# Regional Digital Plan

LODDON CAMPASPE

REGIONAL
PARTNERSHIPS
LODDON CAMPASPE

# Table of Contents

# Context of the Digital Plan

## What is a Digital Plan?

The Digital Plan for each region is an evidence-based, place-based analysis of the supply of and demand for digital services and skills. It identifies unmet digital needs across the region and potential solutions and makes a number of recommendations to relevant stakeholder groups including local, state and Commonwealth governments, industry and community groups.

The Regional Partnership will use this Digital Plan as the basis for advocacy on digital issues, engaging with relevant groups to raise awareness of the issues identified in the Digital Plan and to take ownership of and/or respond to the recommendations made. In this way the Digital Plan can bring about the changes needed to reduce the country-city digital divide. The Digital Plan can also support the efforts of individuals, businesses and community groups to better understand their local digital environment to support their own advocacy and activities.

The Digital Plans complement other regional plans prepared by the government to strengthen local economies and communities across regional Victoria – including Infrastructure, Transport, Skills and Growth Plans.

*While informing the development of digital policies and programs for the regions, the digital plans are not a commitment to any particular course of action by the Victorian Government*.

## Why are Digital Plans needed?

The **digital divide**, where regional users face inferior digital services compared to their metropolitan counterparts, has been a longstanding issue affecting regional Victorians. The lack of comprehensive and comparable data on digital infrastructure supply and demand from place to place has been a critical barrier in the ability to clearly understand, advocate on and better target funding and initiatives towards the most pressing issues.

The Digital Plans are the most developed and comprehensive evidence-base ever produced on regional Victoria's digital infrastructure landscape. They will be a vital tool in effectively reducing the persistent country-city digital divide.

Addressing the digital divide matters more than ever as the realities of the increasingly pervasive digital world strike home.

- *Households* around the world rely more and more on digitally-based communications, entertainment and shopping, banking, news and other personal services
- *Communities* increasingly stay connected and safe, and community services are delivered more effectively, through digital platforms
- *Businesses* of all sizes rely on digital advances – high bandwidth fixed and mobile communications, data capture and analysis, artificial intelligence and digitally-driven production techniques – to increase productivity and remain competitive.

## How will the Digital Plans be used?

The nine Digital Plans provide forward-looking guidance to Regional Partnerships, local governments and business, household and community groups in identifying digital priorities and advocating and developing solutions.

This Digital Plan will be:

- Used by the Regional Partnership as the basis for its actions and advocacy on digital issues, particularly in communicating the recommendations of this plan to relevant stakeholder groups for their consideration, action and response

- Shared with local, state and Commonwealth governments to raise awareness of the digital issues affecting the region and assist in their own advocacy, policy and program development
- Shared with industry and local businesses to encourage them to identify and target investment to areas of highest need across the region
- Made available publicly for interested community members, households and businesses in the region and for other organisations keen to utilise this research and analysis for their own advocacy and activities.

## How were the Digital Plans prepared?

Digital Plans were prepared on behalf of the Regional Partnership, and supported by funding from the Victorian Government's Connecting Regional Communities Program, through:

- Extensive face-to-face consultation with the Regional Partnerships and Digital Plan Working Groups
- In-depth interrogation of the State Level Information Management (SLIM) database[1]
- Fieldwork comprising an online survey of all local governments in regional Victoria, and face-to-face interviews in each region
- Independent expert advice on the fundamental drivers of unmet needs and potential solutions
- Confirmation from each Regional Partnership that the Digital Plan hits the mark as a tool for them and their stakeholders in driving place-based solutions to unmet digital needs.

## Structure of this report

- **Section 1** – The Regional Partnership's digital vision, priority projects, recommendations and a summary of the report's key findings. This section is informed by stakeholder consultation and analysis of the evidence as it relates to the following place and sector perspectives:
    - Significant Places - the most populated cities, towns and localities of the region
    - Primary Production – the most economically significant primary production industries in the region
    - Tourism – the most important tourist attractions / locations in the region, and
    - Transport Corridors – the digital service availability along the region's key transport routes.
- **Section 2** – A detailed place and sector-based analysis of digital services supply and demand analysis and a discussion of digital technology limitations, along with the Regional Partnership's recommendations for action.
- **Section 3** – The supporting evidence base underpinning the plan's analysis and recommendations including a description of the region's geographic, demographic, economic and structural change characteristics and an overview of current digital services in the region.

The intention is for this report to be used in a modular fashion depending on individual stakeholder interests. The general reader can focus primarily on **Section 1**, while others requiring more detailed information and evidence to support their understanding and activities can also refer to **Sections 2** and **3**.

[1] The SLIM database is an interactive place-based repository of current information on the availability of digital services and key demand drivers across regional Victoria

# Regional Partnership Foreword

Loddon Campaspe is a broad, diverse and fast-growing region with a range of attributes and advantages that can be leveraged to establish ourselves as a clear regional leader in digital connectivity.

The region's geography supports the deployment of core digital infrastructure to most major population centres, building off existing high-capacity backbone infrastructure. Loddon Campaspe is home to sophisticated business users that drive demand for skills development and our collaborative businesses and community positions us strongly to identify and progress digital opportunities.

While the opportunity for Loddon Campaspe to be a digital leader is clear, there remain digital connectivity issues across the region impeding our ability to build an inclusive digital economy. We hear this from stakeholders consistently and live this reality but have not had the comprehensive evidence to track the problem effectively.

This is why the Loddon Campaspe Regional Partnership is proud to present our Digital Plan. This plan is the first of its kind for the region and provides the evidence base to facilitate planning and advocacy by the Regional Partnership and Loddon Campaspe stakeholders on our digital issues and priorities.

The Loddon Campaspe Digital Plan outlines key connectivity issues affecting the region and sets out the Regional Partnership's recommendations aimed at addressing the digital connectivity gaps. It also sets out our digital connectivity vision, to become a national regional leader on digital connectivity and use to underpin the growth, competitiveness and resilience of our businesses and industries and drive social outcomes.

Loddon Campaspe has the potential to realise significant economic and social development opportunities by leveraging our advantages through continued and determined effort. Our Digital Plan is just one driver to realise our digital vision – there is still more work to be done, but we have made considerable progress with this plan to support future efforts.

I would like to thank everyone whose efforts have made this plan possible, particularly our digital working group. I am excited to see the changes the Loddon Campaspe region will undergo in the years to come as we work towards bringing our digital vision to life.

**David Richardson**
Chair
Loddon Campaspe Regional Partnership

# Executive Summary

Loddon Campaspe is a broad, diverse and fast-growing region of almost 240,000 residents located to the north west of Greater Melbourne. Bendigo, the main population centre, houses almost half the region's population. Just over 150 kilometres from the centre of Melbourne with good road and rail transport links, Bendigo forms a natural gateway to the region, a hub for north-west road and rail corridors and the location of a wide range of businesses.

Key sectors for employment and Gross Regional Product contribution are health care and community services, education and training, construction, tourism, manufacturing and agriculture. Farming activities analysed in this plan comprise dairy and beef grazing north of Kyabram and around Rochester, dairy grazing west of Mitiamo and sheep meat and wool grazing north-east of Maryborough and north-east of Woodend. While broadacre cropping was not explicitly analysed within the Digital Plan, it is another important aspect of the region's primary production. Tourist sites include permanent attractions such as Hanging Rock and Victorian Goldfields Railway, trails like the O'Keefe Rail Trail, and periodic events like the Riverboats Music Festival and the Loddon Valley Food and Wine Expo.

Much of Loddon Campaspe is closer to Melbourne and more urbanised than most other regions. It has above average education and income levels, and its major industries are growing strongly. Many of its citizens and businesses enjoy core digital services (broadband and mobile) on par with their Melbourne peers.

Loddon Campaspe has a number of valuable digital connectivity strengths and advantages which position the region strongly to be a premier national location for digital connectivity and use. The region's key population centres are largely aligned geographically, a cost advantage when delivering backbone digital infrastructure across the region. Bendigo already has valuable, high-capacity and underutilised fibre assets serving the city. The presence of education institutions like La Trobe University and advanced technology users like Bendigo Health, Coliban Water and Bendigo Telco create an important demand and supply of digital skills in the region. These organisations represent sophisticated users requiring high-capacity digital infrastructure. The Loddon Campaspe region's businesses and community groups have already demonstrated a strong ability to work together collaboratively to develop its digital infrastructure for the benefit of the region broadly, such as with the establishment of the free LoRaWAN network for Bendigo and the opportunity to leverage the Internet of Things (IoT) network established by Coliban Water to support their digital meters.

These elements set Loddon Campaspe apart as a unique region with comparative strengths in its digital connectivity landscape. A concerted effort to leverage these advantages can deliver significant economic and social development opportunities both immediately and in the long-term. This plan sets out the Loddon Campaspe Regional Partnership's recommendations and priority projects that can realise these opportunities.

While the opportunity for Loddon Campaspe to be a regional digital leader is clear, there still exist many gaps in the digital infrastructure and services across the region which impede the ability of businesses and citizens to engage effectively with the digital economy. These issues must be addressed, and the worst served areas prioritised. These areas must be brought up to standard to reduce the digital divide in its various dimensions - city-country, urban-rural, town-fringe and 'technology boundaries' within neighbourhoods – and ensure the benefits of technological progress are shared across the region.

The extensive analysis undertaken in this plan has identified broad ranging digital infrastructure and service issues across the region. These are the 'baseline' issues affecting our region and must be prioritised by those responsible for the policy levers and with the funding capacity that can meaningfully affect their resolution. They include:

- The fixed broadband needs of businesses and households in smaller localities (less than 1,000 residents), on the fringe of larger centres and in rural and remote areas are compromised by the widespread use of NBN fixed wireless and satellite technologies.
- Mobile connectivity remains a priority for regional users. Major population centres appear to be well served but coverage and performance is unsatisfactory in many rural and remote areas. The public

coverage maps underpinning this analysis are unable to show places within population centres where the 'lived experience' of mobile services is inadequate to support, for example, basic web-browsing, highlighting the need for better coverage data to guide future mobile infrastructure investment in these places.

- The high-level picture for businesses and households in primary production areas and tourist sites is of concern, with mobile coverage for farms and tourists lacking. There is also below-par fixed connectivity for farm offices and homesteads and tourist site operators (affecting provision of on-site WiFi for visitors), potentially effecting economic outcomes for businesses in these areas.
- Major roads have good mobile coverage according to public coverage maps, but service is patchy on minor roads. The Bendigo-Melbourne commuter rail link has good mobile coverage and in-carriage reception, but lower quality coverage and in-carriage reception on other rail links such as Bendigo to Echuca and Swan Hill, and Ballarat to Maryborough.
- While there is a general perception the city-country digital divide extends to digital skills and affordability, systematic evidence is not available, making data collection a priority.

The Regional Partnership's priority recommendations to address the Loddon Campaspe digital divide include:

*Local Governments* use their local presence, insights and planning powers to identify localised priority fixed and mobile blackspots, promote early 5G rollout, seek to leverage state-owned assets to extend higher-capacity infrastructure to priority areas and support digital literacy training (possibly in local digital hubs)

*The Victorian Government* reviews and extends its regional telecommunications advocacy, co-investment funding and pilot programs[2]; addresses unmet needs with targeted high-speed broadband deployment; facilitates regional IoT and 5G developments; leverages procurement for local stakeholder and business economic opportunities, invests in digital skills training programs and facilitates access to state-owned digital infrastructure assets

*The Commonwealth Government* continues, reviews and extends its mobile blackspot co-funding program, mandates industry meets stronger NBN service connection and maintenance requirements, invests in addressing IoT blackspots and supports the delivery of public WiFi networks in priority locations

*NBN Co* quickly brings to market effective business-grade services with strong service level agreements (SLAs)

*The telecommunications industry* actively considers opportunities to provide competing broadband services to businesses in high demand precincts, particularly if NBN Co fails to restructure its wholesale pricing or does not provide effective business-grade services and releases more informative public coverage maps to inform future investments.

[2] The Victorian Government has allocated $12 million to trial IoT connectivity for internet enabled on-farm technologies around Birchip (grains), Maffra (dairy), Tatura (horticulture) and Serpentine (sheep); $8 million for public WiFi pilots, originally in Ballarat and Bendigo and now extended to Shepparton and Geelong; and $7 million to pilot new higher-quality broadband networks in Morwell, Geelong and Horsham to address gaps in the NBN.

# SECTION 1 – Vision and summary of report findings

## *Vision and opportunity*

*The Loddon Campaspe Regional Partnership's vision is for the region to be a national regional leader on digital connectivity and use to underpin the growth, competitiveness and resilience of our businesses and industries and drive social outcomes.*

This plan establishes the evidence base of what our regional stakeholders have known and lived for years - there are issues with the coverage and quality of our services compared to metropolitan areas, the so-called 'digital divide'. Our stakeholders have consistently emphasised the importance of improved digital connectivity for economic and social development at our Regional Assemblies.

The Loddon Campaspe Regional Partnership expects governments to continue to focus on addressing gaps in the availability and quality of digital infrastructure across our region and bringing our most underserved areas up to standard. This should be a given to enable regional businesses and households to participate fully in the opportunities offered by digital technologies. Doing so requires continued attention and investment from all levels of government.

However, the Regional Partnership is not just concerned with 'filling the holes' of our region's digital landscape. We also want to use our Digital Plan to capitalise on our existing strengths and opportunities for the Loddon Campaspe region to be a national regional leader in digital. We have the potential to be outstanding and with the right support will realise this goal so that our citizens, businesses and industries are among the most advanced and capable adopters of digital technologies and solutions across Australia.

Digital infrastructure is obviously a critical enabler of this outcome, and therefore the focus of the analysis in this plan, but it is not the whole story. It is also about what we do with our connectivity; the applications and uses we adopt that will create new jobs, grow our industries and attract people and businesses to our region. In this regard our region is also demonstrating its leadership.

There are a variety of valuable and difficult-to-replicate elements of our digital landscape which present Loddon Campaspe with a compelling opportunity to be digital leaders:

**Favourable geography to support high-capacity infrastructure deployment**

Loddon Campaspe's linear geography presents cost advantages to developing a network of high-capacity digital locations which can be relatively easily accessed by nearly all people and businesses across our region. The linear nature of the region's main corridor means people only have to travel around 40 kilometres to access the corridor. This supports movement and access across the region for work, health, education and other services - noting Maryborough and Loddon are the exceptions to this. Our local governments agree that ensuring our major hubs along this route are well serviced will enable our region to thrive.

**Sophisticated business users driving demand for skills and services**

To get the most out of digital infrastructure and to attract and retain the right sort of talent to do so, a region needs a critical mass of sophisticated technology users. Loddon Campaspe is well established in this regard. The region is home to organisations like La Trobe University, Bendigo Telco, Coliban Water and multiple data centres dedicated to the region. Projects like the City of Bendigo and La Trobe University's leading-edge weather monitoring system, and Coliban Water's digital metering and IoT sensor networks demonstrate the advanced technology utilisation occurring within the region and the ways in which digital infrastructure is being utilised for these value-adding applications.

Bendigo Health is another example of the advanced demand environment of our region. Our region is excellent in health services and the sector more broadly across the region is more digitally advanced than elsewhere. The main development focus for the sector is now on applications.

**Collaborative business and community environment**

The Loddon Campaspe local governments share a 'region first' view for economic and social development, placing a high value on initiatives that take a whole-of-region approach rather than disparate, uncoordinated efforts and initiatives. Businesses across the region have also demonstrated a strong ability to work together to achieve shared outcomes from technology projects, such as with the Bendigo Things Network noted below.

**High capacity digital infrastructure already in place**

Loddon Campaspe boasts a range of digital assets that provide the beginnings of a more comprehensive rollout across the key hubs of the region. Within the Bendigo CBD there is underutilised dark fibre capable of being better leveraged to improve services to residents, businesses and visitors in the area. Loddon Campaspe also has five IoT gateways already established by the Bendigo Things Network spearheaded by La Trobe University in partnership with City of Greater Bendigo, Coliban Water, Bendigo Telco and Match X.

There is already lots of work happening around digital initiatives across Loddon Campaspe alongside the production of this Digital Plan. Our stakeholders see the opportunities and are working to make them a reality. We want governments, industry and community groups to work with us to propel this activity forward and help us realise our goal to be the most digitally connected region of Australia, delivering substantial economic and social benefits to our stakeholders and the Victorian economy.

This plan will help to ensure emerging technologies like IoT, 5G and artificial intelligence are capitalised on for the significant opportunities they represent, rather than presenting risks to jobs and competitiveness from a lack of preparedness.

Between the infrastructure gaps identified in this plan and the existing elements described above we have the pieces we need to set Loddon Campaspe apart as a digital leader. This plan sets out the recommendations and initiatives we see as vital to realise this opportunity.

A key priority for the Regional Partnership building off this plan is to develop a strategy using this information that will articulate the specific projects that are needed to unlock the potential of our region. Citizen-focussed use cases and problem statements are an important aspect of prioritising digital connectivity projects and investments.

## *Priority projects and recommendations*

Based on the analysis contained in this plan and stakeholder and working group consultation, the Loddon Campaspe Regional Partnership has identified its priority projects and recommendations as set out below.

### Priority projects

The priority projects listed below represent an initial package of projects the Regional Partnership considers will significantly improve the digital connectivity landscape across the region and meaningfully move us towards our ambition of being a leading region for digital services.

The Regional Partnership and working group will undertake detailed strategy development on this package of projects to further develop the initiatives for cost-benefit analysis. This work will include identifying the scale of funding required for their implementation and proposed timeframes.

**Project 1**

Analyse the benefits of utilising the existing infrastructure, platforms and assets to support other digital initiatives across the region, including those listed below.

**Project 2**

Roll out very fast connectivity in Bendigo and the region's other major centres, including along the Gisborne - Bendigo - Echuca corridor.

**Project 3**

Roll out free public WiFi in the region's major and smaller centres, such as has been done with the Victorian and local government supported free public WiFi network in Bendigo.

**Project 4**

Rural community access to telehealth is needed to reduce the inequalities in health service access and provision. Infrastructure investment is required to enable both group activity in larger spaces and more private telehealth access to consult geographically distant health professionals.

**Project 5**

Develop Loddon Campaspe as a "smart region" with IoT applications to improve social amenity, environmental sustainability and economic efficiency across the region.

## Regional Partnership priority recommendations

The recommendations relate to actions the Regional Partnership will advocate and, in some circumstances, undertake, but also which fall into the responsibilities of other stakeholders, including local, Victorian and Commonwealth governments, industry and community groups.

The Regional Partnership will use this report to advocate to these stakeholder groups on the recommendations they should consider and act on to address the digital issues affecting our region and unlock the potential of our region's existing digital assets and strengths. The recommendations are arranged under key themes that have been revealed through the analysis in this plan and stakeholder consultation.

**Strategy Development**

1. The Loddon Campaspe Regional Partnership will lead the development of a digital infrastructure strategy using this plan as the underlying evidence base. The strategy will detail the key steps, initiatives and investments over the next three years which are needed to achieve our vision of being the leading national region on digital connectivity and utilisation. The Regional Partnership will seek to leverage the Regional Digital Fund to access funding support to develop this strategy and undertake a detailed cost-benefit analysis of the strategy's package of initiatives.
2. Local governments should use this plan to work with the Regional Partnership and business and community stakeholders to identify the priority digital infrastructure supply shortfalls in their region and the projects that will most significantly unlock the economic potential of their region, for input to the Regional Partnership's strategy development.

**General**

3. The Commonwealth and Victorian Governments should continue and expand funding programs aimed at addressing identified gaps in digital infrastructure as outlined in this plan which put these locations at a disadvantage compared to metropolitan users. The emphasis of these 'gap programs' should be on addressing mobile blackspots and inadequate fixed broadband services.
4. The Victorian Government should support the establishment of a regional digital coordination office for Loddon Campaspe and other interested regions whose function will be to ensure digital opportunities (policy, programs, infrastructure investments) are developed in coordination with regional stakeholders and they have meaningful opportunities to influence funding allocation and to participate in program and investment delivery.
5. Government investment into regional infrastructure should be implemented with a focus on ensuring procurement emphasises opportunities for local stakeholders and businesses to deliver projects and influence funding decisions. Government procurement of digital services should also be leveraged to deliver higher-capacity digital infrastructure closer to regional users.

**Mobile/5G connectivity**

6. The Commonwealth and Victorian governments should commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas, coupled with a review of blackspot funding as investment extends into ever more marginal areas. Blackspot funding should include consideration of where coverage is too poor to support reliable voice and data functions, not only locations where there is no coverage.
7. The Victorian Government should work with local governments and Regional Partnerships, similar to the process for engaging with the Mobile Blackspots Program, to develop a 5G priority locations list and advocate to mobile network operators to influence 5G rollout to these locations. The Commonwealth and Victorian governments should also examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand regional areas.

**IoT Networks**

8. Victorian and Commonwealth governments should pilot a low power (LP-WAN) IoT blackspot program and consider an LP-WAN network rollout market facilitation model, such as like the Victorian Government's pilot Agriculture-IoT program, which should be expanded to target other strategic industries including health, education and manufacturing.

**WiFi**

9. The Victorian Government should continue to provide funding for free public WiFi networks in population centres of greatest need and advocate for the Commonwealth Government to do the same to meet local social needs and attract visitors. They should also examine sustainable public WiFi co-investment models such as the state or Commonwealth government meeting the capital costs and local governments (or mobile network operators) meeting the operating costs.
10. The Victorian Government should explore the potential of implementing WiFi services on regional rail lines.

**Fixed Broadband Services**

11. NBN Co should implement stronger service connection and maintenance requirements for NBN services to underpin the service-related obligations that legislation imposes on RSPs and ensure service quality meets regional stakeholder requirements and expectations.
12. The Victorian Government should work with local governments and the Regional Partnership to support the delivery of competing fixed broadband networks for businesses in high-demand areas, such as with the recent Enhanced Broadband projects taking place in Horsham and Morwell. These projects should be used to explore ways of improving the quality and cost of backhaul infrastructure to regional locations.

**Backhaul**

13. The Victorian Government should establish a process by which local governments and regional businesses and community groups can access state-owned telecommunications infrastructure to extend higher-capacity infrastructure to their area.
14. The Regional Partnership will advocate for the development of a commercial model for the extension of fibre to key regional locations and how existing and future businesses should pay for and access this fibre. Regional government offices able to benefit from these infrastructure upgrades should commit to being lead customers on these projects.

**Education and Skills**

15. The Victorian Government should develop, in consultation with the Regional Partnership and stakeholders, new programs to support digital upskilling and recruitment of digital skills to regional businesses and their adoption of productivity enhancing technologies including IoT applications, data analytics platforms and forthcoming technologies related to 5G mobile networks and artificial intelligence.
16. The Victorian Government should fund research that addresses the digital skills and service affordability

information gaps revealed in developing the Digital Plan and examine the case for investing in digital education and training programs, focusing the training across regions as more information on skills needs are revealed.

17. The Victorian Government, alongside the Regional Partnership and local governments should examine the merits of implementing multipurpose digital hubs that can address a range of access, skills and affordability needs (including providing access to reliable high-speed broadband access for those in NBN fixed wireless and satellite footprints).

## *Overview of key issues*

The extensive analysis and consultation undertaken in developing this Digital Plan has identified a range of digital issues across the region, which at a high level are summarised below. Specific 'hot spots', places identified with inadequate digital services, are identified in the heat map tables in the sections below.

Importantly, the analysis in this Digital Plan has reviewed regional cities, towns and localities down to around 500 people. Further analysis will be required to understand the digital infrastructure characteristics of localities smaller than this and whether they face unique issues and unmet needs compared to those identified below.

**Need for better mobile access**

There is a persistent and significant divide in the quality of mobile services available to regional users compared to metropolitan users with important implications for public safety, economic development and general liveability. Regional users have emphasised this issue recently, **registering 312 blackspots**[3] experienced across the region as part of the Commonwealth's black spot funding program.

The Loddon Campaspe Digital Plan has necessarily relied on public mobile coverage maps provided by the mobile network operators to undertake its analysis of mobile coverage. The analysis reveals the maps to be too high-level and low resolution to enable identification of localised areas where coverage is unreliable, weak and incapable of supporting the data services which users have come to expect to access 'on-demand'. This means that while an area may appear well-served by these maps, the 'lived experience' of regional users at particular locations is often very different. As such, throughout this Digital Plan, where a place or sector is assessed as having good mobile coverage based on public coverage maps, this should not be interpreted as saying there are not users in those places who face challenges with their mobile services both within that place and when they move beyond the place analysed. Better data in the future can provide a more complete picture about mobile coverage issues within towns and in areas not yet analysed by the Digital Plans.

The Loddon Campaspe Regional Partnership calls for continued Commonwealth and state funding to address mobile coverage issues and better data from mobile network operators to enable more informed funding decisions. While it appears none of the larger communities require systematic mobile blackspot attention, localities with populations below 1,000 people should be reviewed and mobile 'unmet needs' prioritised. The Regional Partnership plans to work with the Victorian Government to identify priority mobile blackspots in the region.

**Lack of WiFi networks to support disadvantaged residents and tourists**

WiFi for disadvantaged residents and visitors to reliably access the internet in low income areas is lacking, with four low income places identified as facing a major supply shortfall and a further five assessed as having an intermediate supply shortfall. The Regional Partnership has identified a broader rollout of WiFi to major centres and smaller localities with high demand as a priority project for the region.

[3] Based on the Commonwealth's *National Mobile Black Spot Database*, last updated October 2018

**Need to support business utilisation of IoT networks and applications**

At this stage, low-power IoT network supply has largely been found to be sufficient given the low-level, nascent demand for these networks and applications by regional businesses currently. Supply is reasonably good across the region, supported by the presence of five IoT network gateways in the region. However, future competitiveness of these businesses in the next three-to-five years may be compromised if regional businesses are not supported in adopting and utilising the technologies these networks enable, as demand is expected to increase significantly. Monitoring the development of these networks alongside demand growth will be important to ensure user needs are met and industry growth is supported. This represents a priority project of the region to improve social amenity, environmental sustainability and economic efficiency across the region.

**Need for upskilling to encourage technology adoption**

Due to a lack of primary data on digital skills issues, the Digital Plan has used secondary measures of digital skills needs and availability. Together these measures suggest a skills shortfall in the Loddon Campaspe region relative to Melbourne, and differences between LGAs. Generally, the problem of digital literacy and skills availability is more intense the further the distance from a major population centre. This issue can have substantial impacts on future economic development as all aspects of life and business become increasingly digitised.

Loddon Campaspe has many leading users of digital networks, but there are also many businesses being left behind. Government support to upskill these businesses and raise awareness of the existing opportunities and emerging technologies like IoT, 5G, data analytics and artificial intelligence is needed, building a culture of technology adoption and use across businesses in the region.

**Support is needed to leverage Loddon Campaspe's comparative strengths**

Already highlighted in this document are a range of strengths Loddon Campaspe possesses which can help it to become a national digital leader. Stakeholders are already working across a variety of initiatives to make this a reality, however more can be done to fast track this development. Further work is needed to develop a detailed digital strategy for the Loddon Campaspe region, setting out the range of priority projects, funding and timeframes required to join the region's assets and leverage its strengths to unlock the digital opportunities of the region. The Regional Partnership is seeking a commitment from governments to support this objective.

**Concerns regarding adequate NBN business-grade services**

The availability of adequate, business-grade services for regional businesses across all NBN technology types (i.e. FTTP, FTTC, FTTN, fixed wireless and satellite) remains a concern, despite the introduction of NBN's Enterprise Ethernet business service which may address the issue for user groups that have been provisioned with the highest capacity NBN technologies. The provision of adequate business-grade services is about speed as well as quality and resilience of services, requiring adequate Service Level Agreements (SLAs) to be established to ensure connections meet the needs of business users.

Loddon Campaspe is well positioned to develop alternative fibre networks that can deliver higher capacity services to businesses across the region. Bendigo has access to existing dark fibre, and the geographical advantages of the region present opportunities to extend such infrastructure to key hubs across the region to significantly uplift fixed line connectivity for businesses. Delivering very fast connectivity across Bendigo and the region's other major centres, including along the Gisborne-Bendigo-Echuca corridor is a priority project of the Regional Partnership.

**Digitalization of some industries will have a bigger impact on the region than others**

Analysis of the digital intensity requirements of the eight industries representing 73 per cent of Loddon Campaspe employment reveals that five of the industries will rely more heavily on digital services over the next three-to-five years. These include health care and community assistance, tourism and agriculture/forestry. Government investments into health such as through the Commonwealth Home Support Program will increase demand for telehealth, further increasing the need for better digital connectivity. Farms involved in the tourism industry

across the region, such as through wineries and farm stays, report poor digital connectivity affecting their ability to utilise e-commerce and limiting business operations and growth.

Supporting increasing digitalization of these industries over the next three-to-five years will be critical for future productivity, competitiveness and growth for the region with a special emphasis needed on the digital skills required to support these industries.

**Digital divides within communities**

Beyond the broad digital divide between metropolitan and regional areas, there also exist digital divides within streets, suburbs and local government areas within the region. For example, where NBN infrastructure cuts over from fixed line broadband to fixed wireless technology, businesses and homes on either side of the technology boundary will experience different service quality. Understanding where these boundaries exist and adversely impact businesses is important to address disadvantage within localities and support economic development.

**Poor services for primary production and tourism**

The high-level picture for households and businesses in primary production areas and at more isolated tourist sites is of concern, with mobile coverage for farms and tourists lacking. There is also below-par fixed connectivity for farm offices and homesteads and tourist site operators (including for provision of on-site WiFi for visitors), potentially affecting economic outcomes for businesses in these areas. To enable uptake of IoT applications in primary production, IoT infrastructure is being set up in trial regions around Victoria in a $12 million program to help place Victorian farmers at the forefront of the digital agriculture revolution. One of the trial locations is Serpentine within the Loddon Campaspe region which focuses on the sheep farming industry. To enable uptake of IoT applications in primary production, there needs to be comprehensive coverage of IoT networks on farms.

**Households are generally well served by existing services**

Households in population centres down to quite small localities (500 residents) generally appear well served with effective fixed and mobile connectivity. However, it is difficult to reliably conclude what level of mobile service residents in an area receive based on the public coverage maps provided by mobile network operators due to the coverage data limitations noted above.

## *Summary of digital infrastructure analysis and gaps*

This section provides a summary of the digital infrastructure gaps identified across the Loddon Campaspe region. Further detail on these findings and the supporting evidence can be found in the following **Sections 2** and **3**.

The digital connectivity needs of businesses, households, farms, tourist site operators and visitors differ across regional locations. As such, digital supply and demand analysis throughout this report includes an overlay of both places and sectors as follows:

- **Significant Places** – looks at the demand and supply of digital infrastructure and services in the most populated cities, towns and localities of the region to identify where existing infrastructure is unable to meet current demand for businesses, households and the community.
- **Primary Production** – looks at the most economically significant primary production industries in the region, focusing on the availability of wireless technologies like NBN fixed-wireless, mobile and Low-Powered Wide Area Networks (that support Internet of Things applications like remote sensors) which are most relevant to primary production businesses
- **Tourism** – looks at the supply of and demand for digital services in the most important tourist attractions / locations in the region, and
- **Transport Corridors** – looking at the availability of mobile services along the region's key transport routes.

The other lens through which digital needs has been assessed is the technology type. The following technologies form the basis of the digital infrastructure analysis of the report:

- **Fixed access –** includes National Broadband Network (NBN) fixed-line broadband services including fibre to the premises (FTTP), fibre to the node (FTTN), fibre to the curb (FTTC), fixed wireless and satellite
- **Mobile –** availability of digital mobile networks capable of supporting voice telephony and data applications through 4G networks (3G coverage is considered sub-standard)
- **WiFi –** the availability of public WiFi services such as through public libraries and buildings, information centres and other local government initiatives
- **LP-WAN IoT –** the availability of Low Powered Wide Area Networks that can support Internet of Things applications like remote sensors and devices which are becoming increasingly relevant to industry applications.

Further detail on these technology types and the rating methodology used in assessing them is included in **Section 2**. The sections below summarise the identified infrastructure gaps across the region according to a heat map table that compares the supply and demand of digital infrastructure for Significant Places, Primary Production, Tourism and Transport Corridors. The colours in the maps should be interpreted as follows:

- Green = the supply of digital infrastructure is suitable to meet its demand
- Amber = there is an intermediate supply shortfall, for example where a place has a medium supply of a technology but a high demand
- Red = there is a major supply shortfall, for example where a place has a low supply of a technology but a high demand.

**Section 3** includes the supporting evidence which has been used to undertake this analysis and develop the ratings. It brings together coverage data for digital infrastructure such as public coverage maps from mobile phone mobile network operators and NBN Co, as well as demographic data for each place provided largely from Australian Bureau of Statistics census data.

Also supporting the analysis is a newly developed data repository and visualization tool, called the State-Level Information Management (SLIM) database, developed by the Victorian Government that aggregates digital infrastructure data across the state. This tool includes more detailed coverage data in some instances which is not yet publicly available, but which has been used to inform the analysis.

Supply for a technology type is rated high when the services available are similar to what is available across much of metropolitan Melbourne. For example, a high supply of fixed line broadband for businesses is regarded when there is FTTP or FTTC services available from NBN – supply for households is rated high where NBN FTTN is available. For mobile services, a location is considered to have high supply for both business and households where there are at least two network operators available in a location providing 4G services. As the quality and choice of services degrades in a place so too does the supply rating.

However, for mobile coverage analysis in particular it is important to note that the public coverage maps are not sufficiently detailed to ensure the real-world experience of mobile services in a given location is accurately reflected by the coverage maps. As such, mobile coverage analysis is a best-efforts attempt at reviewing the level of mobile coverage in a location and whether there are multiple mobile network operators operating in a given location. A green rating in a given place does not imply all users are able to achieve good services; just that public coverage data suggests the area is relatively well covered by multiple providers. Technical limitations and the relatively lower levels of infrastructure investment in a given area in regional locations together combine to mean that the experience for regional mobile users is generally inferior to that in metropolitan areas, despite perhaps appearing well served according to public coverage maps.

Demand for a technology type is informed by independent expert advice about the current economic landscape and usage of digital services. **Fixed broadband** and **mobile service** demand is rated high across the board reflecting the ubiquitous demand across households and businesses to be able to access these services whenever required to perform a range of activities. Demand by businesses for **LP-WAN/IoT** services in larger centres and for farms is rated medium, and low for businesses in smaller centres and households, both of which become higher in three-to-five years reflecting the rapidly increasing interest in IoT applications. Demand for **WiFi** is rated according to average income levels in a place, with lower income levels correlated with higher demand for the ability of these services to fill connectivity gaps for more disadvantaged residents.

Further detail on the heat map tables below and the analytic approach that underpins them is included in **Section 2**.

## *Significant places findings*

Digital supply-demand balance for selected significant places is shown in Table 1, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about good coverage indicated by public coverage maps.***

Key findings:

- 22 Significant Places were analysed in the plan; all towns above 1,000 population, plus the next largest town below 1,000 population from each local government area.
- There are fixed broadband supply issues for businesses in all 22 of the places that were analysed for business needs (noting the six smallest localities have only been assessed on household and community needs). This finding highlights a lack of adequate NBN business-grade services over the lower quality NBN connections like FTTN and fixed wireless.
- There are fixed broadband supply issues for households in four of the six smallest localities analysed, again reflecting the lower capacity NBN fixed wireless infrastructure generally rolled out in these locations.
- Mobile access appears to be generally good for the significant places analysed, noting that public coverage maps do not reveal specific spots where coverage is weak and services do not meet user needs and expectations. Moving beyond these population centres, mobile services tend to degrade in quality and reliability.
- There is mixed coverage of LP-WAN/IoT networks but is only identified as an intermediate issue for business in two locations, due to the relatively low demand at present but which is expected to grow strongly in coming years

- At present, supply of public WiFi is medium or low in all places considered, with the exception of Bendigo where a free public WiFi pilot project has been rolled out. A major WiFi supply shortfall has been identified in four of the seven smallest localities analysed based on having below-average household incomes, with another five places having an intermediate shortfall.
- Further local data collection is required to identify skills gaps and support the analysis needed to determine if remedial action is required

*Table 1 Significant places: current unmet digital access needs.*

| Place | LGA | Name | User Type | Access | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fixed Supply / Demand | Mobile* Supply / Demand | LP-WAN IoT Supply / Demand | WiFi Supply / Demand |
| City | Bendigo | **Bendigo** (pop. 92,384) | Business | M/H | H/H | M/M | n.a. |
| | | | Home | H/H | H/H | M/L | H/L |
| | | | Community | n.a. | H/H | n.a. | H/L |
| | Campaspe | **Echuca** (pop. 18,523) | Business | M/H | H/H | M/M | n.a. |
| | | | Home | H/H | H/H | M/L | M/L |
| | | | Community | n.a. | H/H | n.a. | M/L |
| Town | Mount Alexander | **Castlemaine** (pop. 9,933) | Business | M/H | H/H | M/M | n.a. |
| | | | Home | H/H | H/H | M/L | M/M |
| | | | Community | n.a. | H/H | n.a. | M/M |
| | Macedon Ranges | **Gisborne** (pop. 9,822) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | L/L |
| | | | Community | n.a. | H/H | n.a. | L/L |
| | Central Goldfields | **Maryborough** (pop. 7,495) | Business | M/H | H/H | L/M | n.a. |
| | | | Home | H/H | H/H | L/L | M/H |
| | | | Community | n.a. | H/H | n.a. | M/H |
| | Campaspe | **Kyabram** (pop. 5,899) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | M/M |
| | | | Community | n.a. | H/H | n.a. | M/M |
| | Macedon Ranges | **Kyneton** (pop. 4,866) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | M/L |
| | | | Community | n.a. | H/H | n.a. | M/L |
| | Macedon Ranges | **Romsey** (pop. 3,871) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | M/L |
| | | | Community | n.a. | H/H | n.a. | M/L |
| | Macedon Ranges | **Woodend** (pop. 3,775) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | M/L |
| | | | Community | n.a. | H/H | n.a. | M/L |
| | Macedon Ranges | **Riddells Creek** (pop. 3,168) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | L/L |
| | | | Community | n.a. | H/H | n.a. | L/L |
| | Macedon Ranges | **Macedon** (pop. 2,807) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | L/L |
| | | | Community | n.a. | H/H | n.a. | L/L |
| | Campaspe | **Rochester** (pop. 2,722) | Business | M/H | H/H | M/M | n.a. |
| | | | Home | H/H | H/H | M/L | L/M |
| | | | Community | n.a. | H/H | n.a. | L/M |
| | Bendigo | **Heathcote** (pop. 1,720) | Business | M/H | H/H | L/M | n.a. |
| | | | Home | H/H | H/H | L/L | M/H |
| | | | Community | n.a. | H/H | n.a. | M/H |
| | Macedon Ranges | **Lancefield** (pop. 1,465) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | L/L |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | Community | n.a. | H/H | n.a. | L/L |
| | Campaspe | **Tongala** (pop. 1,313) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | L/M |
| | | | Community | n.a. | H/H | n.a. | L/M |
| | Mount Alexandra | **Maldon** (pop. 1,263) | Business | M/H | H/H | M/M | n.a. |
| | | | Home | H/H | H/H | M/L | L/H |
| | | | Community | n.a. | H/H | n.a. | L/H |
| Local | Campaspe | **Rushworth** (pop. 962) | Home | M/H | H/H | H/L | L/H |
| | | | Community | n.a. | H/H | n.a. | L/H |
| | Bendigo | **Marong** (pop. 923) | Home | H/H | H/H | H/L | L/L |
| | | | Community | n.a. | H/H | n.a. | L/L |
| | Central Goldfields | **Carisbrook** (pop.586) | Home | H/H | H/H | H/L | L/M |
| | | | Community | n.a. | H/H | n.a. | L/M |
| | Loddon | **Boort** (pop. 750) | Home | M/H | H/H | H/L | L/H |
| | | | Community | n.a. | H/H | n.a. | L/H |
| | Macedon Ranges | **Malmsbury** (pop. 642) | Home | M/H | H/H | L/L | L/L |
| | | | Community | n.a. | H/H | n.a. | L/L |
| | Mount Alexander | **Newstead** (pop. 574) | Home | M/H | H/H | L/L | L/H |
| | | | Community | n.a. | H/H | n.a. | L/H |

***Legend*** **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand.

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level.

## *Primary production findings*

Digital supply-demand balance for selected primary production areas is shown in Table 2, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about good coverage indicated by public coverage maps.***

Key findings:

- There are fixed broadband supply issues for businesses and households in all primary production places analysed, reflecting the lack of quality fixed infrastructure in the more remote, sparsely populated locations
- While only one place analysed (dairy grazing west of Mitiamo) was found to have a mobile service supply shortfall, the reported experience of regional users suggests that service quality issues, especially in these remote locations, are more pronounced than suggested by the public coverage maps
- It is anticipated fixed access supply will change little in the next three-to-five years without policy intervention while demand continues to rise. The potential for oncoming 5G services to address this shortfall is limited given the cost of delivering these networks to rural and remote areas
- Low bandwidth IoT network supply-demand balance is in transition – supply is predominantly reasonable (high or medium) relative to low-level, nascent demand, but this is expected to rise substantially over the next three-to-five years
- While broadacre cropping was not explicitly analysed within the Digital Plan, it is worth noting it is another important aspect of the region's primary production industry.

*Table 2 Primary production areas: current unmet digital access needs*

| Land Use | Location | User Type | Access | | |
|---|---|---|---|---|---|
| | | | **Fixed** Supply / Demand | **Mobile*** Supply / Demand | **LP-WAN IoT** Supply / Demand |
| Dairy & beef grazing | North of Kyabram | Business | L/H | H/H | H/M |
| | | Home | M/H | H/H | H/L |
| | Around Rochester | Business | L/H | H/H | H/M |

| | | | | | |
|---|---|---|---|---|---|
| | | Home | M/H | H/H | H/L |
| Dairy grazing | West of Mitiamo | Business | L/H | M/H | H/M |
| | | Home | L/H | M/H | H/L |
| Sheep meat & wool grazing | Northeast of Maryborough | Business | L/H | H/H | L/M |
| | | Home | L/H | H/H | L/L |
| | Northeast of Woodend | Business | L/H | H/H | H/M |
| | | Home | L/H | H/H | H/L |

***Legend*** **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand.

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level.

## *Tourism findings*

Digital supply-demand balance for selected primary production areas is shown in Table 3, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about good coverage indicated by public coverage maps.***

Key findings:

- Tourist sites include year-round attractions, periodic events and trails
- Only fixed and mobile connectivity is relevant, as WiFi services for tourists must be supported through fixed broadband connectivity of tourism operators
- Nearly all tourism sites analysed have a major supply shortfall in fixed connectivity (with the exception of Victorian Goldfields Railway and Central Deborah Goldmine which have an intermediate shortfall). This compromises the potential for operators to provide WiFi services for tourists and visitors.
- Half of the 14 tourist sites have an intermediate or major shortfall in mobile connectivity, noting reservations about the reliability and quality of mobile services even in the seven locations assessed as adequate
- Looking forward three-to-five years, this pattern is expected to still prevail without intervention – it is unlikely market forces alone will sufficiently improve mobile infrastructure in these locations given the relatively low population densities.

*Table 3 Tourist locations: current unmet needs*

| Type | Location | LGA | User Type | Access | |
|---|---|---|---|---|---|
| | | | | **Fixed** Supply / Demand | **Mobile*** Supply / Demand |
| Permanent | Hanging Rock | Macedon Ranges | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |
| | Victorian Goldfields Railway | Mount Alexander | Operator | M/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Paddys Ranges State Park Maryborough | Central Goldfields | Operator | L/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Central Deborah Gold Mine | Greater Bendigo | Operator | M/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Melville Caves Picnic Area - Kooyoora State Park | Loddon | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |
| | Turpins Falls | Mount Alexander | Operator | L/H | L/H |
| | | | Visitor | n.a. | L/H |
| | Murray River | Campaspe | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |
| Events | Riverboats Music Festival | Campaspe | Operator | M/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Art in the Vines | Macedon Ranges | Operator | L/H | H/H |

| | | | | | |
|---|---|---|---|---|---|
| | | | Visitor | n.a. | H/H |
| | Loddon Valley Food and Wine Expo | Loddon | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |
| | Southern 80 | Campaspe | Operator | L/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Newstead Live | Mount Alexander | Operator | L/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Maryborough Highland Gathering | Central Goldfields | Operator | M/H | H/H |
| | | | Visitor | n.a | H/H |
| | Energy Breakthrough | Central Goldfields | Operator | M/H | H/H |
| | | | Visitor | n.a | H/H |
| | Talbot Farmers' Market | Central Goldfields | Operator | L/H | H/H |
| | | | Visitor | n/a | H/H |
| Trails | O'Keefe Rail Trail | Greater Bendigo | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |
| | Goldfields Track | Central Goldfields, Mount Alexander | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |

***Legend*** **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand.

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level. Outdoor coverage is considered to be generally sufficient for tourist locations.

## *Transport corridors findings*

Digital supply-demand balance for selected primary production areas is shown in Table 4, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about good coverage indicated by public coverage maps.***

Key findings:

- Indicative analysis of mobile coverage (the only relevant technology here) was undertaken on a selection of roads and rail lines in the region to demonstrate the place and sector approach for transport corridors and note any preliminary patterns, noting the limitations of the public coverage maps relied upon
- While there is often some form of mobile coverage on many roads, the lack of continuous service greatly diminishes the value of coverage, with poor ability to utilise data services and voice services that drop in and out
- There appears to be reasonable 4G mobile coverage on major (A-grade) thoroughfares and significant (B-grade) roads, with generally poor coverage on minor (C-grade) roads, noting the limitations of the data available to provide a complete picture of service quality and continuity along roads that appear to be well served
- Mobile coverage of rail routes appears to be generally good from Melbourne to Bendigo and Bendigo to Echuca, but poorer in more remote and less busy rail corridors such as Ballarat to Maryborough and Bendigo to Swan Hill.

*Table 4 Transport corridors: current unmet needs*

| Road Class | ID | From | To | Comment | Mobile* Supply / Demand |
|---|---|---|---|---|---|
| A/B | M79 | Sunbury | Ravenswood | 4G coverage by three mobile network operators | H/H |
| | A79 | Charlton | Wedderburn | 4G coverage by three mobile network operators | H/H |

| | | | | | |
|---|---|---|---|---|---|
| | A790 | Ravenswood | Marong | 4G coverage by three mobile network operators | H/H |
| | B260 | Bendigo | Macorna | Continuous 4G coverage by one carrier only | M/H |
| | B280 | Bendigo | Heathcote | Partial 4G coverage by two mobile network operators for part of journey | L/H |
| | A300 | Bendigo | Stanhope | Continuous 4G coverage by three mobile network operators | H/H |
| | B400 | Gunbower | Wyuna | Continuous 4G coverage by one carrier only | M/H |
| | B75 | Echuca | Heathcote | Partial 4G coverage by three mobile network operators | L/H |
| | B180 | Elphinstone | Avoca | Continuous 4G coverage by at least two mobile network operators | H/H |
| | B240 | Marong | Logan | Continuous 4G coverage by one carrier only | M/H |
| C | All | 86 roads | | Patchy/low coverage | L/H |
| Rail | | Bendigo | Melbourne | 4G coverage by three mobile network operators | H/H |
| | | Bendigo | Echuca | 4G coverage by three mobile network operators – in-carriage reception uncertain | H/H |
| | | Bendigo | Swan Hill | Partial 4G coverage by three mobile network operators – in-carriage reception uncertain | L/H |
| | | Ballarat | Maryborough | Continuous 4G coverage by one carrier – in-carriage reception uncertain | M/H |

***Legend*** **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand.

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level.

# SECTION 2 – Detailed issues analysis and recommendations

This section of the report elaborates on the findings and recommendations presented in **Section 1**. Further explanation of the rating methodology used in generating the heat maps analysis is provided, along with more detailed commentary about the findings.

The recommendations from **Section 1** are also included throughout this section within the discussion of technology limitations as well as alongside the analysis for each place and sector perspective of Significant Places, Primary Production, Tourist Locations and Transport Corridors.

## *Summary*

Analysis of digital supply and demand is conducted on a place and sector basis across the region to provide the evidence base necessary for effective digital planning. The map and table below capture high level findings for the Loddon Campaspe region.

**Loddon Campaspe unmet needs hotspots: fixed broadband and mobile access**

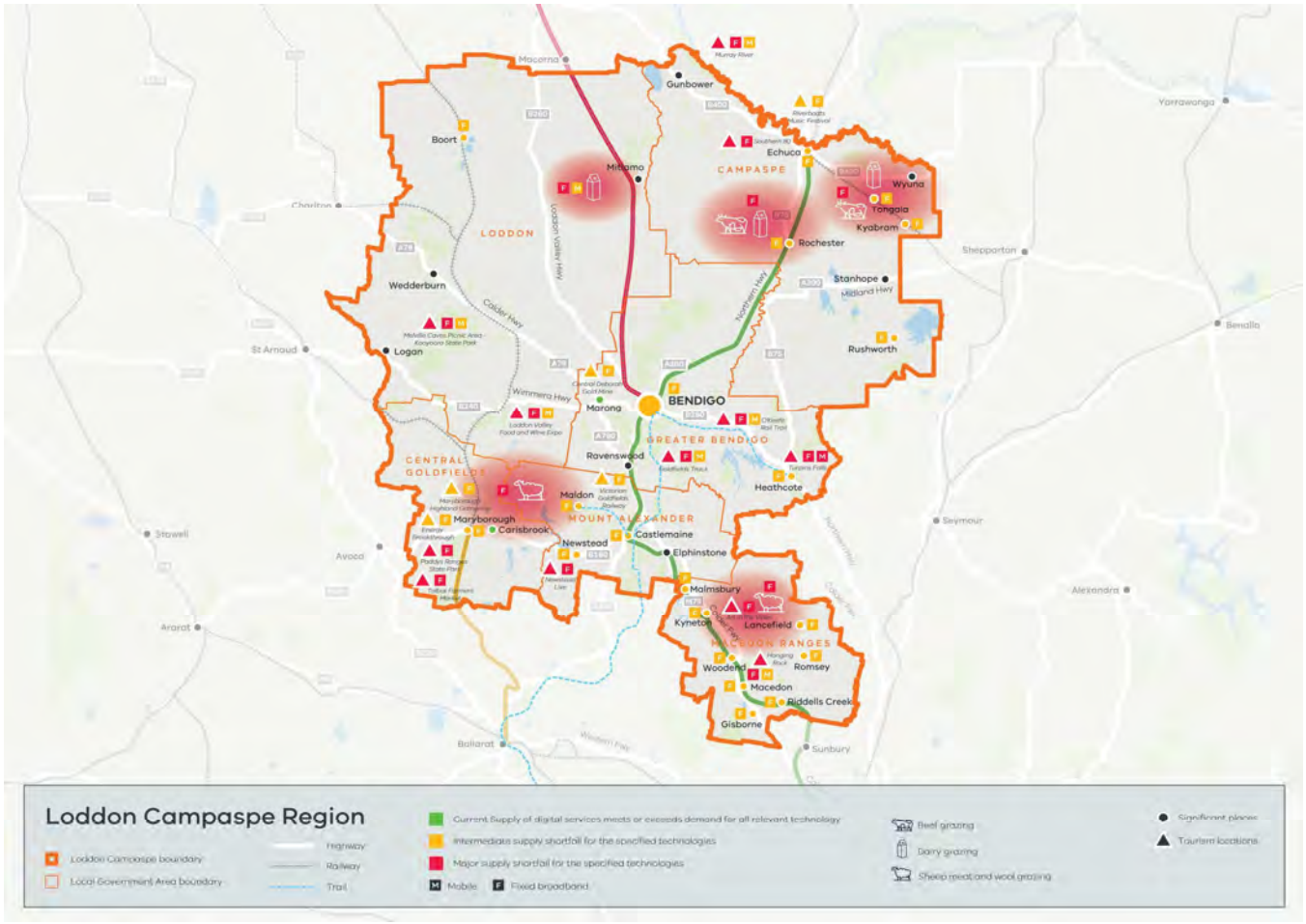



*Figure 1 Loddon Campaspe unmet needs hotspots: fixed broadband and mobile access*

*Table 5 Summary of digital infrastructure demand characteristics and 'unmet needs' for different user groups*

| Place/sector (typology) | Demand characteristics (place/user) | Digital 'unmet needs' |
|---|---|---|
| **Significant places** | | |
| *Businesses* | Concentration of public services (education, health, admin), retail, small business in cities, larger towns | Access to effective business-grade broadband, including on town fringes<br>Improved digital skills |
| *Households* | High-medium population densities, suitable for NBN fixed line services | Access to affordable, high-capacity broadband<br>Improved digital skills |
| *Communities* | Varying digital literacy & ability to afford broadband | Access to affordable broadband (including public WiFi)<br>Increased digital skills |
| **Primary production areas** | | |
| *Farming* | Low population density<br>Variety of farming systems – broadacre cropping & grazing, intensive horticulture & livestock<br>Increasing use of digital farming<br>Varying digital literacy | Mobile coverage<br>Customised solutions (e.g. on-farm WiFi)<br>Broadband & narrowband IoT coverage<br>Digital literacy – farmers, farm service providers |
| **Tourist sites** | | |
| *Permanent attractions* | Both town & remote locations<br>Visitors with high digital literacy & dependence (e.g. TripAdvisor, GPS, Facebook) | Mobile coverage<br>Public WiFi – general and site-specific<br>High bandwidth fixed broadband for WiFi backhaul |
| *Events* | Highly seasonal/periodic | Temporary mobile peak capacity requirements<br>High bandwidth fixed broadband for WiFi backhaul |
| **Transport corridors** | | |
| *Road* | Motorists & freight<br>Mix of major (VicRoads) & minor (local council) roads | Continuous mobile coverage |
| *Rail* | Passengers<br>Increased need for high quality mobile 4G (5G) connectivity | In-carriage reception on rail services between Bendigo and Swan Hill |

### Fixed Connectivity

Available fixed broadband connectivity does not meet the needs of many businesses across the Loddon Campaspe region due to technology limitations – the predominance of NBN FTTN in cities and towns will limit uniform access to effective NBN business-grade services due to the technical limitations of this service. In smaller localities, on the fringe of larger centres and in rural and remote areas, broadband for **businesses** is further compromised by fixed wireless and satellite technologies.

The fixed broadband needs of **households** in larger population centres are generally met at present, but the needs of households in smaller localities (less than 1,000 residents), on the fringe of larger centres and in rural and remote areas are compromised by having access only to NBN fixed wireless and satellite technologies.

### Mobile Connectivity

Mobile coverage generally appears to be good in Loddon Campaspe cities, towns and localities down to 500 residents, and on significant roads and rail links based on analysis of publicly available mobile coverage maps.

However, we know from consistent feedback and concerns of regional users that mobile service continuity and quality in many locations is a real concern.

Mobile coverage for farms and tourists is lacking, exacerbating digital limitations from below-par fixed connectivity for farm offices and homesteads and tourist site operators. Mobile coverage on major roads appears to be generally good, while coverage and performance is unsatisfactory for more minor roads and in many rural and remote areas. Poor in-carriage mobile reception may occur on trains beyond Bendigo.

Undertaking the mobile coverage analysis as part of this plan has highlighted the lack of high-resolution coverage maps from mobile network operators which show real-world performance (i.e. where coverage can support only voice services or more data-intensive activities as well such as web-browsing and mobile applications). This issue is elaborated on below and highlights the need for better data from mobile network operators to enable more informative analysis and identification of priority mobile blackspots in future iterations of this digital plan.

Limits to widespread remediation to these fixed connectivity and mobile coverage issues exist, as the per-user costs of improving fixed line access and blanket mobile coverage rise exponentially with remoteness.

**IoT Connectivity**

Limited low bandwidth Internet-of-Things (LP-WAN IoT) coverage exists for some cities, towns and primary production areas in the Loddon Campaspe. While demand is currently moderate to low, coverage needs to be increased over the next three-to-five years for the adoption of next-generation business practices.

Significantly for farms, IoT connectivity is patchy or non-existent for many broadacre farms, limiting future competitiveness of these businesses in the next three-to-five years unless IoT access improves.

**Public WiFi**

Public WiFi coverage is patchy and warrants careful consideration of how shortfalls are best addressed.

There is also the important and challenging issue of digital ‘have nots’ amongst the ‘haves’. It is critical these ‘below the surface’ digital divide issues are not overlooked.

## *General infrastructure and technology issues*

### Mobile network coverage

Mobile coverage (service availability) depends on local topography and the location and aerial orientation of mobile towers. Users closer to the fringe of a mobile tower’s coverage will receive weaker signal strength and the lower population and revenue densities of regional markets and the larger areas in which people live means there is less mobile infrastructure in a given area compared to metropolitan areas. For these reasons mobile coverage is absent or poor quality in some regional locations.

This Digital Plan has, by necessity, taken the mobile coverage maps publicly provided by the mobile network operators as the starting point for analysis; better data held by the mobile network operators has not yet been made available. What this necessarily superficial, second-best analysis does not show is the significant variation in the real-world connectivity experience of mobile users, with many gaps in coverage, and poor-quality service, in areas shown as fully covered.

Mobile users have increasingly higher expectations of the services they can access on smartphones, ranging from traditional voice and critical emergency communications through to web browsing data apps and video streaming. The situations in which people want to access mobile services are also changing. Once primarily considered a service for on-the-move outdoor use, mobile services are increasingly substituting for fixed services in the home and at work for a significant share of users. However, the publicly available coverage maps fail to distinguish between traditional voice and other narrowband services on the one hand, and high quality mobile broadband access on the other – that is, they do not provide enough information for regional users in particular to identify locations where higher bandwidth services will (and will not) work well.

As such, while the analysis undertaken in this plan has led to many areas being regarded as well covered by existing mobile infrastructure, such conclusions need to be interpreted cautiously taking into account the limitations of the public coverage maps. Mobile coverage conclusions of this plan are intentionally high-level and intended to offer the general perspective of a given city, town, primary production area, tourist location or transport corridor, rather than offering the perspective of individual users in these places who may be located on the fringe of coverage or an area where topography adversely impacts services in their area for example.

It is well understood by the Regional Partnership that even within the apparently well-served areas many people will regularly face issues with access to reliable and high-capacity mobile services such as those available in metropolitan areas. Furthermore, as users move beyond higher density population centres between regional towns and into more remote locations there is inevitably a reduction in mobile coverage and the number of mobile network operators providing good services in any given location. This is experienced by users as a lack of continuous, high-quality mobile services capable of supporting the full range of smart phone functionality users expect.

The Victorian Government understands user disappointment and disillusionment with mobile connectivity in regional areas and has joined industry stakeholders in calling for mobile network operators to publish the richer and more accurate coverage data they possess to accurately identify unmet needs and possible ameliorative actions. The Government in conjunction with the Australian Competition and Consumer Commission (ACCC) and the Commonwealth Government is actively pressing the mobile network operators to publish more useful coverage data and supports the ACCC in its public commitment to take regulatory action if cooperative progress is not made.

The SLIM database is capable of capturing and analysing more detailed location-specific information on the availability and quality mobile coverage in regional areas, with improved coverage data to be incorporated in future iterations of SLIM and the digital plans when this becomes available to enable mobile coverage analysis more closely aligned with the lived experience of residents and visitors.

**The Digital Divide – looking below the surface**

The digital divide between regional Victorian residents, businesses and students and their capital city counterparts – the gap between them in the availability of digital services, the ability of residents and workers to use digital services (digital skills), and the affordability of digital services and digital expertise – is reflected in the RMIT-Swinburne-Roy Morgan-Telstra Digital Inclusion Index (DII) which measures these aspects in different locations. This shows a substantial gap between regional Victoria and Melbourne – rural Victoria rated 56 and Melbourne 65. The divide also exists within the region. These digital divides are shown in the charts below.

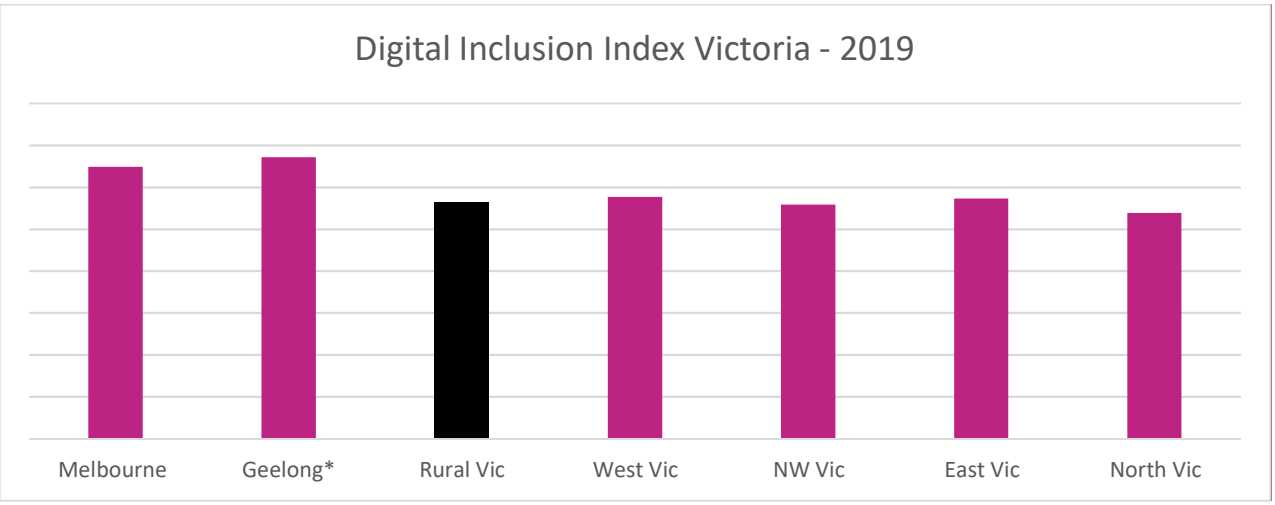



*Figure 2 Summary of 2019 RMIT-Swinburne-Roy Morgan-Telstra Digital Inclusion Index (DII) findings across Victorian regions*
*Sample size <150, exercise caution in interpretation Source: Roy Morgan, April 2018-March 2019

The significant diversity in geographic, demographic, social and economic characteristics within a region, and network design decisions and consequent technology boundaries, mean there are also digital divides within cities, towns, localities and rural/remote areas – digital 'have nots' amongst the 'haves'.

Where NBN infrastructure cuts over from fixed line to fixed wireless technology, or from fibre to the premise (FTTP) to fibre to the node (FTTN) within fixed line areas, businesses and homes on either side of the technology boundary will experience different service quality. Similarly, local topology and antenna settings can result in substantial quality disparities in and between localities.

Furthermore, mobile users have increasingly higher expectations of the services that they can access on smartphones, ranging from traditional voice and critical emergency communications through to web browsing, data apps and video streaming. The situations in which people want to access mobile services are also changing. Once primarily considered a service for on-the-move outdoor use, mobile services are increasingly substituting for fixed services in the home and at work for a significant share of users.

Digital divides within communities and between businesses will also exist for digital skills and affordability, reflecting differences in individual and company digital proficiencies, age, income levels and experience in high technology environments.

**Business-grade broadband services - NBN**

Some regional businesses have experienced service quality difficulties with NBN fixed line services, in particular substantial variations over the course of the day in information rates achievable from NBN-based broadband services and have called for effective NBN business-grade services. The Victorian Government recognises that from its inception in 2010 the mandated purpose of the NBN has been to provide ubiquitous highspeed wholesale broadband coverage to all residential (and very small business) premises at affordable standard national prices rather than larger businesses, and the necessity of NBN Co's technology choices to optimise total network costs. The Victorian Government also recognises and applauds NBN Co for responding to the call from business of effective business-grade broadband services – high-speed (100 Mbps+), symmetric and service level agreements on 24/7 information rate performance – for developing its Enterprise Ethernet business-grade service that meets these requirements for release Q4 CY 2018.

Nonetheless some unmet business needs will remain due to the predominance of fibre to the node (FTTN) technology within the NBN network which utilises long copper loops that will not support the Enterprise Ethernet service. There is no NBN business-grade service foreshadowed for fixed wireless areas, and there is uncertainty about the veracity of the yet-unspecified satellite-based NBN business-grade service due to inherent latency issues and information rate constraints.

**Competing fixed broadband networks**

Competing networks exist in capital city CBDs and some more densely settled metropolitan areas that can provide high quality alternatives to the NBN capable of supporting broadband services that meet the needs of digitally-intensive businesses at affordable prices. The existence of such competing networks leads to better service offerings for businesses and consumers in these areas.

The rollout of 5G wireless technologies as early as 2019 will enhance the capacity for alternative high-quality broadband services to the NBN to be provided. However, an equivalent situation does not exist in regional Victoria, where competing networks capable of broadly affordable business-grade service are in general not present and are unlikely to be widely developed without government support. The emergence of 5G networks has the potential to further exacerbate the digital divide, with more remote regional locations unlikely to be included in the early stages of the rollout and therefore falling further behind metropolitan and large regional city users.

**Common technology issues**

In developing the Digital Plans, numerous digital technology issues were identified through Regional Partnership and stakeholder consultation and expert analysis. Understanding the nature of these issues and the barriers which must be overcome is the first step towards addressing them and their impact on the digital divide. This

section provides deeper insights into these problems arranged under six common themes that are most relevant to Victoria's regions:

1. **Fixed broadband**, in particular, the national broadband network (NBN)
2. **Mobile network coverage** for both voice and data services. For some, this is an alternative to fixed broadband connectivity. For many, the untethered access made possible by the mobile networks is vital to social amenity, safety and productivity
3. **Public WiFi** availability, particularly in low income locations
4. **Low-powered wide area network (LP-WAN) coverage** and uptake for Internet of Things (IoT) applications. Embracing the application of IoT technologies is important if Australia is to achieve best practice in areas such as agriculture, community infrastructure and the like
5. The potential to enhance outcomes by access to **Government infrastructure** – such as the optical fibre deployed along rail routes, and towers used for radio networks
6. **Digital skills** – a vital counterpart to the availability of infrastructure and services.

The end of this section outlines a number of recommendations that can help to dismantle the barriers and accelerate progress.

## 1. Fixed broadband

*NBN Rollout Schedule concerns*

With the NBN rollout still underway, some areas are already able to access NBN services while others are still waiting. Where a non-satellite technology is planned but the rollout has not yet been completed, users are generally not able to procure a satellite service in the interim, meaning their fixed broadband connectivity options remain as they were prior to the NBN initiative. These are generally an ADSL service over Telstra's copper, a non-NBN fixed wireless service, or a satellite service from a commercial provider.

For *most* (but not necessarily all) users, an NBN connection will deliver improved performance relative to the options previously available. Further discussion on where this may not be the case is provided in the following sections. While an improvement in fixed broadband services for many will come in the form of an NBN connection, the lengthy duration of the rollout schedule does mean that areas destined to be serviced in the final years of the NBN rollout face a measure of continuing disadvantage relative to those with access. While not possible to fast track the remaining rollout to all locations, it may (by negotiation with NBN Co) be possible to fast track the rollout to priority locations as identified by local governments.

*Affordability and service quality concerns*

The cost and quality of fixed broadband for regional users has been raised by stakeholders. Details (such as whether the complaints relate to NBN or other services, whether some RSPs figure more prominently than others, what retail plans are involved) are not available to support a comprehensive analysis of root causes. Some of the complaints relate to the type of connection available to them (see discussion later under "*Concerns raised around limitations of NBN technologies"*) and some relate to the performance of services falling short of expectations.

For fixed broadband users, including those already able to access an NBN connection, a common complaint relates to service performance during peak periods – even for those users with the highest performing FTTP connection technology.

In the case of NBN-based services, two key segments in an end-to-end connection where performance may suffer during peak periods are the Connectivity Virtual Circuit (CVC) within the NBN, and the backhaul between an NBN Point of Interconnect (POI) and the RSP's core network. Both of these segments are "shared pipes" where the capacity available is a small fraction of the total demand that *could* be generated if all users were simultaneously active at the maximum speed available on their connection.

Towards strengthening the user's protection against poor performance, the Government passed legislation in mid-2018 setting out the user's remedies should the performance of an NBN-based service fall significantly short of nominal specifications advised by the RSP.

*CVC Capacity*

The under-provisioning of CVC capacity is not due to technical limitations, but rather to a pricing model designed to boost NBN Co's wholesale revenues. In the early life of the NBN, RSPs typically acquired an *average* of just over 1 Mbps per customer (supporting users with connection speeds up to 100/40 Mbps). More recently, NBN Co has introduced pricing incentives to promote the purchase of additional CVC capacity, and at the time of this report, the average had risen to a little over 1.5 Mbps. Nevertheless, congestion can still occur during peak periods.

Inadequate CVC capacity issues would typically affect both urban and regional users equally. However, due to lesser economies of scale, smaller Retail Service Providers (RSPs) may face higher costs in being able to provision adequate CVC to support their customers. Investing at the level required could lead to higher prices or inadequate margins – but failing to do so could leave their users more vulnerable to performance degradation during busy periods.

A CVC-based pricing model limiting the ability for smaller RSPs to compete in regional markets may contribute to inferior outcomes for regional businesses and households.

*Backhaul pricing concerns*

The cost of backhaul for internet service providers to connect with the NBN points of interconnect (POIs) is higher in regional areas due to both the more limited backhaul infrastructure competition and investment, as well as the larger distances involved in connecting to POIs. The premiums attributable to regional backhaul may motivate RSPs to operate their links to regional POIs at higher congestion levels, with the result that regional users experience poorer performance than their urban cousins.

The cost of backhaul to core networks (almost always located in the major capital cities) is one of the barriers to more active competition for the supply of alternative fixed broadband services in regional locations and limits the growth of alternative business-grade networks.

*Concerns raised around limitations of NBN technologies*

Fibre-to-the-Premises (FTTP) represents the ultimate access technology, capable of performance limited only by the electronics driving the fibre. Whilst today's technology delivers 1 Gbps, 10 Gbps FTTP technology is on the horizon. Those serviced by the "lesser" technologies may face constraints on the utility of their connection as discussed further below (including access to effective business-grade services).

Greenfield housing developments present an area of opportunity for establishing FTTP precincts that can meet the needs of residential users with more demanding requirements. Currently, developers are required to procure a FTTP solution for any development comprising 100 or more dwellings.

As the NBN rollout proceeds and more fibre-based infrastructure becomes available throughout Victoria, the 100-dwelling threshold merits review. Consultation with regions suggests that lowering this threshold could improve the prospects of establishing FTTP enclaves in regional areas.

*Satellite concerns*

Satellite services are subject to latency issues which significantly affect the utility of these services, particularly for interactive activities requiring inbound and outbound signals. Geostationary satellite services can also be prone to disruption during periods of heavy rainfall and suffer predictable degradation twice a year due to solar interference.

The finite capacity of NBN Co's satellites is being rationed across the 3-4 per cent of Australian premises that will eventually rely on the service. This constrains the ability to access retail high bandwidth broadband plans with as liberal monthly data quotas as are typically available on terrestrial connection technologies. This can be an

impediment to utilising these services for more data intensive activities such as large-scale data sharing for farming and mining, online education and streamed entertainment. For large-scale agricultural users it is also not possible to use NBN satellite services out in the field as the service needs to be "anchored" to a fixed location, usually the house.

*Fixed wireless concerns*

NBN Co utilises fixed wireless (FW) to a maximum distance of 14 kilometres from the base station. Installations at the limits of this reach may experience some variability in signal quality. The current maximum speed is 50/20 Mbps. NBN Co had signalled its goal of introducing a 100/40 Mbps offering, but no recent announcements have been made as to if and when this will become available.

Fixed wireless technologies share the finite capacity of an antenna beam amongst all of the users in the footprint of that beam. As such, the network is prone to congestion during busy periods. In October 2018 NBN Co acknowledged a problem of congestion on around 4 per cent of FW sites, reducing busy-time performance to below 6 Mbps per user.

*Fibre to the node (FTTN) concerns*

The performance of services supported by FTTN technology is heavily influenced by the length and condition of the copper segment from the node to the customer's premises. While distances of up to about 150m support speeds of or close to 100/40 Mbps, a majority of users are located at longer cable distances from the node, leading to progressively slower performance. In August 2017, NBN Co disclosed the percentages of FTTN-connected premises in different download speed bands as follows:

- 6 per cent in the 12-25 Mbps band;
- 29 per cent in the 25-50 Mbps band;
- 33 per cent in the 50-75 Mbps band; and
- the remainder (32 per cent) in the 75 -100 Mbps band.

Business and household users connected by FTTN technology that are too far from the node to support the higher speed tiers offered over the NBN may be constrained in their online activities and commercial potential (including access to effective business-grade services).

To put this issue in some perspective, NBN Co's 2018 Annual Report indicated that some 52 per cent of NBN FTTN users were selecting plans with download speeds of just 12 or 25 Mbps – achievable on virtually all connections. Affordability (and the adequacy of such speeds for those with modest needs) is undoubtedly a factor for many who choose these plans. However, there are also likely to be some who would opt for higher speed plans if their lines were capable of supporting them.

The individual Digital Plans for each Regional Partnership go some way in identifying locations (such as business precincts) where the NBN technology may limit current or future digital progress. Better information on where these demand hotspots exist can support more targeted and efficient investment and upgrades to NBN services.

Early signs from the CRCP Enhanced Broadband program emphasise the reality of these technology boundaries and the impact on regional communities. Several enhanced broadband pilots are being undertaken to ascertain the appetite among regional communities for services beyond those being provided by the NBN, with alternative service providers demonstrating interest in bidding for these projects. The department will be happy to provide feedback and outcomes from these pilot projects as they become available to shed light on the business model feasibility of NBN bypass and assist the Commonwealth and NBN Co in considering where and how upgrades to the NBN rollout can be best applied to meet local community needs.

The situation for "digitally intensive" businesses is somewhat different from that of residential users. Discussions with regional stakeholders exposed several situations where large businesses with demanding connectivity were suffering from the lack of adequate, competitively priced solutions, ideally over optical fibre. Such businesses and locations could be prioritised for NBN upgrades or policy attention given to procuring competitively priced fibre access in regional locations.

*NBN connection and fault repair experience*

The parliamentary Joint Standing Committee on the NBN released its first report on 29 September 2017. The Committee recommended that appropriate consumer protections be established for broadband services, including service connection and fault repair timeframes, minimum network performance and reliability, and compensation arrangement when required standards were not met.

Strong Service Level Agreements (SLAs) are especially important to businesses, since service disruption and protracted outages have the potential to bring the businesses to its knees.

*Alternatives to NBN connections*

The mobile network operators offering fixed broadband alternatives to the NBN tend to be most active in metropolitan areas. Under its agreement with NBN Co, it is understood that Telstra is not permitted to compete with NBN Co for residential connections once a cabled NBN solution (FTTP, FTTN, or FTTC) is established in an area. However, it is able to offer business-grade services to organisations needing more specialised connections.

An important consideration is ensuring that the organisations which depend on high-speed connectivity for the conduct of their businesses are able to procure the services they need. This underpins the rationale for Victoria's Enhanced Broadband program as part of the CRCP. Cabled solutions that involve the installation of new cabling over any significant distance will typically be priced at a level that only the very largest of businesses could entertain.

One of the options for moderating costs is to establish precincts that can accommodate a cluster of businesses with high connectivity needs.

## 2. Mobile blackspots

In the context of mobile connectivity, the overwhelming issue of concern to regional Australians is gaps in coverage.

Real world experience of mobile coverage indicates that the situation is far more complicated than the coverage maps provided by the mobile network operators suggest. Mobile phone users in regional areas frequently report weak signals and call dropouts in areas that are claimed to have good coverage. It is an unfortunate reality that mobile coverage cannot be accurately summarised in a simple form because of a number of complicating factors:

- networks are constantly evolving, and new sites are periodically commissioned;
- connectivity depends on the quality of antenna in the receiving device;
- device reception can be enhanced by use of an external antenna;
- a large number of environmental factors can be at play, including local complex topography blocking or reflecting signals (known as 'multi-path'), vegetation along the path (especially if it is moist) and adverse weather such as rain, fog or dust;
- signal strength can vary widely as users move around closely proximate locations (for example, when moving from open space into or near a building).

Any given tower can support a mix of technology generations (such as 3G, 4G and in the near future, 5G) at different frequencies (various channels from 700MHz to 2600MHz and higher for 5G). Both the phone and the network continually negotiate the connection and need to adapt for changes in real-time, especially for devices that are actively moving during a call or download. All of these factors combine to deliver an experience that is often well short of what the coverage maps would suggest - and significantly worse than that experienced by metropolitan users.

Connectivity can also fail or degrade due to tower congestion when a large number of users all try to connect at the same time – for example, at an event or a passing bus/train in a remote area.

Blackspots continue to be an issue affecting not only public safety and social amenity, but increasingly business efficiency. Almost every sector of economic activity is evolving to exploit the opportunities that have become

available with anywhere, anytime access to information and services via the mobile networks. Without mobile connectivity, individuals and businesses will find themselves at growing disadvantage.

With large geographic areas of Victoria destined to be limited to satellite for fixed broadband services, the mobile networks can provide a valuable adjunct, fallback or alternative to fixed broadband – providing low latency connections and providing a safety net when satellite services are affected by solar interference or severe weather conditions.

The Digital Plans for individual regions are expected to note conspicuous gaps in mobile coverage that affect:

- significant places (population centres and tourist destinations);
- road and rail transport routes;
- areas of agriculture or other areas of intensive economic activity.

Whilst accepting that 100 per cent landmass coverage is not a realistic goal, it may be sensible that an appropriate national mobile coverage aspiration should be established reflecting worthwhile socio-economic benefits from extending coverage further in regional Australia, most of which cannot be captured by the MNOs.

A "natural monopoly" may be the most efficient approach for providing coverage in areas of very low population density requiring significant public subsidies. This could take various forms, such as:

- concentrating future investment in one carrier, but on condition that the carrier offers mobile roaming to other MNOs; or
- establishing a wholesale-only operator in the areas where no other MNO will go, with that operator providing roaming to all MNOs. e.g. NBN Co or a new special purpose private or government-owned entity.

*Rail coverage*

A significant community of mobile users travel along the various rail corridors across Victoria, both for commuting and as tourists. The importance of good coverage for train travellers is recognised by the Victorian Government's investment partnership with the main MNOs and V/Line to improve in-carriage coverage along the five main commuter rail corridors out of Melbourne. Similar to the experience of road users, train travellers frequently report poor experiences in areas where the MNOs suggest that they provide good coverage due either to localised mobile blackspots or carriage types that block passenger in-carriage reception.

*Disparate coverage*

Because the network footprints of the three MNOs differ, there are many locations where users of one mobile network have no coverage but where coverage is available on one or both of the other two networks. Such situations rarely occur in urban areas.

This is not a problem for emergency calls, since triple-zero (or "112") calls will be accepted on any network. However, for users wanting to maximise network access for more general purposes (both calls and data access), the only option is to maintain multiple network subscriptions – adding to costs and creating ambiguity for callers.

The introduction of mobile roaming between carrier networks is a potential solution to the problems of a disparate patchwork of coverage. While not favoured by the ACCC at present, a change in the approach for blackspot funding towards a natural monopoly could prevent the problems of disparate coverage in very low population density areas from growing.

*Major events capacity shortfalls*

At significant regional events mobile coverage is not just required to support attendees and their needs for connectivity, but also increasingly for vendors who are reliant on 3G/4G coverage for EFTPOS terminals handling onsite payments. This is particularly important in (for example) swap meets, markets and field days where significant amounts of money change hands. A lack of connectivity can be crippling for business.

Potential approaches to alleviate problems with capacity shortfalls include:

- coverage augmentation - this may be applicable to venues that are regularly used, and which warrant a permanent boost in capacity through the deployment of micro-cells.
- WiFi coverage - providing a public WiFi zone covering the area in which the event is conducted may allow a proportion of the demand (notably for data) to be offloaded from the mobile networks, freeing more capacity for voice communications.
- demand aggregation - compiling a consolidated statewide schedule of all events where additional mobile capacity is needed could underpin a procurement process from the MNOs to satisfy these periodic requirements.

## 3. Public WiFi

Virtually all modern smart phones, tablets and notebook computers have the inbuilt capability to connect to WiFi networks. WiFi is therefore a highly accessible connection means supporting faster connection speeds avoiding some of the costs associated with transferring high data volumes over mobile networks. However, the range of WiFi signals is quite limited (indicatively 100m) and therefore multiple base stations are necessary when attempting to provide coverage over a larger area.

Free WiFi zones (open to public use) have been established in various locations throughout regional Victoria. In developing the individual regional plans, interest in public WiFi zones has been reinforced to address a range of needs:

- as a means of access for under-privileged households in the community who may not be able to afford fixed or mobile connectivity;
- for visitors and tourists who want to find out information about their location and/or share experiences with family and friends;
- for travellers passing through an area; and
- for residents living in regions where the only fixed broadband option is a satellite service, or when away from their fixed broadband connection.

## 4. Low powered wide area network (LP-WAN) connectivity (IoT)

IoT investment is forecast to grow dramatically over the coming years. Whilst still in a relatively early stage of development, IoT technology will increasingly underpin best practice in many areas of economic activity and presents opportunities that Australians will need to embrace if they are to remain competitive with global markets.

Some IoT applications are well established, such as the remote camera surveillance for security purposes. Many other IoT applications are still in a developmental phase – trialling different approaches and learning what works and what doesn't work.

On the supply side, there are numerous different technologies that can be used to connect devices – including Bluetooth and Zigbee. However, four LP-WAN technologies – NB-IOT, LoRa, Sigfox and Taggle - are emerging as key pillars of support for emerging IoT needs. These technologies vary in performance characteristics, the distances over which connectivity can be achieved and power requirements. For many applications, batteries are the only viable source of power to sensors and battery life of 10-15 years can be a key requirement.

NB-IOT is an extension of the mobile networks, with coverage being provided by the existing mobile networks. For the other three technologies, coverage is currently being deployed on an "as needed" basis. That is, coverage is not being deployed in advance of commercial opportunities, but rather in response to specific projects that generate revenue to fund the infrastructure.

Given that IoT is a relatively new phenomenon, demand for LP-WAN coverage is emerging but can be expected to grow strongly in the coming years. A key factor will be the extent to which various barriers to adoption are overcome. These barriers may include (but are not limited to):

- lack of end-to-end solutions that can be implemented without specialised systems integration experience;

- lack of network coverage for the particular connectivity technologies used by available solutions;
- insufficient proof of the benefits on offer through IoT technologies to attract end-user investment;
- a shortage of appropriate skills and experience to support the implementation and operation of beneficial applications;
- costs – either capital costs associated with implementation, or ongoing costs associated with connectivity or the operation of solutions.

A range of IoT trials in the agricultural sector are being funded as part of the Victorian Government's CRCP and are expected to yield valuable insights into factors that can accelerate adoption. Suggested approaches to boosting the uptake of IoT technology are expected to be determined in the wake of this work.

## 5. Alternative infrastructure

Various infrastructure providers have deployed optical fibre or other communications technologies to support their operations. Spare capacity is often available that could be made available for other purposes without compromising the host agency's use. However, the availability and capacity of these alternatives is not well known.

Discussions with stakeholders indicated a low level of awareness of the potential for utilising spare capacity on alternative infrastructure. Notwithstanding the lack of overt demand, there are a number of areas in which such capacity could be used to advantage including (but not limited to):

- providing additional backhaul capacity between NBN Co's regional POIs in Victoria and the central RSP networks in Melbourne;
- providing backhaul capacity for enhanced broadband precincts and mobile network operators offering alternatives to NBN services;
- (in the case of towers) supporting microwave links that address critical gaps in high-speed infrastructure.

## 6. Digital skills

Little systematic place-based information on the supply of and demand for digital skills and the affordability of digital services was available to support development of the Digital Plan. This is a clear barrier to deeper understanding of where digital skills issues are prevalent and potential remedies to address them. However, some broad findings and conclusions can be drawn about the current state of affairs.

The extent to which digital literacy is a problem across the regions varies considerably. As a broad generalisation, the problem is more intense the further the distance from a major population centre. It is likely that this relates to the reduced access to education and training resources, potentially setting up a vicious circle.

The character of needs varies from introductory computer literacy (often the foundation for kick-starting more advanced learning) to sophisticated skills of the kind needed to exploit more specialised opportunities.

A rich array of educational resources is available through the Internet. Many of the most effective are video-based – ranging from video clips explaining how to solve particular problems (such as on YouTube) through to streaming webinars (commonly offered through industry groups) and lectures (both streamed live and stored for consumption at the user's convenience). Many are freely available (for example, the massive online open courses, or MOOCs). Some of the more advanced courses culminating in formal accreditation involve enrolment and the payment of fees.

For many regional Victorians, connectivity is still a barrier to taking advantage of these resources – whether due to connectivity costs, low-speed connections or limited data quotas that can be quickly exhausted if video resources are used too liberally. Accordingly, improving the general connectivity landscape via the sort of measures outlined in the earlier sections of this submission can help to improve access to learning resources and contribute to higher digital literacy.

Improving connectivity more generally (both fixed and mobile) can also serve to make regional Victoria a more attractive location for businesses and individuals, decentralising the population distribution and improving the market for supporting industries (such as IT equipment supply and maintenance etc.).

Notwithstanding general improvements to the connectivity landscape, it is predictable that a sector of the community risks being left behind in an increasingly digital world. The most digitally vulnerable include those who:

- cannot afford either fixed or mobile connectivity;
- live outside mobile coverage areas; and
- have connectivity that performs poorly or is subject to restrictive data usage quotas (for example, users in the NBN satellite footprint).

For some such individuals, access to public WiFi can provide an alternative, even if it lacks the convenience of anytime access and requires travel to a point of access.

In general, it is anticipated that the future will bring improved local options for raising digital literacy (including tuition in digital hubs), state-wide vocational training solutions for shortages of IT professionals, and state-wide school education solutions (STEM++) for digital age workforce preparedness.

Digital learning needs to start with baseline skills so that people can find and engage with more advanced materials. Access to foundational education needs to be effective and affordable. Beyond basic literacy, the digital access infrastructure and services documented in the regional digital plans potentially alert users to various resources that can be used to remediate skills shortages – for example, using YouTube, MOOCs (massive online, open courses), and interactive training providers. Education is likely to be most effective when embraced at the local level. Multipurpose digital hubs can play an important focal point in this regard, including good online access and venues where, for example, young people can teach older citizens and workers basic digital literacy skills.

In addition to generic educational resources, further detailed work may expose key gaps that could be usefully addressed with tailored training modules, or potentially a “roadshow” of presentations.

The following summarises some key factors relevant to the success of digital hubs identified through consultation with representatives from three regional digital hubs as part of the Digital Plans’ case study development. These include for hubs to:

- have a clear, well-defined purpose;
- feature a multi-function, flexible layout, be aesthetically inviting, safe and adaptable to all sectors of the community;
- be well-managed and well-supported from information technology, communications and specialised equipment perspective;
- provide learning activities and programs that are well-targeted to the needs of the surrounding community; and
- establish and maintain a program of support volunteers.

## *Recommendations*

*Informed by the analysis above, the Regional Partnership recommends the following:*

**Mobile/5G connectivity recommendations**

The Commonwealth and Victorian governments should commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas, coupled with a review of blackspot funding as investment extends into ever more marginal areas. Blackspot funding should include consideration of where coverage is too poor to support reliable voice and data functions, not only locations where there is no coverage.

The Victorian Government should work with local governments and Regional Partnerships, similar to the process for engaging with the Mobile Blackspots Program, to develop a 5G priority locations list and advocate to mobile network operators to influence 5G rollout to these locations. The Commonwealth and Victorian governments should also examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand regional areas.

**IoT networks recommendations**

Victorian and Commonwealth governments should pilot a low power (LP-WAN) IoT blackspot program and consider an LP-WAN network rollout market facilitation model, like the Victorian Government's pilot Agriculture-IoT program, which should be expanded to target other strategic industries including health, education and manufacturing.

**WiFi recommendations**

The Victorian Government should continue to provide funding for free public WiFi networks in population centres of greatest need and advocate for the Commonwealth Government to do the same to meet local social needs and attract visitors. They should also examine sustainable public WiFi co-investment models such as the state or Commonwealth government meeting the capital costs and local governments (or mobile network operators) meeting the operating costs.

The Victorian Government should explore the potential of implementing WiFi services on regional rail lines.

**Fixed broadband services recommendations**

NBN Co should implement stronger service connection and maintenance requirements for NBN services to underpin the service-related obligations that legislation imposes on RSPs and ensure service quality meets regional stakeholder requirements and expectations.

The Victorian Government should work with local governments and the Regional Partnership to support the delivery of competing fixed broadband networks for businesses in high-demand areas, such as with the recent Enhanced Broadband projects taking place in Horsham and Morwell. These projects should be used to explore ways of improving the quality and cost of backhaul infrastructure to regional locations.

**Backhaul recommendations**

The Victorian Government should establish a process by which local governments and regional businesses and community groups can access state-owned telecommunications infrastructure to extend higher-capacity infrastructure to their area.

The Regional Partnership will advocate for the development of a commercial model for the extension of fibre to key regional locations and how existing and future businesses should pay for and access this fibre. Regional government offices able to benefit from these infrastructure upgrades should commit to being lead customers on these projects.

**Digital skills and affordability recommendations**

The Victorian Government should develop, in consultation with the Regional Partnership and stakeholders, new programs to support digital upskilling and recruitment of digital skills to regional businesses and their adoption of productivity enhancing technologies including IoT applications, data analytics platforms and forthcoming technologies related to 5G mobile networks and artificial intelligence.

The Victorian Government should fund research that addresses the digital skills and service affordability information gaps revealed in developing the Digital Plan and examine the case for investing in digital education and training programs, focusing the training across regions as more information on skills needs are revealed.

The Victorian Government, alongside the Regional Partnership and local governments should examine the merits of implementing multipurpose digital hubs that can address a range of access, skills and affordability needs (including providing access to reliable high-speed broadband access for those in NBN fixed wireless and satellite footprints).

# Digital supply and demand rating methodology

## Fixed access rating methodology

Reflecting the needs of users relative to service quality provided by different fixed and mobile technology types and the situation in metropolitan areas, the following rating standards have been used.

**SUPPLY**

*For businesses*

Rated **High** where:

- Mainly FTTP or FTTC (as these technologies can deliver the forthcoming Enterprise Ethernet business-grade service), AND/OR
- There are one or more competing networks providing comparable business-grade services at similar prices to NBN business-grade service

Rated **Medium** where:

- Mainly FTTN (as users face uncertainty about the availability of the forthcoming Enterprise Ethernet service at a premise as this service cannot be provided over access long loops), AND
- There are no alternative networks offering comparable business-grade services at similar prices

Rated **Low** where:

- Mainly fixed wireless (as no fixed wireless business-grade service in the pipeline, FW service only available up to 50 Mbps and FW information rates can be significantly degraded when network use spikes), OR
- Mainly satellite (as there is no specification available for the mooted business-grade satellite service, latency issues are inherent and current satellite services are only available up to 25 Mbps and there are data limits), AND
- There are no alternative networks offering comparable business-grade services at similar prices

*For households*

Rated **High** where:

- NBN FTTP, FTTC or FTTN are available (as this is comparable to the metro household situation), AND/OR
- There are one or more competing networks offering 100 Mbps+ service at comparable prices to NBN

Rated **Medium** where:

- NBN fixed wireless is available, AND
- There are no competing networks offering 100 Mbps+ service at comparable prices to NBN

Rated **Low** where:

- Only NBN satellite is available, AND
- There are no competing networks offering 100Mbps+ service at comparable prices to NBN

**DEMAND**

Demand for fixed access by businesses and households is rated **High** as both groups need fixed line network performance to meet their current and emerging digital needs.

## Mobile access rating methodology

Local accuracy of mobile coverage analysis is limited by the need to use high-level publicly available mobile coverage maps. Government discussions with mobile network operators to enable access to more detailed

information are occurring. In addition, local "ground-truthing" of mobile coverage will be considered in future updates of the Digital Plan.[4]

**SUPPLY**

*For both businesses and households* (as access to quality mobile services is very important for both groups):

Rated **High** where:

- Two or more 4G networks are available

Rated **Medium** where:

- Only one 4G network is available

Rated **Low** where:

- There is no coverage by any mobile network, OR
- The only coverage available is predominantly 3G

**DEMAND**

- Demand is rated **High** for all mobile users now and in three-to-five years, reflecting mobile's importance for all.

## Narrowband (LP-WAN) IoT access rating methodology [5]

**SUPPLY**

The present supply of LP-IoT is rated:

- **High** for near-complete coverage by at least one LP-WAN network
- **Medium** or **Low** for patchy or no coverage
- At least two networks requirement for High in three-to-five years.

**DEMAND**

Demand by businesses in larger centres and for farms is rated **Medium** at present and **High** in three-to-five years; and **Low** (now) and **Medium** (three-to-five years) for businesses in smaller centres and households, reflecting an explosion in IoT interest and use.

## Public WiFi

**SUPPLY**

Supply of public WiFi is rated:

- **High** where it is available in relevant public places and disadvantaged localities

[4] Note that decisions on Victorian government funding for mobile blackspots are not based on the high-level mobile coverage maps it is necessary to use in the digital plans

[5] Sigfox, Taggle and Optus IoT network coverage was considered, NNNCo and mobile network operator IoT coverage was not considered in the plan analysis as this information was not publicly available at the time of analysis. High bandwidth and 2-way IoT are provided by mobile network operators.

- **Medium** or **Low** for incomplete or no coverage
- For now, and in three-to-five years.

**DEMAND**

Demand by residents is rated according to income levels (**High** where incomes are low), reflecting the importance of mobile access to everybody for everyday life.[6]

[6] This broad measure could be improved by using more detailed information on disadvantaged locations from the ABS Socio-economic Index (SEIFA) and the Jesuit Social Services study *Dropping of the Edge: 2015* (postcode level)

## *Significant places analysis*

Digital supply-demand balance for selected population centres is shown in Table 6, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about the good coverage indicated by public coverage maps.***

*Table 6 Significant places: current unmet digital access needs.*

| Place | LGA | Name | User type | Access | | | |
|---|---|---|---|---|---|---|---|
| | | | | Fixed Supply / Demand | Mobile* Supply / Demand | LP-WAN IoT Supply / Demand | WiFi Supply / Demand |
| City | Bendigo | **Bendigo** (pop. 92,384) | Business | M/H | H/H | M/M | n.a. |
| | | | Home | H/H | H/H | M/L | H/L |
| | | | Community | n.a. | H/H | n.a. | H/L |
| | Campaspe | **Echuca** (pop. 18,523) | Business | M/H | H/H | M/M | n.a. |
| | | | Home | H/H | H/H | M/L | M/L |
| | | | Community | n.a. | H/H | n.a. | M/L |
| Town | Mount Alexander | **Castlemaine** (pop. 9,933) | Business | M/H | H/H | L/M | n.a. |
| | | | Home | H/H | H/H | L/L | M/M |
| | | | Community | n.a. | H/H | n.a. | M/M |
| | Macedon Ranges | **Gisborne** (pop. 9,822) | Business | M/H | H/H | H/M | n.a |
| | | | Home | H/H | H/H | H/L | L/L |
| | | | Community | n.a. | H/H | n.a. | L/L |
| | Central Goldfields | **Maryborough** (pop. 7,495) | Business | M/H | H/H | M/M | n.a. |
| | | | Home | H/H | H/H | M/L | M/H |
| | | | Community | n.a. | H/H | n.a. | M/H |
| | Campaspe | **Kyabram** (pop. 5,899) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | M/M |
| | | | Community | n.a. | H/H | n.a. | M/M |
| | Macedon Ranges | **Kyneton** (pop. 4,866) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | M/L |
| | | | Community | n.a. | H/H | n.a. | M/L |
| | Macedon Ranges | **Romsey** (pop. 3,871) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | M/L |
| | | | Community | n.a. | H/H | n.a. | M/L |
| | Macedon Ranges | **Woodend** (pop. 3,775) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | M/L |
| | | | Community | n.a. | H/H | n.a. | M/L |
| | Macedon Ranges | **Riddells Creek** (pop. 3,168) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | L/L |
| | | | Community | n.a. | H/H | n.a. | L/L |
| | Macedon Ranges | **Macedon** (pop. 2,807) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | L/L |
| | | | Community | n.a. | H/H | n.a. | L/L |
| | Campaspe | **Rochester** (pop. 2,722) | Business | M/H | H/H | M/M | n.a. |
| | | | Home | H/H | H/H | M/L | L/M |
| | | | Community | n.a. | H/H | n.a. | L/M |
| | Bendigo | **Heathcote** (pop. 1,720) | Business | M/H | H/H | L/M | n.a. |
| | | | Home | H/H | H/H | L/L | M/H |
| | | | Community | n.a. | H/H | n.a. | M/H |
| | Macedon Ranges | **Lancefield** (pop. 1,465) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | L/L |
| | | | Community | n.a. | H/H | n.a. | L/L |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Campaspe | **Tongala** (pop. 1,313) | Business | M/H | H/H | H/M | n.a. |
| | | | Home | H/H | H/H | H/L | L/M |
| | | | Community | n.a. | H/H | n.a. | L/M |
| | Mount Alexandra | **Maldon** (pop. 1,263) | Business | M/H | H/H | M/M | n.a. |
| | | | Home | H/H | H/H | M/L | L/H |
| | | | Community | n.a. | H/H | n.a. | L/H |
| Local | Campaspe | **Rushworth** (pop. 962) | Home | M/H | H/H | H/L | L/H |
| | | | Community | n.a. | H/H | n.a. | L/H |
| | Bendigo | **Marong** (pop. 923) | Home | H/H | H/H | H/L | L/L |
| | | | Community | n.a. | H/H | n.a. | L/L |
| | Central Goldfields | **Carisbrook** (pop.586) | Home | H/H | H/H | H/L | L/M |
| | | | Community | n.a. | H/H | n.a. | L/M |
| | Loddon | **Boort** (pop. 750) | Home | M/H | H/H | H/L | L/H |
| | | | Community | n.a. | H/H | n.a. | L/H |
| | Macedon Ranges | **Malmsbury** (pop. 642) | Home | M/H | H/H | L/L | L/L |
| | | | Community | n.a. | H/H | n.a. | L/L |
| | Mount Alexander | **Newstead** (pop. 574) | Home | M/H | H/H | L/L | L/H |
| | | | Community | n.a. | H/H | n.a. | L/H |

***Legend*** **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand, based on SLIM interrogation and subject to the local accuracy limitations of the mobile coverage and other data in SLIM.

## *Commentary*

Fixed access supply in Loddon Campaspe cities and larger towns is currently favourable for households, but under par for businesses as the prevailing NBN FTTN technology will not uniformly support effective business-grade services and alternative NBN-equivalent broadband services are not available. The situation is less favourable for small towns and localities where NBN fixed wireless prevails. Mobile access is generally good for the 22 Loddon Campaspe places examined (recognising there may be coverage issues at specific sites). Coverage of narrowband IoT networks across Loddon Campaspe places is mixed but in general not currently a constraint as demand is also low at present. The supply of public WiFi is low across the region, not meeting latent demand in places with below-average household incomes.

Looking forward three-to-five years, while government advocacy, demand aggregation and co-funding programs for fixed network upgrades may be effective at the margin (guided by the CRCP enhanced broadband trials), widespread fixed access upgrades will be difficult to achieve due to network cost constraints. Furthermore, the delivery of forthcoming 5G mobile coverage in smaller locations may lag demand.

**Fixed access**

Fixed access for cities and towns with population in excess of 1,000 residents is predominantly provided by NBN FTTN technology. While this satisfactorily meets current household needs (on par with metropolitan households), it represents an intermediate supply shortfall for businesses as FTTN will not uniformly support the pending NBN Enterprise Ethernet business-grade service due to long loop lengths for some premises. For some smaller towns and localities NBN fixed wireless is the prevailing network technology, meaning an intermediate supply shortfall for households and major shortfall for businesses as the NBN business-grade service will not be offered on its fixed wireless network.

Looking forward three-to-five years, while NBN FTTP and FTTC networks would support future demand for business-grade services, widespread upgrades will be difficult to achieve. Nonetheless government advocacy, demand aggregation and co-funding programs for enhanced broadband may be effective at the margin for smaller population centres, guided by lessons from the CRCP enhanced broadband trials in Morwell and Horsham.

**Mobile access**

Mobile access according to public coverage maps from mobile network operators appears to be good for all the Loddon Campaspe cities, towns and localities examined (down to 500 residents) with near-complete 4G coverage by at least two mobile network operators (recognising there will be specific sites which experience unsatisfactory mobile performance). The light green shading for mobile coverage analysis in the heat map tables in these sections reflects the concerns regarding the veracity of these conclusions based on the best-available public data used.

However, the three-to-five year outlook is uncertain, as only the larger population centres may receive 5G coverage (based on mobile network operators targeting large and rapidly growing populations). Importantly, the introduction of 5G services will at some point create greater competition between mobile and fixed access providing a potential solution for individual premises and neighbourhoods with poor fixed access.

**Narrowband (LP-WAN) IoT** [7]

While coverage of narrowband IoT networks across Loddon Campaspe cities, towns and localities is currently mixed, demand by businesses, local governments and households is also low with little apparent unmet need at present.

Looking forward three-to-five years - IoT network coverage is expected to increase substantially, driven by rising demand and the relatively low cost of low bandwidth IoT networks and applications (due to the use of low-cost spectrum and the long signal carrying distances of these technologies). Demand developments are less clear – while there is widespread expectation that IoT use will burgeon in the near future, what is not apparent is whether these largely premise-specific business and household IoT needs will be met by in-premise WiFi systems coupled with fixed backhaul or by public IoT networks.

**Public WiFi**

A key benefit of free public WiFi at present is assisting disadvantaged residents access the internet, and for visitors to the location. At present supply of public WiFi is low or medium in all places considered except Bendigo, while demand is rated medium or high in the locations with below-average household incomes (around half the locations analysed). Accordingly, based on the methodology and limited data used, there appears to be an unmet need for public WiFi in some mid-sized and smaller locations.

Looking forward three-to-five years - It is expected some local governments will roll out public WiFi in public places and disadvantaged neighbourhoods in response to these and their own “smart city” unmet needs. This suggests a potential role for targeted Commonwealth and Victorian Government programs – with the current CRCP free public WiFi trials in Shepparton and Geelong providing useful lessons on the design of such programs. However, falling mobile data prices, and scope for mobile networks to support low-power Smart City sensors may mean public WiFi becomes less relevant for social and local government service delivery purposes. Monitoring of trends is required.

**Skills and affordability**

Primary measures of digital literacy, availability of IT professionals and workforce preparedness for the future digital world, including on a place and sector basis, are extremely limited, existing at best at a high level of aggregation. As a result, further local data collection is required to identify skills gaps and shape needed remedial action. Nonetheless there are a range of secondary indicators that, taken together, give a broad indication of skills availability (supply) at an LGA level, including: age, education, the proportion of households that access the internet at home, the share of employment in high-technology industries and the ‘ability’ component of the

[7] Sigfox and Taggle network coverage is considered, NNNCo network coverage is not considered in the plan analysis as this information is not publicly available.

Digital Inclusion Index. Based on these broad indicators, there appears to be a significant skills shortfall in the Loddon Campaspe relative to Melbourne, and substantial differences between LGAs. Furthermore, at any location in the region, there will be individuals and businesses with low digital skills.

Looking forward three-to-five years, workforce preparedness for successful employment in the digital age is important for the whole of Victoria, with shortfalls in regional areas likely to be greater than in Melbourne given lower education levels and older populations. The importance accorded digital skills, apparent from the Digital Plan consultations, highlights the need for data collection on skills supply and demand.

Affordability of digital services has not been considered in the Digital Plan analysis and warrants attention in the next generation Plan.

## *Recommendations*

Recommendations lie primarily with regional stakeholders (local governments, business and community groups and the Regional Partnership), including encouraging and assisting the Victorian Government to make evidence-based representations on needed changes to the Commonwealth Government, NBN Co and other digital service providers. The full list of Digital Plan recommendations is included in **Section 1** above. Some of the actions are high-level and general in nature such as establishing priorities and action plans, while others are technology-specific or focused on skills gaps and affordability. They address both broad shortfalls in the supply of digital services and skills and their affordability, and the frequent situation of 'have-nots' amongst the 'haves'. The recommendations outlined address current and future unmet digital needs.

The Loddon Campaspe Regional Partnership high level recommendations for Significant Places include:

1. The Loddon Campaspe Regional Partnership will lead the development of a digital infrastructure strategy using this plan as the underlying evidence base. The strategy will detail the key steps, initiatives and investments over the next three years which are needed to achieve our vision of being the leading national region on digital connectivity and utilisation. The Regional Partnership will seek to leverage the Regional Digital Fund to access funding support to develop this strategy and undertake a detailed cost-benefit analysis of the strategy's package of initiatives.
2. Local governments should use this plan to work with the Regional Partnership and business and community stakeholders to identify the priority digital infrastructure supply shortfalls in their region and the projects that will most significantly unlock the economic potential of their region, for input to the Regional Partnership's strategy development.
3. The Commonwealth and Victorian governments should continue and expand funding programs aimed at addressing identified gaps in digital infrastructure as outlined in this plan which put these locations at a disadvantage compared to metropolitan users. The emphasis of these 'gap programs' should be on addressing mobile blackspots and inadequate fixed broadband services.
4. The Victorian Government should support the establishment of a regional digital coordination office for Loddon Campaspe and other interested regions whose function will be to ensure digital opportunities (policy, programs, infrastructure investments) are developed in coordination with regional stakeholders and they have meaningful opportunities to influence funding allocation and to participate in program and investment delivery.
5. Government investment into regional infrastructure should be implemented with a focus on ensuring procurement emphasises opportunities for local stakeholders and businesses to deliver projects and influence funding decisions. Government procurement of digital services should also be leveraged to deliver higher-capacity digital infrastructure closer to regional users.

Specific recommendations include:

***Fixed access***

1. NBN Co should implement stronger service connection and maintenance requirements for NBN services to underpin the service-related obligations that legislation imposes on RSPs and ensure service quality meets regional stakeholder requirements and expectations.
2. The Victorian Government should work with local governments and the Regional Partnership to support the delivery of competing fixed broadband networks for businesses in high-demand areas, such as with the recent Enhanced Broadband projects taking place in Horsham and Morwell. These projects should be used to explore ways of improving the quality and cost of backhaul infrastructure to regional locations.
3. The Victorian Government should establish a process by which local governments and regional businesses and community groups can access state-owned telecommunications infrastructure to extend higher-capacity infrastructure to their area.
4. The Regional Partnership will advocate for the development of a commercial model for the extension of fibre to key regional locations and how existing and future businesses should pay for and access this fibre. Regional government offices able to benefit from these infrastructure upgrades should commit to being lead customers on these projects.

***Mobile access***

1. The Commonwealth and Victorian governments should commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas, coupled with a review of blackspot funding as investment extends into ever more marginal areas. Blackspot funding should include consideration of where coverage is too poor to support reliable voice and data functions, not only locations where there is no coverage.
2. The Victorian Government should work with local governments and Regional Partnerships, similar to the process for engaging with the Mobile Blackspots Program, to develop a 5G priority locations list and advocate to mobile network operators to influence 5G rollout to these locations. The Commonwealth and Victorian governments should also examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand regional areas.

***IoT access***

1. Victorian and Commonwealth governments should pilot a low power (LP-WAN) IoT blackspot program and consider an LP-WAN network rollout market facilitation model, like the Victorian Government's pilot Agriculture-IoT program, which should be expanded to target other strategic industries including health, education and manufacturing.

***Public WiFi access***

1. The Victorian Government should continue to provide funding for free public WiFi networks in population centres of greatest need and advocate for the Commonwealth Government to do the same to meet local social needs and attract visitors. They should also examine sustainable public WiFi co-investment models such as the state or Commonwealth government meeting the capital costs and local governments (or mobile network operators) meeting the operating costs.

***Skills***

1. The Victorian Government should develop, in consultation with the Regional Partnership and stakeholders, new programs to support digital upskilling and recruitment of digital skills to regional businesses and their adoption of productivity enhancing technologies including IoT applications, data

analytics platforms and forthcoming technologies related to 5G mobile networks and artificial intelligence.

2. The Victorian Government should fund research that addresses the digital skills and service affordability information gaps revealed in developing the Digital Plan and examine the case for investing in digital education and training programs, focusing the training across regions as more information on skills needs are revealed.
3. The Victorian Government, alongside the Regional Partnership and local governments should examine the merits of implementing multipurpose digital hubs that can address a range of access, skills and affordability needs (including providing access to reliable high-speed broadband access for those in NBN fixed wireless and satellite footprints).

Options to address Loddon Campaspe digital services affordability issues have not been considered in this initial Digital Plan, pending better information on the nature and importance of any affordability gaps. Data collection is the immediate need.

## *Primary production areas analysis*

Digital supply-demand balance for selected primary production areas is shown in Table 7, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about good coverage indicated by public coverage maps.***

*Table 7 Primary production areas: current unmet digital access needs*

| Land Use | Location | User Type | Access | | |
|---|---|---|---|---|---|
| | | | Fixed Supply / Demand | Mobile* Supply / Demand | LP-WAN IoT Supply / Demand |
| Dairy & beef grazing | North of Kyabram | Business | L/H | H/H | H/M |
| | | Home | M/H | H/H | H/L |
| | Around Rochester | Business | L/H | H/H | H/M |
| | | Home | M/H | H/H | H/L |
| Dairy grazing | West of Mitiamo | Business | L/H | M/H | H/M |
| | | Home | L/H | M/H | H/L |
| Sheep meat and wool grazing | Northeast of Maryborough | Business | L/H | H/H | L/M |
| | | Home | L/H | H/H | L/L |
| | Northeast of Woodend | Business | L/H | H/H | H/M |
| | | Home | L/H | H/H | H/L |

***Legend*** **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand.

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level.

## *Commentary*

The unmet needs picture is mixed within each of these primary production areas with fixed supply in most of them rated low and mobile access supply rated medium to high. LP-WAN IoT supply-demand balance is in transition – supply is predominantly reasonable (high or medium) relative to nascent demand which is expected to rise substantially over the next three-to-five years.

### Fixed access

Current situation - fixed access in the primary production areas across regional Victoria comprises a mix of NBN fixed wireless and satellite technologies representing low or medium level supply. Business and household demand is, however, uniformly high, meaning major unmet demand for fixed access across the primary production areas considered.

Looking forward three-to-five years - it is anticipated fixed access supply will change little in the next three-to-five years without policy intervention. With demand inexorably rising, this means the current level of unmet demand for fixed access will become severe. However, policies to materially alleviate this situation are likely to be prohibitively expensive.

### Mobile coverage

Current situation - mobile coverage in primary production areas of Loddon Campaspe is mixed, with expanses of poor service and difficulty in evaluating where the lived experience of users in many locations aligns with the perception of good coverage as shown in public coverage maps.

Looking forward three-to-five years - there is likely to be little market driven improvement on coverage and 5G technology is considered to be unlikely to replace 4G in rural and remote areas. Rising demand in the face of largely static supply will mean the unmet demand situation will worsen. Redesigned mobile blackspot programs

will be needed to ameliorate this growing supply-demand gap, with better coverage data from mobile network operators important to enable more targeted investments.

**Narrowband IoT**

Current situation - Narrowband IoT coverage is currently relatively high across most Loddon Campaspe primary production areas analysed alongside low to medium level demand, with the exception of sheep meat and wool grazing northeast of Maryborough where an intermediate supply shortfall has been identified.

Looking forward three-to-five years - demand for such coverage is expected to grow strongly, as is supply – with the supply-demand balance unclear. There may be a valid role for government market stimulation where more acute supply shortfalls become apparent.

## *Recommendations*

The Loddon Campaspe Regional Partnership high level recommendations for Primary Production Areas are similar to those identified for Significant Places and include:

1. The Loddon Campaspe Regional Partnership will lead the development of a digital infrastructure strategy using this plan as the underlying evidence base. The strategy will detail the key steps, initiatives and investments over the next three years which are needed to achieve our vision of being the leading national region on digital connectivity and utilisation. The Regional Partnership will seek to leverage the Regional Digital Fund to access funding support to develop this strategy and undertake a detailed cost-benefit analysis of the strategy's package of initiatives.
2. Local governments should use this plan to work with the Regional Partnership and business and community stakeholders to identify the priority digital infrastructure supply shortfalls in their region and the projects that will most significantly unlock the economic potential of their region, for input to the Regional Partnership's strategy development.
3. The Commonwealth and Victorian governments should continue and expand funding programs aimed at addressing identified gaps in digital infrastructure as outlined in this plan which put these locations at a disadvantage compared to metropolitan users. The emphasis of these 'gap programs' should be on addressing mobile blackspots and inadequate fixed broadband services.
4. The Victorian Government should support the establishment of a regional digital coordination office for Loddon Campaspe and other interested regions whose function will be to ensure digital opportunities (policy, programs, infrastructure investments) are developed in coordination with regional stakeholders and they have meaningful opportunities to influence funding allocation and to participate in program and investment delivery.
5. Government investment into regional infrastructure should be implemented with a focus on ensuring procurement emphasises opportunities for local stakeholders and businesses to deliver projects and influence funding decisions. Government procurement of digital services should also be leveraged to deliver higher-capacity digital infrastructure closer to regional users.

Specific recommendations include:

***Fixed access***

1. NBN Co should implement stronger service connection and maintenance requirements for NBN services to underpin the service-related obligations that legislation imposes on RSPs and ensure service quality meets regional stakeholder requirements and expectations.

2. The Victorian Government should establish a process by which local governments and regional businesses and community groups can access state-owned telecommunications infrastructure to extend higher-capacity infrastructure to their area.
3. The Regional Partnership will advocate for the development of a commercial model for the extension of fibre to key regional locations and how existing and future businesses should pay for and access this fibre. Regional government offices able to benefit from these infrastructure upgrades should commit to being lead customers on these projects.

***Mobile access***

1. The Commonwealth and Victorian governments should commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas, coupled with a review of blackspot funding as investment extends into ever more marginal areas. Blackspot funding should include consideration of where coverage is too poor to support reliable voice and data functions, not only locations where there is no coverage.
2. The Victorian Government should work with local governments and Regional Partnerships, similar to the process for engaging with the Mobile Blackspots Program, to develop a 5G priority locations list and advocate to mobile network operators to influence 5G rollout to these locations. The Commonwealth and Victorian governments should also examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand regional areas.

***IoT access***

1. Victorian and Commonwealth governments should pilot a low power (LP-WAN) IoT blackspot program and consider an LP-WAN network rollout market facilitation model, such as like the Victorian Government's pilot Agriculture-IoT program, which should be expanded to target other strategic industries including health, education and manufacturing.

## *Tourist locations analysis*

Digital supply-demand balance for selected tourist locations is shown in Table 8, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about the good coverage indicated by public coverage maps.***

*Table 8 Tourist locations: current unmet needs*

| Type | Location | LGA | User Type | Access | |
|---|---|---|---|---|---|
| | | | | Fixed Supply / Demand | Mobile* Supply / Demand |
| Permanent | Hanging Rock | Macedon Ranges | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |
| | Victorian Goldfields Railway | Mount Alexander | Operator | M/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Paddys Ranges State Park Maryborough | Central Goldfields | Operator | L/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Central Deborah Gold Mine | Greater Bendigo | Operator | M/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Melville Caves Picnic Area - Kooyoora State Park | Loddon | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |
| | Turpins Falls | Mount Alexander | Operator | L/H | L/H |
| | | | Visitor | n.a. | L/H |
| | Murray River | Campaspe | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |
| Events | Riverboats Music Festival | Campaspe | Operator | M/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Art in the Vines | Macedon Ranges | Operator | L/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Loddon Valley Food and Wine Expo | Loddon | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |
| | Southern 80 | Campaspe | Operator | L/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Newstead Live | Mount Alexander | Operator | L/H | H/H |
| | | | Visitor | n.a. | H/H |
| | Maryborough Highland Gathering | Central Goldfields | Operator | M/H | H/H |
| | | | Visitor | n.a | H/H |
| | Energy Breakthrough | Central Goldfields | Operator | M/H | H/H |
| | | | Visitor | n.a | H/H |
| | Talbot Farmers Market | Central Goldfields | Operator | L/H | H/H |
| | | | Visitor | n/a | H/H |
| Trails | O'Keefe Rail Trail | Greater Bendigo | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |
| | Goldfields Track | Central Goldfields, Mount Alexander | Operator | L/H | M/H |
| | | | Visitor | n.a. | M/H |

***Legend*** **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand.

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level. Outdoor coverage is considered to be generally sufficient for tourist locations.

## Commentary

Here only fixed and mobile access technologies are relevant – fixed access to enable site operators to provide WiFi services and for the day-to-day conduct of the business, and mobile access for both visitors and operators. Three types of tourist locations are considered: permanent tourist attraction, periodic events such as an annual music festival, and trails.

Present situation: Fixed access for site/event operator provision of WiFi is mainly low relative to demand for the tourist locations analysed due to primarily receiving fixed wireless or satellite technology. Mobile coverage is mixed with moderate or major supply shortfalls for more remote permanent attractions and trails and reasonable supply for other permanent attractions and some annual events (generally those in or near towns). Looking forward three-to-five years, this pattern is expected to still prevail without intervention – it is unlikely market forces alone will sufficiently shift the supply-demand fundamentals in more remote tourist locations.

For governments, tourism-focused digital enhancement programs for permanent attractions and periodic events in more remote locations are likely to be more costly (and warrant a higher return) than events closer to settled areas.

In three-to-five years: Demand for fixed access at tourist sites is expected to rise strongly in coming years as live streaming of events becomes more prevalent and digital access and enhancements to permanent attractions becomes more important to their financial viability. Mobile coverage demand will also grow as ready mobile connectivity becomes the mandatory norm for any event or permanent attraction – including coverage on surrounding roads for map applications.

## Recommendations

The Loddon Campaspe Regional Partnership high level recommendations for Tourist Locations are similar to those identified for Significant Places and include:

1. The Loddon Campaspe Regional Partnership will lead the development of a digital infrastructure strategy using this plan as the underlying evidence base. The strategy will detail the key steps, initiatives and investments over the next three years which are needed to achieve our vision of being the leading national region on digital connectivity and utilisation. The Regional Partnership will seek to leverage the Regional Digital Fund to access funding support to develop this strategy and undertake a detailed cost-benefit analysis of the strategy's package of initiatives.
2. Local governments should use this plan to work with the Regional Partnership and business and community stakeholders to identify the priority digital infrastructure supply shortfalls in their region and the projects that will most significantly unlock the economic potential of their region, for input to the Regional Partnership's strategy development.
3. The Commonwealth and Victorian governments should continue to expand funding programs aimed at addressing identified gaps in digital infrastructure as outlined in this plan which put these locations at a disadvantage compared to metropolitan users. The emphasis of these 'gap programs' should be on addressing mobile blackspots and inadequate fixed broadband services.
4. The Victorian Government should support the establishment of a regional digital coordination office for Loddon Campaspe and other interested regions whose function will be to ensure digital opportunities (policy, programs, infrastructure investments) are developed in coordination with regional stakeholders and they have meaningful opportunities to influence funding allocation and to participate in program and investment delivery.
5. Government investment into regional infrastructure should be implemented with a focus on ensuring procurement emphasises opportunities for local stakeholders and businesses to deliver projects and

influence funding decisions. Government procurement of digital services should also be leveraged to deliver higher-capacity digital infrastructure closer to regional users.

Specific recommendations include:

***Fixed access***

1. NBN Co should implement stronger service connection and maintenance requirements for NBN services to underpin the service-related obligations that legislation imposes on RSPs and ensure service quality meets regional stakeholder requirements and expectations.
2. The Victorian Government should establish a process by which local governments and regional businesses and community groups can access state-owned telecommunications infrastructure to extend higher-capacity infrastructure to their area.
3. The Regional Partnership will advocate for the development of a commercial model for the extension of fibre to key regional locations and how existing and future businesses should pay for and access this fibre. Regional government offices able to benefit from these infrastructure upgrades should commit to being lead customers on these projects.

***Mobile access***

1. The Commonwealth and Victorian governments should commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas, coupled with a review of blackspot funding as investment extends into ever more marginal areas. Blackspot funding should include consideration of where coverage is too poor to support reliable voice and data functions, not only locations where there is no coverage.
2. The Victorian Government should work with local governments and Regional Partnerships, similar to the process for engaging with the Mobile Blackspots Program, to develop a 5G priority locations list and advocate to mobile network operators to influence 5G rollout to these locations. The Commonwealth and Victorian governments should also examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand regional areas.

## *Transport corridors analysis*

Digital supply-demand balance for selected transport corridors is shown in Table 9, red shading indicating major supply shortfall relative to demand, amber an intermediate supply shortfall and green where current supply meets or exceeds demand. ***Note the light green shading for mobile access denotes reservations, based on local mobile access experience, about the good coverage indicated by public coverage maps.***

Here only mobile access is relevant.

*Table 9 Transport corridors: current unmet needs*

| Road Class | ID | From | To | Comment | Mobile* Supply / Demand |
|---|---|---|---|---|---|
| A/B | M79 | Sunbury | Ravenswood | 4G coverage by three mobile network operators | H/H |
| | A79 | Charlton | Wedderburn | 4G coverage by three mobile network operators | H/H |
| | A790 | Ravenswood | Marong | 4G coverage by three mobile network operators | H/H |
| | B260 | Bendigo | Macorna | Continuous 4G coverage by one carrier only | M/H |
| | B280 | Bendigo | Heathcote | Partial 4G coverage by two mobile network operators for part of journey | L/H |
| | A300 | Bendigo | Stanhope | Continuous 4G coverage by three mobile network operators | H/H |
| | B400 | Gunbower | Wyuna | Continuous 4G coverage by one carrier only | M/H |
| | B75 | Echuca | Heathcote | Partial 4G coverage by three mobile network operators | L/H |
| | B180 | Elphinstone | Avoca | Continuous 4G coverage by at least two mobile network operators | H/H |
| | B240 | Marong | Logan | Continuous 4G coverage by one carrier only | M/H |
| C | All | 86 roads | | Patchy/low coverage | L/H |
| Rail | | Bendigo | Melbourne | 4G coverage by three mobile network operators | H/H |
| | | Bendigo | Echuca | 4G coverage by three mobile network operators – in-carriage reception uncertain | H/H |
| | | Bendigo | Swan Hill | Partial 4G coverage by three mobile network operators – in-carriage reception uncertain | L/H |
| | | Ballarat | Maryborough | Continuous 4G coverage by one carrier – in-carriage reception uncertain | M/H |

***Legend*** **Red** - Major supply shortfall | **Amber** - Intermediate supply shortfall | **Green** - current supply meets or exceeds demand.

* Mobile coverage taken from public carrier coverage maps which may not reflect detailed coverage at the local level.

Table 9 summarises the limited analysis of mobile coverage supply and demand on major and more minor roads and a rail link in Loddon Campaspe conducted to demonstrate the place and sector approach for transport corridors and note any preliminary patterns.

### Commentary

The pattern from the sample of major and minor roads is that there is reasonable mobile coverage on major (A-grade) thoroughfares and significant (Class B) roads, with poor coverage on minor (C-grade) roads, again noting the limitations of the data available to provide a complete picture of service quality and continuity along roads

that appear to be well served. Mobile coverage of rail routes appears to be generally good, although in-carriage reception on the Bendigo to Echuca, Swan Hill and Maryborough links is likely to be patchy on VLocity trains.

Looking forward three-to-five years, this tentative pattern is expected to continue, with intervention required to lift mobile coverage on more minor roads.

These findings, if substantiated by further analysis, also have two-way implications: drivers will experience better mobile coverage to the extent they can stick to more significant roads, and that mobile blackspot programs aiming to achieve good coverage on more minor roads are likely to be expensive and warrant careful targeting.

## Recommendations

The Loddon Campaspe Regional Partnership recommendations for Transport Corridors relate to mobile access only and are similar to those identified for Tourist Locations. They include:

***Mobile access***

1. The Commonwealth and Victorian governments should commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas, coupled with a review of blackspot funding as investment extends into ever more marginal areas. Blackspot funding should include consideration of where coverage is too poor to support reliable voice and data functions, not only locations where there is no coverage.
2. The Victorian Government should work with local governments and Regional Partnerships, similar to the process for engaging with the Mobile Blackspots Program, to develop a 5G priority locations list and advocate to mobile network operators to influence 5G rollout to these locations. The Commonwealth and Victorian governments should also examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand regional areas.

# Glossary

**ABS**: Australian Bureau of Statistics

**ACCC:** Australian Competition and Consumer Commission

**Cat-M1**: Narrowband IoT technology

**CPCP:** Victorian Government $45 million Connecting Regional Communities Program

**DJPR**: Department of Jobs, Precincts and Regions (Victoria)

**DII:** RMIT-Swinburne-Telstra Digital Inclusion Index

**F**: Fixed internet access services – NBN fixed line, fixed wireless and satellite connections

**FTTC**: Fibre to the curb NBN fixed line technology – capable of providing very fast internet access

**FTTN**: Fibre to the node NBN fixed line technology – access speed limited by long copper loops for some customers

**FTTP**: Fibre to the premise NBN fixed line technology – capable of providing extremely fast internet access

**GRP**: Gross Regional Product (the region equivalent of Gross Domestic Product – GDP)

**IoT**: Internet of Things

**LCCC**: Local Community Connectivity Centres - facilities providing high bandwidth connectivity for the public

**LGA:** Local government area

**NB-IoT**: Narrowband Internet of Things

**BB-IoT**: Broadband Internet of Things

**M**: Mobile services – third, fourth and fifth generation technology (3G, 4G, 5G)

**NBN**: National Broadband Network – the government-owned wholesale network covering all premises in Australia

**NBN Co**: The Commonwealth Government-owned business responsible for building and operating the NBN

**MBSP:** Mobile Black Spot Program (Commonwealth Government)

**MNO:** Mobile network operator

**RDAC**: Regional Development Advisory Committee – the chairs of the nine Regional Partnerships

**SLA**: Service Level Agreement

**SLIM**: State Level Information Management database

**VMP:** Victoria Mobile Program

**WiFi**: Wireless mobile access technology for residents and visitors in public places and some neighbourhoods

# SECTION 3 – Supporting evidence base

# 1 Loddon Campaspe general characteristics

**Loddon Campaspe population centres, primary production areas, tourist sites & transport corridors**

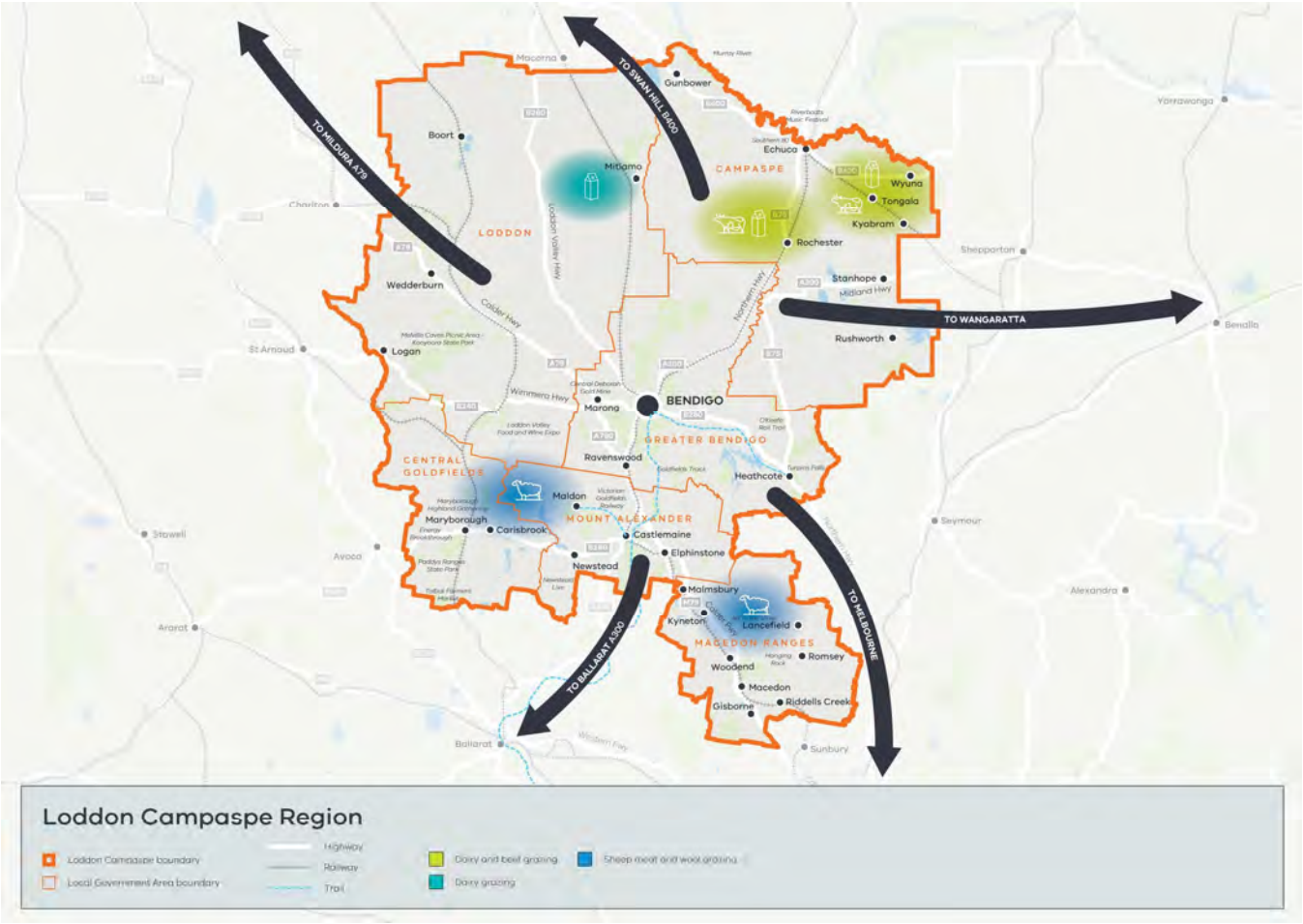



*Figure 3 Loddon Campaspe population centres, primary production areas, tourist sites & transport corridors*

## 1.1 The land and the people

Population density differs widely across the region – 37 residents per square kilometre for Bendigo LGA, 1 for Loddon. Almost 40 per cent of the region's population lives in Bendigo, with a further 33 per cent in the other cities, towns and localities. The remaining 27 per cent live on the fringe of these centres and in rural remote and locations and, reflecting their greater dispersion, experience less favourable digital connectivity than their more urbanised peers.

Farming in the region, both land use and value of production, is predominantly livestock grazing – dairy, beef and sheep (meat and wool).

Tourist sites include year-round attractions and signature annual festivals and other periodic events. The digital connectivity needs of farms and farm households, tourist site operators and visitors differ across these locations depending on the nature of the primary production and tourist activities, requiring the overlay of both places and sectors in digital supply-demand analysis.

Road and rail transport corridors need good mobile coverage for continuous mobile connectivity. Although there are mobile repeaters on Vlocity trains to Bendigo that ensure good in-carriage reception, the rail fleet

servicing the Echuca and Swan Hill routes has not been fitted with repeaters meaning in-carriage connectivity may be compromised.

Key features of Loddon Campaspe are:

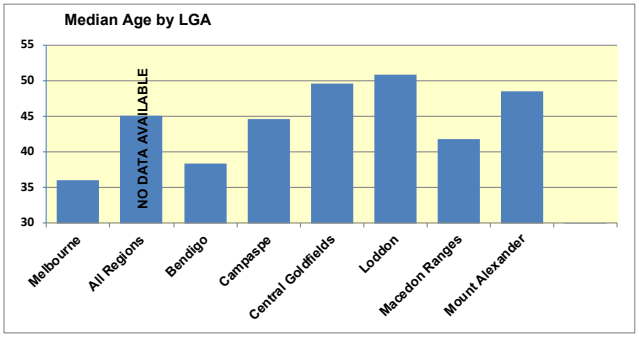
- North-west of and adjoining Greater Melbourne
- Approximately 19,000 km² (relatively small)
- Population 236,000 (2017) – population density 12 residents /km2 (high for regional Victoria)
- Six local government areas (LGAs) – Bendigo (population 112,000), Campaspe (37,000), Central Goldfields (13,000), Loddon (7,000), Macedon Ranges (48,000) and Mount Alexander (19,000)
- Main cities and towns: Bendigo (92,000, approximately 40% of the region's population), Echuca (13,000), Castlemaine (10,000), Maryborough (7,000), Kyabram (6,000), Kyneton (5,000), Romsey (4,000) – typical structure of major hub and smaller nodes
- Substantial LGA diversity – size, population, density and land use – usual for regional Victoria.

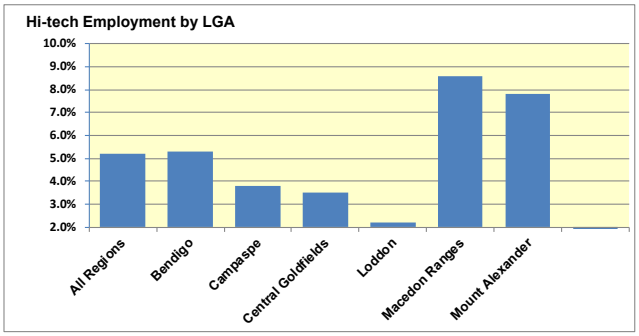
## 1.2 The community

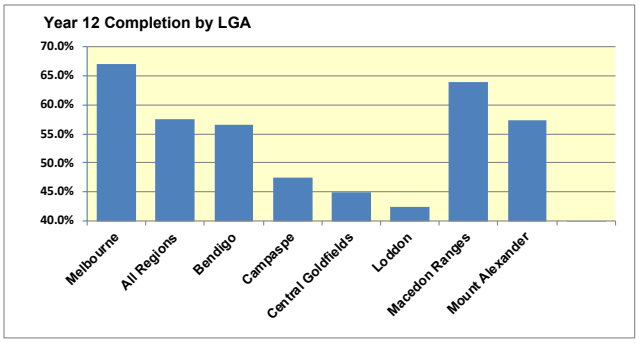
Whilst there are noteworthy variations across the region, the following summarises the overall profile:

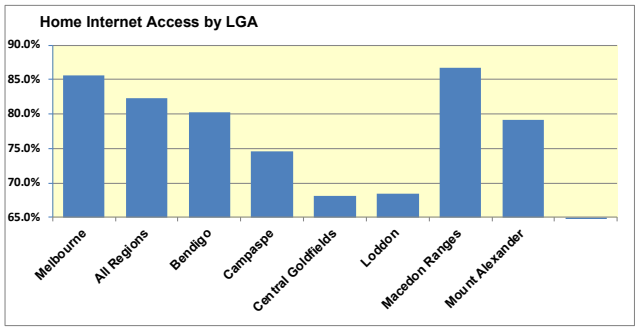
- Age: 30% of population <25 years, 50% 25-64, 20% 65+ – identical to the whole of regional Victoria (30:50:20 regional Victoria average)
- Education: 35% of the population have post-secondary qualifications – marginally higher than regional average (34%)
- Unemployment: 5.7% total, 11.6% youth – similar to the regional average (5.9% total, 11.5% youth)
- Digital inclusion: mid-ranked on the RMIT-Swinburne-Telstra Digital Inclusion Index[8]
- Overall socio-economic disadvantage: third most disadvantaged region on ABS SEIFA score[9] (with Central Goldfields Shire in the region having the lowest score in the state).

Some of the more noteworthy variations across the region are demonstrated in the following charts.




[8] Measuring Australia's Digital Divide – the Australian Digital Inclusion Index 2017

[9] ABS Socio-economic Index for Australia: SEIFA

Notably, the residents of the Central Goldfields and Loddon LGAs are on average older, left school earlier, are less likely to access the internet from home and less likely to work in a high-technology job than those residing elsewhere in the region – at risk of being left behind on digital development.

## 1.3 The economy

Gross Regional Product (GRP) $10.5 billion (mid-sized), with modest growth over the past 10 years.

Eight industries make up almost three-quarters of employment in the region:

*Table 10 Key industries by employment*

| | |
|---|---|
| Health care & social assistance | 15% |
| Retail Trade | 10% |
| Manufacturing | 9% |
| Education & training | 9% |
| Construction | 9% |
| Tourism (Accommodation and food services) | 52.0% |
| Agriculture, forestry, fishing | 6% |
| Public admin and safety | 6% |
| Total | 72% |

Loddon Campaspe residents are employed across occupational categories as follows:

- Professional (19% of residents), technical & trades (15%), managers (14%)
- Clerical & administration (12%), community & personal services (12%)
- Labourers (12%), sales (10%), machine operators & drivers (6%).

International exports $2.4 billion (2017), with export-intensity (exports relative to GRP) close to regional average.

## 1.4 Structural change

Health is a strong industry in the region in terms of employee numbers, followed by retail, construction, manufacturing and education/training. These sectors are followed closely by tourism, which is showing the second highest employment growth rate (after health), and therefore is expected to become the second largest industry in the next five years. This suggests that the most important industries for digital enablement are health and tourism – to step up to a higher level of digital intensity over the next five years to ensure best practice efficiency and competitiveness – as indicated in the table below.

However, a somewhat different picture emerges when GRP contribution is considered. From this perspective manufacturing and agriculture, two of the fastest declining industries in terms of employee numbers, are the two leading sectors, suggesting that both also warrant particular attention to their digital enablement - agriculture in particular needs to shift from its current low to high digital intensity over the next five years to be competitive in Australia and internationally.

## 1.5 Digital intensity – now and in three-to-five years

*Table 11 Comparison of digital intensity requirements now and in 3-5 years across key sectors[10]*

| Regional sector | Digital intensity now (current practice) | Digital intensity needed in three-to-five years (best practice) |
|---|---|---|
| Healthcare & social assistance | Fixed access for patient records | Patient & GP fixed and mobile connectivity. Digitisation of records, analytics & data transparency. Robot-assisted operations |
| Education & training | School, home fixed & mobile access | Student fixed & mobile home connectivity, online learning. Augmented & virtual reality in classrooms for enhanced teaching methods |
| Construction | Fixed & mobile connectivity | Fixed & mobile connectivity, digital models |
| Tourism (Accommodation and food services) | Mobile coverage of tourist hot spots | Mobile road coverage. WiFi & IoT at popular venues. Augmented/virtual reality tours |
| Manufacturing | Fixed connectivity | Fixed connectivity, industrial IoT, fault prevention & data analytics for logistics |
| Public admin & safety | Resident fixed & mobile connectivity, connected public infrastructure | Resident fixed & mobile, IoT-for Smart Cities, enhanced security & digital profiles for individuals |
| Agriculture/forestry | Mobile coverage of farming areas<br>Nascent use of IoT | Wide narrowband & broadband IoT access, apps & skills for intensive and broadacre horticulture, cropping & livestock |
| Retail trade | Shop & building access | Retail at threat from online shopping. IoT can help retail stores connect to customers through promotions & mobile payment methods |

Low | Medium | High

## 1.6 General characteristics informing digital planning

The Loddon Campaspe region has substantial LGA diversity in size, population, population density, age and industry sectors supporting employment. This diversity is further revealed from analysis of more specific region and LGA characteristics including:

- LGA and population - Bendigo LGA has a population of 114,000, almost half the region's population in an area of 3,000km². In contrast, the Loddon LGA has a population of 7,000 and is the largest LGA in the region covering 7,000km².
- Population density – differs widely across the region from 38 residents per square kilometre for Bendigo LGA down to 1 for Loddon LGA.
- Median age - differs significantly across the region from 38 in Bendigo to just over 50 in Loddon.

[10] McKinsey Digital – Digital Australia: Seizing the opportunity from the Fourth Industrial Revolution; OCED – A taxonomy of digital intensive sectors

- Industry sectors supporting employment – eight industries make up almost three quarters of Loddon Campaspe employment with these being dispersed across the region.

Analysis of the digital intensity requirements of the seven industries supporting 70 per cent of the Loddon Campaspe workforce reveals that five of the industries will rely heavily on digital services over the next three to five years. Three of the industries will move from having a low reliance on digital services to relying heavily on digital services. These include health and social assistance, tourism and agriculture/forestry. To ensure service improvements and productivity gains are achieved for these industries, addressing the increasing digital needs of these and other industries is important.

This summary of the Loddon Campaspe characteristics and structural change demonstrates the significant regional diversity and the many factors that need to be considered when developing a regional digital plan.

In this Plan, a framework has been developed that attempts to address regional diversity and take into account the current and future needs of people, businesses, places and industry sectors. The framework includes place and sector-based analysis of digital supply and demand necessary for identifying specific unmet digital needs and identifying priorities. Further development of this framework is required in subsequent digital plans.

# 2 Regional supply overview

## 2.1 Fixed broadband

### Coverage by land area

The map following shows NBN coverage of the Loddon Campaspe region, with the LGA boundaries marked.

Areas served with FTTP, FTTC and FTTN represent less than two per cent of the land area in the region and accordingly are barely visible at the scale of this map. Many of these locations are discussed in Part 3 below.

Of note at the scale of this map is the proportion of the region that is *not* shaded with any colour – representing the areas that are serviced with the lowest performing of NBN Co's access technologies – satellite coverage.

Also visible at this scale are the areas where fixed wireless has been deployed (dark purple) or will be deployed (light purple) and some of the larger population centres where FTTP (brown) or FTTN (blue) has (or is due to be) deployed.

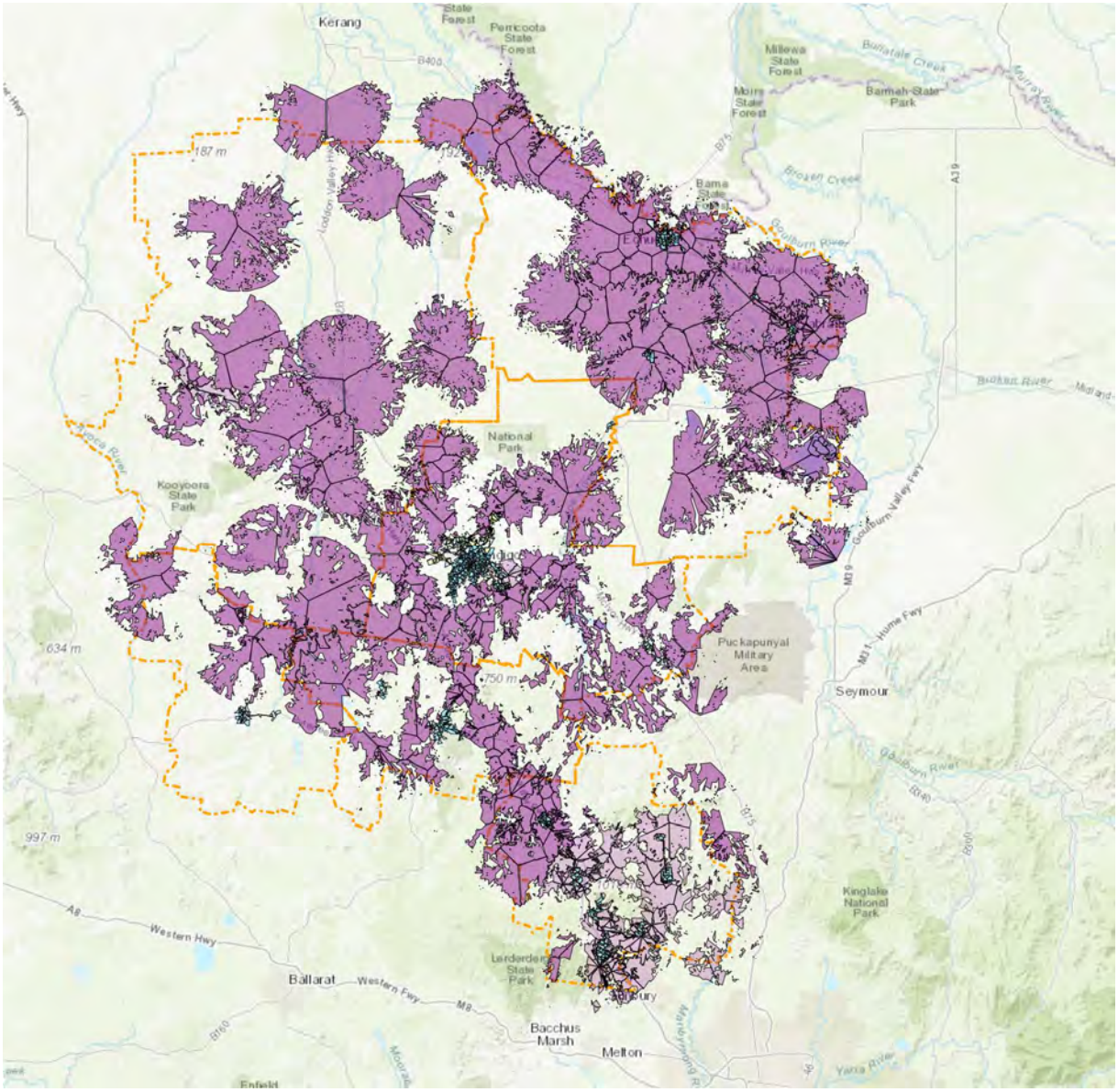



*Figure 4 An Overview of NBN Technology Coverage of the Loddon Campaspe Region (SLIM)*

The split between fixed wireless and satellite coverage is particularly relevant in assessing how well areas of the region are served. The following table summarises NBN Co's present or planned use of these technologies for each LGA.

*Table 12 Proportion of area covered by fixed wireless or satellite technology by LGA*

| LGA | Area (km2) | NBN Technology (% Area) | |
|---|---|---|---|
| | | FW | SAT |
| Bendigo | 3,003 | 21% | 76% |
| Campaspe | 4,520 | 38% | 61% |
| C Goldfields | 1,529 | 7% | 92% |
| Loddon | 6,685 | 30% | 70% |
| Macedon Ranges | 1,743 | 32% | 65% |
| Mt Alexander | 1,533 | 15% | 83% |
| Region ($km^2$) | 19,013 | 5,277 | 13,524 |

## Coverage of businesses

Across the Loddon Campaspe region, there are 8,026 businesses registered with WorkCover. The NBN technology that either currently serves (or is destined to serve) these businesses is as shown in the chart below.

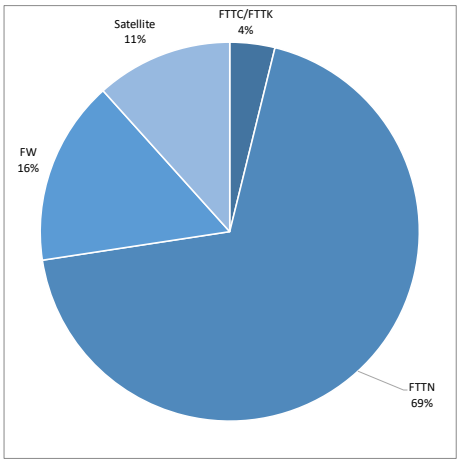



*Figure 5 Businesses served by different NBN technologies*

Differences across the LGAs that make up the region are quite significant, as summarised in the table below.

*Table 13 Proportion of businesses covered by different NBN technology types*

| LGA | No. Bus. | Approximate Coverage (%) | | | | |
|---|---|---|---|---|---|---|
| | | FTTP | FTTB FTTC | FTTN | FW | SAT |
| Bendigo | 3,486 | 0% | 9% | 80% | 6% | 5% |
| Campaspe | 1,620 | 0% | 0% | 59% | 25% | 17% |
| C Goldfields | 360 | 0% | 0% | 76% | 8% | 17% |
| Loddon | 287 | 0% | 0% | 0% | 72% | 28% |
| Macedon R | 1,725 | 0% | 0% | 65% | 20% | 15% |
| Mt Alexander | 548 | 0% | 0% | 71% | 11% | 18% |
| Region (no.) | 8,026 | 4 | 308 | 5515 | 1264 | 935 |

## Coverage of dwellings

NBN Co's use of different technologies to service particular residential areas has been examined visually within SLIM by zooming to a detailed (town or street level) view.

At an overview level, the following table summarises coverage by technology type for GNAF[11] addresses *(see important qualification in footnote)* that lie within residential-zoned areas.

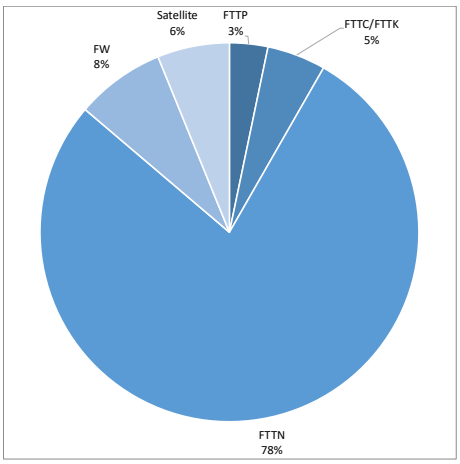



*Figure 6 GNAF addresses served by different NBN technologies*

[11] The GNAF database contains addresses in land that is zoned commercial, industrial and residential. As such, it excludes properties located (for example) within land zoned for farming.

*Table 14 Proportion of dwellings covered by different NBN technology types*

| LGA | No. Res. | Approximate Coverage (%) | | | | |
|---|---|---|---|---|---|---|
| | | FTTP | FTTB FTTC | FTTN | FW | SAT |
| Bendigo | 56,622 | 4% | 9% | 78% | 6% | 3% |
| Campaspe | 12,636 | 1% | 0% | 84% | 6% | 8% |
| C Goldfields | 6,640 | 0% | 0% | 74% | 9% | 17% |
| Loddon | 373 | 0% | 0% | 0% | 73% | 27% |
| Macedon R | 18,084 | 4% | 0% | 73% | 13% | 10% |
| Mt Alexander | 5,708 | 1% | 0% | 90% | 5% | 3% |
| Region (no.) | 100,063 | 3,274 | 5,011 | 77,988 | 7,630 | 6,160 |

Whilst NBN Co's satellite solution is intended to service the most remote three per cent of the population, a very much higher proportion will be reliant on it in the Campaspe, Central Goldfields, Loddon and Macedon Ranges LGAs. The overall percentage (six per cent) is also higher than the national average and could possibly be higher if the additional dwellings in farming areas were to be included.

## 2.2 Mobile coverage

### Public coverage maps

Access to mobile coverage data is currently under discussion between the Department and the mobile network operators.

In the interim, only very high-level perspectives can be obtained from the public coverage maps provided by each of the three established mobile network operators.

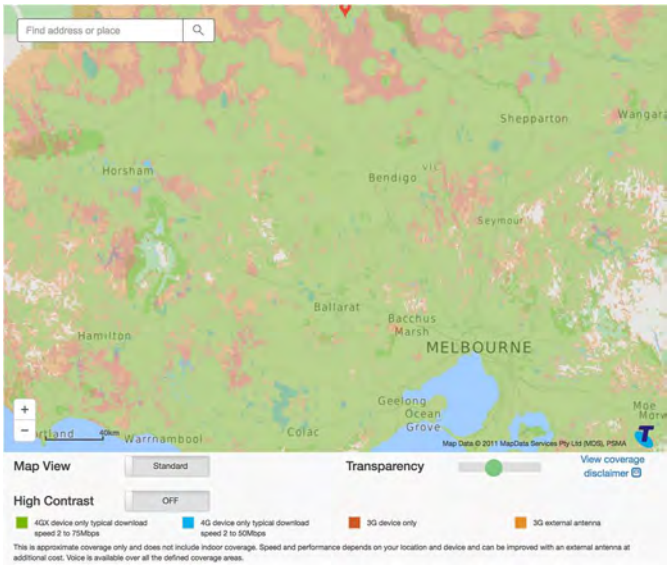



*Figure 7 Telstra Public Coverage Map of Loddon Campaspe Region*

Telstra's public coverage map indicates good coverage with:

- 4GX (typically download speed 2 to 75 Mbps) in green;
- 3G in dark brown; and
- 3G with external antenna in light brown.

By simple visual examination of this map, Telstra appears to support coverage over at least 90 per cent of the region.

The Optus public coverage map (see next page) is based on using a nominated device outdoors. For the purposes of this report, a handheld iPhone 6 has been assumed. In interpreting the map:

- purple indicates 4G Plus coverage;
- blue indicates 3G coverage; and
- yellow indicates 3G coverage with an external antenna.

By simple visual examination of this map, Optus appears to offer coverage of at least 90 per cent of the region, comparable to Telstra.

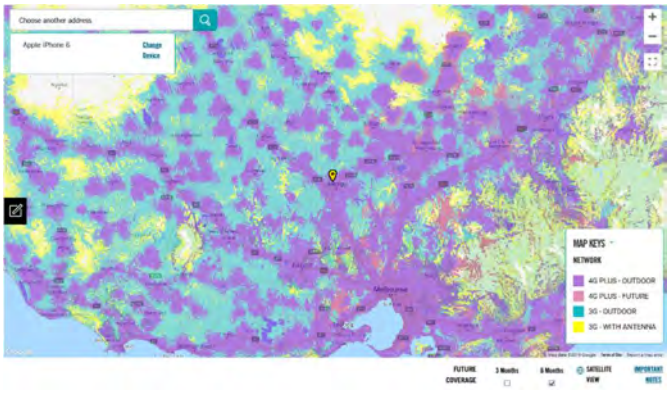



*Figure 8 Optus Public Coverage Map of Loddon Campaspe Region*

As for Optus, Vodafone's public coverage maps are based on using a nominated device, and for comparison with the Optus map, an iPhone6 has been assumed.

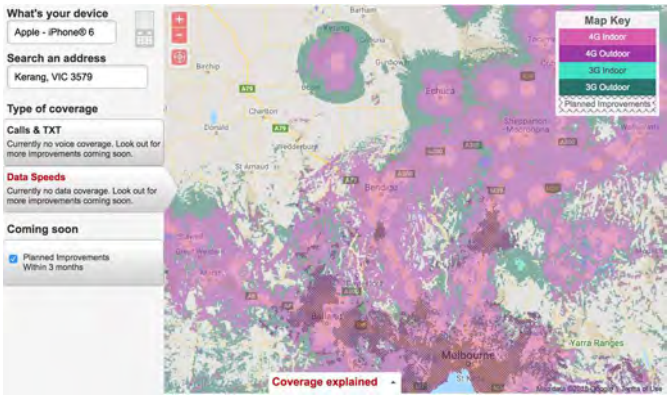



*Figure 9 Vodafone Public Coverage Map of Loddon Campaspe Region*

In interpreting the map:

- light purple indicates 4G indoor coverage;
- dark purple indicates 4G outdoor coverage;
- light green indicates indoor 3G coverage;
- dark green indicates outdoor 3G coverage; and
- shaded areas indicate where coverage enhancements are due to take place in the near future.

Based on the maps, Vodafone's coverage is not as extensive as that of Telstra and Optus but appears to include good coverage of the major roads.

## Crowd-sourced coverage information

In practice, the public coverage maps provided by the mobile network operators do not always accord with end-user experience. A range of applications have been developed to capture users' real world experiences and integrate these into databases.

An example is the OpenSignal[12] application and database, and a sample of the maps produced from these sources (in this case, in the area of Ararat in the Central Highlands region) is provided below. These applications can provide useful insights into (especially) transport mobile blackspots – but are less useful in assessing wide area coverage because of the difficulties of testing everywhere.

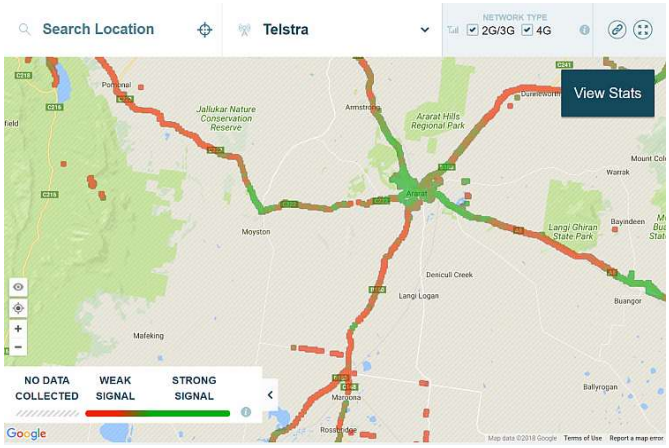



*Figure 10 OpenSignal Mapping of Coverage around Ararat*

The use of these applications by stakeholders (such as local Government staff) may be valuable in building evidence of transport mobile blackspots.

## General notes

Coverage is constantly evolving as a result of ongoing MNO investment in new base stations - including new base stations supported by the Commonwealth Mobile Blackspot Programs (MBSP) and the Victorian Government's Blackspot Programs (VMP).

In addition, the mobile networks are evolving through successive technology generations.

In particular, fifth generation (5G) mobile technology is expected to commence general deployment in 2020, bringing with it significantly increased capacity, the ability to support a vastly increased number of devices

12 See https://opensignal.com/networks, accessed on 10 July 2018.

and new features of particular relevance to "Internet of Things" (IoT) applications.

Mobile coverage is discussed in the analysis that is provided in **Section 3** for cities, towns and smaller localities in the region. *In all cases*, the outlook five years hence depends significantly on the pace and extent to which 5G technology is rolled out in regional areas of Victoria.

The mobile network operators are progressively introducing support for the Cat-M1 and NB-IOT protocols – suited to various IoT purposes. To date, only Optus has provided information for inclusion in SLIM. The Optus coverage relates to agricultural IOT trials being conducted in the north of the state and in Gippsland. Coverage that extends to any areas of this region is noted.

### Mobile coverage challenges

The market dynamics of the fixed and mobile markets vary considerably in Australia.

In the fixed broadband market, the Commonwealth Government responded with the NBN initiative to address a growing divide between urban and rural areas. In urban areas, high population densities and concentrated consumer spending attract network investment and competition. In addition, Telstra was required to grant other mobile network operators access to its copper network to moderate what would otherwise have been a near-monopoly grip on the market.

There has been no similar intervention in Australia's mobile network - though the challenges are broadly parallel. In particular, investment has flourished in urban areas, but has languished in rural areas where there is insufficient revenue-generating traffic to drive commercial returns. As a result, only around one-third of Australia's landmass enjoys mobile coverage. The percentage in Victoria is significantly higher – estimated at around 75 per cent - as a consequence of comparatively high population densities.

It is not realistic to expect 100 per cent coverage of Australia's vast landmass. However, with the advent of smart phones and data capabilities, the mobile networks are becoming ever more important to all Australians for many different purposes including (but not limited to):

- social amenity;
- occupational health and safety (noting that in emergency situations, triple-zero calls can be made on *any* available network);
- on-the-spot access to information and services relevant to one's business, lifestyle and/or well-being;
- supporting IoT applications
- as a supplement (or alternative) to a fixed broadband service, especially in areas served only by NBN Co's satellite service.

At the present level of coverage (by any MNO) many of the potential socio-economic benefits remain 'out of reach'. In this context, pushing the boundaries of mobile network coverage promises social-economic benefits that can be disproportionate to the additional revenue opportunities available to MNOs.

The challenges for the MNOs are understandable. If investment in extending coverage to an area does not generate sufficient additional revenue generating traffic to be profitable, it is not a prudent use of shareholder funds.

The structure of the mobile market in Australia leads to the question of what constitutes a mobile blackspot. Most Australians subscribe to one and only one mobile network – and for many such Australians, a blackspot exists if the particular operator they have chosen does not offer coverage relevant to their location and transport patterns.

However, one of the benefits of the vigorous competition that prevails to attract mobile users in urban areas is a rich array of competitively priced options. As a result, for those users whose preferred MNO does not provide coverage in all the areas that they frequent, the cost of subscribing to a secondary plan is typically not prohibitive. There are also dual SIM phones that facilitate management of connectivity in a two-network environment.

## *2.3 LP-WAN coverage*

### General notes

LP-WAN technologies are designed for low-bandwidth transmission of small packets of information, with the radio technology supporting battery life of several years, making it well-suited for remote IoT sensors. Two-way protocols can be used for both monitoring (for example, meters, alarms etc.) and control responses. In contrast, one-way protocols support only

monitoring, but typically achieve longer battery life by obviating the need to "listen" for transmissions.

The original providers of LP-WAN technology coverage are:

- NNNCo, with LoRaWAN technology; LoRa is a two-way protocol; at the time of analysis, no information about coverage was available
- Thinxtra, with Sigfox technology – Sigfox is also a two-way protocol; and
- Taggle, a one-way technology used widely for water meter reading.

Deployment of these LP-WAN technologies (LoRa, Sigfox and Taggle) is driven by project-specific opportunities, rather than by up-front investment in coverage in the hope that applications will follow.

The major mobile network operators are rapidly moving into the provision of LP-WAN services (NB-IoT), with data available for digital plan analysis on Optus NB-IoT coverage. Telstra's LTE-M (LTE Cat-M1) public coverage map shows full coverage for Victoria except for some alpine areas.

In addition to utilising LP-WAN technologies, Smart City and Smart Town initiatives can often take advantage of short-range technologies such as WiFi, coupled with backhaul provided by an NBN service, an independently sourced connectivity solution or a mobile network service.

Given the low bandwidth utilised by these technologies, much less infrastructure investment is required to provide coverage to large areas.

## LoRa

An Australian company, NNNCo Pty. Ltd., is a leading proponent of LoRa technology and is known to be working in a range of smart city and rural applications. Details of coverage established in support of these projects is not published. In addition to NNNCo, various other parties are known to have deployed LoRa base stations for trial purposes and/or for particular applications.

## Sigfox

Sigfox publishes a global coverage map[13]. The diagram below shows coverage in the Loddon Campaspe Region in blue. In contrast to the Taggle map (see following), the Sigfox map appears to take account of topographic occlusions – as evidenced by the irregular patterns of coverage at the fringes of coverage areas.

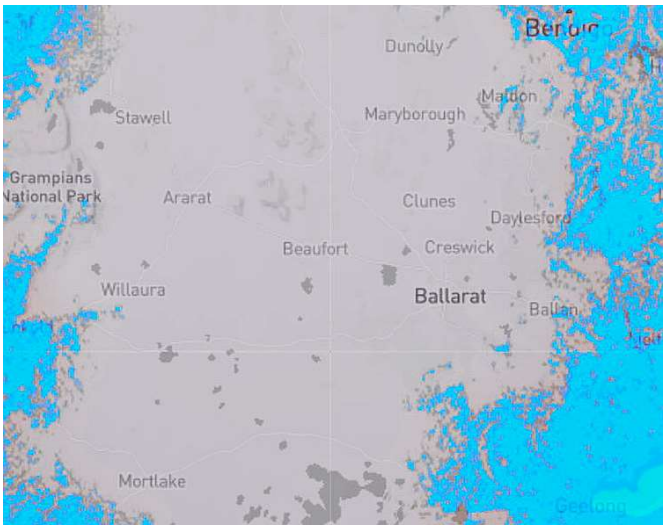



*Figure 11 Sigfox Coverage of Loddon Campaspe Region.*

Based on this map, there may be some coverage around the fringes of the Loddon Campaspe Region.

## Taggle

Taggle has provided indicative coverage maps for inclusion in the SLIM GIS, but they do not reflect any topographic occlusions that may affect communications at the margins. Nominal coverage is as shown in orange in the diagram that follows – field testing to confirm communications towards the fringes of coverage areas would be prudent as additional base stations may need to be deployed to assure good connectivity.

[13] Map derived from Sigfox coverage map published at http://www.sigfox.com/en/coverage (accessed on 3 July 2018).

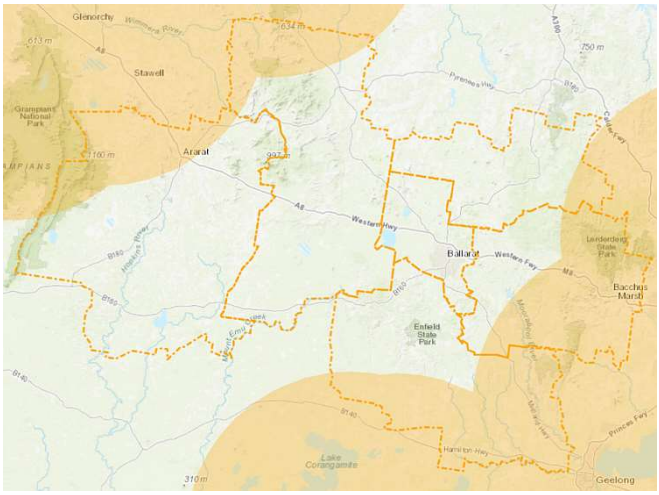



*Figure 12 Taggle Coverage of the Loddon Campaspe Region (SLIM)*

## 2.4 Other connectivity options

The Victorian Government agency VicTrack has fibre links running along regional rail corridors. The analysis of places notes where VicTrack fibre passes through (or nearby) a population centre. Access to the fibre may be possible subject to commercial arrangements, and the availability of suitable access points.

Also, in the context of other connectivity options, the power transmission network commonly includes optical fibre in the Overhead Power Ground Wires (OPGWs) that protect the power lines below from lightning strikes. Whilst it is not known if fibre capacity is available and accessible on any particular segment of the power transmission network, the proximity of a location to the power transmission network is noted where applicable.

In various locations, commercial providers such as Telstra, Optus, Nextgen and potentially others may be able to offer connectivity solutions for a wide range of purposes. Details of their infrastructure are currently not available in SLIM.

## 2.5 SLIM analysis

Whilst some of the broad perspectives offered in this report are based on information from the SLIM GIS, SLIM is at its most powerful for detailed analysis of particular areas. Stakeholders are encouraged to build familiarity with the system when it is publicly available in order to be able to investigate particular needs in their jurisdictions, combining the information in SLIM with local knowledge.

# 3 Significant Places

The 22 places selected for analysis in this section include all cities (population[14] > 10,000), all towns (population > 1,000) and the largest locality (population <1,000) in each LGA that makes up the region.

In combination, the 22 places accommodate 73.4 per cent of the region's population of 239,267. The proportion included in the analysis would be higher if those living in the immediate surrounds of each named place were to be counted.

The balance of the region's population (26.6 per cent) is living in communities with a population of less than 185, or on isolated properties (farms and the like). Based on an average Victorian household size of 2.6 as reported by the ABS[15], this equates to an estimated 22,028 households outside of the places considered in the following subsections.

The source of data in this section is cited for the first (only) reference of its type.

## 3.1 City of Bendigo

Bendigo is a city located very close to the geographical centre of the state and approximately 150 kilometres northwest of Melbourne. As of June 2016, Bendigo was the fourth largest inland city in Australia and fourth most populous city in the state. It is the administrative centre for the City of Greater Bendigo. The discovery of gold in the soils of Bendigo during the 1850s made it one of the most significant Victorian era boomtowns in Australia. Bendigo is the largest finance centre in Victoria outside Melbourne and is home to the Bendigo Bank.

General characteristics of the city that provide an indication of the city's likely telecommunications demand profile include:

- The population of Bendigo grew by 21.5% over a decade to 92,379 in 2016, well above the median growth rate of 9.7% for the 21 major places analysed in the region
- 43,486 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 53.0% being in full-time employment and 34.7% in part-time employment (with the remainder not at work at the time of the June 2016 census).
- 10.2% of the labour force classified themselves as managers, 20.7% as professionals and 12.4% as clerical and administrative workers
- 6.9% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals), 2.9% cited banking and 2.6% cited primary education
- The city has 2 public and 1 private hospital
- The city has 7 primary schools, 3 primary/secondary schools, 2 secondary schools, 2 special development schools and a TAFE
- With a median age of 38, Bendigo has one of the youngest populations in regional Victoria and just above the Victorian median of 37
- The ABS reports a median annual household income of $61.1K for Bendigo, above the median of $51.4K for the places analysed in the region but below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 2,505 businesses in the city or its near surrounds
- In 80.0% of dwellings, at least one person accessed the internet from home.

### Skills

ABS Census data indicates:

- 24.8% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 19.0% have completed level III or IV trade certificates; and
- another 13.1% have completed year 12.

[14] All population figures cited in this report are based on the 2016 Census, published by the Australian Bureau of Statistics.

[15] Much of the data for locations and larger areas is sourced from the ABS Quickstats site (see http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/2?opendocument).

ABS Industry employment data from 2016 indicated that the Bendigo LGA had 5.3 per cent employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Bendigo as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Bendigo is primarily serviced by NBN FTTN, with building underway for NBN FTTC in some outer areas in the north and north-west. NBN fixed wireless serves some areas outside the NBN fixed line footprint where there are higher concentrations of residential and business premises around Bendigo, such as to the north-west and south-east.

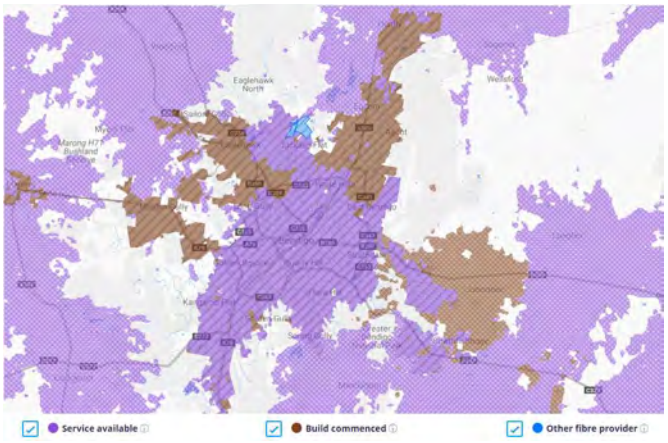



*Figure 13 Fixed Broadband Coverage of Bendigo*

The map above shows only NBN satellite services around much of the fixed line footprint. Examining aerial imagery of the area shows several businesses in Kangaroo Flat, south-west Bendigo, falling just outside the NBN fixed line footprint, serviced by satellite. Premises in these locations are likely to experience significant service disparities compared to the nearby premises within the NBN fixed line footprint.


*Figure 14 Aerial imagery showing NBN satellite coverage of businesses in the south-west of Bendigo*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire city.
- Optus shows 4G Plus *outdoor* coverage across the entire city.
- Vodafone shows 4G *indoor* coverage across the entire city.

In summary, there appear to be no mobile coverage issues in the city, with the three major mobile network operators all offering service.

## LP-WAN Coverage

There is partial SigFox coverage in Bendigo with limited Optus agricultural IoT coverage in the region. Testing may be needed to confirm coverage.

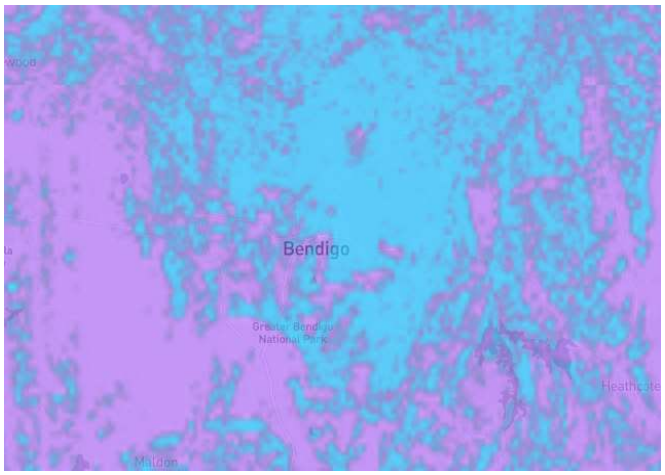



*Figure 15 SigFox coverage in Bendigo*

Taggle is not currently available in Bendigo.

## Public WiFi Coverage

There is extensive free public WiFi in Bendigo with the rollout of the Victorian Government free WiFi pilot. Free WiFi access is available throughout the CBD, and major tourist attractions in central Bendigo.

## Other

VicTrack fibre transits the southern fringe of the city, following the route of the train line to Castlemaine.

220v power is available through the Bendigo-Ballarat transmission terminal.

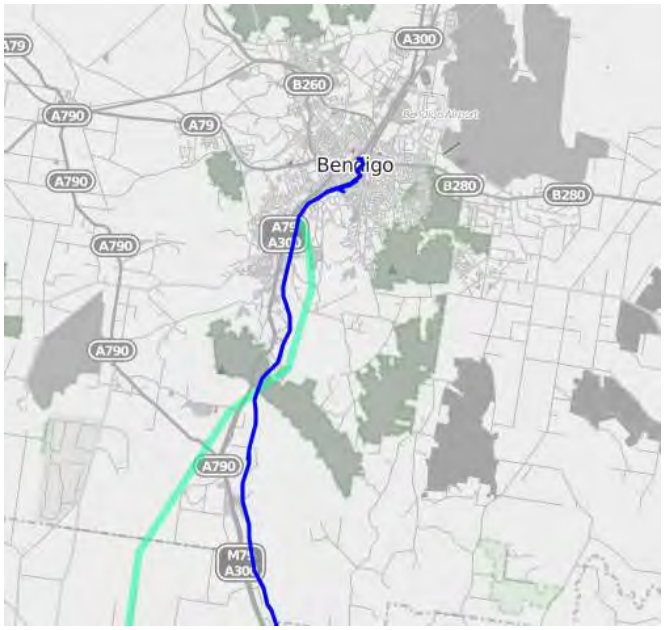



*Figure 16 VicTrack fibre (dark blue) and power south of Bendigo*

## 3.2 City of Echuca-Moama

Echuca-Moama is a population centre located 214 kilometre north of Melbourne on the banks of the Murray River and Campaspe River. Moama is located adjacent to Echuca in Victoria on the northern side of the Murray River in New South Wales. Echuca is the administrative centre and largest settlement in the Shire of Campaspe. Echuca's position at the closest point of the Murray to Melbourne contributed to its development as a thriving river port city during the 19th century.

General characteristics of the city that provide an indication of the city's likely telecommunications demand profile include:

- The population of Echuca-Moama grew by 4.4% over a decade to 12,906 in 2016, below the median growth rate of 9.7% for the 21 major places analysed in the region
- 5,868 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 54.8% being in full-time employment and 33.4% in part-time employment
- 11.3% of the labour force classified themselves as managers, 16.0% as professionals and 9.9% as clerical and administrative workers
- 5.3% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals), 3.2% cited secondary education and 2.9% cited accommodation
- One public hospital is located in the city
- The city has 5 primary schools, 2 secondary schools, a specialist development school and a TAFE
- With a median age of 43, Echuca-Moama is slightly younger than the median of 45 for the places analysed in the region, but above the Victorian median of 37
- The ABS reports a median annual household income of $57.5K for Echuca-Moama, above the median of $51.4K for the places analysed in the region but still below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 748 businesses in the city or its near surrounds
- In 74.7% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 18.8% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 20.0% have completed level III or IV trade certificates; and
- another 11.0% have completed year 12.

ABS Industry employment data from 2016 indicated that the Campaspe LGA had 3.8% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Echuca-Moama as advised by NBN Co in September 2018. The purple/striped areas show the locations

currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Echuca-Moama is serviced largely by NBN FTTN, with NBN fixed wireless servicing farms and rural properties in the areas surrounding the city to the east, south and west. The NSW town of Moama to the north has some patchy coverage of NBN satellite services. There do not appear to be any significant aggregations of businesses in the fixed wireless footprint.

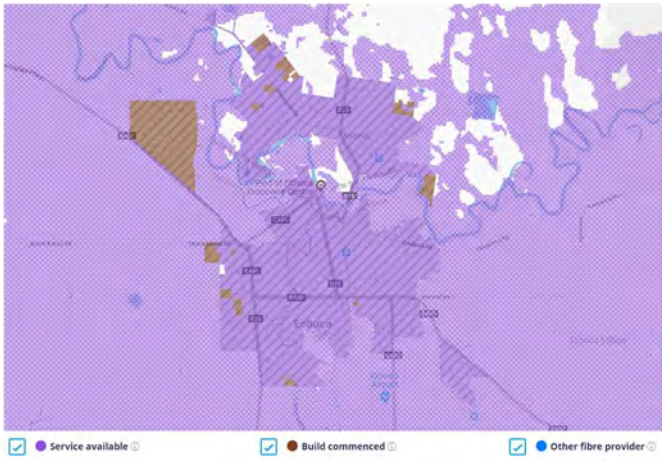



*Figure 17 Fixed Broadband coverage of Echuca-Moama*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire city.
- Optus shows 4G Plus *outdoor* coverage across the entire city.
- Vodafone shows 4G *indoor* coverage across the entire city, with new coverage under construction.

In summary, there appear to be no mobile coverage issues in the city, with the three major mobile network operators all offering service.

## LP-WAN Coverage

There is no SigFox or Taggle IOT coverage in Echuca-Moama with limited Optus agricultural IOT coverage in the region. Testing may be needed to confirm coverage.


*Figure 18 Optus NB-IOT coverage in Echuca-Moama*

## Public WiFi Coverage

Free WiFi is available at the Echuca Library.

## Other

VicTrack fibre does not transit Echuca-Moama region.

# 3.3 Town of Gisborne

Gisborne is a town in the Macedon Ranges, approximately 54 kilometres northwest of Melbourne. The town was named after Henry Fyshe Gisborne, the first Commissioner for Crown Lands of the Port Phillip District. Gisborne is the largest township in the Macedon Ranges, and the closest to Melbourne's CBD. Proximity to the city and the area's natural beauty are drawing large numbers of new residents, making the local population growth rate among the fastest in regional Victoria.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Gisborne grew by 53.5% over a decade to 9,822 in 2016, well above the median growth rate of 10.5% for the 17 major places analysed in the region
- 4,901 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 57.4% being in full-time employment and 33.3% in part-time employment

- 14.3% of the labour force classified themselves as managers, 23.0% as professionals and 15.0% as clerical and administrative workers
- 3.0% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 2.4% cited local government administration
- One public hospital is located in the town
- The town has 5 primary schools and a secondary school
- With a median age of 37, Gisborne has one of the youngest populations in regional Victoria
- The ABS reports a median annual household income of $96K for Gisborne, above Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 368 businesses in the town or its near surrounds
- In 89.9% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 33.8% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 18.8% have completed level III or IV trade certificates; and
- another 14.5% have completed year 12.

ABS Industry employment data from 2016 indicated that the Macedon Ranges LGA had 8.6% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Gisborne as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Gisborne is serviced by NBN FTTN. The patch shown to be under construction, the brown striped area in the centre of the below image, is also planned to be serviced by NBN FTTN. Our analysis also shows that a large perimeter of the suburbs surrounding Gisborne is proposed to be serviced by NBN fixed wireless, however the NBN map below does not show the fixed wireless network to have begun construction yet. Small patches of this area will be serviced by Satellite. Examining aerial imagery of the future NBN satellite area shows no significant aggregations of businesses or residences in these areas.

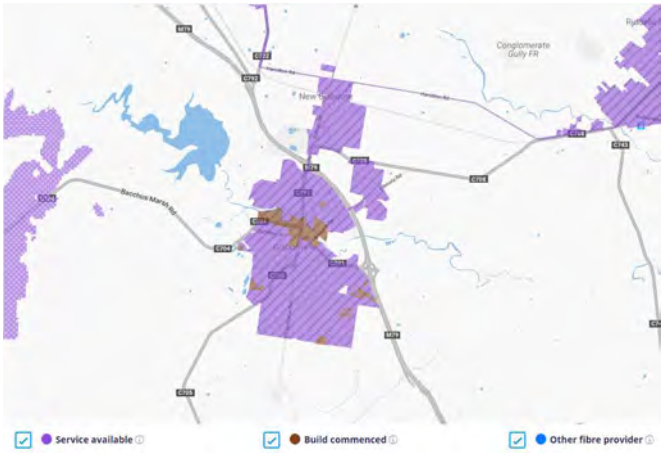



*Figure 19 Fixed Broadband coverage of Gisborne*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* and *outdoor* coverage across the entire town, with new coverage under construction.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

## LP-WAN Coverage

There is extensive Taggle coverage and limited SigFox available in Gisborne.

## Public WiFi Coverage

Free WiFi is available at the Gisborne Library.

## Other

VicTrack fibre transits Gisborne through the northern fringe of the town, following the train line.

## 3.4 Town of Castlemaine

Castlemaine is a small city in the Goldfields region of Victoria about 120 kilometres northwest of Melbourne and about 40 kilometres from the major provincial centre of Bendigo. It is the administrative and economic centre of the Shire of Mount Alexander. Castlemaine began as a gold rush boomtown in 1851 and developed into a major regional centre. It is home to many cultural institutions including the Theatre Royal, the oldest continuously operating theatre in mainland Australia.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Castlemaine grew by 37.0% over a decade to 9,932 in 2016 well above the median growth rate of 9.7% for the 21 major places analysed in the region
- 3,952 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 47.5% being in full-time employment and 41.8% in part-time employment
- 12.0% of the labour force classified themselves as managers, 26.3% as professionals and 9.7% as clerical and administrative workers
- 6.4% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 2.9% cited primary education
- One public hospital is located in the town
- The town has 4 primary schools, a primary/secondary school, a secondary school and a TAFE
- With a median age of 47, Castlemaine is just older than the median of 45 for the places analysed in the region and older than the Victorian median of 37
- The ABS reports a median annual household income of $49.8K for Castlemaine, just below the median of $51.4K for the places analysed in the region and below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 262 businesses in the town or its near surrounds
- In 77.6% of dwellings, at least one person accessed the internet from home.

### Skills

ABS Census data indicates:

- 31.6% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 13.0% have completed level III or IV trade certificates; and
- another 10.4% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mount Alexander LGA had 7.8% employment in the industry sectors with strong technology exposure.

### Fixed Broadband

The map below shows the status of the NBN rollout in Castlemaine as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

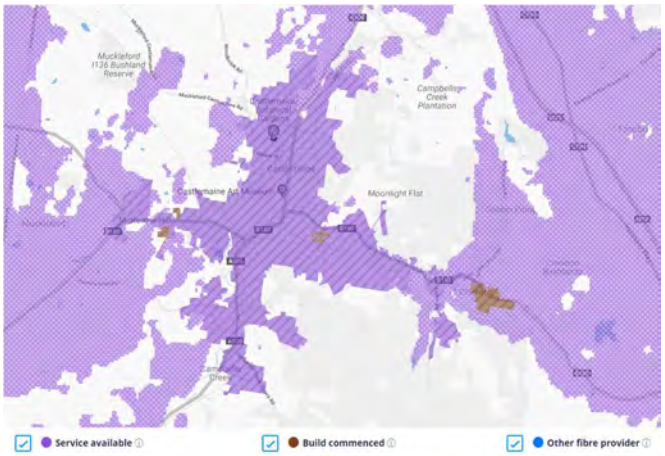



*Figure 20 Fixed Broadband Coverage of Castlemaine*

Our analysis shows that Castlemaine is largely serviced by FTTN, with fixed wireless and satellite coverage in the outer suburbs. As the above image shows, there are large patches of satellite coverage close to the town, to the north-west, north-east, south-west and south-east.

Aerial imagery shows that while there are few businesses and a low concentration of residences in the areas serviced by satellite surrounding Castlemaine, some small clusters close to the town fall just outside the fixed line and fixed wireless footprints,

such as is shown in the image below of an area south of the town. Premises in these locations are likely to experience significant service disparities compared to the nearby premises within the NBN fixed line footprint.


*Figure 21 Aerial imagery showing satellite coverage of residences south of Castlemaine*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town, with new coverage enhancements under construction.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

## LP-WAN Coverage

There is limited SigFox coverage in Castlemaine. Optus Ag-IOT and Taggle are not currently available in Castlemaine.

## Public WiFi Coverage

Free WiFi is available at the Castlemaine Library.

## Other

VicTrack fibre transits through the centre of Castlemaine, following the route of the train line to Bendigo.

220v power is available through the Bendigo-Ballarat transmission terminal.

# 3.5 Town of Maryborough

Maryborough is a town located on the Pyrenees Highway, 58 kilometres north of Ballarat and 168 kilometres northwest of Melbourne, in the Shire of Central Goldfields. Gold was discovered at White Hill, four kilometres north of Maryborough, in 1854, leading to prospectors rushing to the area. The last gold mine in Maryborough closed in 1918. In 1924 the Maryborough Knitting Mills opened, which established the town as a centre for the wool industry.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Maryborough declined by 2.5% over a decade to 7,496 in 2016, one of the lowest growth rates of the 21 places analysed in the region and below the median of 9.7%
- 2,635 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 48.0% being in full-time employment and 37.9% in part-time employment
- 10.2% of the labour force classified themselves as managers, 11.7% as professionals and 10.0% as clerical and administrative workers
- 4.9% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 4.0% cited aged care residential services
- One public hospital is located in the town
- The town has 1 primary school, 1 secondary school and a primary/secondary school
- With a median age of 50, Maryborough is older than the median age of 45 for the places analysed in the region and above the Victorian median of 37
- The ABS reports a median annual household income of $39.7K for Maryborough, one of the lowest in the region and well below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 270 businesses in the town or its near surrounds
- In 65.4% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 12.6% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 19.4% have completed level III or IV trade certificates; and
- another 11.5% have completed year 12.

ABS Industry employment data from 2016 indicated that the Central Goldfields LGA had 3.5% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Maryborough as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite.

Our analysis shows that the town of Maryborough is largely serviced by NBN FTTN, with NBN satellite servicing the farmland and rural properties surrounding the town. Aerial imagery shows that this perimeter is largely bushland with few residences or businesses.

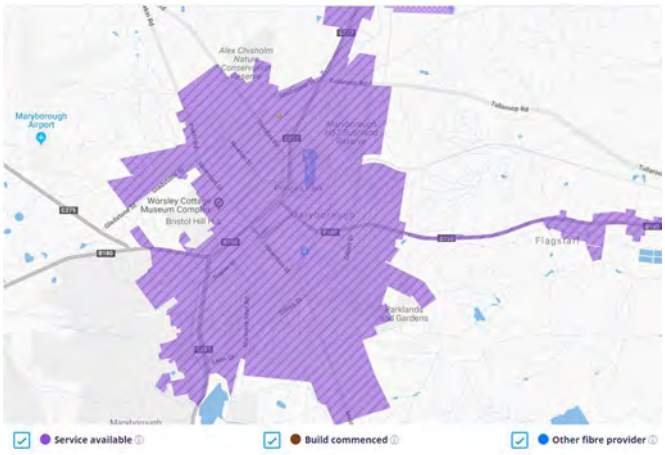



*Figure 22 Fixed Broadband coverage of Maryborough*

Aerial imagery shows a cluster of premises, which includes two businesses, to the west of Maryborough falling just outside of the Fixed line footprint. Premises in these locations are likely to experience significant service disparities compared to the nearby premises within the NBN fixed line footprint.

Stakeholder feedback has indicated that new developments around Maryborough have experienced connectivity issues for internet speeds and mobile coverage. More detailed analysis would be required to determine the exact boundaries of these performance issues.


*Figure 23 Aerial imagery showing satellite coverage of businesses and residences in west Maryborough*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

Looking forward five years, an important measure of the adequacy of mobile services will be the pace at which the next generation of 5G mobile technology is introduced into the Bacchus Marsh area.

## LP-WAN Coverage

There is limited to no SigFox coverage in Maryborough. Optus Ag-IOT and Taggle are not currently available in Castlemaine.

## Public WiFi Coverage

Free WiFi is available at the Maryborough Library.

## Other

VicTrack fibre does not transit through Maryborough.

## 3.6 Town of Kyabram

Kyabram is located in the centre of a rich irrigation district in the Goulburn River Valley, 200 kilometres north of Melbourne. Kyabram, the second-largest town in the Shire of Campaspe, is situated between the towns of Echuca and Shepparton and is close to the Murray River, Goulburn River, Campaspe River and Waranga Basin. The district is dependent on the primary industries of dairy and fruit orchards.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Kyabram grew by 4.9% over a decade to 5,899 in 2016, below the median growth rate of 9.7% for the 21 major places analysed in the region
- 2,379 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 53.4% being in full-time employment and 33.2% in part-time employment
- 9.7% of the labour force classified themselves as managers, 16.0% as professionals and 11.6% as clerical and administrative workers
- 5.5% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals), 4.0% cited aged care residential services and 2.7% cited secondary education
- One public hospital is located in the town
- The town has 2 primary/secondary schools
- With a median age of 47, Kyabram is slightly older than the median of 45 for the major places analysed in the region
- The ABS reports a median annual household income of $49.9K for Kyabram, just below the median of $51.4K for the places analysed in the region and below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 235 businesses in the town or its near surrounds
- In 71.2% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 16.2% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 19.1% have completed level III or IV trade certificates; and
- another 9.7% have completed year 12.

ABS Industry employment data from 2016 indicated that the Campaspe LGA had 3.8% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Kyabram as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services and the purple/spotted areas show locations serviced by NBN fixed wireless services, and white areas locations serviced by NBN satellite.

Our analysis shows that Kyabram is largely serviced by NBN FTTN with wide coverage of fixed wireless servicing the farmland and rural properties surrounding the town.

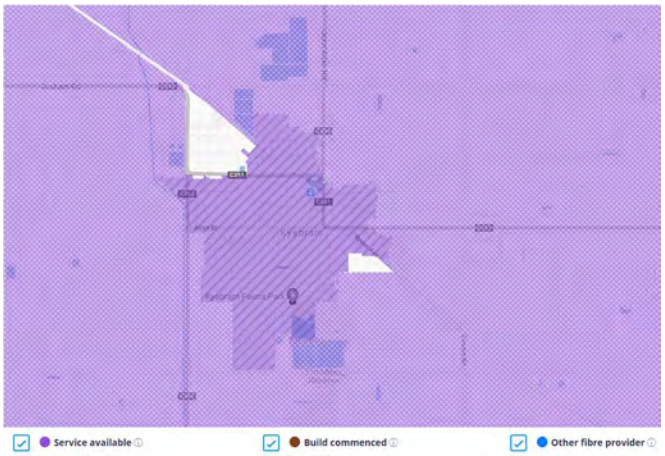



*Figure 24 Fixed Broadband Coverage of Kyabram*

The above image shows a small patch of satellite coverage in the east of the town, and a larger patch in the north-west. Aerial imagery shows that there are no businesses in the small eastern patch, but an aggregation of residences. The patch in the north-west is an industrial area with a high concentration of businesses. Premises in these locations are likely to experience significant service disparities compared to the nearby premises within the NBN fixed line footprint.

*Figure 25 Aerial imagery showing NBN satellite coverage of businesses in the north-west of the town of Kyabram*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

## LP-WAN Coverage

There is extensive Optus Ag-IOT coverage in Kyabram. Taggle and SigFox IOT are not currently available in Kyabram.

## Public WiFi Coverage

Free WiFi is available at the Kyabram Library.

## Other

VicTrack fibre does not transit through Kyabram.

# *3.7 Town of Kyneton*

Kyneton is a town in the Macedon Ranges region of Victoria located 83 kilometre northwest of Melbourne. Unlike a majority of towns in the area, Kyneton predates the Victorian gold rushes, having been established in 1850; the gold rushes started the year after. Kyneton offers tourists several points of interest locally including the Botanic Gardens (established in the mid-1800s) and several walks along the Campaspe River and various Farmers Markets and festivals throughout the year make the town popular as a day trip destination.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Kyneton grew by 13.5% over a decade to 4,866 in 2016 above the median growth rate of 9.7% for the 21 major places analysed in the region
- 2,095 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 52.7% being in full-time employment and 36.5% in part-time employment
- 12.5% of the labour force classified themselves as managers, 20.5% as professionals and 11.7% as clerical and administrative workers
- 3.6% of the labour force cited their industry of employment as aged care residential and 3.0% cited primary education
- One public hospital is located in the town
- The town has 2 primary schools, 2 secondary schools and 2 TAFEs
- With a median age of 45, Kyneton has the median age of the 21 major places analysed in the region, and above Victoria's median age of 37
- The ABS reports a median annual household income of $58.9K for Kyneton, above the median of $51.4K for the places analysed in the region but below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 269 businesses in the town or its near surrounds
- In 76.8% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 27.0% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 15.3% have completed level III or IV trade certificates; and
- another 12.9% have completed year 12.

ABS Industry employment data from 2016 indicated that the Macedon Ranges LGA had 8.6% employment

in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Kyneton as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN fixed wireless services and white areas locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Kyneton is largely serviced by NBN FTTN, with a small new development area in the south of the town, just above Campaspe River, serviced by NBN FTTP, and a large perimeter of fixed wireless servicing farmland and rural properties around the town. There are some small patches of NBN satellite in the south of the town, but there do not appear to be any premises in these areas.

Our analysis shows that the small patch in the south of the town of Kyneton shown to have services under construction is a new development area that will be serviced by NBN FTTP. The small patches in the north and east will be serviced by NBN FTTN.

Our analysis shows that there are no significant aggregations of businesses in the NBN fixed wireless footprint surrounding Kyneton.

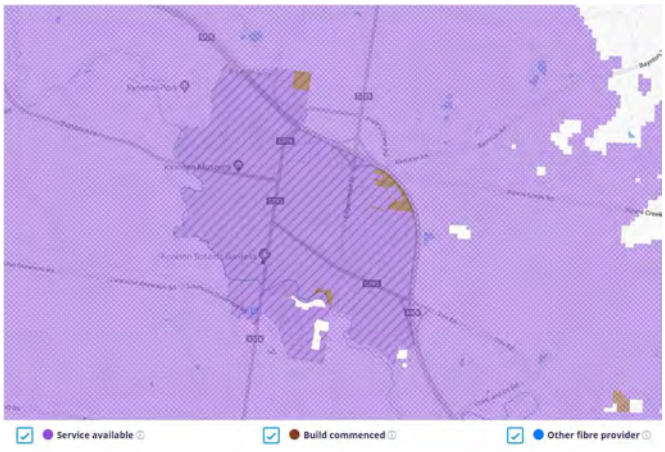



*Figure 26 Fixed Broadband Coverage of Kyneton*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

## LP-WAN Coverage

There is extensive Taggle IOT coverage in Kyneton. Optus Ag-IOT and SigFox are not currently available in Kyneton.

## Public WiFi Coverage

Free WiFi is available at the Kyneton Library.

## Other

VicTrack fibre transits through the west of Kyneton following the train line.

# 3.8 Town of Romsey

Romsey is a town in the local government area of the Shire of Macedon Ranges, 61 kilometres north of Melbourne. Romsey is a growing community which has multiple major projects in progress.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Romsey grew by 9.7% over a decade to 3,868 in 2016, which is the median growth rate of the 21 places analysed in the region
- 1,901 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 57.7% being in full-time employment and 31.4% in part-time employment
- 10.4% of the labour force classified themselves as managers, 14.4% as professionals and 14.1% as clerical and administrative workers
- 2.8% of the labour force cited their industry of employment as primary education and 2.2% cited secondary education
- The nearest hospital is located in Kyneton to the northwest
- The town has 1 primary school

- With a median age of 40, Romsey has one of the younger populations in the region but above the Victorian median of 37
- The ABS reports a median annual household income of $81.1K for Romsey, one of the highest in the region and just above Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 154 businesses in the town or its near surrounds
- In 87.6% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 22.7% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 22.0% have completed level III or IV trade certificates; and
- another 14.6% have completed year 12.

ABS Industry employment data from 2016 indicated that the Macedon Ranges LGA had 8.6% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Romsey as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services and white areas locations serviced by NBN satellite. The brown / spotted areas show the locations where NBN fixed wireless services are planned or under construction.

Our analysis shows that Romsey is largely serviced by NBN FTTN. New development areas in the south and south-eastern outskirts of the town are serviced by NBN FTTP or services are under construction. A large perimeter of fixed wireless around Romsey is planned or under construction. This includes the farmland between Romsey and Lancefield to the north, and Ridells Creek to south-west, with some small patches of satellite between these towns.

The small patches of NBN satellite on the north and south perimeter of the NBN fixed line footprint do not appear to cover any premises.

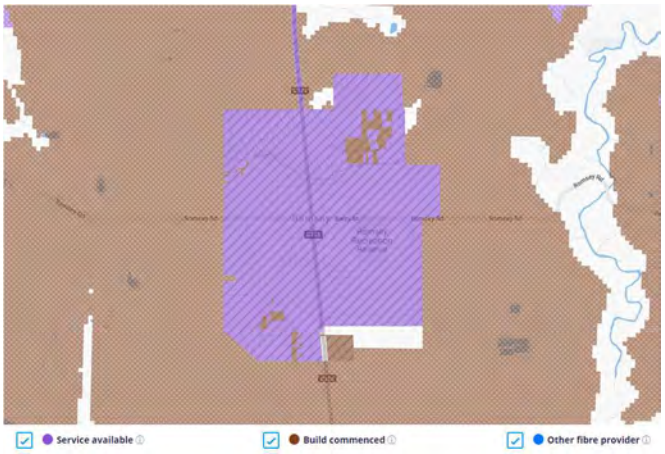


*Figure 27 Fixed Broadband coverage of Romsey*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 3G and 4G *outdoor* coverage across the entire town, with new coverage under construction.

In summary, residents have options for good coverage in the town and surrounding area from two of the three mobile network operators and marginal outdoor coverage from the remaining mobile network operator.

## LP-WAN Coverage

There is extensive Taggle IOT coverage and partial SigFox in Romsey. Optus Ag-IOT is not currently available in Romsey.

## Public WiFi Coverage

Free WiFi is available at the Romsey Library.

## Other

VicTrack fibre does not transit through Romsey.

# *3.9 Town of Woodend*

Woodend is located in the Shire of Macedon Ranges local government area and is bypassed to the east and north by the Calder Freeway. The town is located about halfway between Melbourne and

Bendigo. Woodend is close to such attractions as Mt Macedon and Hanging Rock located at nearby Newham, and numerous waterfalls. The area supports a large horse racing community.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Woodend grew by 19.0% over a decade to 3,775 in 2016 above the median growth rate of 9.7% for the 21 major places analysed in the region
- 1,773 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 54.1% being in full-time employment and 34.2% in part-time employment
- 13.3% of the labour force classified themselves as managers, 29.9% as professionals and 10.2% as clerical and administrative workers
- 3.7% of the labour force cited their industry of employment as primary education and 3.7% cited hospitals (except psychiatric hospitals)
- The nearest hospital in the region is located in Kyneton to the northwest
- The town has 1 primary schools and a secondary school
- With a median age of 43, Woodend is younger than the median of 45 for the places analysed in the region but older than the Victorian median of 37
- The ABS reports a median annual household income of $79.4K for Woodend, one of the highest in the region and just below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 179 businesses in the town or its near surrounds
- In 86.6% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 39.0% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 14.3% have completed level III or IV trade certificates; and
- another 12.1% have completed year 12.

ABS Industry employment data from 2016 indicated that the Macedon Ranges LGA had 8.6% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Woodend as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN Fixed wireless services and white areas locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Woodend is largely serviced by NBN FTTN and a small patch of NBN FTTP in new development areas in the north and east of the town. NBN satellite services the majority of the surrounding areas, with some NBN Fixed wireless servicing areas to the north-east of the town, and some under construction in areas to the north and north-west. NBN FTTN is under construction in a large area in the south of the town.

Our analysis shows there are no significant aggregations of businesses outside of the NBN FTTN footprint.

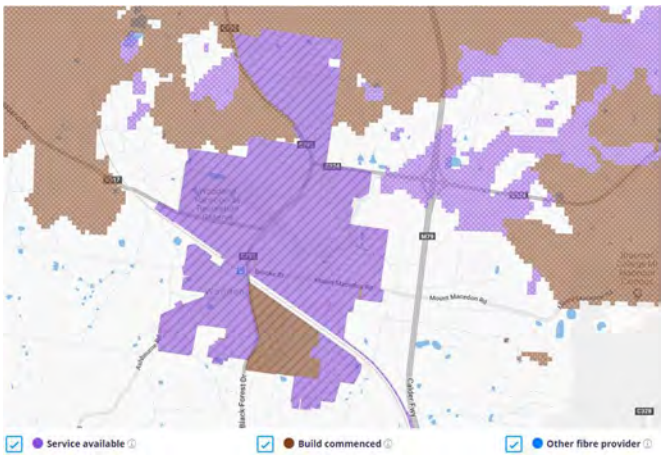



*Figure 28 Fixed Broadband coverage of Woodend*

Examining a satellite map of the same area shows a substantial number of premises outside the FTTP/FTTN area, with some serviced by fixed wireless and some in the satellite footprint.

Whilst residents in central Woodend are well-equipped with the best available NBN technology, many of those living in satellite coverage areas within a few kilometres of the city centre would find the fixed broadband coverage limited. In addition, recent publicity has highlighted performance issues with the

NBN fixed wireless service, culminating in NBN Co's decision to discontinue plans for a 100/40 Mbps service, at least for the time being.

*Figure 29 Aerial imagery showing an example of the gaps in Fixed wireless coverage around Woodend*

The *General Infrastructure and Technology Issues* outlined in **Section 1** contains a brief discussion of the limitations associated with the different NBN Co access network technologies.

### Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

### LP-WAN Coverage

There is extensive Taggle IOT coverage and partial SigFox in Woodend. Optus Ag-IOT is not currently available in Kyneton.

### Public WiFi Coverage

Free WiFi is available at the Woodend Library.

### Other

VicTrack fibre transits the through the west of Woodend following the train line.

## 3.10 Town of Riddells Creek

Riddells Creek is located in the Shire of Macedon Ranges. Riddells Creek is also the name of the main watercourse which flows through the township, and which is a tributary of Jacksons Creek to the south. Riddells Creek is on the southern foothills of the Macedon Ranges. Riddells Creek is home to two historic railway bridges and is surrounded by natural bushland.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Riddells Creek grew by 20.6% over a decade to 3,167 in 2016, above the median growth rate of 9.7% for the 21 major places analysed in the region
- 1,717 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 56.8% being in full-time employment and 34.0% in part-time employment
- 11.7% of the labour force classified themselves as managers, 19.3% as professionals and 16.4% as clerical and administrative workers
- 3.3% of the labour force cited their industry of employment as primary education and 2.8% cited hospitals (except psychiatric hospitals)
- The nearest hospital in the region is located in Kyneton to the northwest
- The town has 1 primary school
- With a median age of 41, Riddells Creek has one of the younger populations in the region, but above the Victorian median of 37
- The ABS reports a median annual household income of $96.5K for Riddells Creek, one of the highest in the region and above Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 120 businesses in the town or its near surrounds
- In 91.9% of dwellings, at least one person accessed the internet from home.

### Skills

ABS Census data indicates:

- 31.1% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 21.6% have completed level III or IV trade certificates; and

- another 14.0% have completed year 12.

ABS Industry employment data from 2016 indicated that the Macedon Ranges LGA had 8.6% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Riddells Creek as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services and white areas show locations serviced by NBN satellite. The brown / spotted areas show the locations where NBN Fixed wireless services are planned or under construction.

Our analysis shows that Riddells Creek is largely serviced by NBN FTTN, with a section of NBN FTTP in new development areas in the south-east of the town, covering five to ten per cent of the fixed line footprint. Most of this NBN FTTP is planned or still under construction.

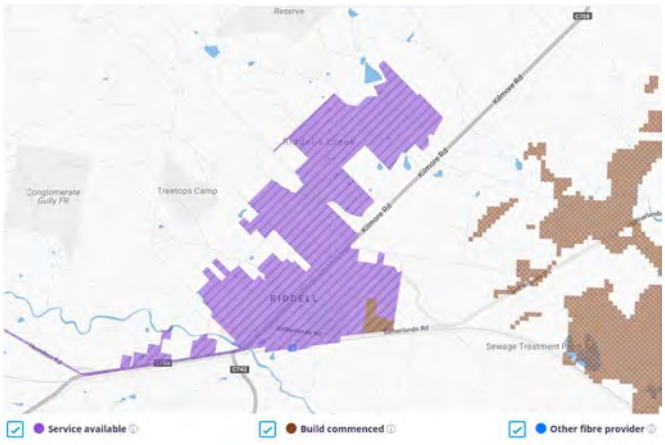



*Figure 30 Fixed Broadband Coverage of Riddells Creek*

NBN satellite services the outskirts of the town and the surrounding farmland and rural properties. While there do not appear to be any significant aggregations of businesses, aerial imagery shows that there are concentrated residential areas falling just outside the NBN fixed line footprint. Premises in these locations are likely to experience significant service disparities compared to the nearby premises within the NBN fixed line footprint.


*Figure 31 Aerial imagery showing a section towards the southern end of the town of Riddells Creek outside of the NBN fixed line footprint*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town, with new coverage under construction.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

## LP-WAN Coverage

There is extensive Taggle IOT coverage and partial SigFox in Riddells Creek. Optus Ag-IOT is not currently available in Riddells Creek.

## Public WiFi Coverage

There are no known free public WiFi services in Riddells Creek.

## Other

VicTrack fibre transits through the south of Riddells Creek, following the train line.

# *3.11 Town of Macedon*

Macedon is a town located near the Calder Freeway between Melbourne and Bendigo in the

Macedon Ranges in central Victoria. It is in the local government area of the Shire of Macedon Ranges at the foot of Mount Macedon, a 1,013-metre peak to the north.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Macedon grew by 95.1% over a decade to 2,808 in 2016, one of the highest growth rates in the region
- 1,375 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 55.9% being in full-time employment and 33.0% in part-time employment
- 18.5% of the labour force classified themselves as managers, 31.0% as professionals and 10.3% as clerical and administrative workers
- 3.8% of the labour force cited their industry of employment as primary education and 3.0% cited hospitals (except psychiatric hospitals)
- The nearest hospital is located in Kyneton to the northwest
- The town has 1 primary school
- With a median age of 44, Macedon is just below the median of 45 for the major places analysed in the region and older than Victoria's median age of 37
- The ABS reports a median annual household income of $101.3K for Macedon, the highest among the places analysed in the region and well above Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 66 businesses in the town or its near surrounds
- In 90.7% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 44.7% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 14.1% have completed level III or IV trade certificates; and
- another 12.8% have completed year 12.

ABS Industry employment data from 2016 indicated that the Macedon Ranges LGA had 8.6% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Macedon as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services and white areas show locations serviced by NBN satellite.

Our analysis shows that the town of Macedon is largely serviced by NBN FTTN, with surrounding farmland and rural properties serviced by NBN satellite. There do not appear to be any significant aggregations of businesses outside of the NBN FTTN footprint.

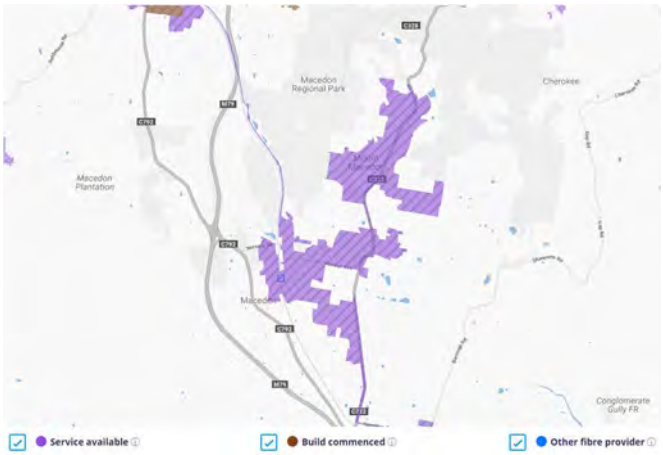



*Figure 32 Fixed Broadband Coverage in Macedon*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

## LP-WAN Coverage

There is extensive Taggle IOT coverage and partial SigFox in Macedon. Optus Ag-IOT is not currently available in Macedon.

## Public WiFi Coverage

There are no known free public WiFi services in Macedon.

## Other

VicTrack fibre transits through the centre of Macedon, following the train line.

## 3.12 Town of Rochester

Rochester is a small town located 180 kilometres north of Melbourne with a mixture of rural and semi-rural communities on the northern Campaspe River, between Bendigo and the Murray River port of Echuca. Agriculture plays an important part in the economy of Rochester. Primary agriculture includes dairy, tomatoes, cattle and sheep.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Rochester declined by 3.7% over a decade to 2,724 in 2016
- 1,052 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 54.4% being in full-time employment and 32.3% in part-time employment
- 13.2% of the labour force classified themselves as managers, 12.7% as professionals and 10.5% as clerical and administrative workers
- 5.4% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 3.6% cited secondary education
- One public hospital is located in the town
- The town has a primary/secondary school
- With a median age of 51, Rochester is older than the median of 45 for the places analysed in the region and older than Victoria's median age of 37
- The ABS reports a median annual household income of $47.3K for Rochester, below the median of $51.4K for the places analysed in the region and below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 96 businesses in the town or its near surrounds
- In 68.2% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 13.4% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 18.2% have completed level III or IV trade certificates; and
- another 9.1% have completed year 12.

ABS Industry employment data from 2016 indicated that the Campaspe LGA had 3.8% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Rochester as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services and the purple/spotted areas show locations serviced by NBN Fixed wireless services.

Our analysis shows that Rochester's fixed line footprint is entirely NBN FTTN, with a large perimeter of Fixed wireless surrounding the town and servicing the extensive area of farmland and rural properties in the area.

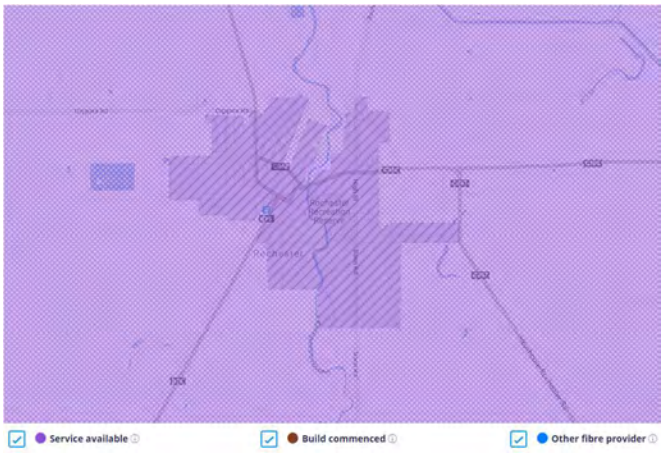



*Figure 33 Fixed Broadband coverage of Rochester*

Aerial imagery of the area shows a large number of premises in the west of Rochester falling just outside the NBN fixed line footprint. Our analysis shows that this includes several businesses. Similarly, a residential area in the south-west of the town falls just outside of the footprint. Premises in these locations are likely to experience significant service disparities compared to the nearby premises within the NBN fixed line footprint.


*Figure 34 Aerial imagery showing NBN Fixed wireless coverage of premises in the west of the town of Rochester*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

## LP-WAN Coverage

There is partial SigFox and Optus Ag-IOT coverage in Rochester. Testing is required to determine exact coverage in the region.

Taggle is not currently available in Rochester.

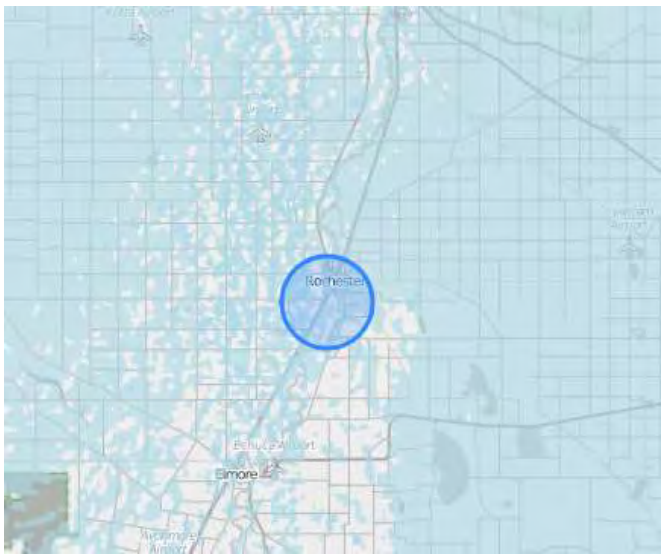



*Figure 35 Optus AG-IOT coverage in Rochester*

## Public WiFi Coverage

There are no known free public WiFi services in Rochester.

## Other

VicTrack fibre is not currently available in Rochester.

# *3.13 Town of Heathcote*

Heathcote is a town in central Victoria situated on the Northern Highway 110 kilometres north of Melbourne and 40 kilometres south-east of Bendigo. Heathcote's local government area is the City of Greater Bendigo. With the decline of gold mining the region took on an increased importance as a pastoral district.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Heathcote grew by 9.2% over a decade to 1,716 in 2016, just below the median growth rate of 9.7% for the 21 major places analysed in the region
- 538 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 50.6% being in full-time employment and 33.3% in part-time employment
- 13.4% of the labour force classified themselves as managers, 11.4% as professionals and 8.8% as clerical and administrative workers
- 4.6% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 3.4% cited primary education
- One public hospital is located in the town
- The town has 2 primary schools
- With a median age of 57, Heathcote has one of the older populations in the region, well above Victoria's median of 37
- The ABS reports a median annual household income of $38.8K for Heathcote, one of the lowest in the region and well below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 80 businesses in the town or its near surrounds
- In 66.4% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 13.6% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 18.9% have completed level III or IV trade certificates; and
- another 8.7% have completed year 12.

ABS Industry employment data from 2016 indicated that the Bendigo LGA had 5.3% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Heathcote as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN Fixed wireless services and white areas locations serviced by NBN satellite.

Our analysis shows that Heathcote is largely serviced by NBN FTTN, with two small sections of NBN FTTC planned or under construction in the centre and the south-eastern end of the town. Patchy Fixed wireless serves the surrounding areas, although the largest gaps are primarily bush. There do not appear to be any significant aggregations of businesses in the NBN Fixed wireless or Satellite footprints.

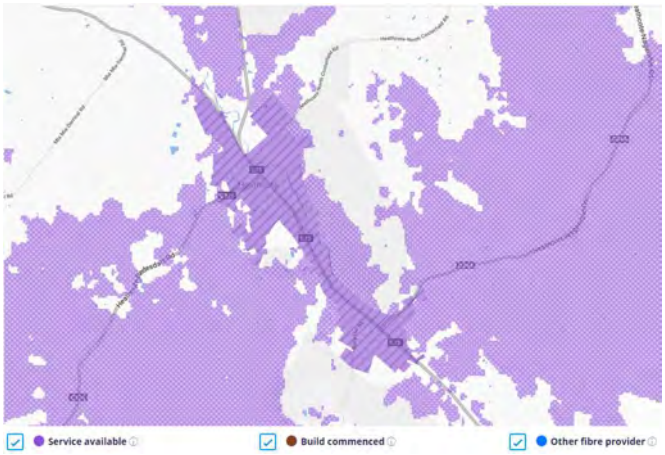



*Figure 36 Fixed Broadband coverage of Heathcote*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows no mobile coverage in the area.

In summary, residents have options for good coverage in the town and surrounding area from two of the three mobile network operators.

## LP-WAN Coverage

SigFox, Taggle and Optus Ag-IOT are not currently available in Heathcote.

## Public WiFi Coverage

Free public WiFi services are available at the Heathcote Library.

## Other

VicTrack fibre is not currently available in Heathcote.

# *3.14 Township of Lancefield*

Lancefield is a town in the Shire of Macedon Ranges local government area, 69 kilometres north of Melbourne. Lancefield's elevation and climate made it a popular summer resort in the 1880s. In recent years, many local wineries have been established in the area.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Lancefield grew by 23.5% over a decade to 1,462 in 2016 above the median growth rate of 9.7% for the 21 major places analysed in the region
- 704 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 56.5% being in full-time employment and 31.5% in part-time employment
- 10.2% of the labour force classified themselves as managers, 16.2% as professionals and 13.7% as clerical and administrative workers
- 4.4% of the labour force cited their industry of employment as primary education, 3.1% cited hospitals (except psychiatric hospitals) and 3.1% cited local government administration
- The nearest hospital is located in Kyneton to the west
- The town has 2 primary schools

- With a median age of 41, Lancefield is younger than the median of 45 for the major places analysed in the region, but older than Victoria's median age of 37
- The ABS reports a median annual household income of $69.4K for Lancefield, above the median of $51.4K for the places analysed in the region but still below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 67 businesses in the town or its near surrounds
- In 81.9% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 23.4% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 23.2% have completed level III or IV trade certificates; and
- another 12.1% have completed year 12.

ABS Industry employment data from 2016 indicated that the Macedon Ranges LGA had 8.6% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Lancefield as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN Fixed wireless services and white areas locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that Lancefield is largely serviced by FTTN, with large sections in the north and south-west of the town still under construction. There are some patches of NBN satellite to the west and south-west of the town, but aerial imagery reveals that there are few premises in these areas. A large perimeter of NBN Fixed wireless covers the farmland and rural properties surrounding Lancefield.

*Figure 37Fixed Broadband coverage of Lancefield*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 3G *outdoor* coverage across most of the town, at the edges of its coverage.

In summary, residents have options for good coverage in the town and surrounding area from two of the three mobile network operators, with partial (marginal) coverage from the third operator.

## LP-WAN Coverage

There is extensive Taggle coverage and limited SigFox coverage in Lancefield.

## Public WiFi Coverage

There are no known free public WiFi services available in Lancefield.

## Other

VicTrack fibre is not currently available in Lancefield.

# *3.15 Town of Tongala*

Tongala is a town in the Goulburn Valley region of northern Victoria in the Shire of Campaspe local government area, between Kyabram and Echuca, 225 kilometres north of Melbourne. Dairy is the most significant industry in the town's economic structure that also includes food processing at a Nestlé plant.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Tongala grew by 4.5% over a decade to 1,318 in 2016
- 538 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 50.7% being in full-time employment and 37.2% in part-time employment
- 9.2% of the labour force classified themselves as managers, 8.4% as professionals and 8.0% as clerical and administrative workers
- 8.7% of the labour force cited their industry of employment as aged care residential
- The nearest hospital is located in Kyabram to the south-east
- The town has 2 primary schools
- With a median age of 43, Tongala is younger than the median of 45 for the major places analysed in the region, but older than the Victorian median of 37
- The ABS reports a median annual household income of $50.5K for Tongala, just below the median of $51.4K for the places analysed in the region and below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 235 businesses in the town or its near surrounds
- In 69.7% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 12.1% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 20.3% have completed level III or IV trade certificates; and
- another 10.4% have completed year 12.

ABS Industry employment data from 2016 indicated that the Campaspe LGA had 3.8% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Tongala as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN Fixed wireless services.

Our analysis shows that the town of Tongala is largely serviced by NBN FTTN. There is vast coverage of Fixed wireless servicing the farmland and rural properties surrounding Tongala.


*Figure 38Fixed Broadband coverage of Tongala*

Aerial imagery of the area shows a concentration of businesses and residences in the south and south-west falling just outside of the NBN fixed line footprint, creating a technological divide running from north-west to south-east through the town. Premises south of this divide are likely to experience significant service disparities to the near-by premises falling inside the NBN fixed line footprint.

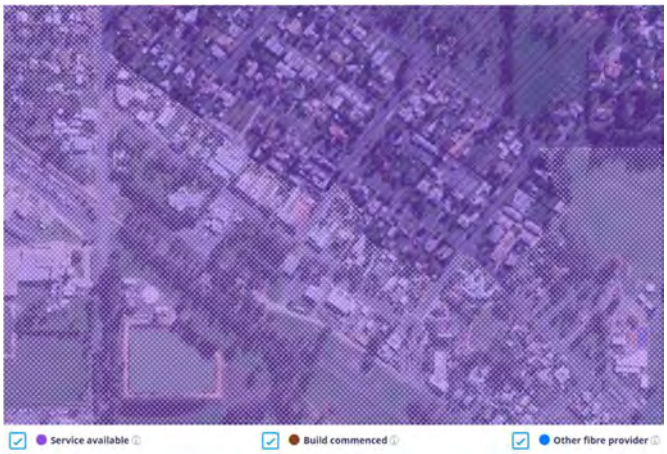



*Figure 39Aerial imagery showing Fixed wireless coverage of premises in the south-west of the town of Tongala*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.

- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 3G and 4G *indoor* coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

### LP-WAN Coverage

There is extensive Optus Ag-IOT coverage in Tongala. SigFox and Taggle IOT are not currently available.

### Public WiFi Coverage

There are no known free public WiFi services available in Tongala.

### Other

VicTrack fibre is not currently available in Tongala.

## *3.16 Town of Maldon*

Maldon is a town in the Shire of Mount Alexander local government area located 136 kilometres northwest of Melbourne. The town was declared "Australia's first notable town" in 1966 by the National Trust of Victoria for its 19th-century appearance, maintained since gold rush days. Maldon is now sustained by its appeal as a retreat and retirement venue for artists and writers, as well as tourist trade.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Maldon grew by 3.4% over a decade to 1,263 in 2016, below the median growth rate of 9.7% for the 21 major places analysed in the region
- 507 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 47.9% being in full-time employment and 42.8% in part-time employment
- 16.3% of the labour force classified themselves as managers, 20.7% as professionals and 11.6% as clerical and administrative workers
- 10.4% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- One public hospital is located in the town
- The town has 1 primary school
- With a median age of 58, Maldon has one of the oldest populations in the region, well above the Victorian median of 37
- The ABS reports a median annual household income of $41.5K for Maldon, one of the lowest in the region and well below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 62 businesses in the town or its near surrounds
- In 76.7% of dwellings, at least one person accessed the internet from home.

### Skills

ABS Census data indicates:

- 35.7% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 15.7% have completed level III or IV trade certificates; and
- another 11.5% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mount Alexander LGA had 7.8% employment in the industry sectors with strong technology exposure.

### Fixed Broadband

The map below shows the status of the NBN rollout in Maldon as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN Fixed wireless services and white areas locations serviced by NBN satellite.

Our analysis shows that Maldon is largely serviced by NBN FTTN, with NBN satellite servicing the surrounding areas and some small patches of Fixed wireless in outer areas of the town to the north and south-west. There do not appear to be any significant aggregations of businesses outside of the NBN fixed line footprint.

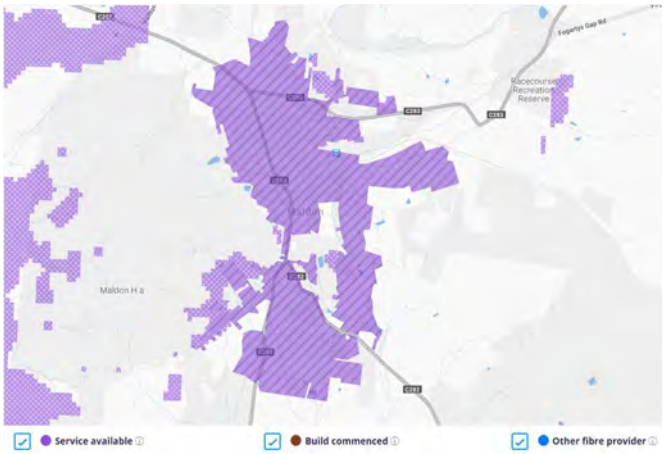



*Figure 40 Fixed Broadband coverage of Maldon*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town, with new coverage under construction in the area.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

## LP-WAN Coverage

Optus Ag-IOT and Taggle IOT are not currently available in Maldon. Limited SigFox coverage is available in Maldon. Testing should be conducted to confirm availability.

## Public WiFi Coverage

There are no known free public WiFi services available in Maldon.

## Other

220v power is available approximately 14 kilometres east of Maldon through the Bendigo Ballarat transmission terminal.

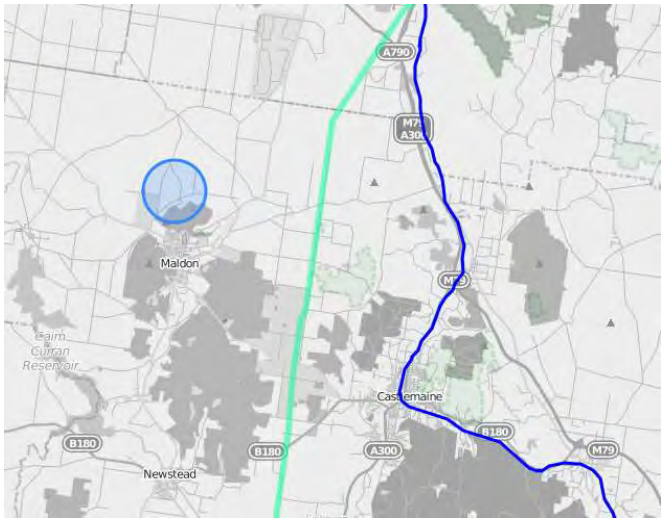



*Figure 41Power transmission east of Maldon*

## 3.17 Locality of Rushworth

Rushworth is a town located 157 kilometres north of Melbourne. Rushworth was established during the Victorian gold rush in 1853. The goldfields became no longer viable due to the underground water table and were closed during the gold rush.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Rushworth declined by 7.2% over a decade to 965 in 2016, the lowest growth rate among the 21 places analysed in the region
- 311 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 50.5% being in full-time employment and 36.7% in part-time employment
- 13.4% of the labour force classified themselves as managers, 11.4% as professionals and 8.4% as clerical and administrative workers
- 8.6% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 7.0% cited local government administration
- One public hospital is located in the town
- The town has 1 primary school and a primary/secondary school
- With a median age of 55, Rushworth has one of the older populations in the region, above the median of 45 among the major population centres analysed

- The ABS reports a median annual household income of $40.2K for Rushworth, one of the lowest in the region and well below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 37 businesses in the town or its near surrounds
- In 66.0% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 11.7% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 14.4% have completed level III or IV trade certificates; and
- another 10.3% have completed year 12.

ABS Industry employment data from 2016 indicated that the Campaspe LGA had 3.8% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Rushworth as advised by NBN Co in September 2018. The purple/spotted areas show locations serviced by NBN Fixed wireless services and white areas locations serviced by NBN satellite.

There is no NBN fixed line service in Rushworth, the locality is served by NBN fixed wireless. There do not appear to be any significant aggregations of businesses or residences in the NBN satellite footprint.

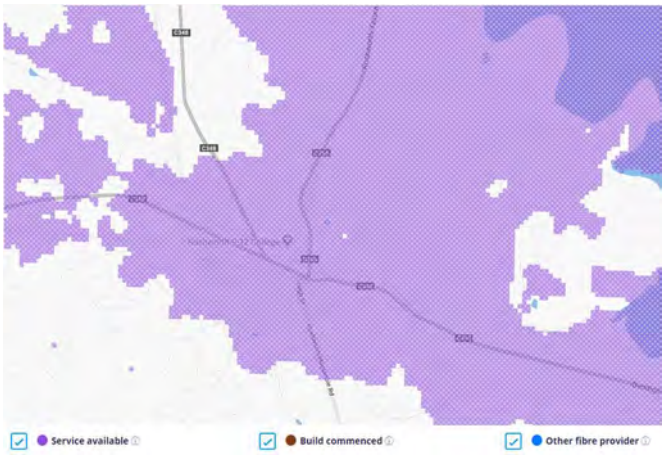



*Figure 42 Fixed wireless coverage of Rushworth*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 3G and 4G *indoor* coverage across the majority of the town, with some areas receiving no coverage.

In summary, residents have options for good coverage in the town and surrounding area from two of the three mobile network operators, with partial coverage from the third operator.

## LP-WAN Coverage

Extensive Optus Ag-IOT is currently available in Rushworth. SigFox and Taggle IOT are not currently available in Rushworth.

## Public WiFi Coverage

There are no known free public WiFi services available in Rushworth.

## Other

VicTrack fibre is not available in Rushworth.

# *3.18 Locality of Marong*

Marong is located 157 kilometres northwest of Melbourne and 17 kilometres west of Bendigo at the junction of the Calder Highway and the Calder Alternate Highway. Its local government area is the City of Greater Bendigo.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Marong grew by 238.7% over a decade to 928 in 2016, the highest growth rate for the 21 places analysed in the region
- 458 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 64.2% being in full-time employment and 26.0% in part-time employment
- 8.5% of the labour force classified themselves as managers, 14.3% as professionals and 14.3% as clerical and administrative workers

- 8.2% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals), 5.5% cited primary education and 4.7% cited banking
- The nearest hospitals are located in Bendigo to the east
- The town has 1 primary school
- With a median age of 28, Marong has one of the youngest populations in regional Victoria
- The ABS reports a median annual household income of $82.4K for Marong, one of the highest in the region and above Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 12 businesses in the town or its near surrounds
- In 89.9% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 22.4% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 27.3% have completed level III or IV trade certificates; and
- another 15.2% have completed year 12.

ABS Industry employment data from 2016 indicated that the Bendigo LGA had 5.3% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Marong as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services, the purple/spotted areas show locations serviced by NBN Fixed wireless services and white areas locations serviced by NBN satellite. The brown/striped areas show the locations where NBN fixed line services are planned or under construction.

Our analysis shows that the majority of Marong is planned to be serviced by NBN FTTN and a small section of NBN FTTC in the centre of the town. Large sections in the south of the town are also currently or planned to be serviced by FTTP. NBN Fixed wireless currently services the farmland and rural properties surrounding Marong. There do not appear to be any significant aggregations of businesses outside of the NBN fixed line footprint, nor the small patches of NBN satellite.

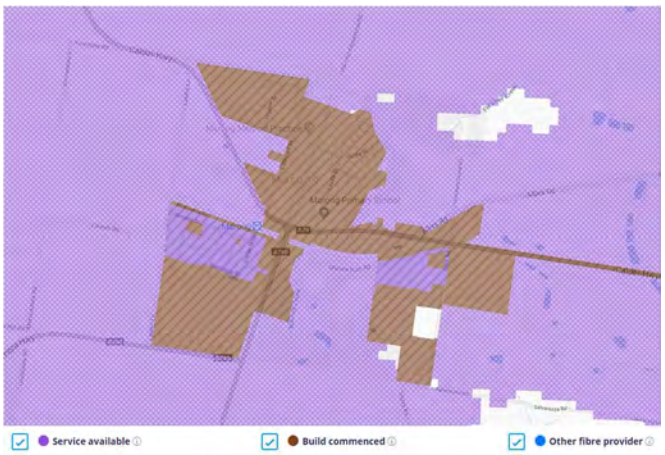



*Figure 43 Fixed Broadband Coverage of Marong*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

## LP-WAN Coverage

Extensive Optus Ag-IOT is currently available in Marong. Limited SigFox is available, testing is required to determine coverage. Taggle IOT is not currently available in Marong.

## Public WiFi Coverage

There are no known free public WiFi services available in Marong.

## Other

VicTrack Fibre is not available in Marong.

# *3.19 Locality of Carisbrook*

Carisbrook is located on the Pyrenees Highway, 165 kilometres north-west of Melbourne and 7 kilometres east of the regional and local government centre

of Maryborough, in the Shire of Central Goldfields. Carisbrook is closely linked with Maryborough historically, socially and economically.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Carisbrook grew by 19.9% over a decade to 855 in 2016, above the median growth rate of 9.7% for the 21 major places analysed in the region
- 382 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 52.6% being in full-time employment and 35.6% in part-time employment
- 12.6% of the labour force classified themselves as managers, 10.1% as professionals and 8.4% as clerical and administrative workers
- 6.5% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals) and 4.4% cited local government administration
- The nearest hospital is located in Maryborough close by to the west
- The town has 1 primary school
- With a median age of 44, Carisbrook is just below the median of 45 for the 21 places analysed in the region
- The ABS reports a median annual household income of $51.4K for Carisbrook, the median for the places analysed in the region and below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 13 businesses in the town or its near surrounds
- In 75.5% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 15.1% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 25.5% have completed level III or IV trade certificates; and
- another 13.3% have completed year 12.

ABS Industry employment data from 2016 indicated that the Central Goldfields LGA had 3.5% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Carisbrook as advised by NBN Co in September 2018. The purple/striped areas show the locations currently serviced by NBN fixed line services and white areas show locations serviced by NBN satellite.

Our analysis shows that the town of Carisbrook is currently serviced by NBN FTTN, with the surrounding areas serviced by Satellite. There does not appear to be any significant number of businesses or residences outside of the NBN fixed line footprint.

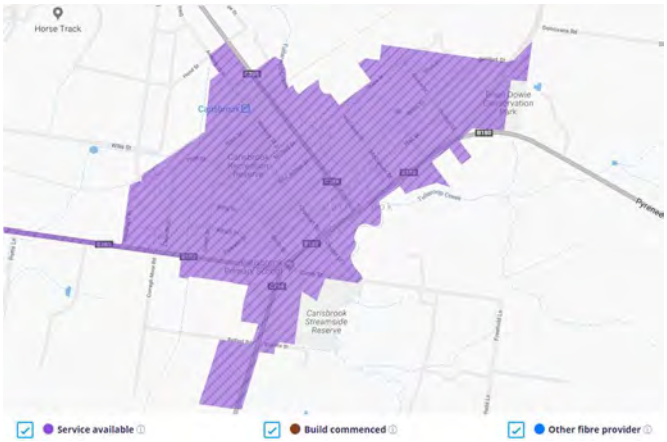



*Figure 44 Fixed Broadband Coverage of Carisbrook*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows partial 4G *indoor* and partial 4G *outdoor* coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

## LP-WAN Coverage

Taggle, SigFox and Optus Ag-IOT are currently available in Carisbrook.

## Public WiFi Coverage

There are no known free public WiFi services available in Carisbrook.

## Other

VicTrack Fibre is not available in Carisbrook.

## 3.20 Locality of Boort

Boort is located next to Lake Boort, in the Shire of Loddon, 251 kilometres north-west of Melbourne. The town is known for its native birdlife. The main sources of employment are retail, olive processing and tourism. Agriculture is a major industry and employer in the Boort region. Produce includes cereal crops, tomatoes, canola, olives and wool.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Boort declined by 3.1% over a decade to 749 in 2016, one of the lowest growth rates among the 21 places analysed in the region
- 274 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 46.7% being in full-time employment and 36.1% in part-time employment
- 23.4% of the labour force classified themselves as managers, 16.6% as professionals and 6.8% as clerical and administrative workers
- 12.6% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals), and 4.3% cited local government administration
- One public hospital is located in the town
- The town has 1 primary/secondary school
- With a median age of 56, Boort has one of the older populations in the region
- The ABS reports a median annual household income of $44.6K for Boort, one of the lowest in the region and below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 38 businesses in the town or its near surrounds
- In 66.6% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 17.1% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 14.5% have completed level III or IV trade certificates; and
- another 6.8% have completed year 12.

ABS Industry employment data from 2016 indicated that the Loddon LGA had 2.2% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Boort as advised by NBN Co in September 2018. The purple/spotted areas show locations serviced by NBN Fixed wireless services.

Boort is entirely serviced by NBN Fixed wireless.


*Figure 45 Fixed wireless coverage of Boort*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows partial 3G *outdoor* coverage across parts of town.

In summary, residents have options for good coverage in the town and surrounding area from two of the three mobile network operators, with partial (marginal) coverage from the third operator.

## LP-WAN Coverage

Extensive Taggle and Optus Ag-IOT are currently available in Boort. Limited SigFox is available, testing is required to determine coverage.

## Public WiFi Coverage

There are no known free public WiFi services available in Boort.

## Other

VicTrack Fibre is not available in Boort.

## *3.21 Locality of Malmsbury*

Malmsbury is a town in central Victoria on the Old Calder Highway, 95 kilometres north-west of Melbourne and 11 kilometres north-west of Kyneton. The Malmsbury area is known for its deposits of bluestone, used in the construction of notable buildings both locally and throughout the state.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Malmsbury grew by 9.2% over a decade to 641 in 2016, below the median growth rate of 9.7% for the 21 major places analysed in the region
- 338 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 48.8% being in full-time employment and 43.5% in part-time employment
- 14.5% of the labour force classified themselves as managers, 20.5% as professionals and 7.3% as clerical and administrative workers
- 5.4% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- The nearest hospital is located In Kyneton to the southeast
- The town has 1 primary school
- With a median age of 45, Malmsbury has the lowest median age of the 21 major places analysed in the region
- The ABS reports a median annual household income of $64.5K for Malmsbury, above the median of $51.4K for the places analysed in the region but still below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 28 businesses in the town or its near surrounds
- In 86.6% of dwellings, at least one person accessed the internet from home.

## Skills

ABS Census data indicates:

- 29.5% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 22.7% have completed level III or IV trade certificates; and
- another 9.2% have completed year 12.

ABS Industry employment data from 2016 indicated that the Macedon Ranges LGA had 8.6% employment in the industry sectors with strong technology exposure.

## Fixed Broadband

The map below shows the status of the NBN rollout in Malmsbury as advised by NBN Co in September 2018. The purple/spotted areas show locations serviced by NBN Fixed wireless services and white areas locations serviced by NBN satellite.

Malmsbury is entirely serviced by Fixed wireless with only a few small patches of Satellite coverage in the farming areas surrounding the locality.

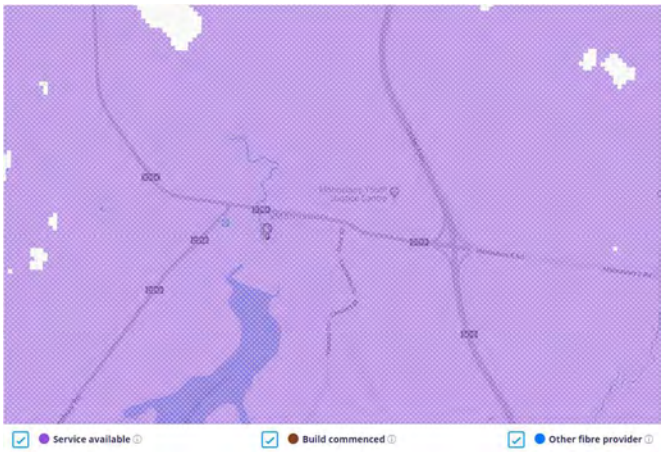



*Figure 46 Fixed wireless coverage of Malmsbury*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows 4G *indoor* coverage across the entire town.

In summary, there appear to be no mobile coverage issues in the town, with the three major mobile network operators all offering service.

### LP-WAN Coverage

Taggle coverage is available to the south east of Malmsbury, testing is required to determine coverage.

### Public WiFi Coverage

There are no known free public WiFi services available in Malmsbury.

### Other

VicTrack Fibre transits through the west of Malmsbury, following the train line.

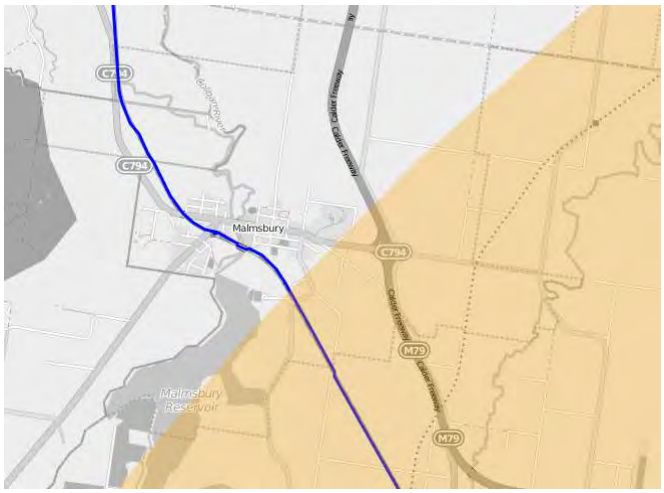



*Figure 47 VicTrack Fibre transiting Malmsbury and Taggle coverage south east of the region.*

## 3.22 Locality of Newstead

Newstead is a town in Victoria, situated along the Loddon River. It is in the Shire of Mount Alexander local government area. Newstead has many festivals and folk events and is in the centre of the golden triangle, close to many tourist attractions and events.

General characteristics of the town that provide an indication of the town's likely telecommunications demand profile include:

- The population of Newstead grew by 17.5% over a decade to 572 in 2016, above the median growth rate of 9.7% for the 21 major places analysed in the region
- 230 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 50.4% being in full-time employment and 40.4% in part-time employment
- 12.0% of the labour force classified themselves as managers, 18.1% as professionals and 6.0% as clerical and administrative workers
- 7.6% of the labour force cited their industry of employment as hospitals (except psychiatric hospitals)
- The nearest hospital is located in Castlemaine to the northeast
- The town has 1 primary school
- With a median age of 51, Newstead is older than the median of 45 for the major places analysed in the region and well above the Victorian median of 37
- The ABS reports a median annual household income of $44.3K for Newstead, one of the lowest in the region and well below Melbourne's $80.4K
- Data in SLIM on businesses registered with WorkCover indicates approximately 11 businesses in the town or its near surrounds
- In 82.1% of dwellings, at least one person accessed the internet from home.

### Skills

ABS Census data indicates:

- 30.3% of people aged 15 and over have gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 21.5% have completed level III or IV trade certificates; and
- another 10.5% have completed year 12.

ABS Industry employment data from 2016 indicated that the Mount Alexander LGA had 7.8% employment in the industry sectors with strong technology exposure.

### Fixed Broadband

The map below shows the status of the NBN rollout in Newstead as advised by NBN Co in September 2018. The purple/spotted areas show locations serviced by NBN Fixed wireless services and white areas locations serviced by NBN satellite.

Newstead is entirely serviced by Fixed wireless, with Satellite coverage of rural properties east of Newstead.

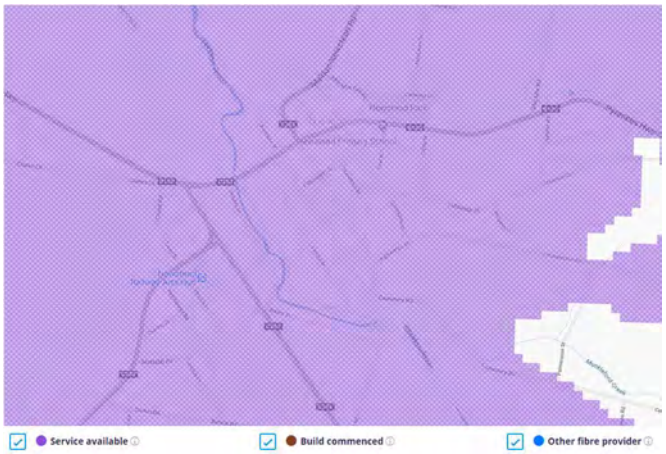


*Figure 48 Fixed wireless coverage of Newstead*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the entire town.
- Optus shows 4G Plus *outdoor* coverage across the entire town.
- Vodafone shows minimal 3G *outdoor* coverage in the area.

In summary, residents have options for good coverage in the town and surrounding area from two of the three mobile network operators.

## LP-WAN Coverage

Taggle, SigFox and Optus Ag-IOT are not currently available in Newstead.

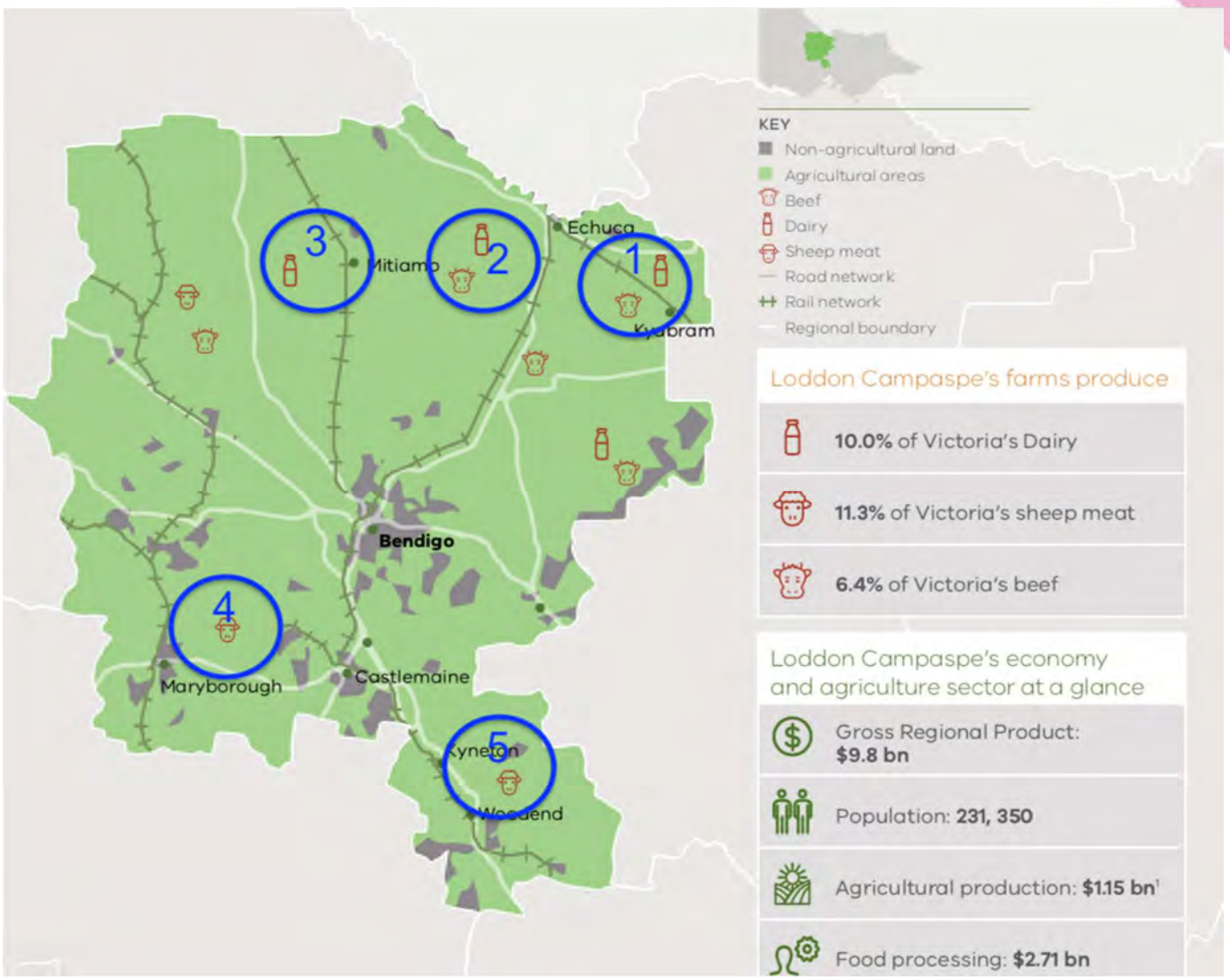
## Public WiFi Coverage

There are no known free public WiFi services available in Newstead.

## Other

VicTrack fibre is not available in Newstead.

# 4 Primary Production




1. Grazing – Dairy / Beef meat – area north of Kyabram
2. Grazing – Dairy / Beef meat – area around Rochester
3. Grazing – Dairy – area west of Mitiamo
4. Grazing – Sheep – area northeast of Maryborough
5. Grazing – Sheep – area northeast of Woodend

## *4.1 Land use classification*

The Victorian Land Use Information System sub-classifies primary production land use in the categories shown on the map below.

As is evident from the land use map following, the overwhelming categorization of land across the region is classified as Grazing – both Dairy (pink) and Grazing sheep and beef (pale green). LGA boundaries are overlaid in red.

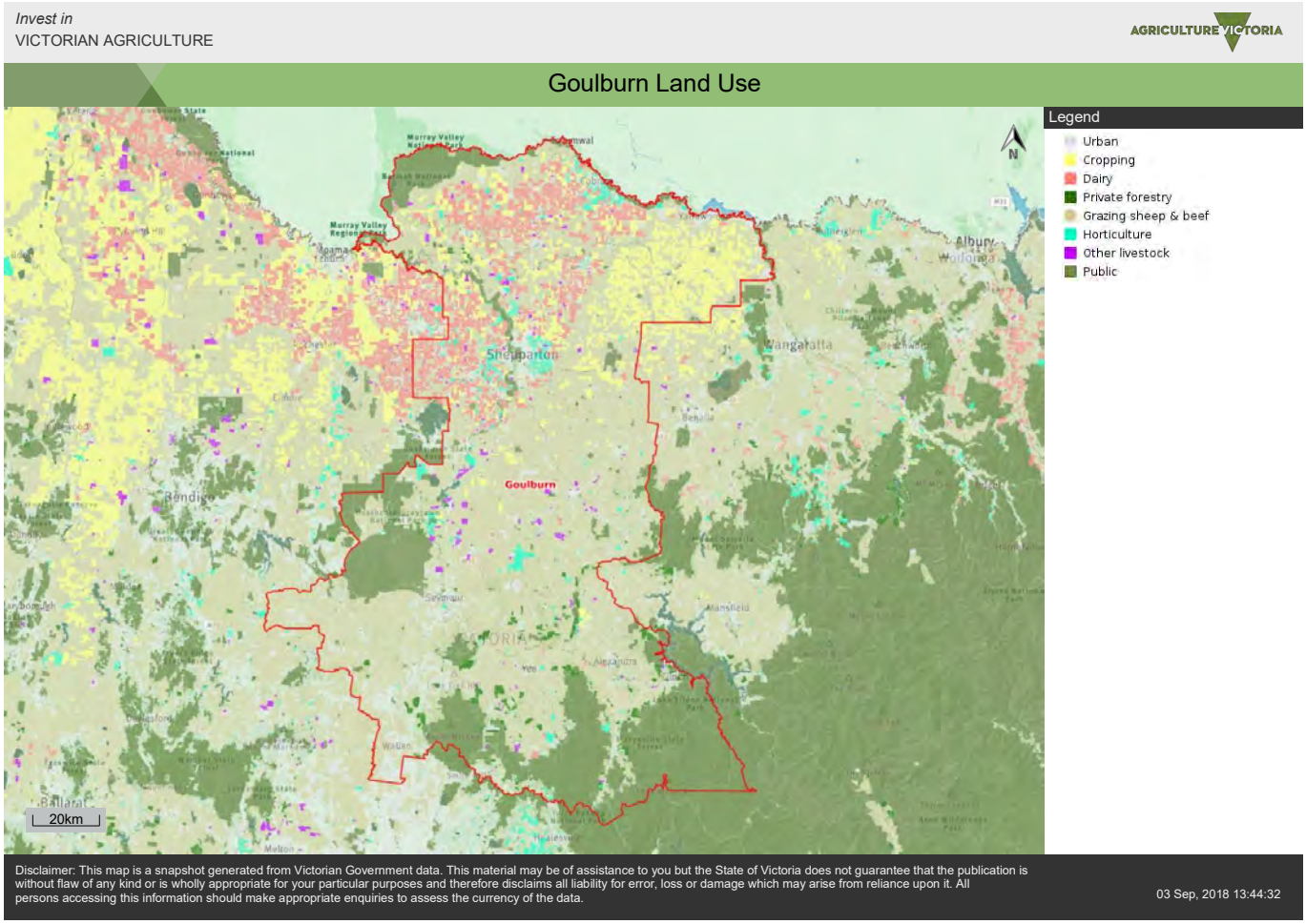



*Figure 49 Primary production land in the Region (Agriculture Victoria)*

The character of digital needs and opportunities will inevitably vary for different types of agriculture. By way of just a few examples:

- in livestock production areas, detailed animal tracking, identification, biometrics and feed management can optimise yields;
- in cropping areas, technology for real-time machinery monitoring and guidance is becoming more common, and satellite imagery can provide valuable insights into crop development and health;
- in irrigation areas, soil moisture monitoring and water management are becoming increasingly important to minimise costs and maximise production;
- in all areas, general access to information *where* and *when* it is needed can support informed decision-making; and
- with agriculture posing many occupational health and safety risks, access to communications in emergency situations can be the difference between life and death.

In light of this, all forms of agriculture will need to exploit information technology and communications more actively in the future if they are to remain globally competitive.

Accordingly, it is relevant to consider the supply of fixed broadband *(important at homesteads and business locations in rural land*), mobile coverage (*for both voice and data communications*) and LP-WAN coverage (*for emerging IoT applications*).

## 4.2 Fixed broadband supply

### NBN services

The map below shows NBN coverage of the Loddon Campaspe region.

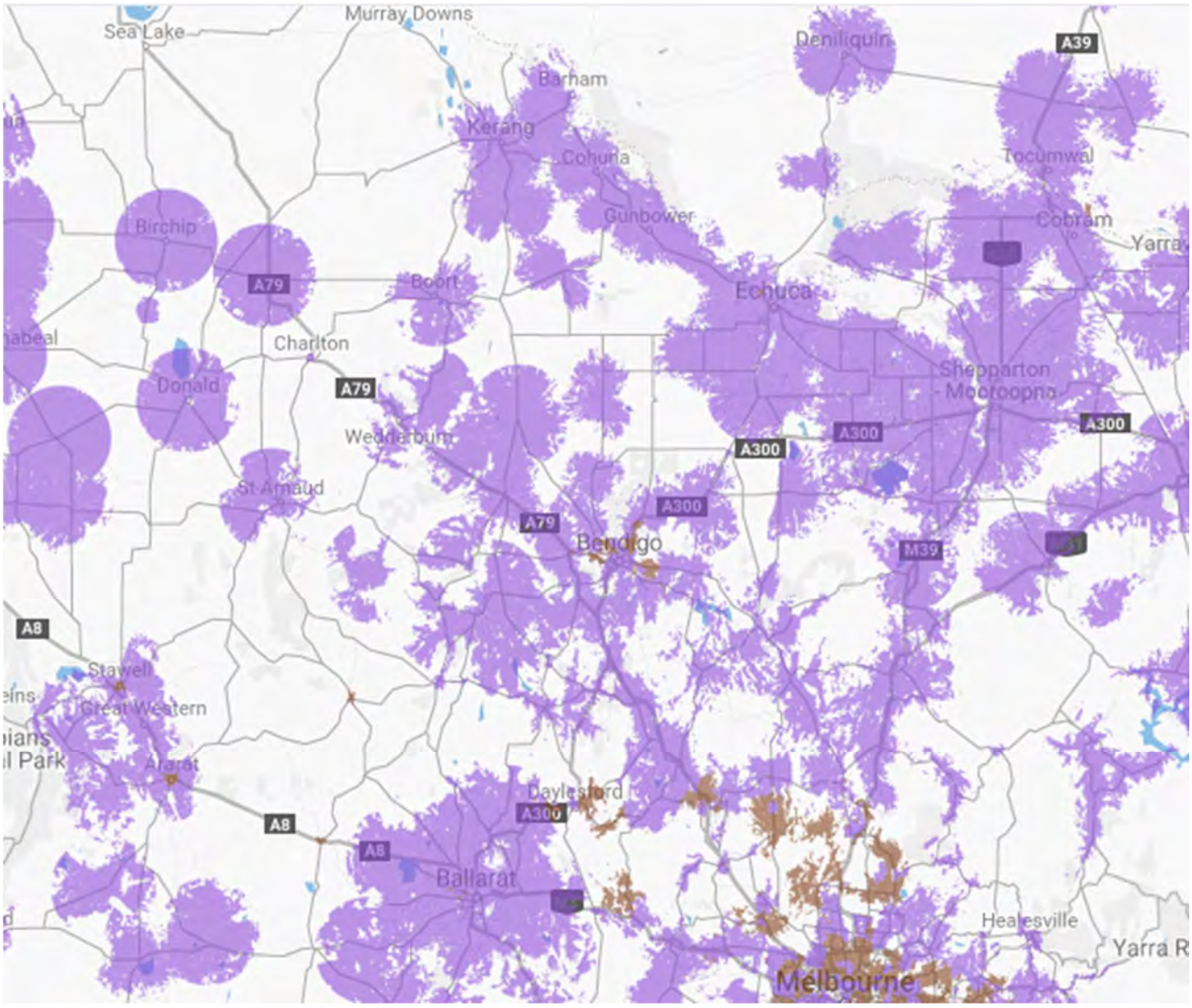



*Figure 50 NBN Co Coverage of the Loddon Campaspe region (NBN Co)*

The most significant feature is the split between fixed wireless coverage (in purple) and the areas with satellite coverage (no colour). Technologies such as FTTP, FTTC and FTTN are barely visible at the scale of this map – but since these technologies are limited to population centres, they are only marginally relevant to an analysis of primary production land.

Overall, by simple visual estimation, it appears that around 40 per cent of rural land in the Loddon Campaspe region has access to NBN Co's satellite solution, and most of the remainder has access to (or is due to receive) the higher-performing fixed wireless solution.

By Local Government Area, the indicative percentage of the area of rural land with satellite coverage is shown in the table following.

*Table 15 Proportion of LGA covered by satellite services*

| LGA | Population in Rural Land[16] | Estimated Area of Satellite Coverage |
|---|---|---|
| Bendigo | 17,381 | 60% |
| Campaspe | 6,916 | 10% |

[16] The number of individuals living in rural areas is estimated by subtracting the number in cities, towns and localities with a population greater than 185 from the total population in the LGA.

| | | |
|---|---|---|
| Central Goldfields | 3,766 | 50% |
| Loddon | 4,926 | 45% |
| Macedon Ranges | 17,625 | 45% |
| Mount Alexander | 6,660 | 80% |

Note that the rural population is not necessarily evenly distributed across the rural land, and therefore the number of homes and businesses in NBN Co's satellite footprint does not necessarily correlate with the proportion of satellite coverage by land area.

## Grazing

- *Dairy / beef meat*
- *The area north of Kyabram*

The map below shows NBN Fixed wireless coverage in the area.

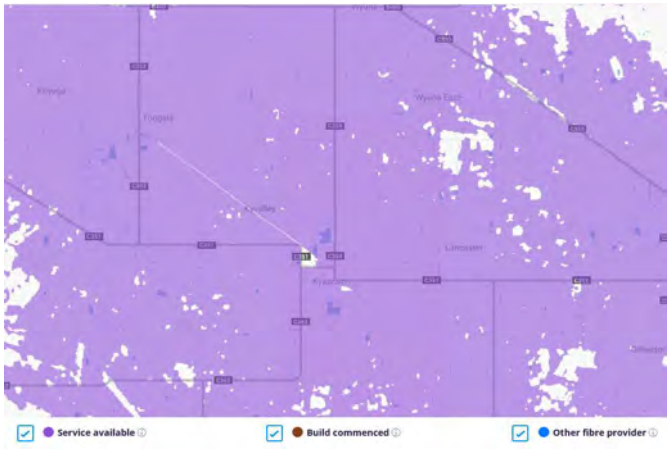



*Figure 51 NBN Coverage of the farming area north of Kyabram (NBN Co)*

## Grazing

- *Dairy / beef meat*
- *The area around Rochester*
- The map below shows NBN Fixed wireless coverage in the area.

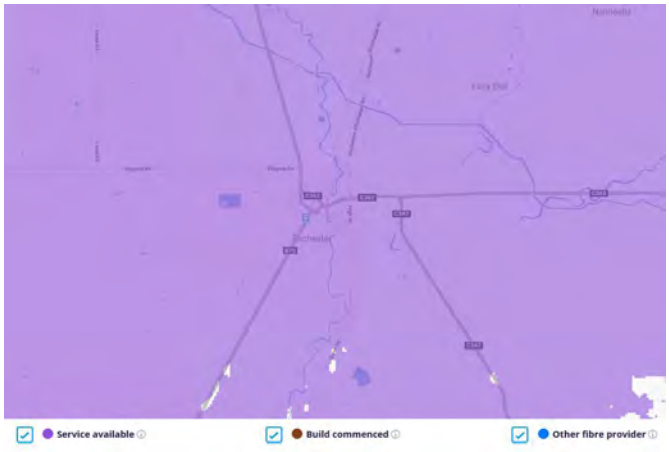



*Figure 52 NBN Coverage of the farming area around Rochester (NBN Co)*

## Grazing

- *Dairy / beef meat*
- *The west of Mitiamo*

The map below shows NBN satellite coverage in the area.

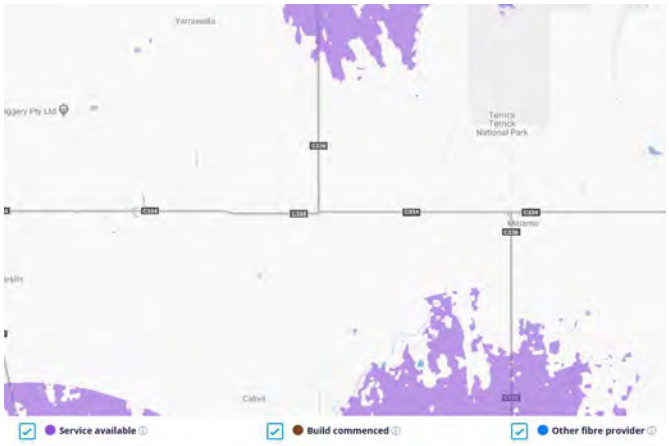



*Figure 53 NBN Coverage of the farming area west of Mitiamo (NBN Co)*

## Grazing

- *Sheep*
- *The area northeast of Maryborough*

The map below shows NBN satellite coverage in the area.

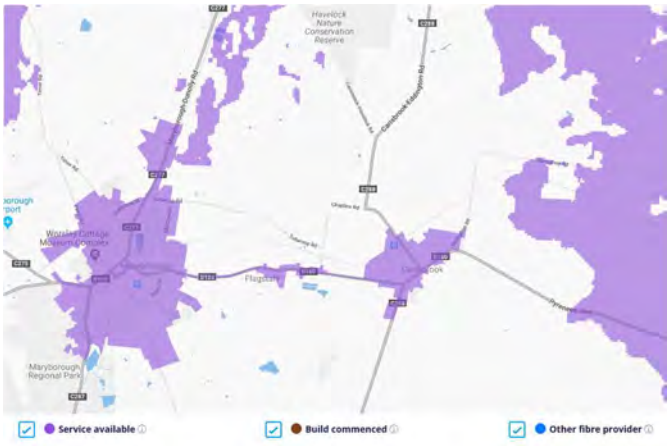



*Figure 54 NBN Coverage of the farming area northeast of Maryborough (NBN Co)*

## Grazing

- *Beef meat / dairy / other livestock*
- *The area northeast of Woodend*

The map below shows limited NBN Fixed wireless coverage, with most farms in the area serviced by NBN satellite.

Further analysis reveals NBN Fixed wireless is in development for the north region and significant areas of the east.

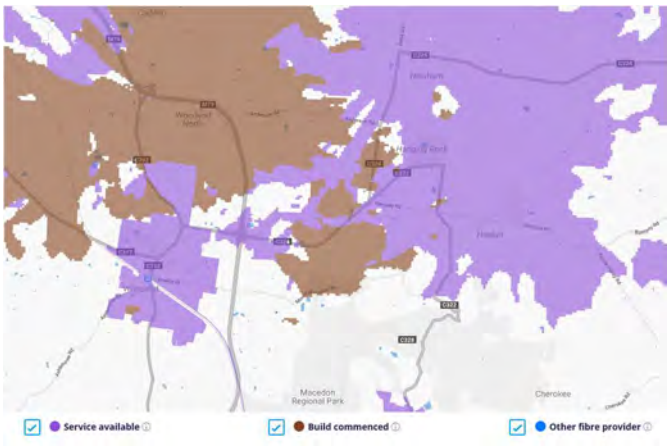



*Figure 55 NBN Coverage of the farming area northeast of Woodend (NBN Co)*

## Other Fixed Connectivity Options

For those living in rural areas where satellite is the only technology supported by NBN Co, there are several noteworthy technology alternatives:

- Wireless technologies (microwave and enhanced WiFi configured for long-reach) can be used to extend capacity from an area with better service;
- The mobile network operators are starting to introduce plans with high data allowances that may substitute or augment a satellite service; and
- Other providers (notably Telstra) may be able to provide a service.

## More detailed supply-demand analysis

More detailed information on local areas – down to the level of individual businesses can be obtained using SLIM – as illustrated in the map following showing the area around Ararat.

In this map:

- green areas show individual agricultural land parcels;
- purple areas show NBN fixed wireless coverage;

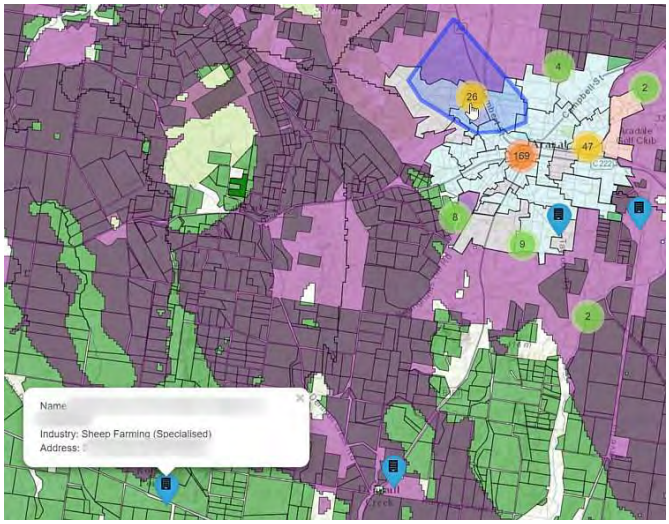



*Figure 56 SLIM outputs at a more detailed level (SLIM)*

- the “popup” at the bottom left shows details of an individual sheep farming business at the location marked with the blue marker;
- the coloured circles indicate the number of businesses in an area; and
- the hand-shape pointer touching on the circle with the number “26” is lighting up (with blue boundary and shading) the area within which those 26 businesses are located.

## *4.3 Mobile coverage*

Simple visual examination of these maps of Telstra and Optus suggest extensive coverage across the Central

Highlands region, with most coverage gaps confined to areas of hilly terrain and national or state parks.

In contrast, Vodafone's coverage is more limited, concentrating on significant population centres and major national roads.

Looking to the future, the ability of the mobile networks to support agricultural IoT applications will be enhanced by the activation of the NB-IoT and Cat-M1 protocols, and by the advent of 5G. The mobile network operators' plans for regional areas are not known.

## Grazing

- *Dairy / Beef meat*
- *The area north of Kyabram*

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows continuous 4GX and 3G *outdoor* handheld device coverage across the area.
- Optus shows continuous 4G Plus and 3G *outdoor* coverage across the region, with some patches of 3G antenna coverage along the Murray River.
- Vodafone shows continuous 4G and 3G *outdoor* coverage across the region, with new coverage under construction around Echuca.

In summary, there is good mobile coverage in the area with coverage provided by all three mobile network operators.

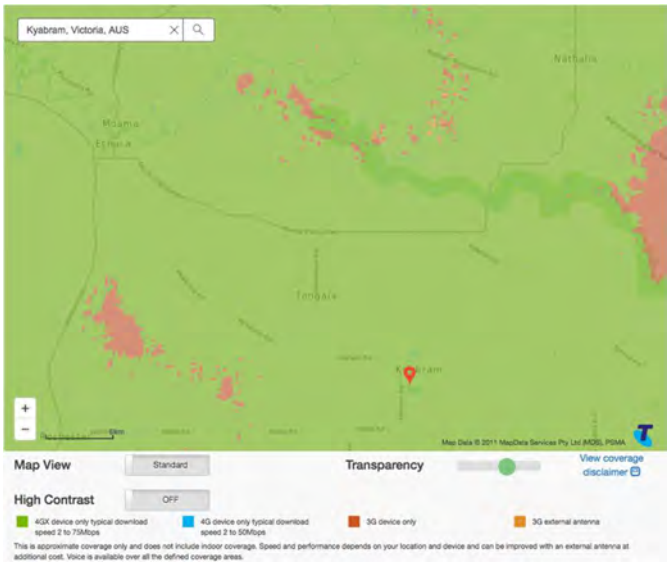



*Figure 57 Telstra coverage north of Kyabram*

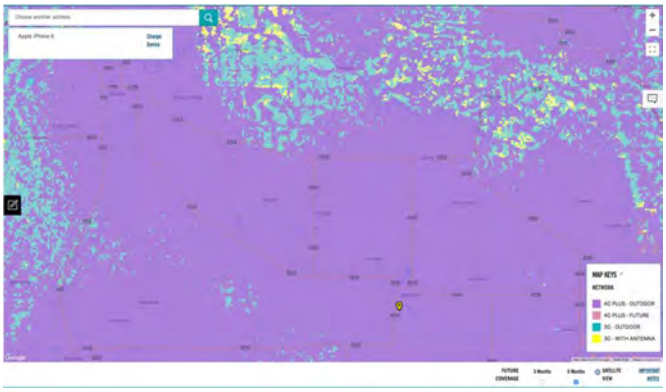


*Figure 58 Optus coverage north of Kyabram*

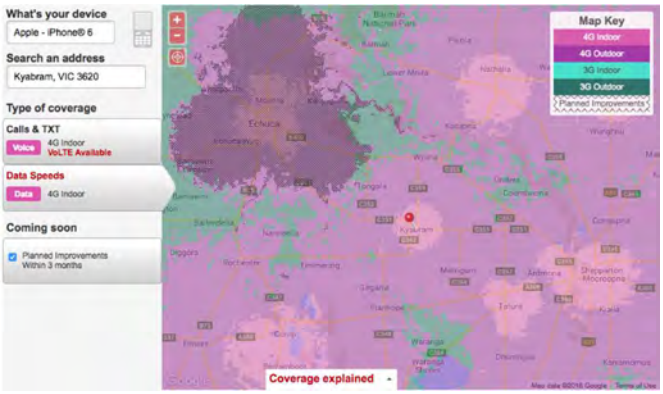



*Figure 59 Vodafone coverage north of Kyabram*

## Grazing

- *Dairy / Beef meat*
- *The area around Rochester*

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows continuous 4GX and 3G *outdoor* handheld device coverage across the area.
- Optus shows continuous 4G Plus and 3G *outdoor* coverage across the region, with some patches of 3G antenna coverage along the Murray River.
- Vodafone shows continuous 4G and 3G *outdoor* coverage across the region, with new coverage under construction around Echuca, however there is no coverage west of Lockington.

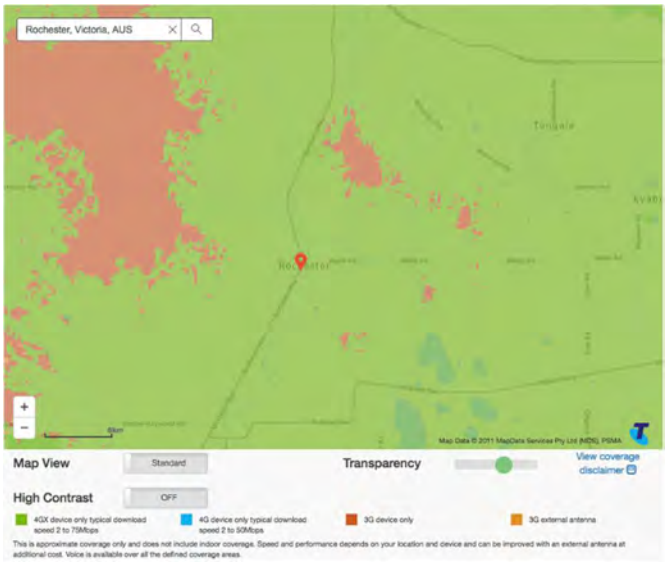



*Figure 60 Telstra coverage around Rochester*

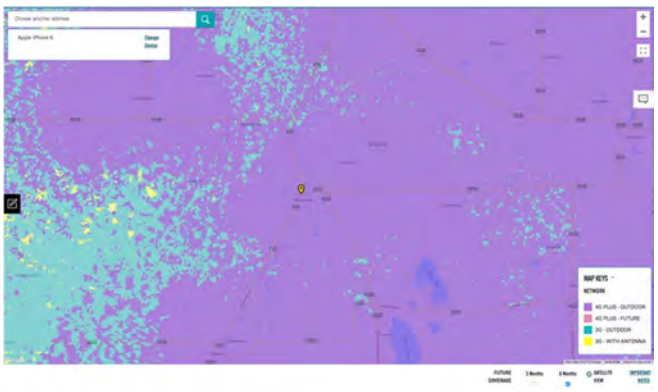


*Figure 61 Optus coverage around Rochester*

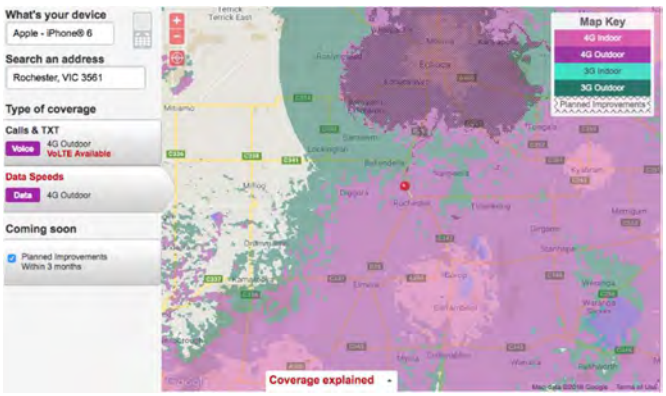



*Figure 62 Vodafone coverage around Rochester*

In summary, there is mobile coverage in the area with coverage provided by two mobile network operators with partial coverage by the third.

## Grazing

- *Dairy / Beef meat*
- *The area west of Mitiamo*

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows continuous 3G *outdoor* handheld device and external antenna coverage across the area.
- Optus shows continuous 4G Plus and 3G *outdoor* coverage across the region, with significant patches of 3G antenna coverage around Jarklin.
- Vodafone shows no coverage around Mitiamo but does provide 3G coverage around Yarrawalla and Pyramid Hill as spill coverage from near Macorna.

In summary, there is mobile coverage in the area with coverage provided by two mobile network operators with partial coverage by the third.

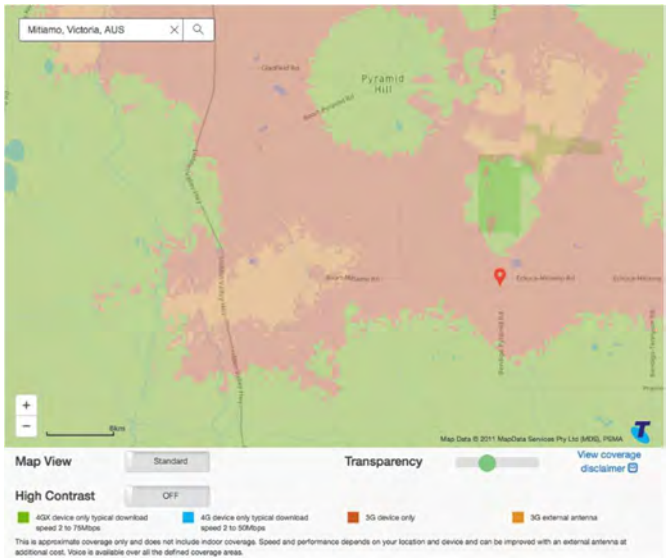



*Figure 63 Telstra coverage west of Mitiamo*

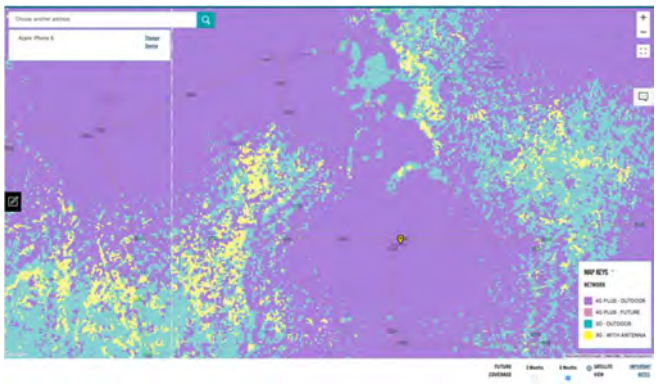


*Figure 64 Optus coverage west of Mitiamo*

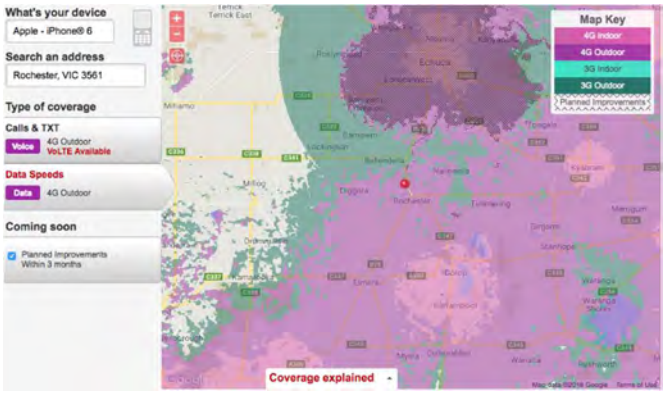



*Figure 65 Vodafone coverage west of Mitiamo*

## Grazing

- *Sheep*
- *The area north-east of Maryborough*

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows continuous 4GX *outdoor* handheld device coverage across the area.
- Optus shows continuous 4G Plus and 3G *outdoor* coverage across the region, with small patches of 3G antenna coverage and significant new coverage under construction around Baringhup.
- Vodafone shows continuous 4G and 3G *outdoor* coverage as far as Baringhap, but significant blackspots thereafter, with new coverage under construction around Maryborough.

In summary, there is mobile coverage in the area with coverage provided by all three mobile network operators.

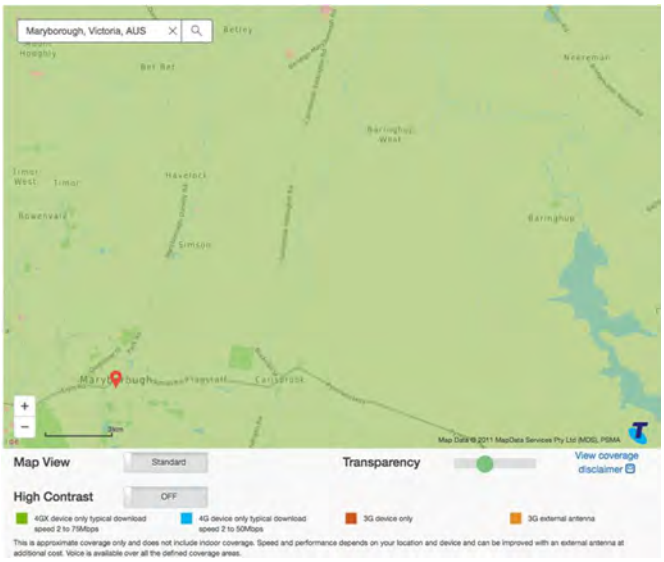



*Figure 66 Telstra coverage northwest of Maryborough*

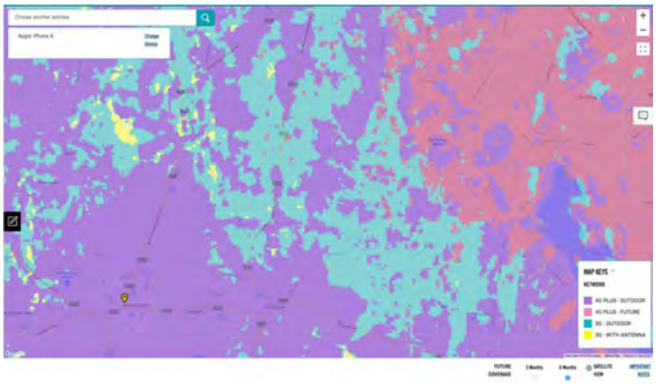


*Figure 67 Optus coverage northwest of Maryborough*

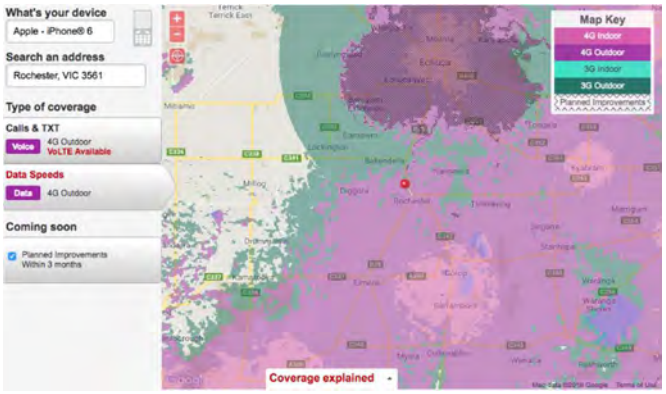



*Figure 68 Vodafone coverage northwest of Maryborough*

## Grazing

- *Sheep*
- *The area north-east of Woodend*

Due to the size of the area under consideration, public coverage maps do not provide sufficient resolution to conduct detailed analysis, so comments are general in nature. Based on public coverage maps:

- Telstra shows continuous 4GX *outdoor* handheld device coverage across the area.
- Optus shows continuous 4G Plus and 3G *outdoor* coverage across the region, with small patches of 3G antenna coverage around Cobaw.
- Vodafone shows continuous 4G *outdoor* coverage in the area around Woodend, but significant blackspots are evident around Newham, Rochford and Lancefield.

In summary, there is mobile coverage in the area with coverage provided by all three mobile network operators.

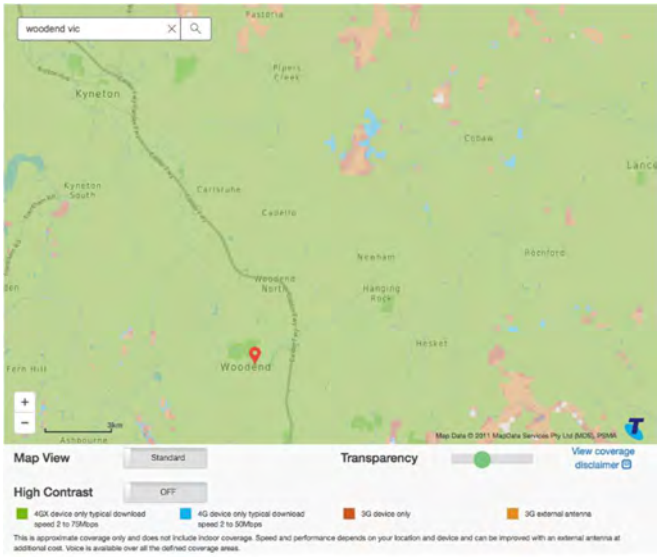



*Figure 69 Telstra coverage northwest of Woodend*

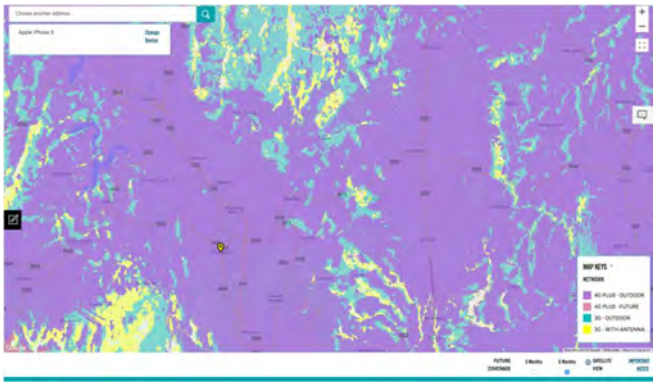


*Figure 70 Optus coverage northwest of Woodend*

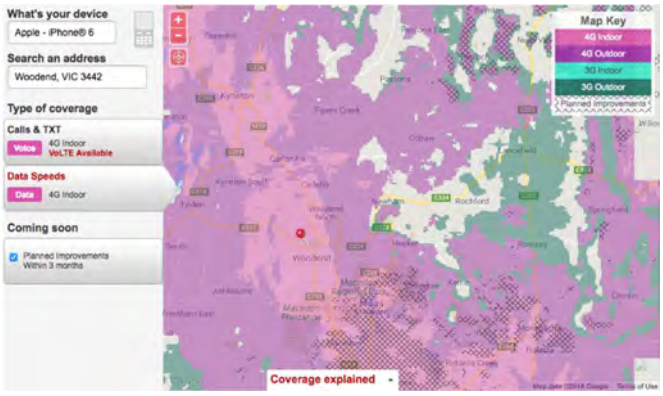



*Figure 71 Vodafone coverage northwest of Woodend*

## 4.4 LP-WAN coverage

Coverage maps for two of three major LP-WAN technologies (Sigfox and Taggle) are provided in **Section 2.3**. Coverage of the third major LP-WAN technology (LoRa) is unknown.

Based on these maps:

- Extensive Sigfox coverage is available towards the northern and eastern fringes of Bendigo;
- Taggle coverage appears to be available towards the north-western region including and Wedderburn; and
- Optus Ag-IOT trials show throughout the north-eastern and north western regions within Loddon Campaspe.

In areas towards the fringes of coverage footprints, testing is necessary to confirm the viability of communications connectivity. If it is marginal, better antennas and antenna positioning may help, or the installation of additional base stations may be necessary to get reliable communications.

Agricultural IoT trials currently being undertaken may yield further insight into the needs, opportunities and barriers in the adoption of IoT technologies.

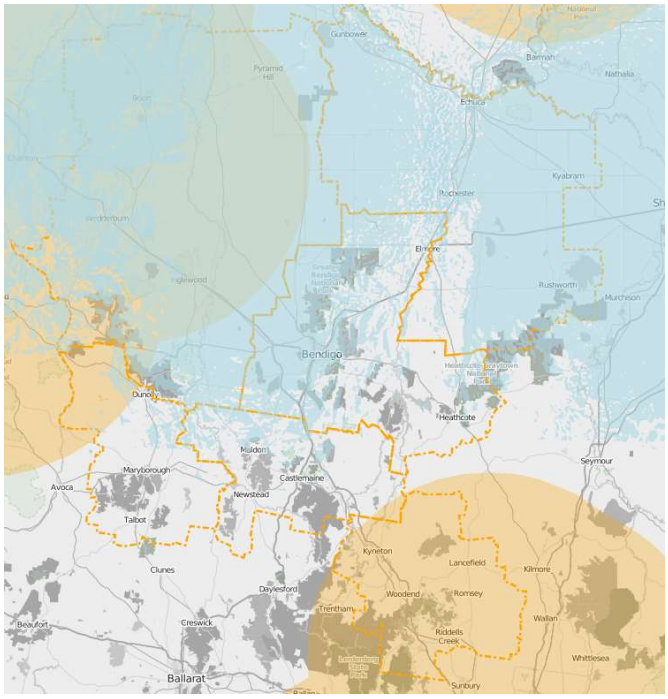



*Figure 72 Optus Ag-IOT (blue) and Taggle coverage in Loddon Campaspe*

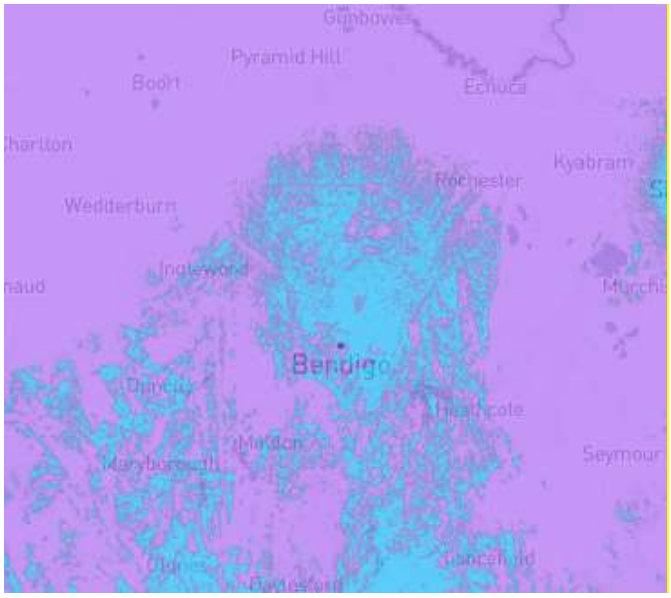



*Figure 73 SigFox coverage in Loddon Campaspe*

## Grazing

- *Dairy / beef meat*
- *The area north of Kyabram*

Optus Ag-IOT trials appears to be available in and around the area including Kyabram, Echuca and Tongala.

- Taggle and Sigfox maps show no coverage in the area.

## Grazing

- *Dairy / beef meat*
- *The area around Rochester*

The SLIM database show Optus Ag-IOT trials coverage appear to be available in and around the area Rochester.

- Taggle and Sigfox maps show no coverage in the area.

## Grazing

- *Dairy / beef meat*
- *The west of Mitiamo*

The SLIM database show extensive Taggle and Optus Ag-IOT trials coverage west of Miatamo.

- Sigfox maps show no coverage in the area.

## Grazing

- *Sheep*
- *The area north-east of Maryborough*

The SLIM database and public maps for SigFox, Taggle IOT and the Optus NB-IOT trials show no coverage in the area.

## Grazing

- *Beef meat / dairy / other livestock*
- *The area north-east of Woodend*

Extensive SigFox coverage is available north-east of Woodend.

The SLIM database and public maps for Taggle IOT and the Optus NB-IOT trials show no coverage in the area.

## *4.5 Skills*

No specific information regarding the skill level of these operating businesses or those living in agricultural areas is currently available.

An *indirect* indicator of skillsets useful in taking advantage of digital technologies *may* be deduced from general education levels.

Across the Loddon Campaspe region, ABS Quickstats data indicates the proportions of the population with

an educational attainment of Year 12 or higher (Level III or IV certificate, Diploma or Advanced Diploma, Bachelors degree or above) as shown in the table following.

Of some note, the highest educational attainment in the three western-most local government areas is significantly lower than for other local government areas.

| LGA | Population | % Year 12+ |
|---|---|---|
| Bendigo | 113,617 | 56.6% |
| Campaspe | 37,463 | 47.4% |
| Central Goldfields | 13,073 | 45.0% |
| Loddon | 7,505 | 42.4% |
| Macedon Ranges | 48,438 | 63.9% |
| Mount Alexander | 19,171 | 57.3% |
| **Region** | **239,267** | **55.6%** |

# 5 Tourist Destinations

For tourist destinations, the communication demands tend to comprise:

- the needs of the host, predominantly comprising fixed broadband connectivity
- the needs of tourists visiting the region, predominantly comprising mobile connectivity and potentially WiFi connectivity in the surrounding towns or at accommodation venues.

The communications options for population centres across the region are discussed in **Section 3**, and an overview of mobile coverage outside these centres is provided in **Section 2.2**.

For major events, mobile coverage is a primary concern, not just for the event venue itself, but also for the surrounding area. Visitors increasingly rely on network access for purposes such as navigation.

Note the Loddon Campaspe region features numerous additional tourist attractions and events beyond those covered in this section.

## 5.1 Hanging Rock

Hanging Rock is a distinctive rock formation in the Macedon Ranges, located approximately 70 kilometres north-west of Melbourne.

The former volcano rises 105 metres above the surrounding plain, with rainwater creating rock formations including the Black Hole of Calcutta and the Cathedral. The locality has a rich Aboriginal history and is still considered a sacred place by the Indigenous people.

Made famous by the novel 'Picnic at Hanging Rock', the attraction hosts musical performances throughout the year and the country race day on New Years Day and Australia Day. Visitors have the option of camping overnight.

*Figure 74 Hanging Rock*[17]

*Figure 75 Aerial imagery of Hanging Rock*

### Fixed Broadband

Our analysis reveals Hanging Rock has NBN Fixed wireless coverage.

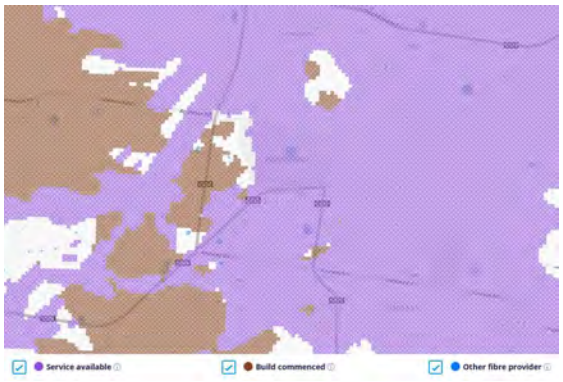



*Figure 76 NBN Coverage of Hanging Rock (NBN Co)*

### Mobile Coverage

Based on public coverage maps:

[17] https://www.visitvictoria.com/regions/daylesford-and-the-macedon-ranges/things-to-do/nature-and-wildlife/national-parks-and-reserves/vv-hanging-rock

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of Hanging Rock.
- Optus shows 3G *outdoor* coverage of Hanging Rock however, 4G Plus is planned for the area.
- Vodafone shows 4G *outdoor* coverage of the summit walk with the remaining area without coverage.

In summary, there appears to be coverage of Hanging Rock from one of the mobile network operators with coverage under construction in the area from the other two operators.


*Figure 77 Telstra coverage of Hanging Rock*

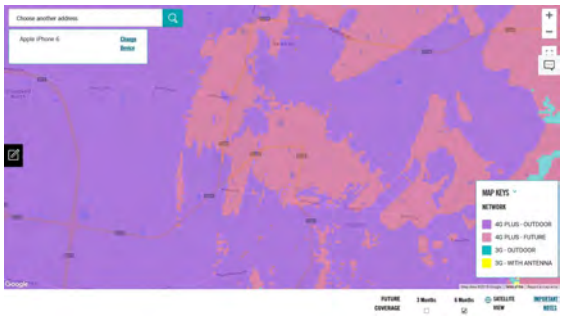



*Figure 78 Optus coverage of Hanging Rock*

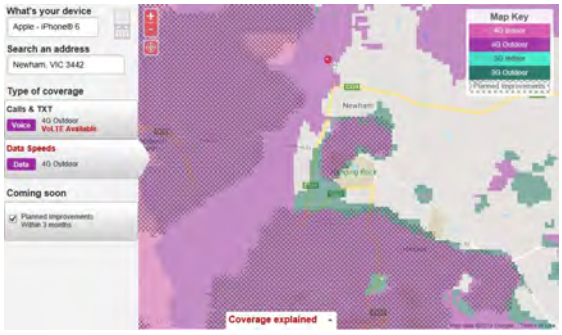



*Figure 79 Vodafone coverage of Hanging Rock*

## 5.2 Victorian Goldfields Railway

The Victorian Goldfields Railway is an authentic steam train connecting the gold mining towns of Castlemaine and Maldon, operating every Wednesday, Sunday and Saturday on the school holidays.

Castlemaine is a 90 minute drive from Melbourne on the Calder Freeway.

*Figure 80 The Victorian Goldfields Railway steam train[18]*

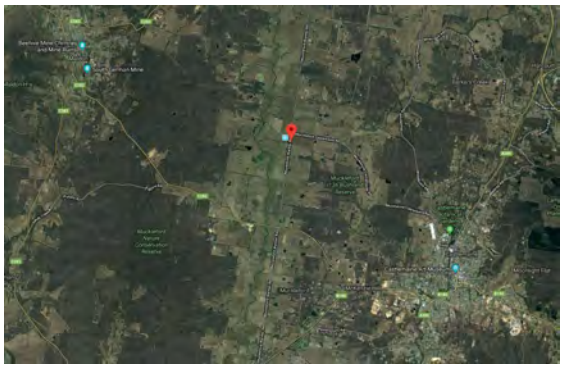


*Figure 81 Aerial imagery of the Victorian Goldfields Railway steam train route*

[18] https://www.visitmelbourne.com/regions/goldfields/things-to-do/history-and-heritage/gold-rush-history/victorian-goldfields-railway

## Fixed Broadband

Refer to Significant Places for fixed broadband coverage of Castlemaine and Maldon.

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the railway line.
- Optus shows predominately 4G Plus *outdoor* coverage of the railway line however, a section closer to Maldon has 3G *outdoor* coverage.
- Vodafone shows 4G *indoor* and *outdoor* coverage of the railway line.

In summary, there appears to be coverage of the railway line from the three mobile network operators.


*Figure 82 Telstra coverage of Victorian Goldfields Railway line*

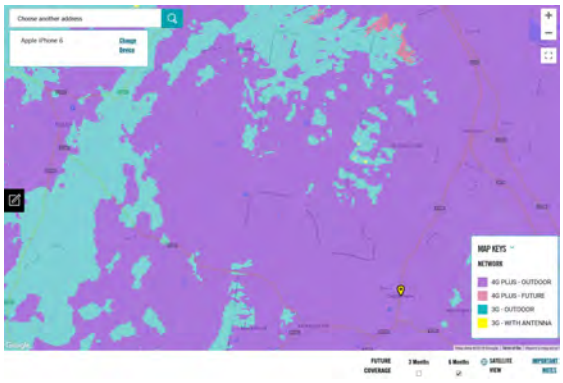



*Figure 83 Optus coverage of Victorian Goldfields Railway line*

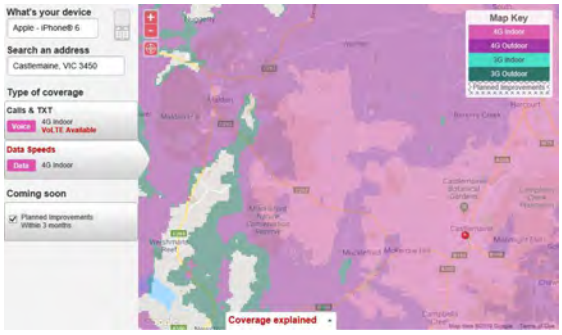



*Figure 84 Vodafone coverage of Victorian Goldfields Railway line*

## 5.3 Paddys Ranges State Park

The Paddys Ranges State Park is located six kilometres south of Maryborough and 170 kilometres north-west of Melbourne.

Popular activities in the forest include bushwalking, picnicking and camping. Free camping is available at unpowered campsites with a first in, best dressed policy. Facilities present at the campsite are picnic tables, non-flush toilets and wood barbeques.

*Figure 85 Paddys Ranges State Park[19]*

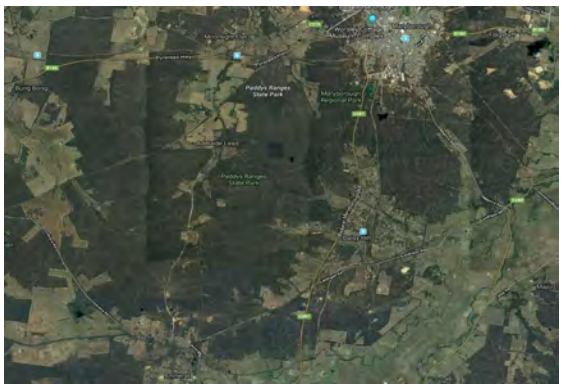


*Figure 86 Aerial imagery of Paddys Ranges State Park*

[19]https://www.visitmelbourne.com/regions/goldfields/things-to-do/nature-and-wildlife/national-parks-and-reserves/paddys-ranges-state-park

## Fixed Broadband

Our analysis reveals Paddys Ranges State Park falls within the NBN satellite footprint.

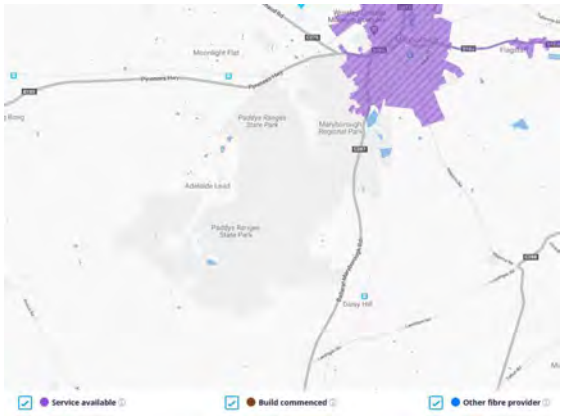



*Figure 87 NBN Coverage of Paddys Ranges State Park (NBN Co)*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the park including the campground.
- Optus shows 4G Plus *outdoor* and 3G *outdoor* handheld coverage of the park, including 3G *outdoor* coverage of the campground.
- Vodafone shows 4G *indoor* and *outdoor* coverage of the park.

In summary, there appears to be coverage of the park and campground from the three mobile network operators.

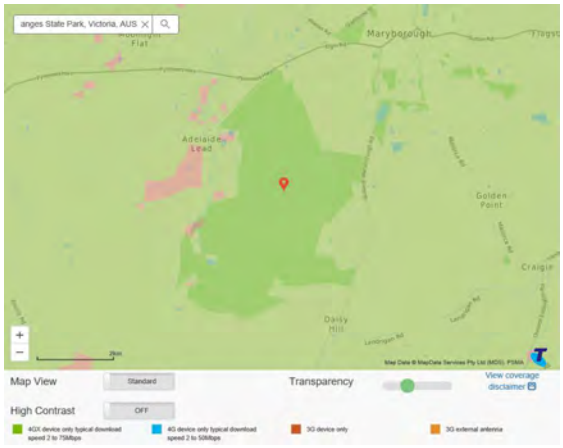



*Figure 88 Telstra coverage of Paddys Ranges State Park*

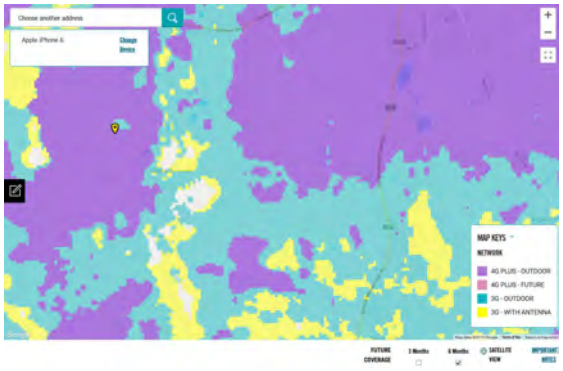



*Figure 89 Optus coverage of Paddys Ranges State Park*

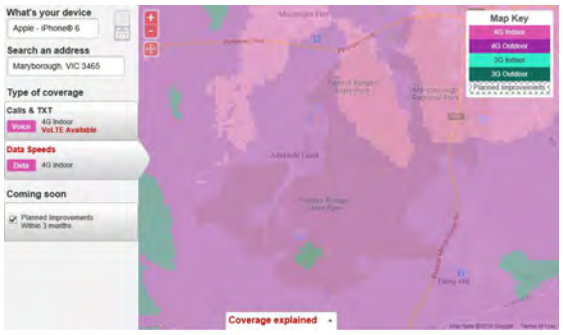



*Figure 90 Vodafone coverage of Paddys Ranges State Park*

## 5.4 Central Deborah Gold Mine

The hugely popular Central Deborah Gold Mine in Bendigo City offers a unique experience into the underground gold mine tunnels that operated during the gold rush of the 1900s.

Three different tours are available to book - Mine Experience Tour, Underground Adventure Tour and the

Nine Levels of Darkness Tour. The tours are available to book every day of the year except for Christmas Day.

*Figure 91 Children experiencing the underground tunnel*[20]

*Figure 92 Aerial imagery of the Central Deborah Gold Mine*

## Fixed Broadband

Refer to Significant Places for fixed broadband coverage analysis of Bendigo.

## Mobile Coverage

Refer to Significant Places for mobile coverage analysis of Bendigo.

# 5.5 Melville Caves - Kooyoora State Park

The Melville Caves are situated in the Kooyoora State Park, Brenanah. The Melville Caves Picnic area, campground and Melville Caves Lookout are all in close proximity to each other.

The picnic area has tables, shelter, toilets and water for visitors. The unpowered campsite facilities include non-flush toilets, picnic tables and wood barbeques. No booking is required with a first in, best dressed policy. The lookout can be accessed from the carpark and is short 15 minute walk.

*Figure 93 Melville Caves*[21]

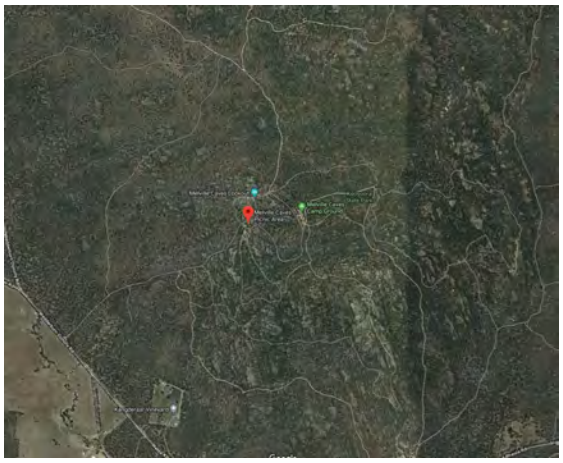


*Figure 94 Aerial imagery of the Melville Caves area*

## Fixed Broadband

Our analysis reveals the Melville Caves area falls within the NBN satellite footprint.

[20] https://www.bendigotourism.com/tours/bendigo-cbd/central-deborah-gold-mine

[21] https://www.goldfieldsguide.com.au/explore-location/133/melville-caves/


*Figure 95 NBN Coverage of Melville Caves (NBN Co)*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of Melville Caves.
- Optus shows 4G Plus *outdoor* coverage of the lookout and campground with 3G *outdoor* provided at the picnic area.
- Vodafone shows 3G *outdoor* coverage of the lookout and picnic area. 4G *outdoor* coverage is provided to the campground area.

In summary, there appears to be coverage of the Melville Caves area from the three mobile network operators.


*Figure 96 Telstra coverage of Melville Caves*


*Figure 97 Optus coverage of Melville Caves*


*Figure 98 Vodafone coverage of Melville Caves*

## 5.6 Turpins Falls

Turpins Falls is located approximately 12 kilometres north of Kyneton, along the Campaspe River.

Scenic views of the falls can be seen from the lookout, a short walk from the carpark. There are no facilities at the reserve.

*Figure 99 Turpins Falls*[22]

[22] https://www.goldfieldsguide.com.au/explore-location/105/turpins-falls/

*Figure 100 Aerial imagery of Turpins Falls (Google Maps)*

## Fixed Broadband

Our analysis reveals the Turpin Falls area is serviced by NBN satellite.

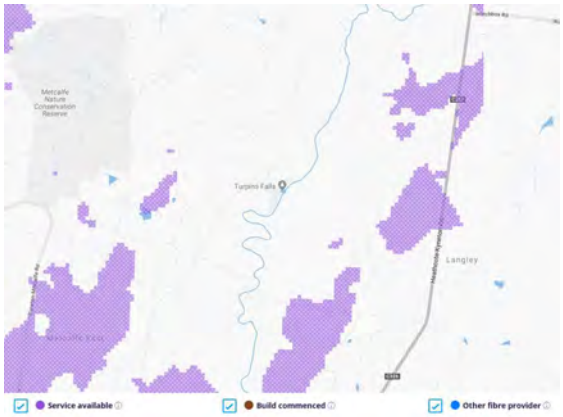



*Figure 101 NBN Coverage of Turpins Falls (NBN Co)*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 3G handheld device coverage of the reserve.
- Optus shows 3G *outdoor* coverage of the reserve.
- Vodafone shows 3G *outdoor* coverage of the reserve.

In summary, there appears to be 3G outdoor handheld device coverage from the three mobile network operators.


*Figure 102 Telstra coverage of Turpins Falls*

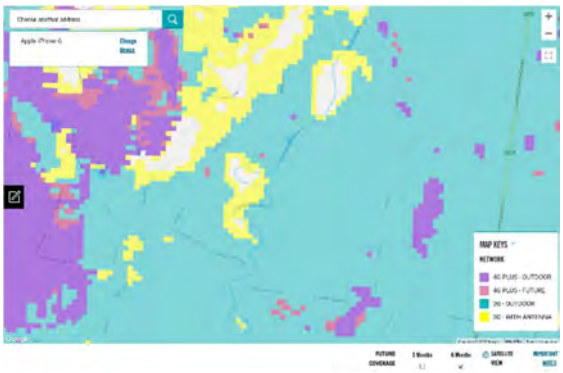


*Figure 103 Optus coverage of Turpins Falls*

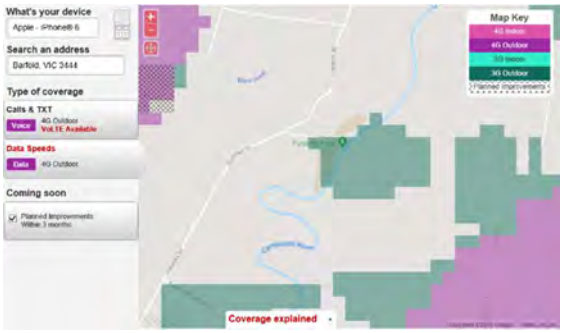



*Figure 104 Vodafone coverage of Turpins Falls*

## 5.7 Murray River

The Murray River stretches from the Gunbower area to the west of Echuca-Moama in the Loddon Campaspe region.

The entire length of the river is 2,700 kilometres from the Great Diving Range in North Eastern Victoria to near Adelaide in South Australia. The river was inhabited by Aboriginal people for thousands of years with Europeans eventually settling in the area using boats on the river to transport supplies.

Outdoor and water activities are enjoyed by many on the river including boating, kayaking, fishing, travelling on a houseboat or historic paddle steamer. Beach camping areas are available at Christies Beach and Betts Beach, Echuca. Christies Beach facilities include toilets, picnic tables and fireplaces however, Betts Beach camp area is without any facilities. Additional accommodation options are available in Echuca-Moama City.

*Figure 105 Paddle steamer on the Murray River*[23]

*Figure 106 Aerial imagery of Murray River in Loddon Campaspe region*

## Fixed Broadband

Our analysis reveals Christies Beach and Betts Beach camping areas fall within the NBN Fixed wireless footprint. The remaining section of Murray River is serviced by NBN Fixed wireless and NBN satellite.

Refer to Significant Places for fixed broadband analysis of Echuca-Moama city.

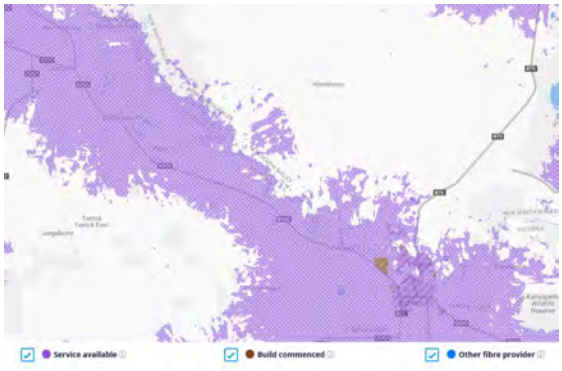



*Figure 107 NBN Coverage of Murray River (NBN Co)*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the Murray River including the two campgrounds.
- Optus shows 4G Plus *outdoor* coverage around the Echuca area with continuous 3G *outdoor* and 4G Plus *outdoor* coverage from near Wharparilla to Gunbower.
- Vodafone shows 4G *indoor* and *outdoor* coverage from Echuca area to approximately halfway where 3G *outdoor* continues the coverage.

In summary, there appears to be coverage from the three mobile network operators.

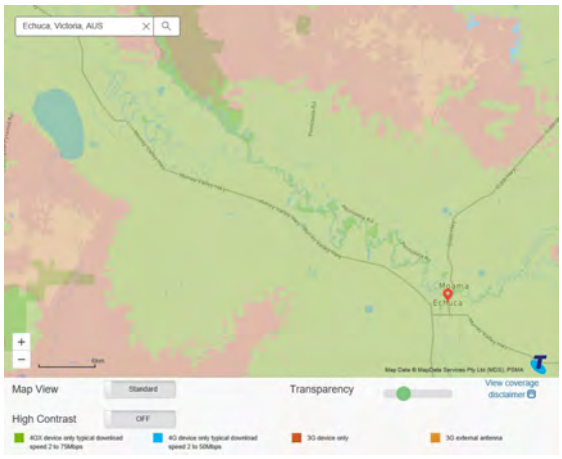



*Figure 108 Telstra coverage of Murray River*

[23] https://www.visitvictoria.com/regions/the-murray/things-to-do/nature-and-wildlife/the-murray-river

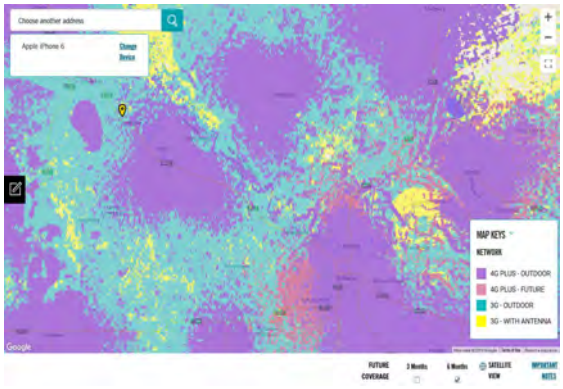



*Figure 109 Optus coverage of Murray River*

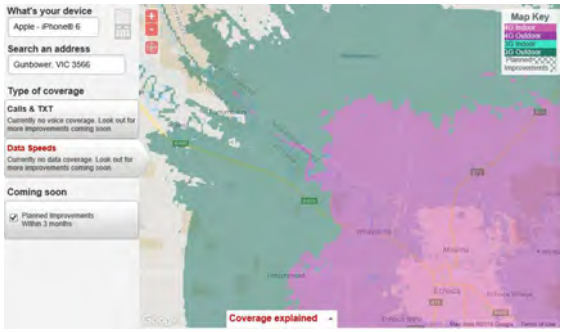



*Figure 110 Vodafone coverage of Murray River*

## 5.8 Riverboats Music Festival

The Riverboats Music Festival is held on the third weekend in February each year at the Aquatic Reserve in Echuca.

The premier music event takes place in the outdoors under tall river red gums, by the Murray River. Talented artists perform on the one stage with food available to purchase from the various food trucks.

*Figure 111 A performance at the Riverboats Music Festival*[24]

*Figure 112 Aerial imagery of Aquatic Reserve (Google Maps)*

### Fixed Broadband

Our analysis reveals the event location is serviced by NBN FTTN Fixed line within the fixed line footprint.

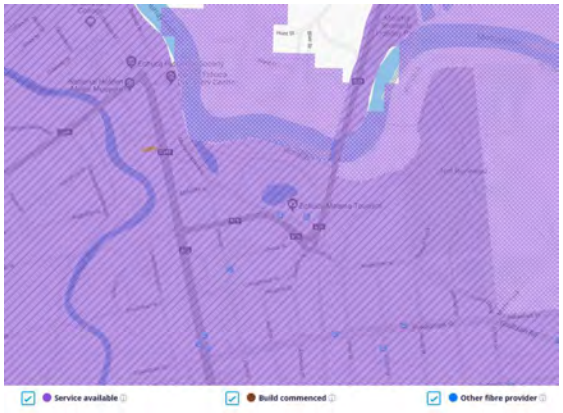



*Figure 113 NBN Coverage of Aquatic Reserve (NBN Co)*

### Mobile Coverage

Refer to Significant Places for mobile coverage analysis of Echuca-Moama.

## 5.9 Art in the Vines

Art in the Vines was held for the first time at the Hanging Rock Winery in Macedon Ranges from 10 November 2018 until the 31 March 2019. The event entails 25 handcrafted works of art by international, national and local artists on display throughout the winery's lawns.

[24] https://www.riverboatsmusic.com.au/gallery

*Figure 114 Sculpture at the Hanging Rock Winery*[25]

*Figure 115 Aerial imagery of the Hanging Rock Winery (Google Maps)*

## Fixed Broadband

Our analysis reveals the Hanging Rock Winery falls within the NBN Fixed wireless footprint.

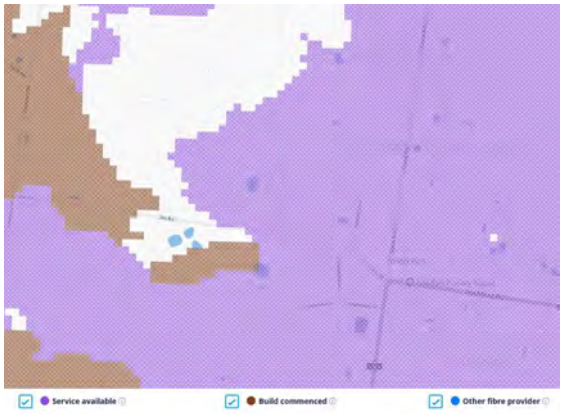



*Figure 116 NBN Coverage of Hanging Rock Winery (NBN Co)*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the winery.
- Optus shows 4G Plus outdoor coverage of the winery.
- Vodafone shows 4G *outdoor* coverage of the winery.

In summary, there appears to be 4G coverage from the three mobile network operators.


*Figure 117 Telstra coverage of Hanging Rock Winery*

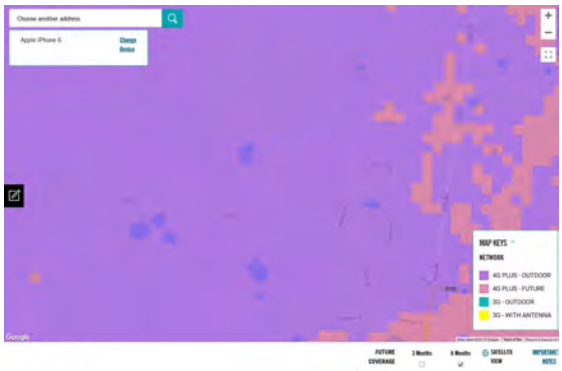
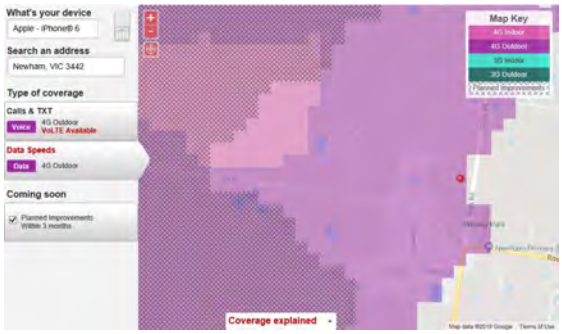



*Figure 118 Optus coverage of Hanging Rock Winery*




[25] https://www.visitmacedonranges.com/events/art-in-the-vines-at-hanging-rock-winery-an-exhibition-of-sculpture/

*Figure 119 Vodafone coverage of Hanging Rock Winery*

## 5.10 Loddon Valley Food and Wine Expo

The Loddon Valley Food and Wine Expo showcases the region's gourmet food and wine with live music and entertainment, including kids' entertainment at the Riverside Reserve in Newbridge.

*Figure 120 Aerial imagery of the Riverside Reserve (Google Maps)*

### Fixed Broadband

Our analysis reveals the Riverside Reserve in Newbridge, falls within the NBN Fixed wireless footprint.

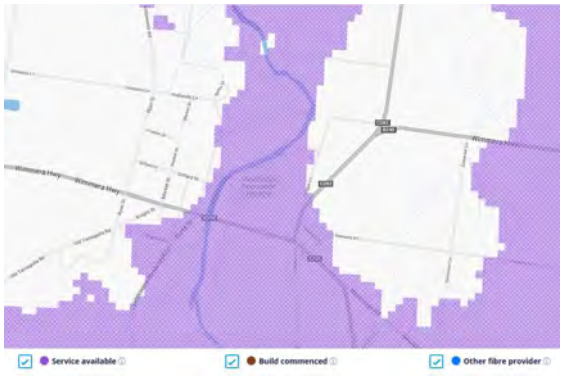



*Figure 121 NBN Coverage of the Riverside Reserve (NBN Co)*

### Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of the reserve.
- Optus shows 3G *outdoor* coverage of the reserve.
- Vodafone shows marginal 4G *outdoor* coverage in the area.

In summary, there appears to be coverage from two of the three mobile network operators with partial coverage from the third operator.


*Figure 122 Telstra coverage of the Riverside Reserve*

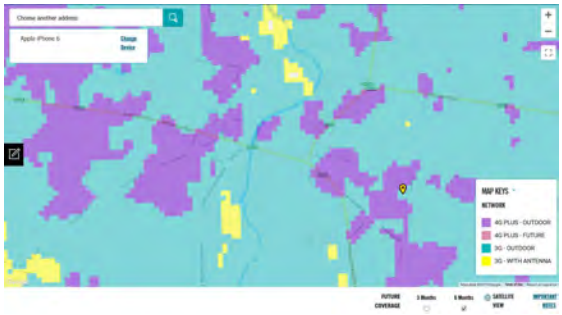


*Figure 123 Optus coverage of the Riverside Reserve*

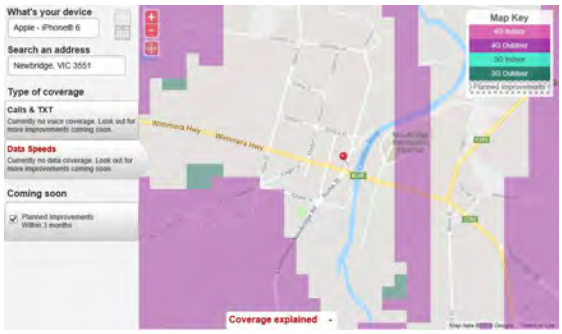



*Figure 124 Vodafone coverage of the Riverside Reserve*

## 5.11 Southern 80

The Southern 80 event takes place on the Murray River in Echuca-Moama every February.

The biggest water ski race in the world attracts a large number of locals and visitors with the finish line visible from Victoria Park, Echuca.

*Figure 125 Racing at Southern 80*[26]

## Fixed Broadband

Our analysis reveals Victoria Park falls within the NBN Fixed wireless footprint.

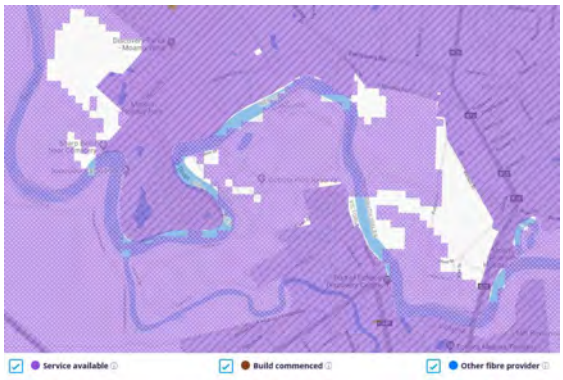



*Figure 126 NBN Coverage of Victoria Park (NBN Co)*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of Victoria Park.
- Optus shows 4G Plus *outdoor* coverage of Victoria Park.
- Vodafone shows 4G *indoor* coverage of Victoria Park.

In summary, there appears to be coverage from the three mobile network operators, however the coverage signal and speeds may be affected by the increase in visitor numbers during the event.


*Figure 127 Telstra coverage of Victoria Park*

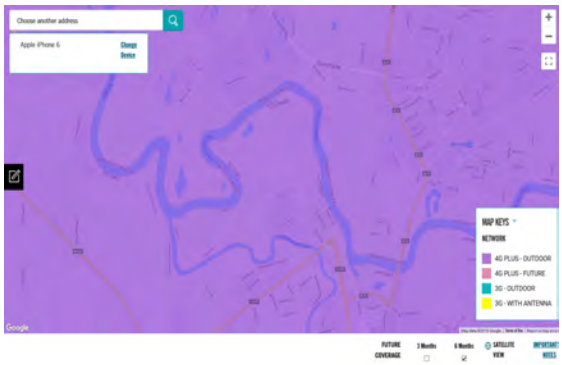



*Figure 128 Optus coverage of Victoria Park*

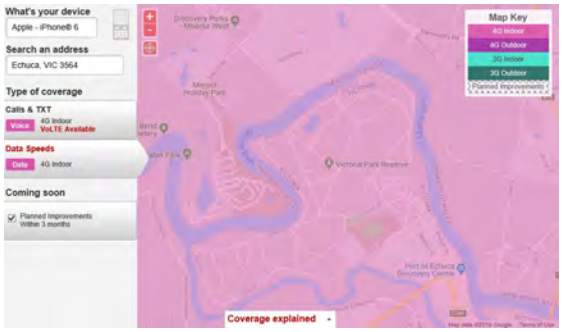



*Figure 129 Vodafone coverage of Victoria Park*

## 5.12 Newstead Live

Newstead Live takes place over the last weekend of January and features live folk-roots music performances in various venues throughout the town

[26] http://www.murrayriver.com.au/event/2282-2015-club-marine-southern-80-ski-race/

of Newstead including The Troubadour Live Music Venue and Bar, Lilliput, The Anglican Church and Daffy's.

*Figure 130 Performance at Newstead Live*[27]

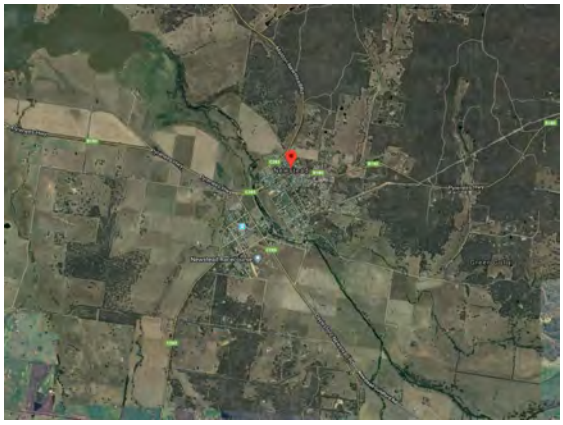


*Figure 131 Aerial Imagery of Newstead town (Google Maps)*

## Fixed Broadband

Refer to Significant Places for fixed broadband analysis of Newstead.

## Mobile Coverage

Refer to Significant Places for mobile coverage analysis of Newstead.

# *5.13 O'Keefe Rail Trail*

The O'Keefe Rail Trail is a 49 kilometre journey from Bendigo to Heathcote. The mostly level walking and cycling track travels through natural bushland, waterways, recreation reserves and a number of bridge crossings.

Complementary attractions, experiences and accommodation options are available along the journey. The town of Axedale is the rail trail's halfway point and features the Campaspe River Reserve. There are multiple access points if a shorter journey is desired.

*Figure 132 Cyclists on the O'Keefe Rail Trail*[28]


*Figure 133 Map of the O'Keefe Rail Trail*[29]

## Fixed Broadband

Refer to Significant Places for fixed broadband analysis of Bendigo and Heathcote.

Our analysis reveals the town of Axedale and Longlea are serviced by NBN Fixed wireless. The town of Junortoun is serviced by NBN FTTN fixed line services and Knowsley is serviced by NBN satellite.

[27] https://www.bendigotourism.com/whats-on/next-7-days/event/23949-newstead-live

[28] https://www.bendigotourism.com/things-to-do/cycling-and-walking/okeefe-rail-trail

[29] https://www.bendigotourism.com/things-to-do/cycling-and-walking/okeefe-rail-trail

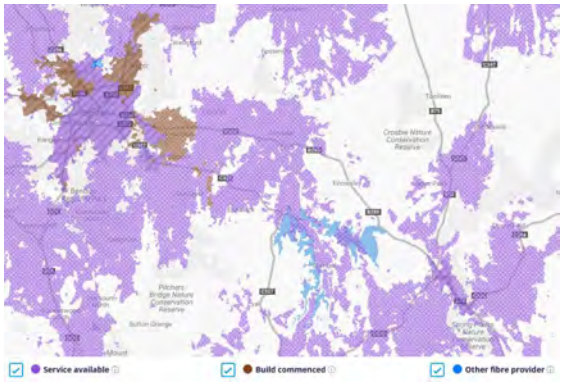



*Figure 134 NBN Coverage of the towns on the O'Keefe Rail Trail (NBN Co)*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) from Bendigo to Knowsley. 4GX and 3G device coverage is shown between Knowsley and Heathcote.
- Optus shows 4G Plus *outdoor* coverage from Bendigo to Knowsley with 4G Plus and 3G *outdoor* device coverage between Knowsley and Heathcote.
- Vodafone shows 4G *indoor* and *outdoor* coverage between Bendigo and Axedale. Predominately 4G *outdoor* coverage is shown between Axedale and Knowsley with 3G *outdoor* evident closer to Knowsley. Limited 4G *outdoor* and 3G *outdoor* coverage is evident between Knowsley and Heathcote.

In summary, there appears to be 4G coverage from two of the three mobile operators with partial 4G coverage from the third operator.

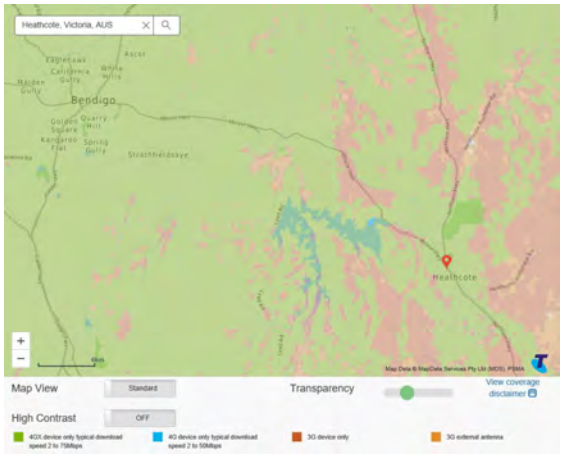



*Figure 135 Telstra coverage of the O'Keefe Rail Trail*

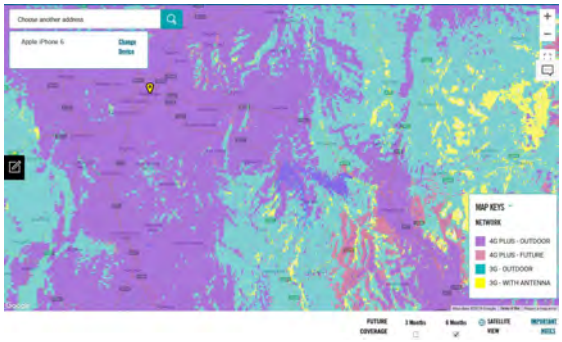



*Figure 136 Optus coverage of the O'Keefe Rail Trail*

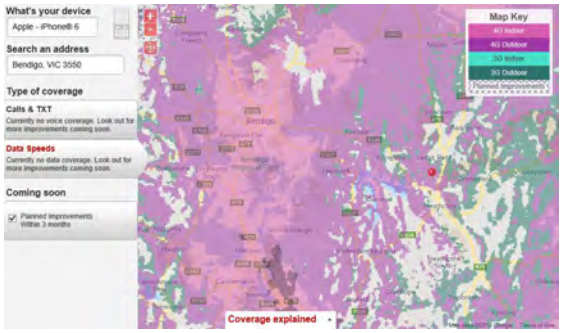



*Figure 137 Vodafone coverage of the O'Keefe Rail Trail*

## 5.14 The Goldfields Track

The Goldfields Track, in its entirety, is a 210 kilometre cross country journey from Mount Buninyong to Bendigo named the Great Dividing Trail.

The track can be tackled in one journey or separated into three sections – Wallaby Track from Mount Buninyong to Daylesford, Dry Diggings Track from Daylesford to Castlemaine and the Leanganook Track from Castlemaine to Bendigo.

The Dry Diggings Track and Leanganook Track are easy/medium grade tracks travelling through the Loddon Campaspe region. The 61 kilometres length of the Dry Diggings Track is a two-to-three day walk or a one day cycling trip. The highlights include travelling through ironbark, box and stringybark bushland, discovering the gold mining history and experiencing spa areas of Vaughan, Glenluce and Hepburn.

The Leanganook Track is a 58 kilometre journey featuring the Castlemaine Diggings National Park, insight into the gold rush history, Specimen Gully Road Lookout and the Salomon Gully Flora Reserve.

Free or low cost camping is available on or slightly off track. Each town on the route offers a range of accommodation options.

*Figure 138 Rock formations on the Leanganook Track*[30]

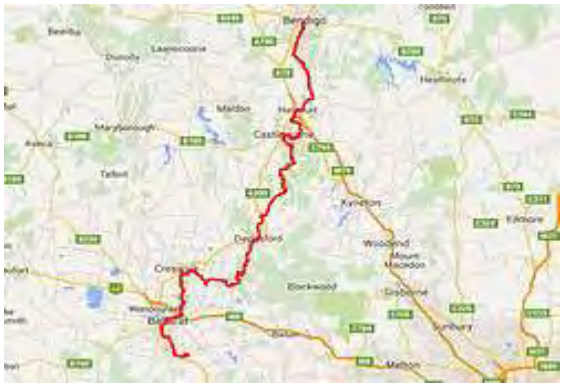


*Figure 139 Map of the Goldfields Track*[31]

## Fixed Broadband

Our analysis reveals the towns of Vaughan, Golden Point and Harcourt are serviced by NBN Fixed wireless with Fryerstown and Irishtown serviced by NBN satellite.

Refer to Significant Places for fixed broadband analysis of Castlemaine and Bendigo.

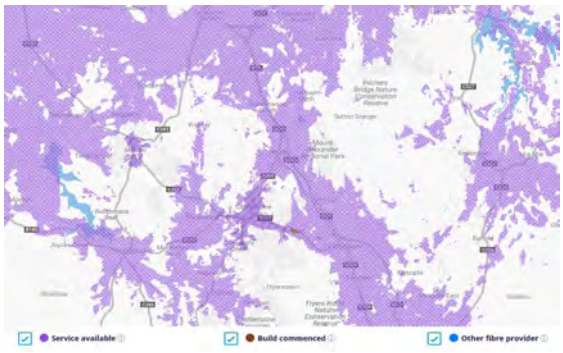



*Figure 140 NBN Coverage of the towns on the Goldfields Track (NBN Co)*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows predominately 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) with small patches of 3G device coverage of the track.
- Optus shows predominately 4G Plus *outdoor* coverage with patchy 3G *outdoor* coverage south of the track (around the Vaughan area).
- Vodafone shows predominately 4G *indoor* and *outdoor* coverage of the track however, 3G *outdoor* and blackspots are evident in the Fryerstown area.

In summary, there appears to be coverage from the three mobile network operators.

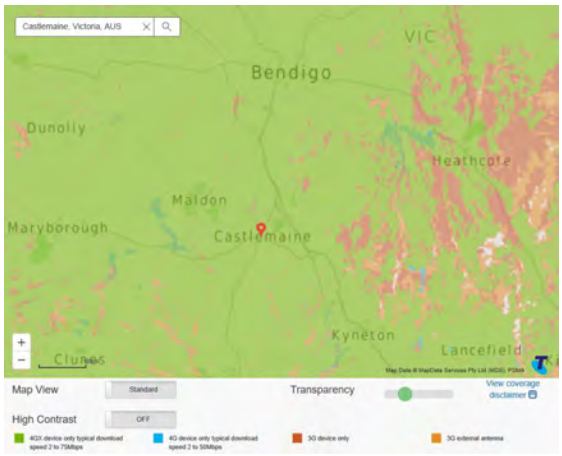



*Figure 141 Telstra coverage of the Goldfields Track*

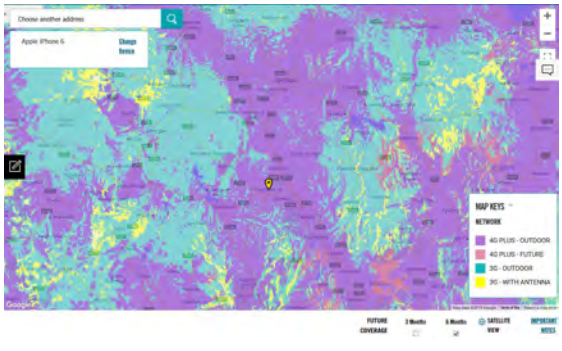



*Figure 142 Optus coverage of the Goldfields Track*

[30] https://www.visitvictoria.com/Regions/Goldfields/Things-to-do/Outdoor-activities/Cycling/The-Goldfields-Track

[31] https://www.fittours.com.au/goldfields-track-classic

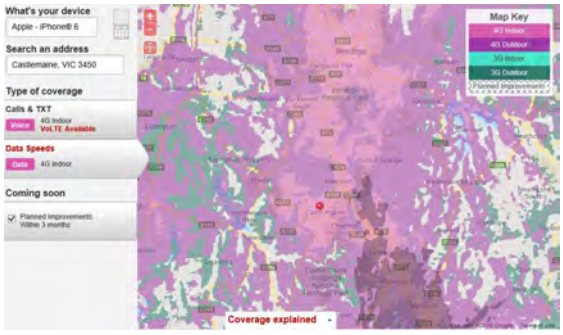



*Figure 143 Vodafone coverage of the Goldfields Track*

## 5.15 Maryborough Highland Gathering

The Maryborough Highland Gathering is Australia's oldest continuous running sporting event. It was first established in 1857 and is held every New Year's Day in the town of Maryborough in Princes Park.

The Highland Gathering attracts large numbers of people to the township and the increase in visitors presents issues with digital connectivity during the event.

### Fixed Broadband

Refer to Significant Places for fixed broadband analysis of Maryborough.

### Mobile Coverage

Refer to Significant Places for mobile coverage analysis of Maryborough.

*The coverage signal and speeds may be affected by the increase in tourist numbers during peak holiday seasons.*

## 5.16 Energy Breakthrough

The Energy Breakthrough is a joint initiative of the Country Education Partnership (CEP) and the Central Goldfields Shire Council (CGSC).

It is a program where students, teachers, parents and local industry work together to design and construct a vehicle, a machine or innovation in technology that will represent an 'energy breakthrough'. They then gather in the town of Maryborough to demonstrate and trial their designs in a celebration that spans four days.

The event attracts over 20,000 people to the area, almost tripling the population of the town itself. This presents digital connectivity issues for the town during the event.

### Fixed Broadband

Refer to Significant Places for fixed broadband analysis of Maryborough.

### Mobile Coverage

Refer to Significant Places for mobile coverage analysis of Maryborough.

*The coverage signal and speeds may be affected by the increase in tourist numbers during peak holiday seasons.*

## 5.17 Talbot Farmers Market

Talbot Farmers Market is based in the Goldfields Region of Central Victoria. It is held on the third Sunday of every month in the small locality of Talbot.

The stalls sell a range of products, including seasonal fruit and organic vegetables, local artisan cheese, fresh bread, local wine, gourmet oils, delicious delicacies and more.

The event attracts an average of 5,000 visitors per month and is one of the largest farmers markets in the state.

### Fixed Broadband

Our analysis reveals the locality of Talbot is serviced by NBN satellite.


*Figure 144 NBN Coverage of Talbot Farmers Market (NBN Co)*

## Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) of Talbot.
- Optus shows predominately 3G *outdoor* coverage with patchy 4G Plus *outdoor* coverage around Talbot.
- Vodafone shows predominately 4G *indoor* coverage of the locality with large patches of 3G *outdoor* coverage to the north-west of Talbot.

In summary, there appears to be coverage from the three mobile network operators in the area.


*Figure 145 Telstra coverage of the Talbot Farmers Market*

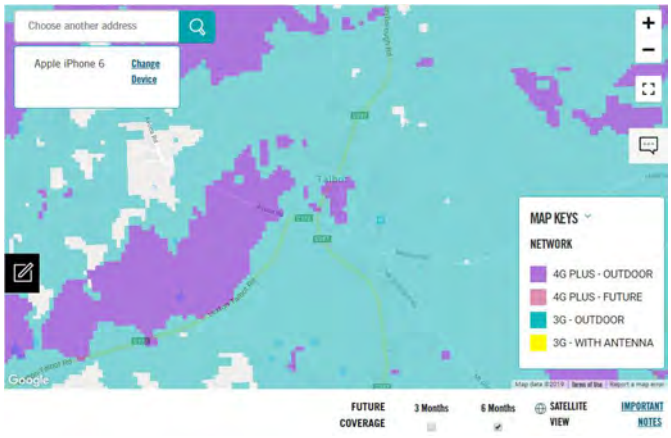



*Figure 146 Optus coverage of the Talbot Farmers Market*

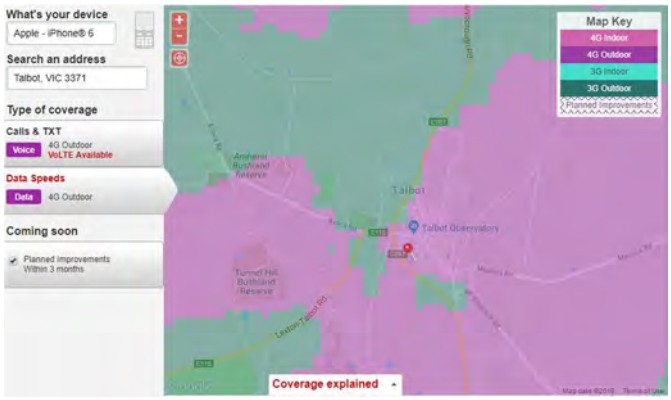



*Figure 147 Vodafone coverage of the Talbot Farmers Market*

# 6 Transport Corridors

## 6.1 Introduction

For the purposes of transport, only cellular network coverage is considered in this report. Fixed broadband is, by its nature, inapplicable to mobile users. Transport-related IoT applications utilising LP-WAN technologies may emerge in the future but are not on the radar at this stage.

In terms of meeting the needs of mobile users, this report considers both road and rail. In the case of rail services, mobile reception depends not only on the availability of coverage along the route, but also on the design of carriages (which can block signals) and the provision of any internal repeaters (to boost internal reception). Since the carriages serving a route can vary from day to day, this report can only consider the level of mobile coverage along the route and note the possibility of poor in-carriage reception.

In the case of road transport, the main indicator of demand is the road classification (designated M/A, B or C-grade roads)[32]. It is recognised that there may be other local roads that carry high traffic volumes or that have a poor accident history and where there is poor coverage, thereby warranting attention. Local knowledge is the most effective means of identifying such locations.

Discussions with the MNOs are underway to explore incorporation of the public coverage information into SLIM. If and when such information becomes available, it will become more practical to identify and characterise transport mobile blackspots more easily and efficiently.

Fieldwork commencing at the time of preparation of this report may also yield more accurate insights into significant transport mobile blackspots.

[32] "A" and "B" routes are arterial highways (classification AH). "C" routes typically link smaller population centres to larger regional centres, or roads (classification AO).


*Figure 148 Loddon Campaspe region declared roads and rail routes*

## 6.2 Freeways/Motorways

Practical experience of call dropouts and coverage blackspots when driving some of the roads suggests that the carrier coverage maps tend to overstate the quality of coverage, however cars fitted with external antennae will receive more consistent coverage.

There is one motorway in the region with a visual scan of public carrier maps shown below.

### M79 Calder Freeway (~98km)

- From near Sunbury
- To near Ravenswood

Maps show continuous 4G *outdoor* coverage or better by all three mobile network operators. Vodafone is constructing significant new coverage in the area around Gisborne and Castlemaine. This is considered to be a result of the Regional Rail Connectivity Project investment to improve rail coverage between Melbourne and Seymour.

## 6.3 A/B-grade roads

There are a number of A and B-grade roads in the region. Those listed in the table below are the most significant ones, which have been reviewed by a visual scan of public carrier maps.

| Highway Name | Approx Start | Approx End | Dist (km) |
|---|---|---|---|
| A79 CALDER HIGHWAY | Near Ravenswood | Between Charlton and Wedderburn | 100 |
| A790 CALDER ALTERNATIVE HIGHWAY | Near Ravenswood | Marong | 20 |
| B260 LODDON VALLEY HIGHWAY | Bendigo | Macorna | 102 |
| B280 MCIVOR HIGHWAY | Bendigo | Heathcote | 44 |
| A300 MIDLAND HIGHWAY | Bendigo | Stanhope | 89 |
| B400 MURRAY VALLEY HIGHWAY | Gunbower | Wyuna | 83 |
| B75 NORTHERN HIGHWAY | Echuca/ Moama | Heathcote | 95 |
| B180 PYRENEES HIGHWAY | Elphinstone | Avoca | 78 |
| B240 WIMMERA HIGHWAY | Marong | Logan | 69 |

### A79 Calder Highway (~100km)

- From near Ravenswood
- To between Charlton and Wedderburn

This highway connects the end of the Calder Freeway to Broken Hill in NSW, traversing Bendigo, Wycheproof, Ouyen and Mildura. The section of the highway within the region ends midway between Charlton and Wedderburn.

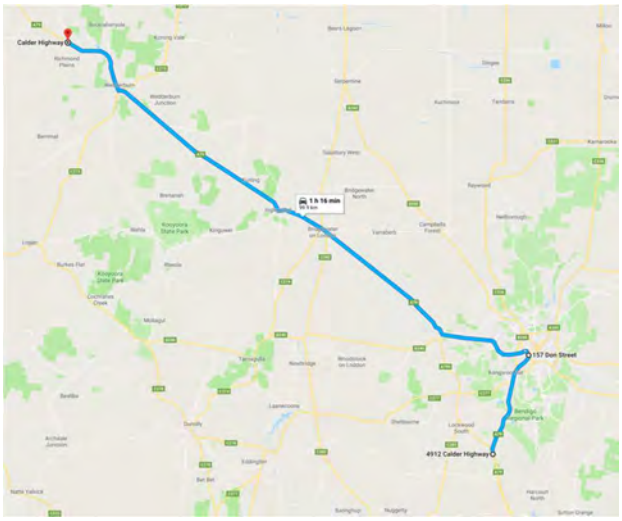


*Figure 149 A79 Calder Highway within the region (Google Maps)*

Based on public coverage maps:

- Telstra shows continuous 4GX *outdoor* coverage
- Optus shows continuous 4G *outdoor* coverage
- Vodafone shows continuous 4G *outdoor* coverage or better.

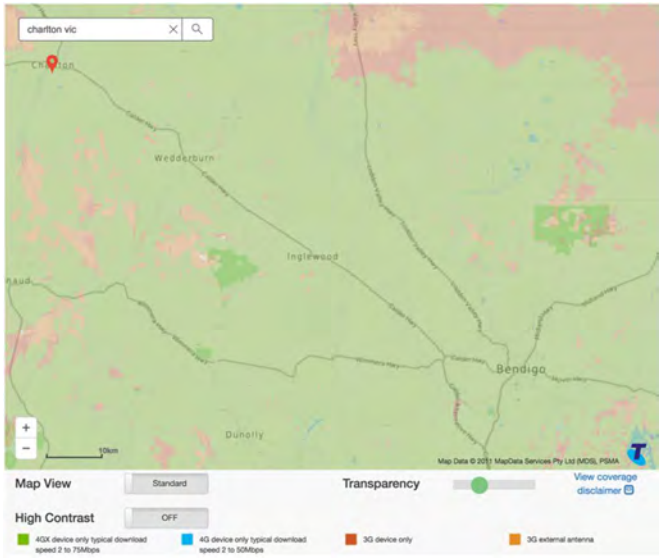



*Figure 150 Telstra coverage on the section of A79 Calder Highway*

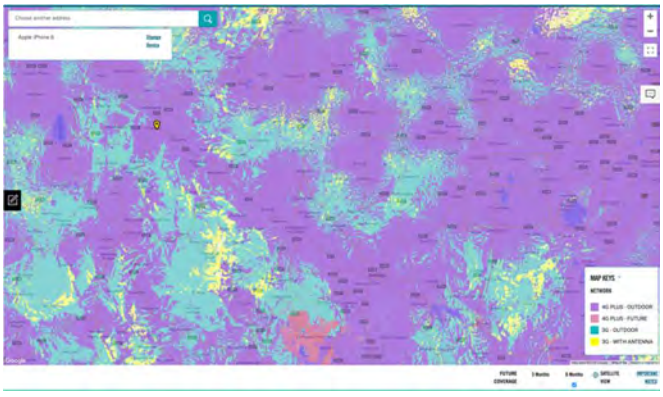


*Figure 151 Optus coverage on the section of A79 Calder Highway*

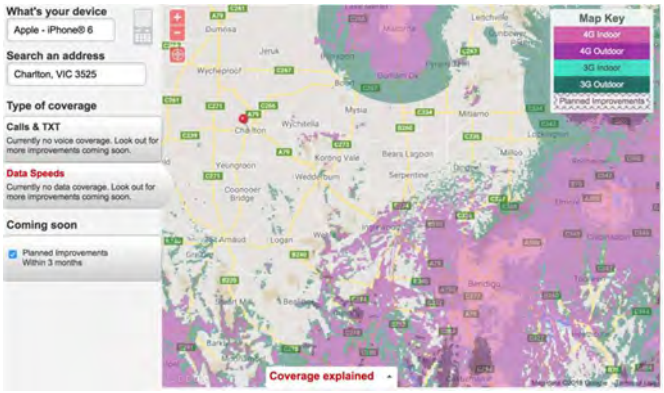



*Figure 152 Vodafone coverage on the section of A79 Calder Highway*

Based on public coverage maps, there appears to be continuous 4G *outdoor* coverage by all three mobile network operators.

## A790 Calder Alternative Highway (~20km)

- From near Ravenswood
- To Marong

This highway connects the end the Calder Freeway to A79 Calder Highway bypassing Bendigo CBD and suburbs.

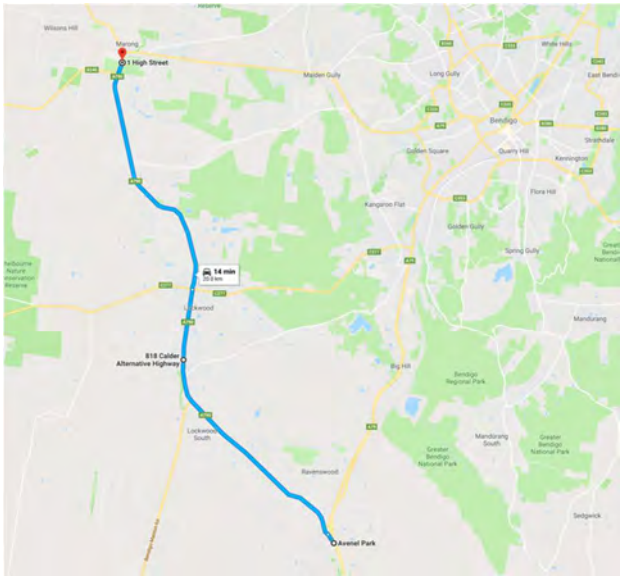


*Figure 153 A79 Calder Alternative Highway within the region (Google Maps)*

Based on public coverage maps:

- Telstra shows continuous 4GX *outdoor* coverage, with a small section of 3G *outdoor* coverage near Lockwood/Lockwood South
- Optus shows continuous 4G *outdoor* coverage
- Vodafone shows continuous 4G *outdoor* coverage or better

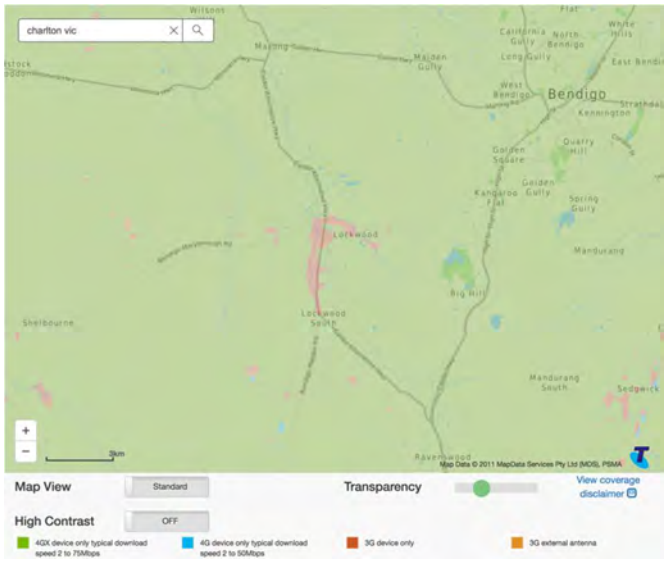



*Figure 154 Telstra coverage on A790 Calder Alternative Highway*

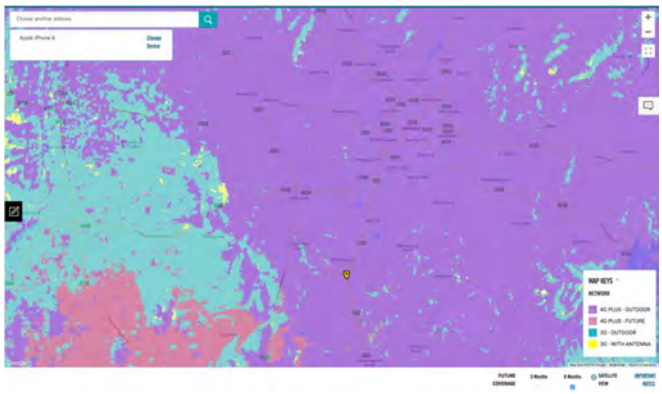


*Figure 155 Optus coverage on A790 Calder Alternative Highway*

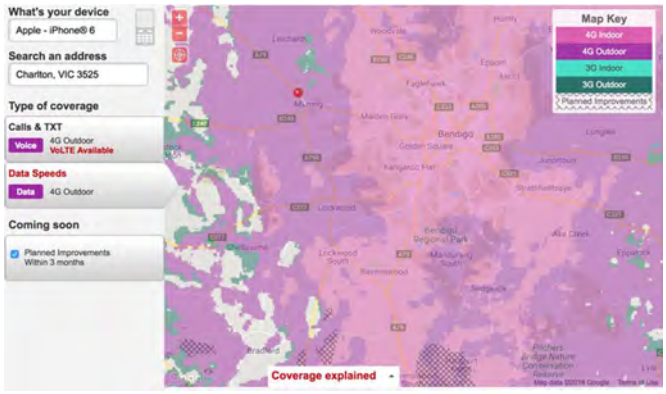



*Figure 156 Vodafone coverage on A790 Calder Alternative Highway*

Based on public coverage maps, there appears to be continuous 4G and 3G *outdoor* coverage by all three mobile network operators.

## B260 Loddon Valley Highway (~102km)

- From Bendigo
- To Macorna

This highway connects the end the A79 Calder Highway near Bendigo CBD to Kerang. The section of highway within the region ends at Macoma.

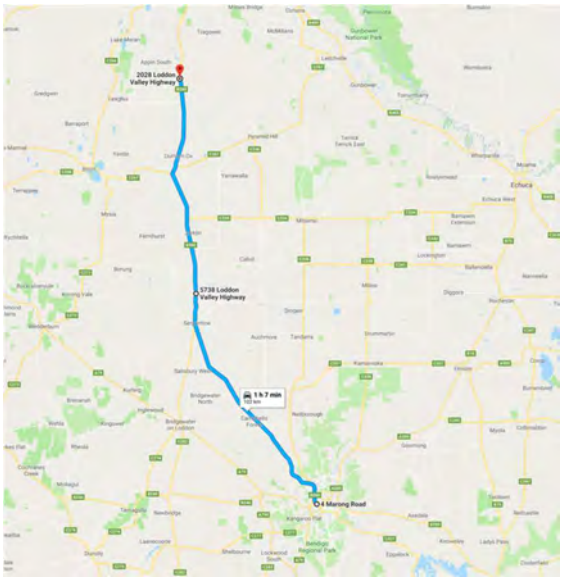


*Figure 157 B260 Loddon Valley Highway within the region (Google Maps)*

Based on public coverage maps:

- Telstra shows continuous 4GX *outdoor* coverage as far as Jarklin, with 3G handheld and external antenna coverage thereafter until near Kerang
- Optus shows continuous 4G *outdoor* coverage with patchy 3G handheld and 3G external antenna coverage between Campbell's Forest and Jarklin
- Vodafone shows continuous 4G *outdoor* coverage only as far as Campbell's Forest then no coverage until the approach to Macorna.

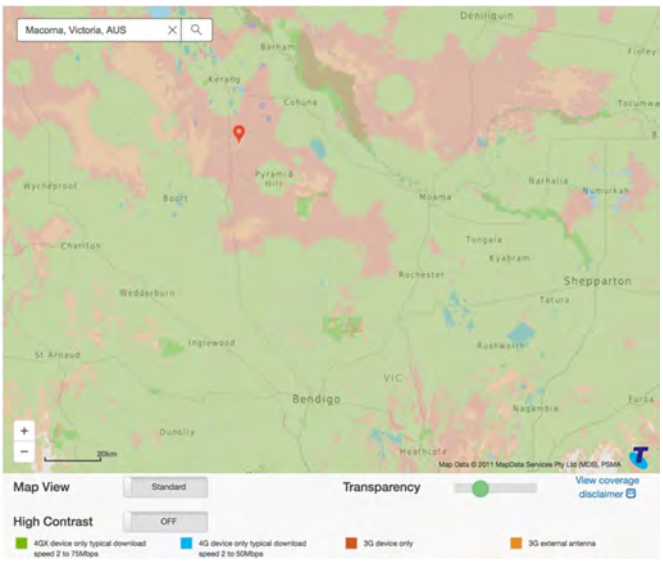



*Figure 158 Telstra coverage on B260 Loddon Valley Highway*

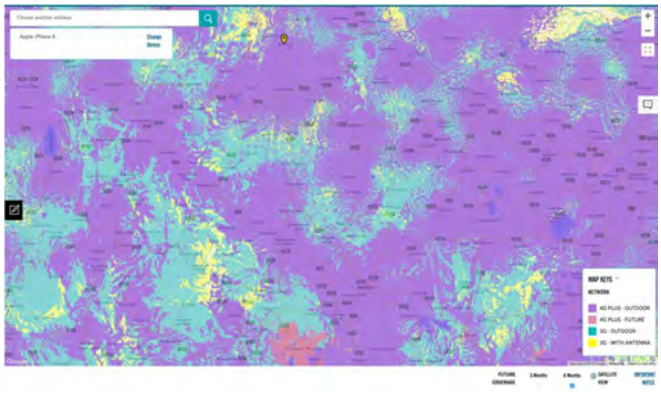


*Figure 159 Optus coverage on B260 Loddon Valley Highway*

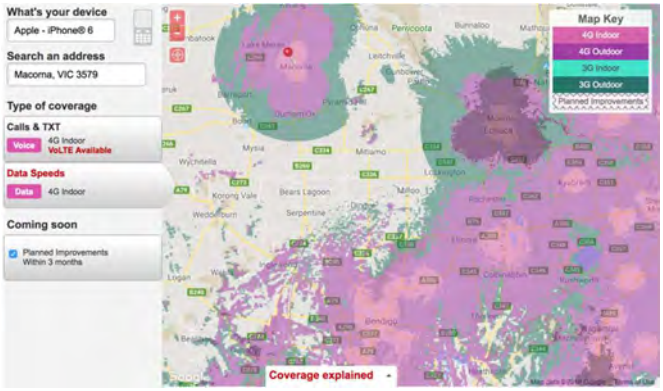



*Figure 160 Vodafone coverage on B260 Loddon Valley Highway*

Based on public coverage maps, there appears to be 4G, 3G *outdoor* and external antenna continuous coverage across the entire route by two mobile network operators, with partial coverage by the third carrier.

## B280 McIvor Highway (~44km)

- From Bendigo
- To Heathcote

This highway connects Bendigo to Heathcote.

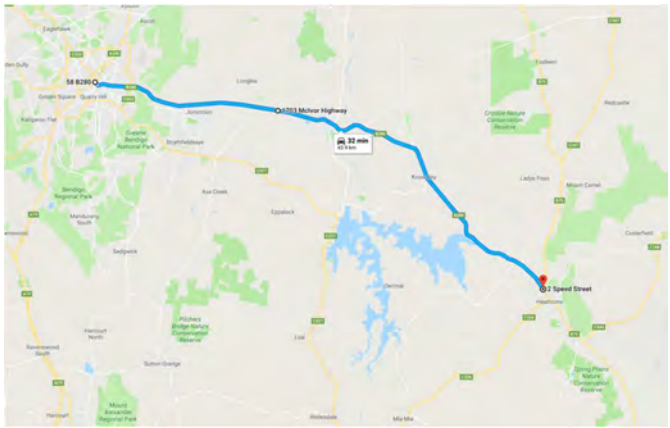


*Figure 161 B280 McIvor Highway (Google Maps)*

Based on public coverage maps:

- Telstra shows continuous 4GX *outdoor* coverage as far as Knowsley, except for an area of 3G handheld coverage around Knowsley.
- Optus shows continuous 4G *outdoor* coverage from Bendigo until near Knowsley with coverage then falling to 3G handheld and external antenna
- Vodafone shows continuous 4G *outdoor* coverage from Bendigo until near Knowsley but poor to no coverage thereafter.

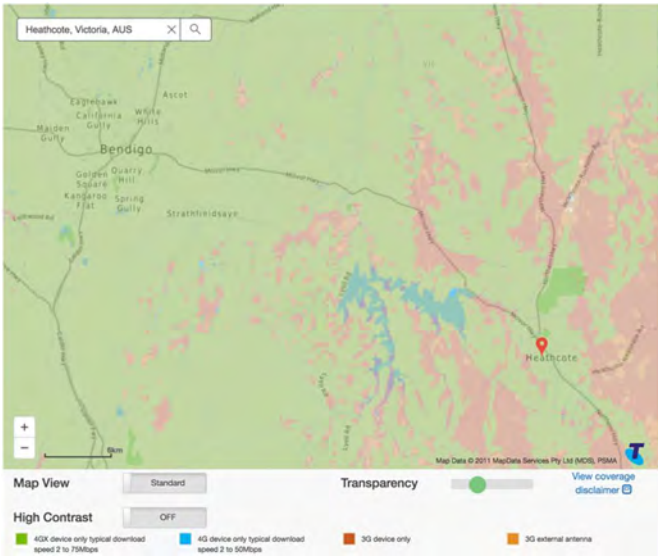



*Figure 162 Telstra coverage on B280 McIvor Highway*

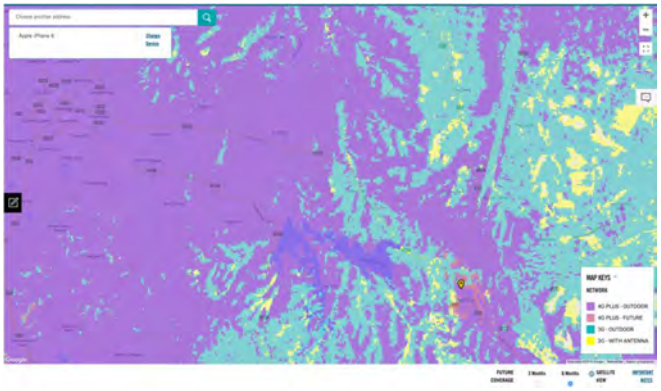


*Figure 163 Optus coverage on B280 McIvor Highway*

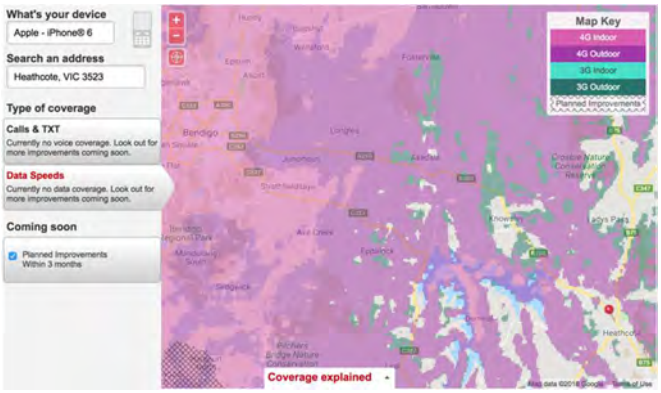



*Figure 164 Vodafone coverage on B280 McIvor Highway*

Based on public coverage maps, there appears to be continuous coverage across the entire route by two mobile network operators, with partial coverage by the third carrier.

## A300 Midland Highway (~89km)

- From Bendigo
- To near Stanhope

This highway connects Bendigo to Shepparton. The section of the highway that falls within the region ends near Stanhope.

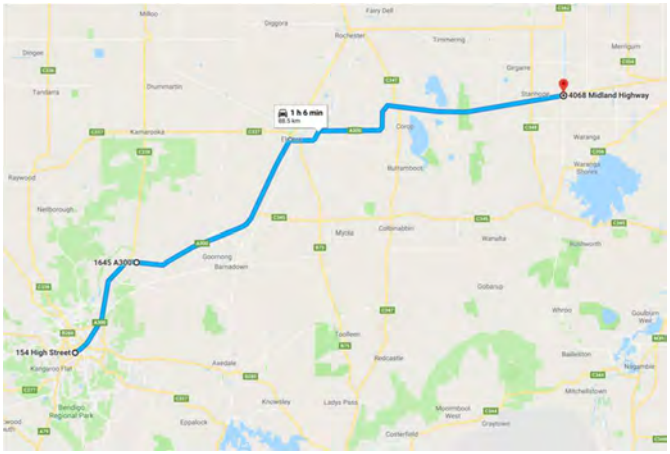



*Figure 165 B280 McIvor Highway*

Based on public coverage maps:

- Telstra shows continuous 4GX *outdoor* coverage across the route
- Optus shows continuous 4G *outdoor* coverage across the route
- Vodafone shows continuous 4G *outdoor* coverage across the route.

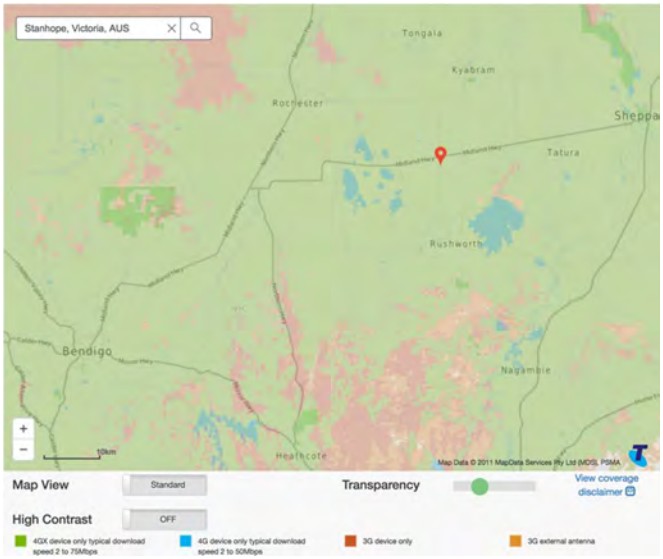



*Figure 166 Telstra coverage on A300 Midland Highway*

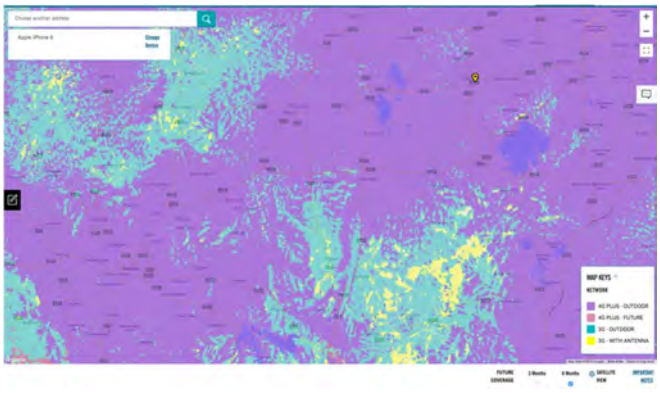


*Figure 167 Optus coverage on A300 Midland Highway*

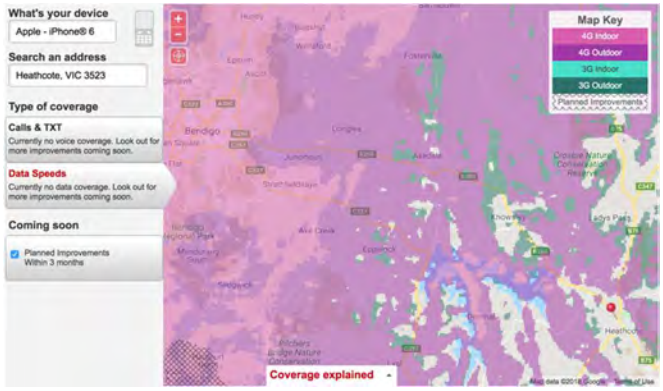



*Figure 168 Vodafone coverage on A300 McIvor Highway*

Based on public coverage maps, there appears to be continuous coverage across the entire route by all three mobile network operators.

## B400 Murray Valley Highway (~83km)

- From Gunbower
- To Wyuna

This highway connects Bendigo to Shepparton. The section of the highway that falls within the region ends near Stanhope.

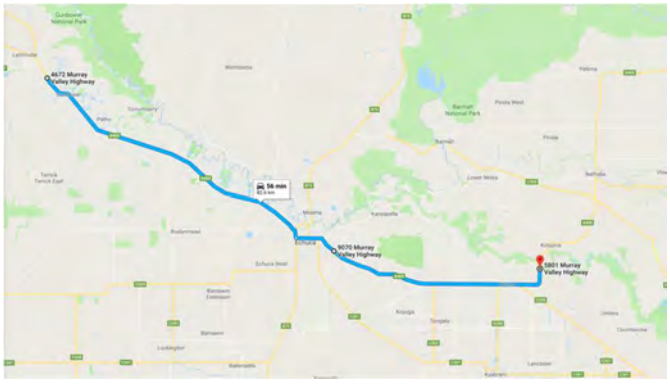


*Figure 169 B400 Murray Valley Highway (Google Maps)*

Based on public coverage maps:

- Telstra shows continuous 4GX *outdoor* coverage across the route
- Optus shows continuous 4G and 3G *outdoor* coverage across the route
- Vodafone shows no coverage between Gunbower and Patho, where 3G coverage is provided, then continuous 4G *outdoor* coverage across the remainder of the route.

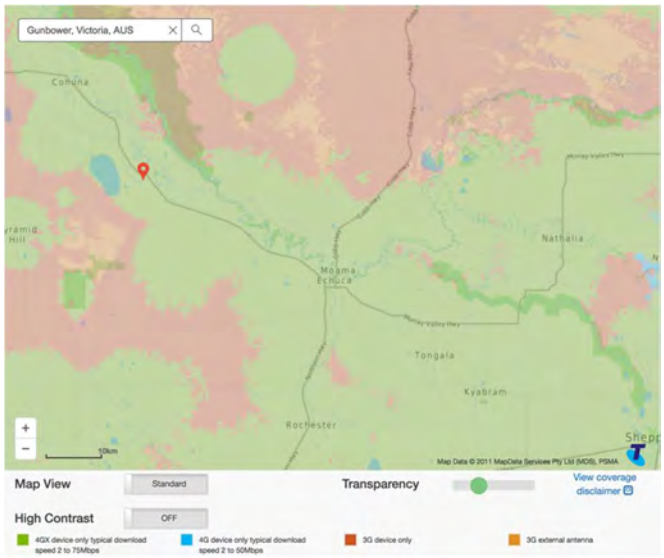



*Figure 170 Telstra coverage on B400 Murray Valley Highway*

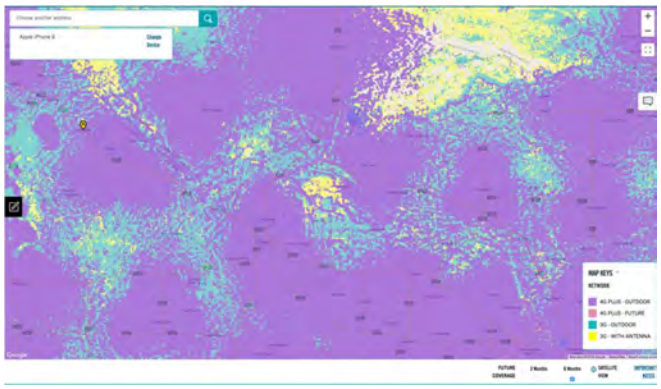


*Figure 171 Optus coverage on B400 Murray Valley Highway*

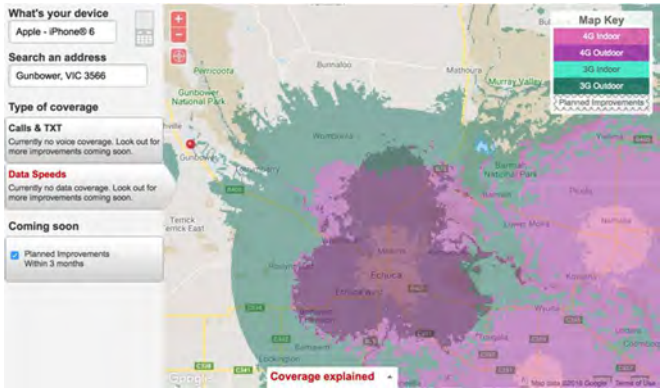



*Figure 172 Vodafone coverage on B400 Murray Valley Highway*

Based on public coverage maps, there appears to be continuous coverage across the entire route by at least two mobile network operators, with partial coverage by the third.

## B75 Northern Highway (~95km)

- From Echuca
- To Heathcote

This highway connects Echuca to Kilmore. The section of the highway that falls within the region ends near Heathcote.

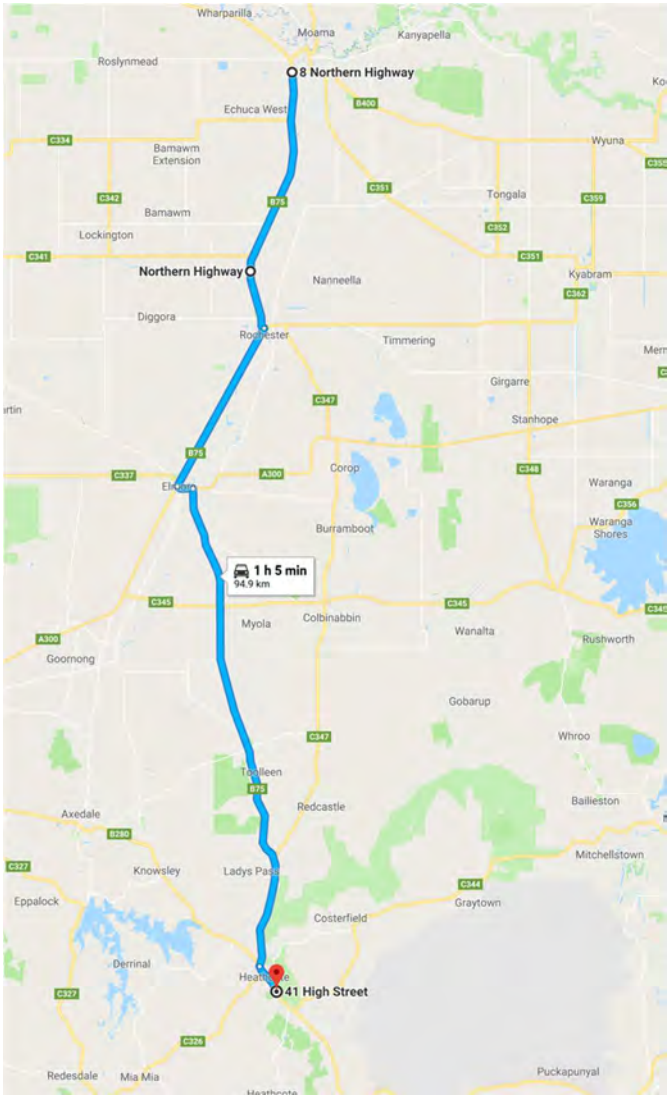



*Figure 173 B400 Murray Valley Highway (Google Maps)*

Based on public coverage maps:

- Telstra shows continuous 3G or better device coverage between Heathcote and Myola, but thereafter shows 4GX *outdoor* coverage across the remainder of the route to Echuca
- Optus similarly shows 3G coverage between Heathcote and Myola then continuous 4G *outdoor* coverage across the remainder of the route
- Vodafone shows poor to no coverage between Heathcote and Myola, then continuous 4G *outdoor* coverage across the remainder of the route, with new coverage under construction around Echuca.

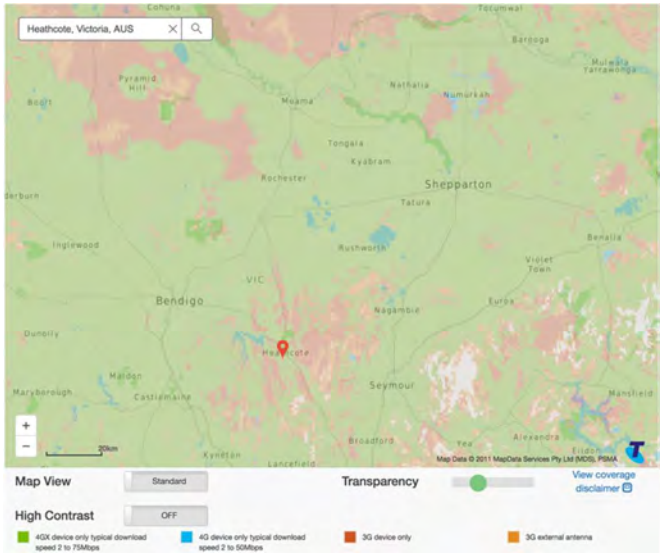



*Figure 174 Telstra coverage on B75 Northern Highway*

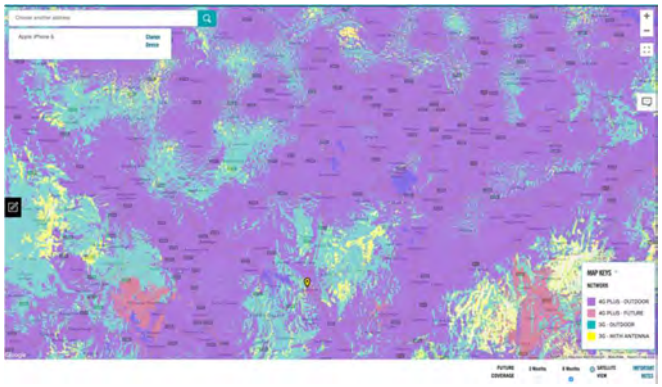


*Figure 175 Optus coverage on B75 Northern Highway*

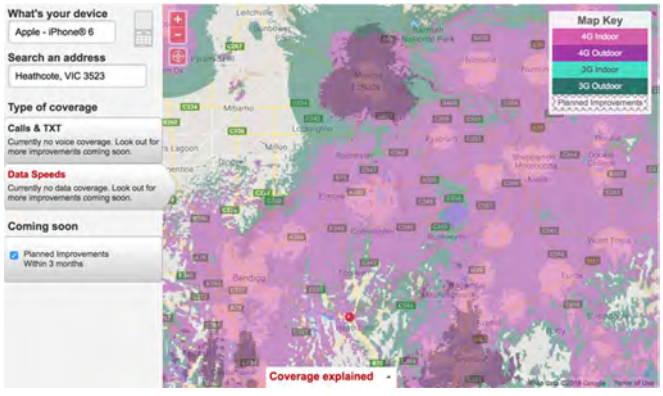



*Figure 176 Vodafone coverage on B75 Northern Highway*

Based on public coverage maps, there appears to be continuous coverage at 3G or better across the entire

route at least two mobile network operators, with partial coverage by the third.

## B180 Pyrenees Highway (~78km)

- From Elphinstone
- To Avoca

This highway connects the Calder Freeway near Elphinstone to Ararat via Castlemaine, Maryborough and Avoca. The section of the highway that falls within the region runs from the Calder Freeway exit at Elphinstone to near Avoca.

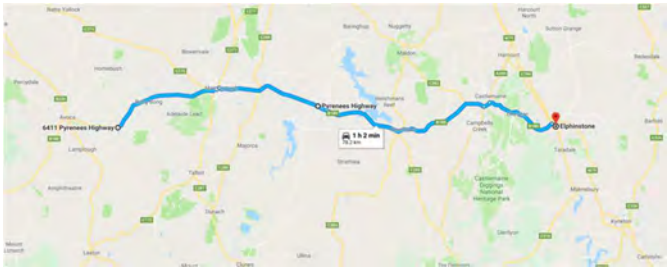


*Figure 177 B180 Pyrenees Highway (Google Maps)*

Based on public coverage maps:

- Telstra shows continuous 4GX coverage over the entire route
- Optus shows 4G coverage over the entire route
- Vodafone shows 4G and 3G *outdoor* coverage or better across the route, except for black spots around Joyces Creek and Newstead. Vodafone is constructing new coverage at several locations along the highway, although none of these will result in continuous coverage.

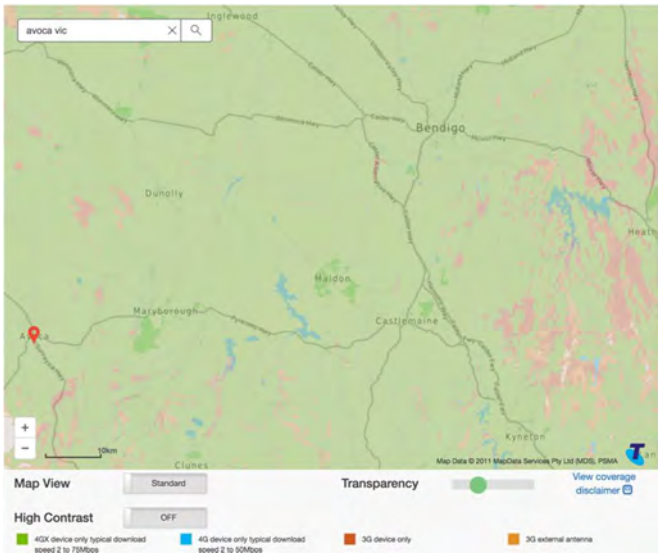



*Figure 178 Telstra coverage on B180 Pyrenees Highway*

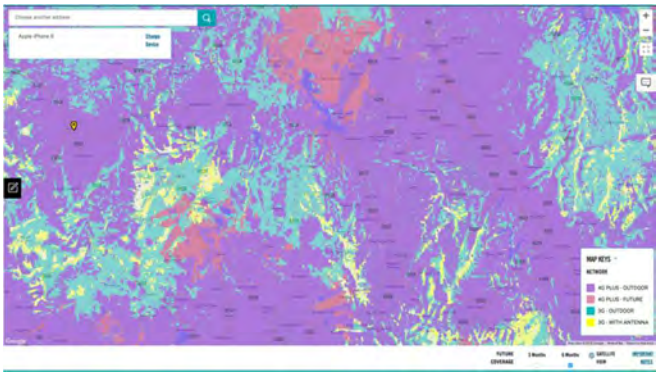


*Figure 179 Optus coverage on B180 Pyrenees Highway*

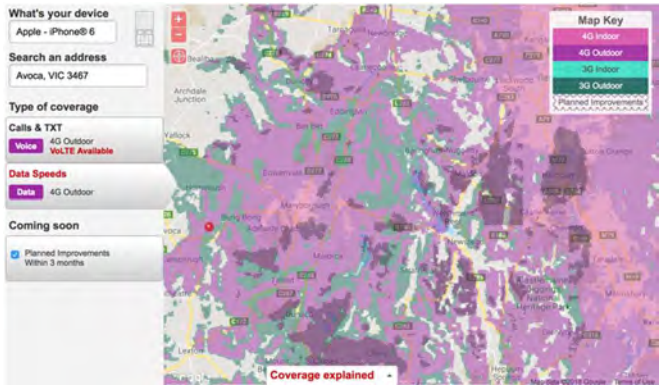



*Figure 180 Vodafone coverage on B180 Pyrenees Highway*

Based on public coverage maps, there appears to be continuous coverage at 4G across the entire route at least two mobile network operators, with partial coverage by the third.

## B240 Wimmera Highway (~69km)

- From Calder Highway, Marong
- To Logan

This highway connects the Calder Highway near Marong to near Horsham via St Arnaud. The section of the highway that falls within the region runs from the Calder Highway exit at Marong to Logan (near St Arnaud).

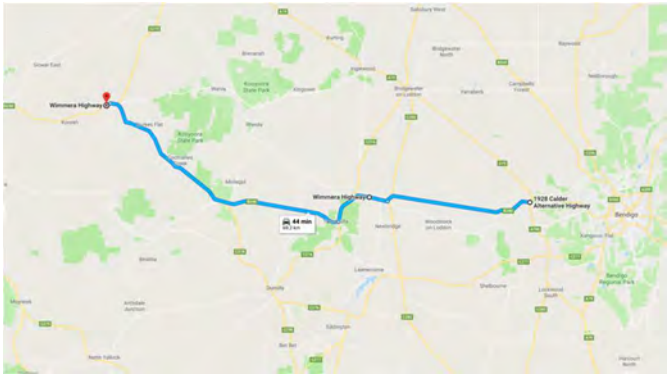


*Figure 181 B240 Wimmera Highway (Google Maps)*

Based on public coverage maps:

- Telstra shows continuous 4GX coverage over the entire route
- Optus shows 3G coverage or better over the route, but shows poor to no coverage around Tarragulla to Cochranes Creek
- Vodafone shows very little coverage across the entire route.

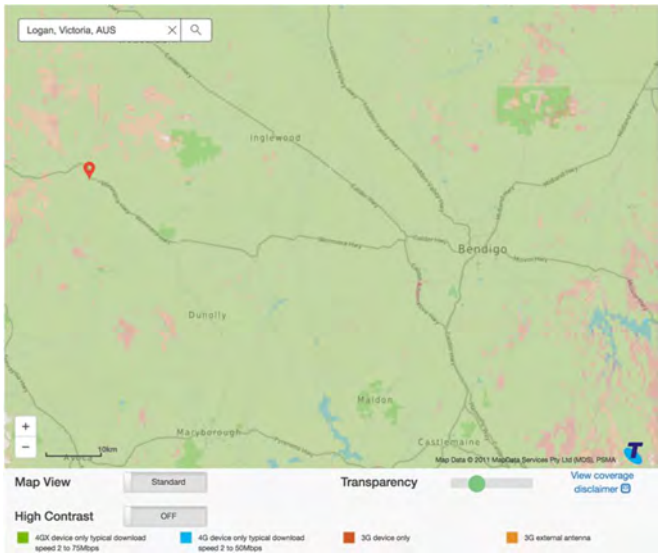



*Figure 182 Telstra coverage on B240 Wimmera Highway*

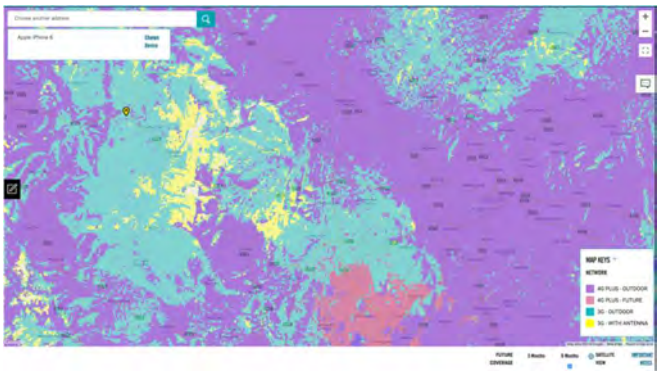


*Figure 183 Optus coverage on B240 Wimmera Highway*

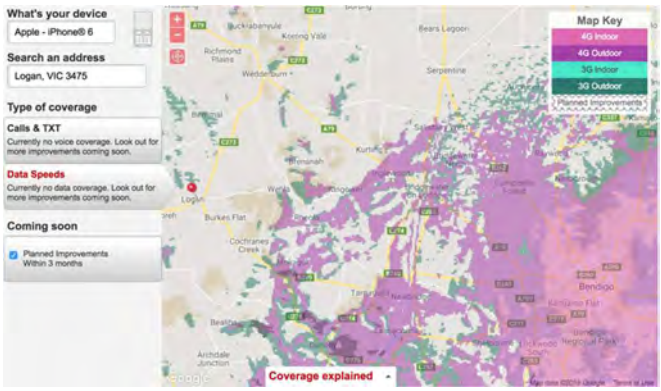



*Figure 184 Vodafone coverage on B240 Wimmera Highway*

Based on public coverage maps, there appears to be continuous coverage at 4G across the entire route at least one mobile carrier, with reasonable 3G coverage by Optus and very little coverage by Vodafone.

## 6.4 C-grade Roads

There are 86 declared C-grade roads in the region forming a mesh between major and small communities. In general, there is good highway coverage across the region, however mountainous regions and national park land present very low population density and infrastructure challenges for all mobile network operators. C-grade roads also tend to traverse sparsely populated areas, and this also tends to mean poor quality mobile coverage (either 3G or fewer mobile network operators providing service).

## 6.5 Rail

### Melbourne – Bendigo

The Victorian Government is undertaking a program to improve mobile services on regional rail routes. This project includes installation of in-train mobile repeaters in all VLocity rail cars as well as improved track-side mobile coverage in certain areas.

As a result of this program, all passengers travelling on the Melbourne-Bendigo route have improved mobile coverage from all three MNOs.

### Bendigo – Echuca

For passengers travelling on the rail line between Bendigo and Echuca, the route carries up to two services per weekday. Annual patronage for 2017-18 was 32,000 - a 22 per cent decrease on 2016-17.

The route is not served by dedicated V/Line diesel-hauled rolling stock therefore there are no in-train repeaters in the trains. However, these cars also do not suffer from the severe radio frequency shielding as the VLocity rail cars. Consequently, mobile carrier public coverage maps can be used as a guide to in-train mobile coverage.

The train route roughly parallels the Northern Highway between Bendigo and Echuca:

- Telstra shows continuous 4GX coverage over the entire route

- Optus shows continuous 4G and 3G coverage over the entire route
- Vodafone shows 4G coverage over most of the route, with 3G coverage between Rochester and Echuca.

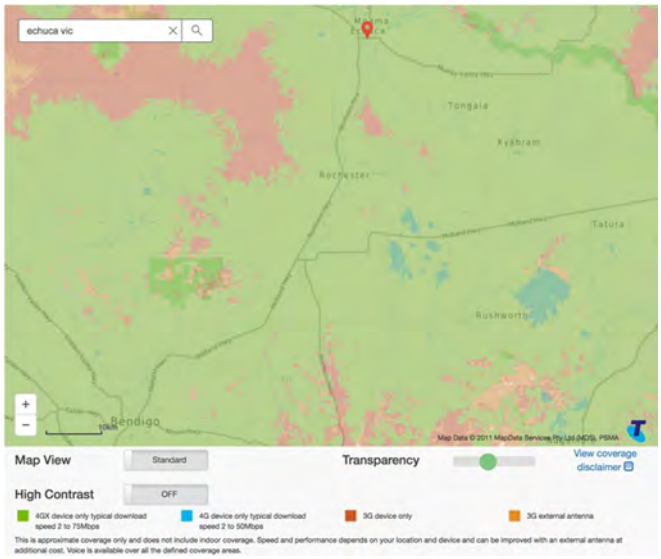



*Figure 185 Telstra rail coverage between Bendigo and Echuca (rail route parallels the Northern Highway)*

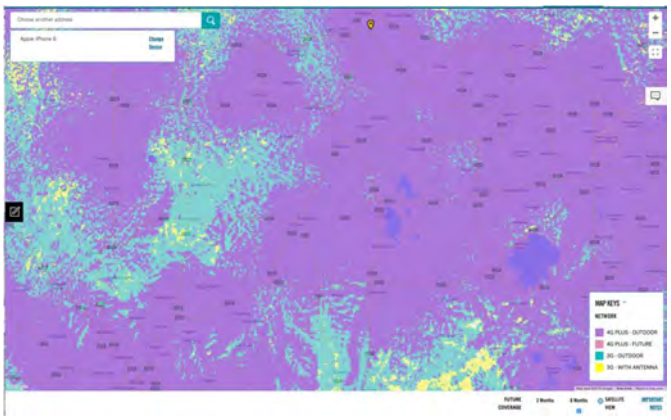


*Figure 186 Optus rail coverage between Bendigo and Echuca*

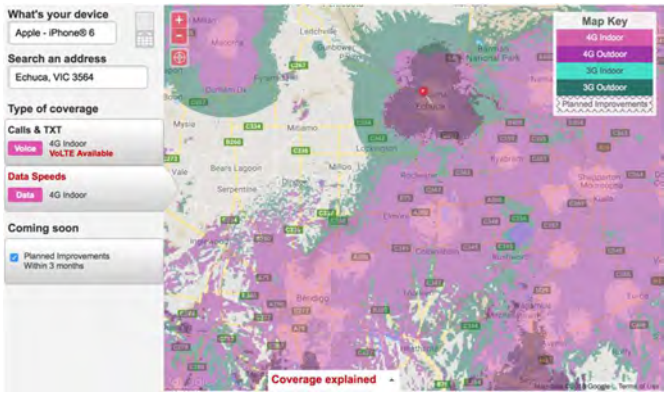



*Figure 187 Vodafone rail coverage between Bendigo and Echuca*

In summary, there appear to be no mobile coverage issues on the route, with the three major mobile network operators all offering near-continuous service, noting that localised conditions such as cuttings and overpasses may temporarily disrupt continuous coverage as the train passes through. Further measurement of in-train mobile coverage may be required.

## Bendigo – Swan Hill

For passengers travelling on the rail line between Bendigo and Swan Hill, the route carries up to four services per weekday. Annual patronage for 2017-18 was 84,000 - a 10 per cent decrease on 2016-17.

The route is not served by dedicated VLine diesel-hauled rolling stock and therefore there are no in-train repeaters in the trains. However, these cars also do not suffer from the severe radio frequency shielding as the VLocity rail cars. Consequently, mobile carrier public coverage maps can be used as a guide to in-train mobile coverage.

The train route cuts a path almost directly between Bendigo and Swan Hill and does not follow a major highway route. The section of the route that falls within the region boundaries is from Bendigo to a location mid-way between Pyramid Hill and Kerang.

- Telstra shows continuous 3G coverage or better over the entire route
- Optus shows continuous 3G coverage or better over the entire route
- Vodafone shows 4G coverage only in the area around Bendigo and Pyramid Hill with a significant area of no coverage.

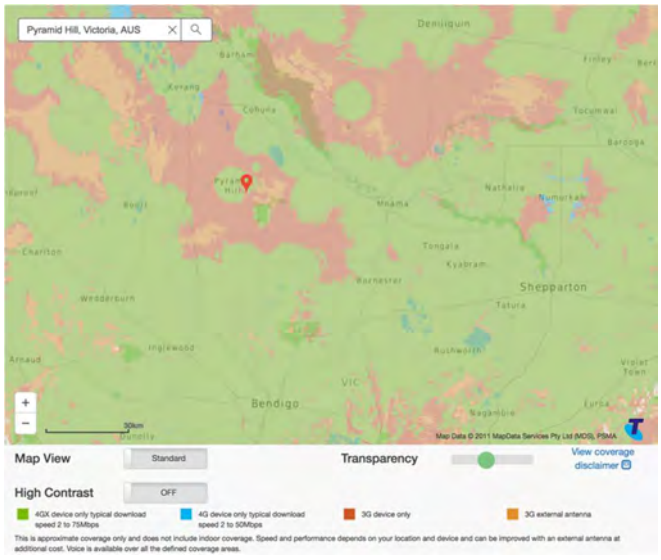



*Figure 188 Telstra rail coverage between Bendigo and Echuca (rail route parallels the Northern Highway)*

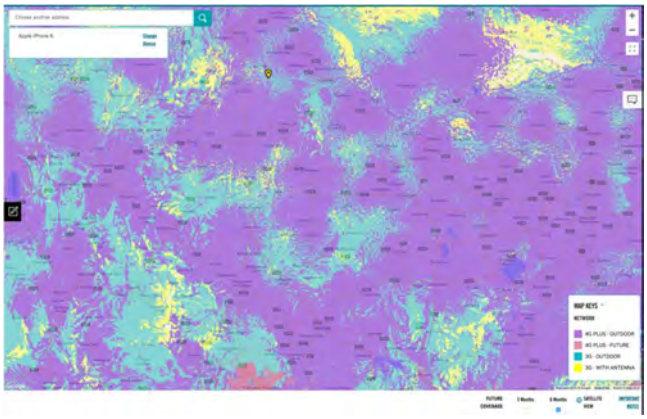


*Figure 189 Optus rail coverage between Bendigo and Echuca*

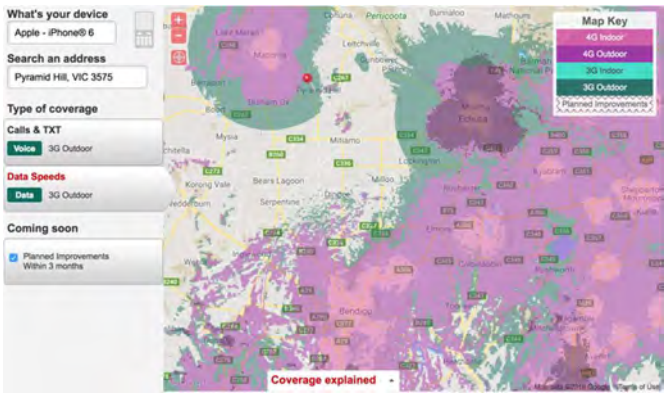



*Figure 190 Vodafone rail coverage between Bendigo and Echuca*

In summary, there appear to be no mobile coverage issues on the route, with two of the three major mobile network operators all offering near-continuous service (albeit at 3G), noting that localised conditions such as cuttings and overpasses may temporarily disrupt continuous coverage as the train passes through. Further measurement of in-train mobile coverage may be required.

## Ballarat – Maryborough

For passengers travelling on the rail line between Ballarat and Maryborough, the route carries up to four services per weekday. Annual patronage for 2017-18 was 18,000 - a 10 per cent increase on 2016-17.

The route is not served by dedicated VLine diesel-hauled rolling stock and therefore there are no in-train repeaters in the trains. However, these cars also do not suffer from the severe radio frequency shielding as the VLocity rail cars. Consequently, mobile carrier public coverage maps can be used as a guide to in-train mobile coverage.

The section of the route that falls within the region boundaries is from near Talbot to Maryborough in a path that parallels the Ballarat-Maryborough Road.

- Telstra shows continuous 4GX coverage over this section of the rail line
- Optus shows 4G and 3G coverage over the majority of the section of the rail line, however there is no handheld coverage in the area around Daisy Hill
- Vodafone shows continuous 4G and 3G coverage over this section of the rail line.

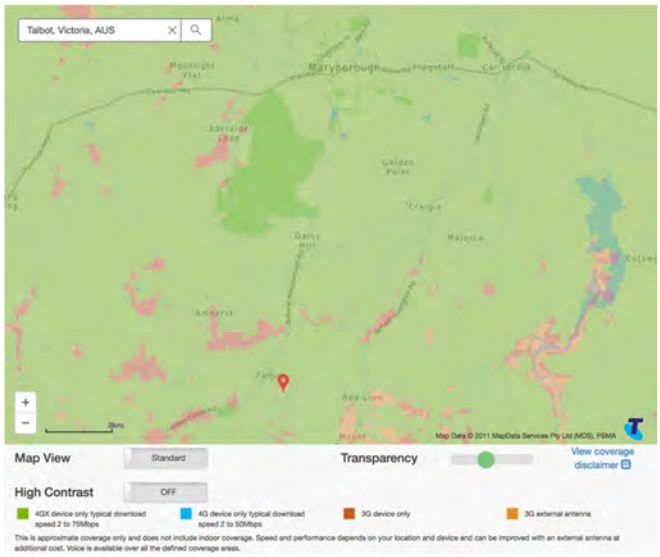



*Figure 191 Telstra rail coverage between near Talbot and Maryborough (rail route parallels the Ballarat-Maryborough Rd)*

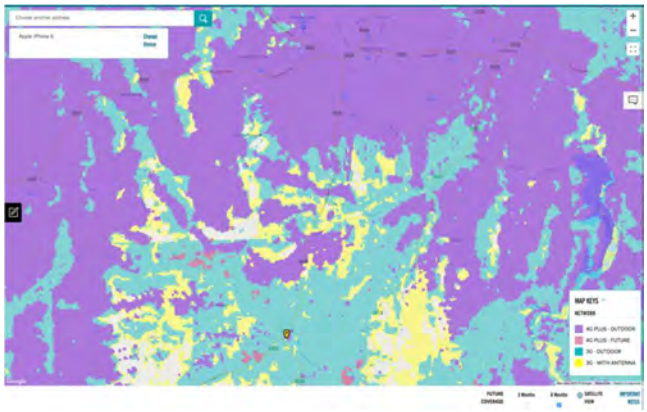


*Figure 192 Optus rail coverage between near Talbot and Maryborough (rail route parallels the Ballarat-Maryborough Rd)*

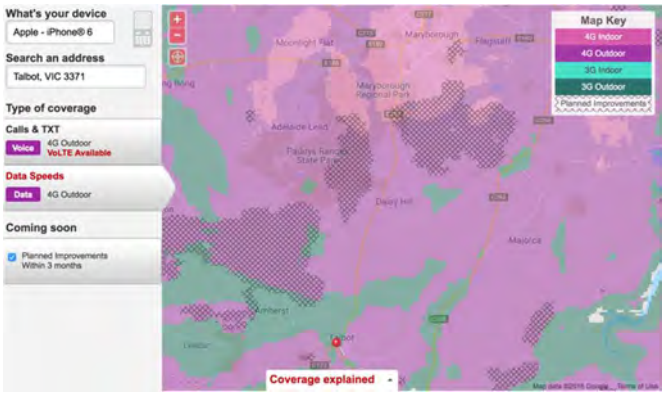



*Figure 193 Vodafone rail coverage between near Talbot and Maryborough (rail route parallels the Ballarat-Maryborough Rd)*

In summary, there appear to be no mobile coverage issues on the route, with two of the three major mobile network operators all offering near-continuous service and partial service by the third mobile carrier. Note that localised conditions such as cuttings and overpasses may temporarily disrupt continuous coverage as the train passes through. Further measurement of in-train mobile coverage may be required.

# A. Acknowledgements & Qualifications

## Acknowledgements

This report includes numerous images and cites many details about locations that have been obtained from a range of sources. Citing a reference for commonly accessed data sources would clutter the document and undermine the flow of relevant information. Accordingly, this section sets out some important acknowledgements regarding data sources.

1. The **Australian Bureau of Statistics** (ABS) provides a rich repository of information at varying levels of aggregation. Two sources in particular have been used extensively over the period from May 2018 to July 2018 during which time this report was prepared.

- Data by Region[33] – providing statistics at the level of Local Government Area (LGA)
- Quickstats[34] - providing statistics at varying levels of aggregation, but in particular, at the level of urban centre/locality (UCL) and slightly higher levels of aggregation as appropriate.

2. Screen images generated by the **State Level Information Management** (SLIM) **Graphical Information System** (GIS) are compiled from various sources, and typically include an acknowledgement of the relevant sources in the bottom right corner of the image. Such acknowledgements have often been clipped from the images presented in this report, but are acknowledged (based on the type of background) as follows:

- For grey street map backgrounds: "Leaflet | © OpenStreetMap"
- For coloured street map backgrounds: "Leaflet | Tiles © Esri – Source: Esri, DeLorme, NAVTEQ, USGS, Intermap, iPC, NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, 2012"
- For satellite imagery backgrounds: "Leaflet | Tiles © Esri – Source: Esri, i-cubed, USDA, USGS, AEX, GeoEye, Getmapping, Aerogrid, IGN, IGP, UPR-EGP, and the GIS User Community"
- For plain grey background: "Leaflet | Tiles © Esri – Esri, DeLorme, NAVTEQ"
- For topographic backgrounds, "Leaflet | Tiles © Esri – Source: Esri, De Lorme, NAVTEQ, TomTom, Intermap, iPC, USGS, FAO, NPS, NRCAN, Geobase, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esi China (Hong Kong), and the GIS User Community"

3. For any screen capture of **Telstra**'s public coverage map that does not show an acknowledgement of the data sources, the following acknowledgement applies: "Map Data © 2011 MapData Services Pty Ltd (MDS), PSMA".

4. For any screen capture of **Optus**'s public coverage that does not show an acknowledgement of the data sources, the following acknowledgement applies: "Map data ©2018 Google".

5. For any screen capture of **Vodafone**'s public coverage that does not show an acknowledgement of the data sources, the following acknowledgement applies: "Map data ©2018 GBRMPA, Google".

6. For any screen capture of **Sigfox** coverage that does not show an acknowledgement of the data source, the following acknowledgement applies: "Leaflet".

7. Digital Inclusion Index data at the Region level has been purchased from Roy Morgan.

## Qualifications

1. The ABS periodically makes corrections to its data (including the 2016 Census data utilised widely in this report), so minor discrepancies may be noted between figures cited in this report and data obtained from the ABS website.

2. Coverage by different network technologies reflects the situation at a point in time. Network

[33] See http://stat.abs.gov.au/itt/r.jsp?databyregion

[34] See for example http://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/UCL211002?opendocument

operators regularly expand and reconfigure the networks with resulting changes to coverage. Before placing reliance on any information presented in this report, it is prudent to obtain the latest available information.

3. Mobile reception depends on many factors including the type of device, whether the device has an external antenna and the like. Both the Optus and Vodafone public coverage maps require nominating a device. For consistency, the coverage maps shown are based on a “middle of the range” iPhone6.
4. A fourth Mobile Network Operator (MNO) – TPG – has been considering its potential entry into the Australian market. Its coverage intentions are not currently known.

# B. Fieldwork

Two streams of fieldwork tap into the practical experience of the six local governments in Loddon Campaspe and gather information for the business case feasibility analysis of a top priority project:

- A detailed online survey of local governments
- Face-to-face onsite interviews by expert market research field staff
- Analysis of existing studies provided by respondents.

Results from the fieldwork will be provided to the Regional Partnership when available.

## Online survey of local governments

The survey was sent to the senior economic development officer (or equivalent) in each local government. It sought local government information and views on:

- The importance in their LGA of common unmet digital needs including digitals skills, mobile coverage, NBN service quality, public WiFi, Internet-of-things knowledge and uptake, and access to government infrastructure
- The locations and industries in which these unmet needs impact most severely
- Digital proficiency training needs and more IT professionals
- The location of residential and business developments, and tourist sites, in their LGA
- Details on any digital hubs in their LGA
- The relative importance of the priority digital projects identified by the Regional Partnership and the Digital Plan Working Group

## Onsite interviews

Onsite interviews were used to gather detailed information required for the business case analysis. The online survey also requested reports relevant to the survey topics be provided.

# C. Analytical Framework

The digital planning framework has been developed to systematically analyse the significant body of supply, demand and other key information gathered to support the digital planning process, which in turn provides the evidence base to recommend priorities on a place and sector-based level. This approach takes into account the significant diversity within the region. Analysis is conducted to provide a view of the current supply and demand situation and a three-to-five year forward view. The framework is designed to be flexible, repeatable, easy to use and at the summary level at a glance, and guide where to focus action to address the digital divide. Further development of this framework is required in subsequent digital plans.

The planning framework takes inputs from multiple information sources including:

- General regional characteristics
- Supply characteristics at a regional level
- Place-based analysis of population centres, the rural hinterland and key primary production areas, tourist locations and transport corridors
- SLIM database
- The Regional Digital Plans: Common Themes report
- Regional Assembly feedback
- Local government area surveys and onsite fieldwork
- The Digital Inclusion Index
- Australian Bureau of Statistics information
- Other sources highlighted in this document.

Shortfalls in internet access are identified by comparing supply and demand for public network access services classified by technology type (fixed, mobile, Internet of Things and WiFi) in different locations and for the various user groups (businesses, households, communities, visitors and road and rail travellers). This is done by assigning High, Medium and Low ratings (H, M, L) ratings for the supply of, and demand for, these services.

Analysis is first conducted for the present, to understand what needs fixing to catch up to capital city and international standards. It is also done looking forward three-to-five years – where supply is expected to be without further Victorian Governmentintervention relative to where the region needs to be in three-to-five years to be a competitive business location and an attractive place to live and work.

The potential solutions canvassed give a range of options for reducing the digital divide for consideration by the Regional Partnership, local, State and Commonwealth governments and local business and community leaders.

## The ‘digital divide’

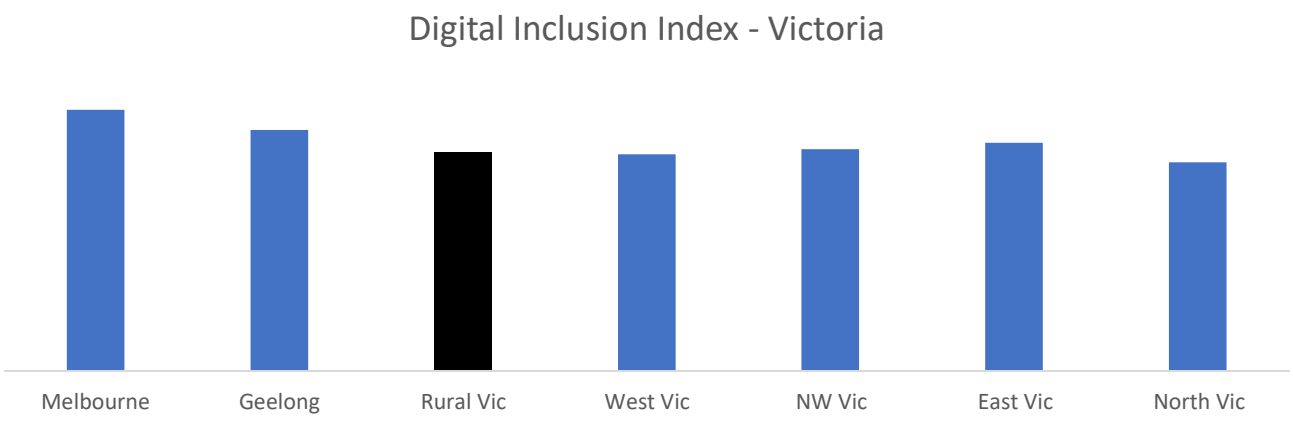
In essence, the Digital Plan addresses the country-capital city digital divide (access, ability and affordability) by:

- Examining the geographic, demographic, social, economic characteristics of the region and the important structural changes occurring
- Identifying shortfalls in the availability and performance of internet access technologies, in a place and sectoral frame that reflects the region’s characteristics and structural change challenges
- Canvassing priority action to address unmet needs
- Highlighting the need for good information skills gaps and the affordability of digital services.

The usual focus of the digital divide is on the situation in the regions relative to capital city locations. However, the significant diversity in geographic, demographic, social and economic characteristics within a region means there are also digital divides within regions and localities. Accordingly, effective digital planning needs to be place and sector specific and able to identify priorities at this detailed level. However, current data limitations mean some of the analysis in this first Loddon Campaspe Digital Plan relates to the high-level city-country digital divide and simply acknowledges and discussing the locally-based digital divide issue.

The digital divide between regional Victoria residents and businesses and their capital city counterparts – the gap between them in the *availability* of digital services, the *ability* of residents and workers to use digital services (digital skills), and the *affordability* of digital services and digital expertise – is reflected in the 2018 Royal Melbourne Institute of Technology-Swinburne-Telstra Digital Inclusion Index (DII) which measured these aspects in different locations. This shows a substantial gap between regional Victoria and Melbourne – regional Victoria rated 53 and Melbourne 64.

The DII also shows substantial variation between and within regions, shown in the following chart.




Digital divides within localities are driven by the intersection of topography, population density, the inherent performance characteristics of key digital technologies and network deployment economics. These factors cause variations in service quality for standard fixed line technologies, local gaps in mobile coverage, and technology boundary issues. This can result in highly localised 'digital have nots' amongst and contiguous to 'digital haves' and technology coverage boundary issues (e.g. on the fringes of towns).

## Digital technologies

**Fixed networks** provide high-speed internet access at a set location (for example an office, factory or residence), currently at a relatively low price compared to mobile access. The NBN, an Australia-wide ubiquitous wholesale public access network will, in conjunction with retail service providers, be the main fixed access means for most Australian households and smaller businesses when completed in 2020. It comprises three core technology types – fixed line (cable-based), fixed wireless and satellite (Sky Muster). NBN fixed line technology in turn comprises fibre to the premise (FTTP – the 'gold standard'), fibre to the curb (FTTC – short copper loops to premises with effective performance close to that of FTTP) and fibre to the node (FTTN – longer copper loops which can degrade service quality).[35]

What this high-level analysis does not show is technology boundary effects that can determine broadband haves and have nots at the local level – that some people in a given location are supplied with different technology and accordingly experience different service quality to their neighbours. For example, where NBN infrastructure cuts over from fixed line to fixed wireless technology (or FTTP to FTTN within fixed line technology), businesses on either side of the boundary will experience different service quality. This will often occur on the fringes of, and sometimes within cities, towns and localities.

The analysis also does not show critical service quality issues that are not due to the NBN infrastructure connecting the users' premises. This includes retail service providers not purchasing enough NBN and backhaul data throughput capacity to meet the speed and reliability needs of users (and advertised service performance).

[35] It is anticipated NBN Co will commence a program of shortening the length of copper loops in FTTN areas once rollout is completed in 2020.

Awareness of these important issues is essential to understanding the user experience and addressing the various dimensions of the digital divide. The SLIM database provides the means to capture and analyse the locations affected by the above limitations, which will help build the evidence base around these issues. However, this will take time beyond this first iteration of the Digital Plan. In the meantime, fieldwork and case study analysis will be used to build the evidence necessary for effective advocacy for measures which address such service quality anomalies, for example through NBN Co extending its technology boundaries and retail service providers purchasing sufficient data capacity.

**Mobile networks** provide 'untethered – on-the-move' internet access from three major and one nascent networks (TPG). 3G and 4G mobile technologies are currently in use. Mass deployment of high-performance 5G service is planned to commence in capital cities and larger regional centres in 2020. Coverage (service availability) depends on local topography and the location and aerial orientation of mobile towers, and for these reasons is absent or poor quality in some locations.

The Digital Plan has, by necessity, taken the mobile coverage maps publicly provided by the mobile network operators as the starting point for analysis – better data held by the mobile network operators has not yet been made available. What this necessarily-superficial, second-best analysis does not show is the significant variation in the real-world connectivity experience of mobile users, with many gaps in coverage, and poor-quality service, in areas shown as fully covered.

Furthermore, mobile users have increasingly higher expectations of the services that they can access on smartphones, ranging from traditional voice and critical emergency communications through to web browsing, data apps and video streaming. The situations in which people want to access mobile services are also changing. Once primarily considered a service for on-the-move outdoor use, mobile services are increasingly substituting for fixed services in the home and at work for a significant share of users. However, the publicly available coverage maps fail to distinguish between traditional voice and other narrowband services on the one hand, and high quality mobile broadband access on the other – that is, they do not provide enough information for regional users in particular to identify locations where higher bandwidth services will (and will not) work well.

The Victorian Government understands user disappointment and disillusionment with mobile connectivity in regional areas and has joined industry stakeholders in calling for mobile network operators to publish the richer and more accurate coverage data they possess to accurately identify unmet needs and possible ameliorative actions. The Government in conjunction with the Australian Competition and Consumer Commission (ACCC) and the Commonwealth Government is actively pressing the mobile network operators to publish more useful coverage data and supports the ACCC in its public commitment to take regulatory action if cooperative progress is not made.

The SLIM database is capable of capturing and analysing more detailed location-specific information on the availability and quality of mobile coverage in regional areas, with improved coverage data to be incorporated in future iterations of SLIM and the Digital Plans when this becomes available.

**Internet of Things networks** provide one and two-way communications between sensors and central data storage and analysis facilities. These can be high bandwidth (HB-IoT) for large data volumes in either direction, or low volume low power (LP) IoT (typically one way, from a remote sensor in a paddock, factory of residence). High bandwidth IoT is currently delivered on existing mobile networks (with wider coverage). LP-IoT is currently provided on LP-WAN networks by operators such as Taggle and Sigfox, although the mobile network operators are examining the technology and business case for providing low power IoT applications on their networks.

**Public WiFi networks** provide a no-cost-to-user link between mobile devices (e.g. smartphones and tablets) and mobile service providers.[36] Free public WiFi is typically provided by local governments for disadvantaged citizens, the wider public and visitors in larger cities and towns.[37] Local government WiFi networks also support Smart City applications.

## Digital skills

Ensuring wide access to digital technologies can only be effective if consumers and the workforce have the skills to properly take advantage of these developments. Necessary digital skills fall into three broad groups: the general digital literacy of consumers and the workforce (familiarity and competence with everyday digital services), the availability of IT professionals for recruitment and provision of advisory services, and workforce preparedness for successful employment in an age of ongoing digital disruption – the capacity of individuals for independent learning, flexibility, knowledge management, design thinking and innovation and risk-taking.

There are few (if any) direct measures of skills supply and demand (particularly at a place and sector level), requiring local data collection to accurately identify skills gaps and shape necessary remedial action.

There are, however, a number of secondary indicators that, taken together, can give a broad indication of skills availability at an LGA and region level – age, education, the proportion of households that access the internet at home, the share of employment in high-technology industries and the 'ability' component of the Digital Inclusion Index.

Matching these supply-side indicators with demand metrics to identify unmet skills is not possible at present – collection of data for this purpose is urgently required.

## Digital services affordability

The affordability of digital services (and skills) relative to other regions and Melbourne is a function of both their price and the ability of businesses, local governments and consumers to pay.

There is no clear evidence that public-network fixed and mobile access services are more expensive in regional locations, as NBN Co is required to price its wholesale services uniformly Australia-wide, and broadband and mobile service providers price nationally not on a location basis. Nonetheless it is likely many regional users pay more for these services on a quality-adjusted basis – an equally-priced fixed wireless or satellite service does not in general provide the same value-for-money as an equivalent fixed line service. Similarly, an equally-prices mobile service will be lower value-for-money for regional users that frequently experience blackspots and service degraded service.[38]

In addition, unconfirmed anecdotal evidence indicates regional users are not offered the same range of specials and one-off customer retention incentives as their capital city counterparts. Anecdotal evidence also suggests the cost of bespoke connectivity solutions (such as a dedicated fibre connection) is higher in the regions as there are fewer competing suppliers.

Regarding ability to pay, it is well known that annual household incomes in the regions are on average substantially lower than in Melbourne; around $50,000 compared to $80,000. This means regional consumers in general, and those in lower-income regions and LGAs in particular, have a lower ability to pay than their capital city peers. Evidence on the ability to pay of regional businesses compared to those in capital city locations has not

[36] The provider of the free public WIFI service – typically a local government (which may in turn commission a mobile operator to provide the service) meets the cost of the link

[37] Free public WiFi is also provided by the operators of some cafes, fast food restaurants, shopping centres, airports, tourist locations and other commercial premises to improve customers' on-site experience.

[38] The price of IoT services in the regions relative to capital city locations has not yet been conducted, but is expected to be higher on a quality-adjusted basis

yet been investigated. Finally, a local government IT manager has indicated IT costs are a substantially higher share of the budget in the regions than for local governments in Melbourne.

## Priority actions

The options for action lie with both regional stakeholders (local governments, business and community groups and the Regional Partnership), the Victorian Government, the Commonwealth Government, mobile network operators – including evidence-based representations by the Regional Partnership to the various layers of government. Some of the options are high-level and general in nature such as establishing priorities and action plans, while others are technology-specific or focused in a general way on skills gaps. They address the broad shortfalls in the supply of digital services and skills and acknowledge and comment on the frequent boundary and 'Swiss cheese' situation of 'have-nots' amongst the 'haves'. The options outlined address current and future unmet digital needs.

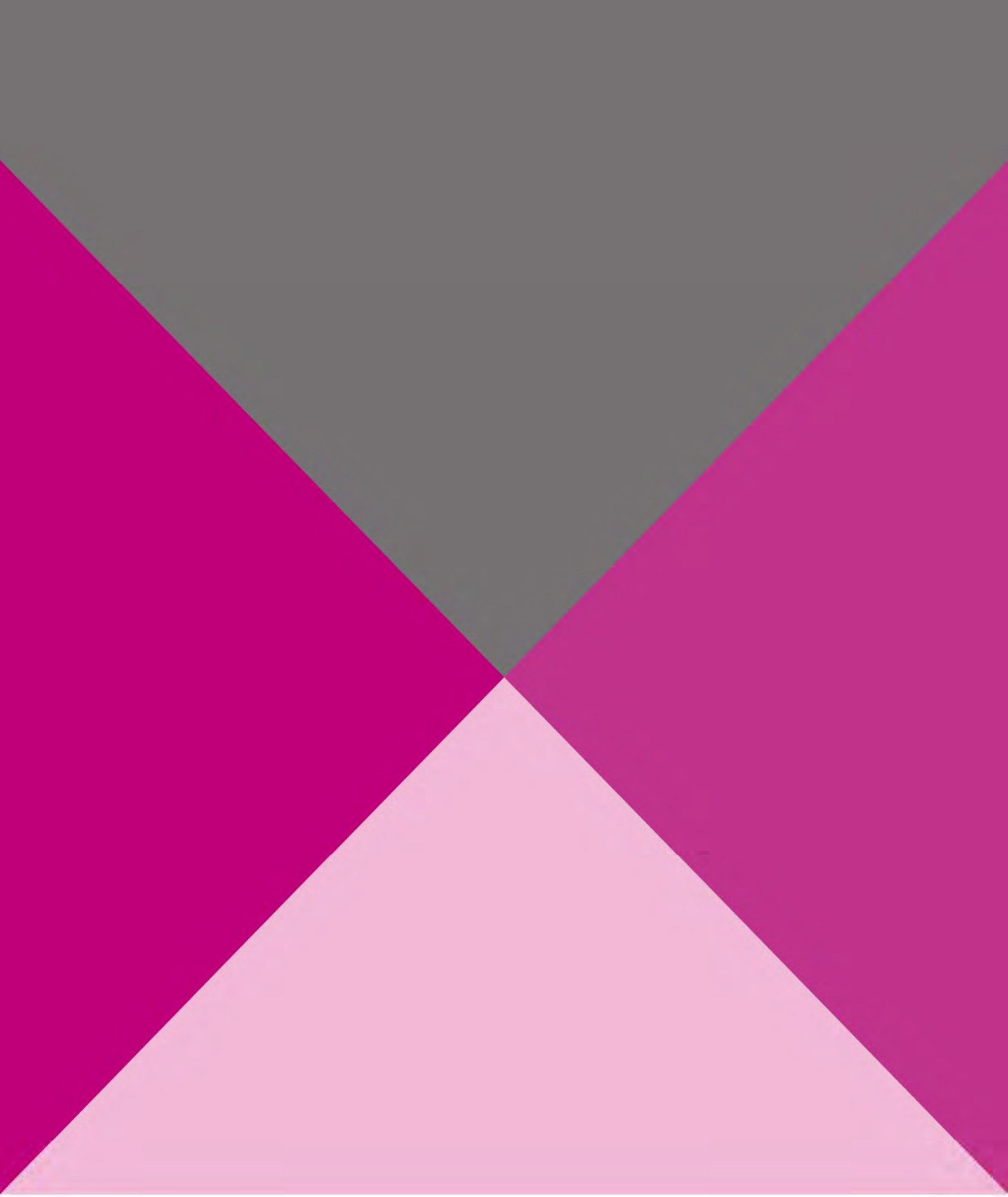
Options for addressing skills shortfalls are not developed in detail in this version of the Digital Plan due to the limited understanding of this issue on a place and sector basis. Rather, data collection is the key immediate imperative. However, it is anticipated that local solutions will be important in addressing digital literacy gaps (including training at digital hubs), state-wide vocational training solutions for shortages of IT professionals, and state-wide school education solutions (STEM++) for digital age workforce preparedness.[39]

Affordability solutions are not addressed in this first-generation Digital Plan – the collection and analysis the key immediate action.

## State Level Information Management (SLIM) database

The State Level Information Management (SLIM) database is an interactive place-based repository of current information on the availability of digital services, key demand drivers and place-based data on the characteristics of each region. The development of the SLIM database is a CRCP initiative funded by the Victorian Government. SLIM has initially been prepared for Victorian Governmentuse only from a variety of public and commercial-in-confidence data. The protocols necessary for wide use are being developed to support future versions of the Digital Plans.

[39] Involving the Department of Education and Training.



REGIONAL
PARTNERSHIPS
LODDON CAMPASPE