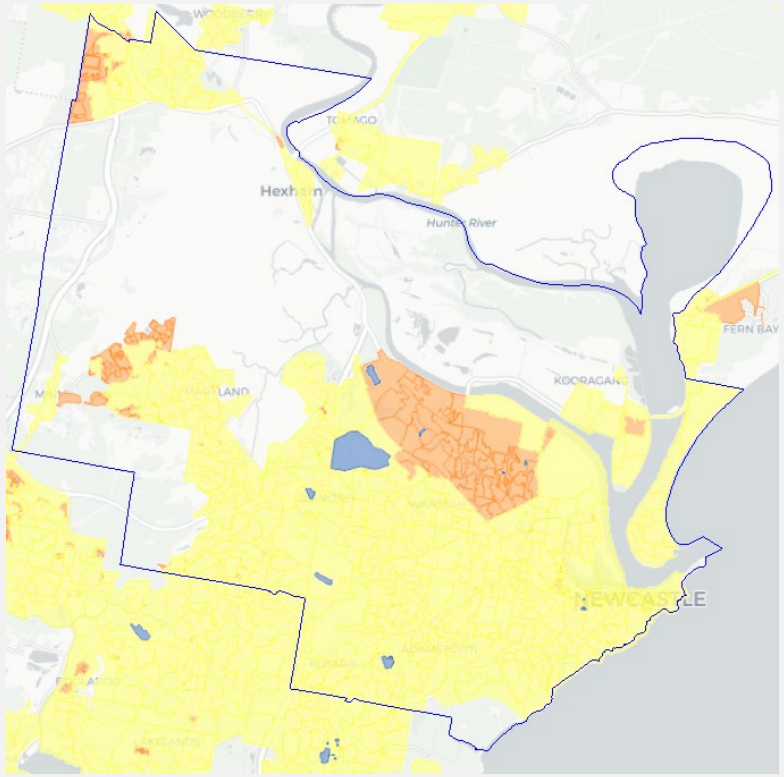

To understand the infrastructure required to fibre a certain region, it is necessary to obtain and comprehend the current deployed infrastructure and the existing number of houses with fibre access at the moment. In this case, for the Muswellbrook region, it is possible to draw the following conclusions

- Total Number of private Dwellings for Muswellbrook Region: **8,193**
- Current Percentage of private dwellings with fibre access: **89.57%**
- Existing Types of Fibre Access:
  - **Fibre to the Premises:** Present in around **11%** of the dwellings
  - **Fibre to the Curb:** Present in around **1%** of total dwellings
  - **Fibre to the Node:** Present in around **77%** of total dwellings
- Current suburbs without any type of fibre access (top 3):
  - Muscle Creek **871 dwellings**
  - McCullys Gap **101 dwellings**
  - Sandy Hollow **92 dwellings**

# Wireline - Existing households with Fibre: Newcastle

The analysis below enables the understanding of the current state in terms of development of the different types of fibre access provided by the NBN and comprehending the number of existing homes covered by each of these technologies. The analysis below relates to the Newcastle region.

## Existing households with Fibre



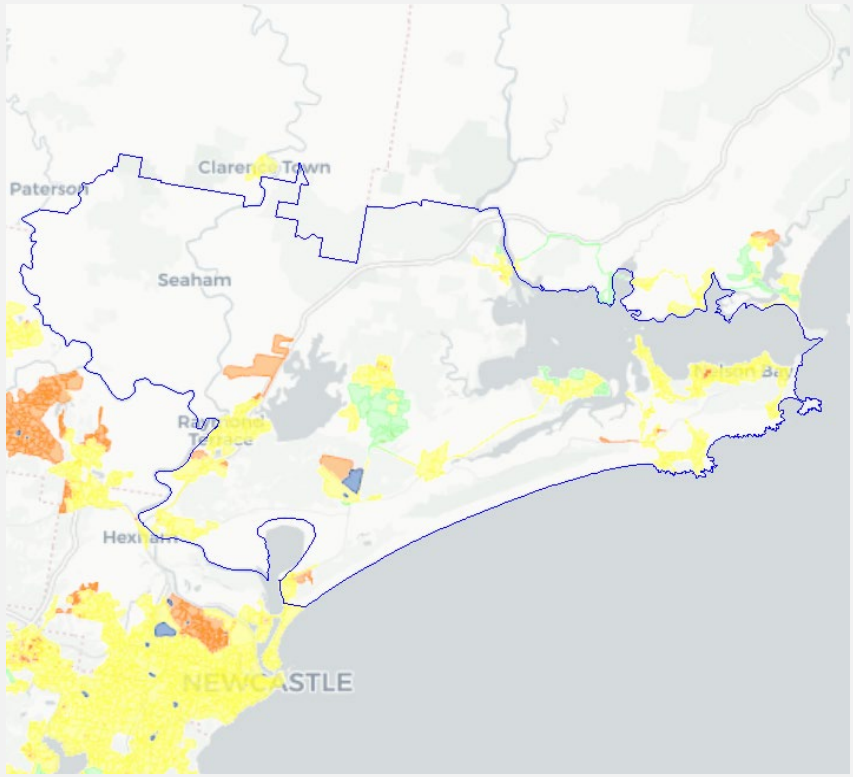

To understand the infrastructure required to fibre a certain region, it is necessary to obtain and comprehend the current deployed infrastructure and the existing number of houses with fibre access at the moment. In this case, for the Newcastle region, it is possible to draw the following conclusions

- Total Number of private Dwellings for Newcastle Region: **75,771**
- Current Percentage of private dwellings with fibre access: **99.62%**
- Existing Types of Fibre Access:
  - **Fibre to the Premises:** Present in around 20% of the dwellings
  - **Fibre to the Building:** Deployed in buildings such Callaghan - University of Newcastle and John Hunter Hospital
  - **Fibre to the Node:** Present in around 89% of total dwellings
- Current suburbs without any type of fibre access (top 3):
  - Black Hill **181 dwellings**
  - Sandgate **276 dwellings**
  - Lenaghan **22 dwellings**

# Wireline - Existing households with Fibre: Port Stephens

The analysis below enables the understanding of the current state in terms of development of the different types of fibre access provided by the NBN and comprehending the number of existing homes covered by each of these technologies. The analysis below relates to the Port Stephens region.

## Existing households with Fibre



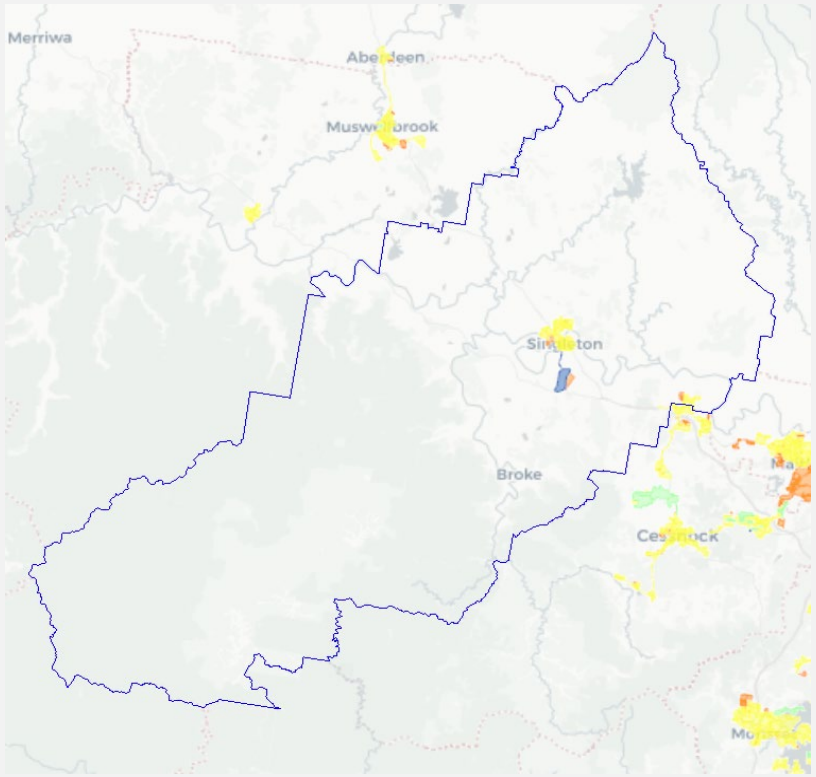

To understand the infrastructure required to fibre a certain region, it is necessary to obtain and comprehend the current deployed infrastructure and the existing number of houses with fibre access at the moment. In this case, for the Port Stephens region, it is possible to draw the following conclusions

- Total Number of private Dwellings for Port Stephens Region: **37,730**
- Current Percentage of private dwellings with fibre access: **90.71%**
- Existing Types of Fibre Access:
  - **Fibre to the Premises:** Present in around **9%** of the dwellings
  - **Fibre to the Building:** Deployed in part of the RAAF Base Williamtown
  - **Fibre to the Curb:** Present in around **10%** of the dwellings
  - **Fibre to the Node:** Present in around **71%** of total dwellings
- Current suburbs without any type of fibre access (top 3):
  - North Arm Cove **340 dwellings**
  - Seaham **339 dwellings**
  - Wallalong **339 dwellings**

# Wireline - Existing households with Fibre: Singleton

The analysis below enables the understanding of the current state in terms of development of the different types of fibre access provided by the NBN and comprehending the number of existing homes covered by each of these technologies. The analysis below relates to the Singleton region.

## Existing households with Fibre



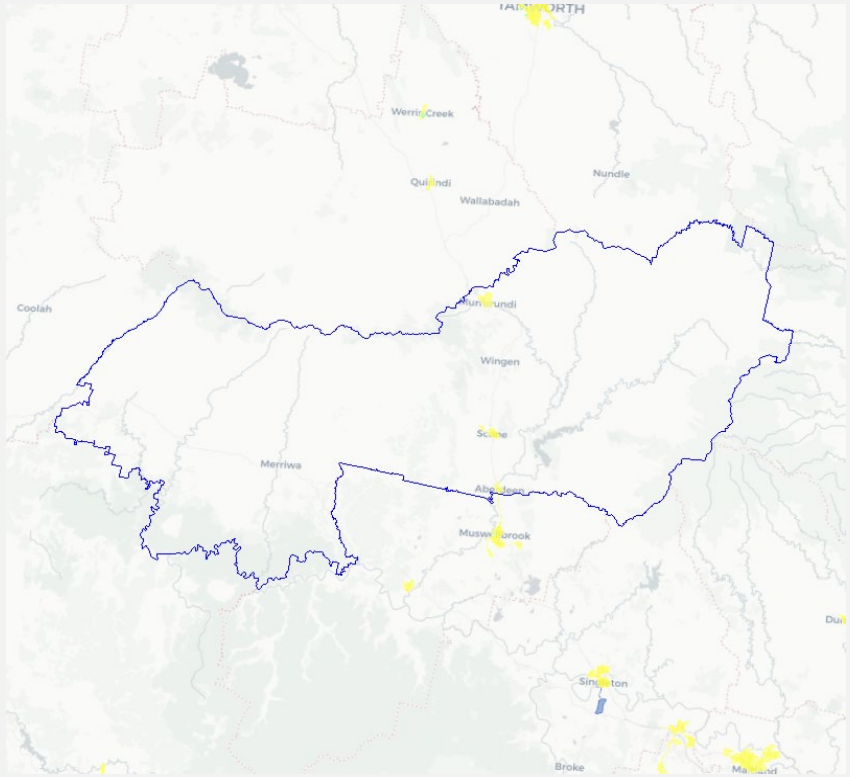

To understand the infrastructure required to fibre a certain region, it is necessary to obtain and comprehend the current deployed infrastructure and the existing number of houses with fibre access at the moment. In this case, for the Singleton region, it is possible to draw the following conclusions

- Total Number of private Dwellings for Singleton Region: **9,348**
- Current Percentage of private dwellings with fibre access: **64.54%**
- Existing Types of Fibre Access:
  - **Fibre to the Premises:** Present in around **1%** of the dwellings
  - **Fibre to the Building:** Deployed in the Singleton Military Area
  - **Fibre to the Node:** Present in around 63% of total dwellings
- Current suburbs without any type of fibre access (top 3):
  - Wattle Ponds **382 dwellings**
  - Broke **280 dwellings**
  - Whittingham **172 dwellings**

# Wireline - Existing households with Fibre: Upper Hunter

The analysis below enables the understanding of the current state in terms of development of the different types of fibre access provided by the NBN and comprehending the number of existing homes covered by each of these technologies. The analysis below relates to the Upper Hunter region.

## Existing households with Fibre




Fibre to the Node

To understand the infrastructure required to fibre a certain region, it is necessary to obtain and comprehend the current deployed infrastructure and the existing number of houses with fibre access at the moment. In this case, for the Upper Hunter region, it is possible to draw the following conclusions

- Total Number of private Dwellings for Upper Hunter Region: **12,168**
- Current Percentage of private dwellings with fibre access: **44.69%**
- Existing Types of Fibre Access:

**Fibre to the Node:** Present in around **44%** of total dwellings

- Current suburbs without any type of fibre access (top 3):
  - Merriwa **871 dwellings**
  - Gunning **357 dwellings**
  - Taralga **243 dwellings**