Regional Digital Plan

CENTRAL HIGHLANDS

REGIONAL
PARTNERSHIPS
CENTRAL HIGHLANDS

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July 2019

Authorised by the Victorian Government, Melbourne.

Designed by DJPR Design Studio

Disclaimer

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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 is aimed at identifying 'unmet needs' and potential solutions, at present and over the next 3-5 years. The Plans empower advocacy and action by local communities, households and businesses – operating individually and through the Regional Partnerships – in bringing about needed change.

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?

Region-level digital plans are needed to effectively reduce the persistent country-city **digital divide**: regional shortfalls in **access** to digital services, the **ability** to effectively use these services, and their **affordability** relative to their capital city counterparts. 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 entertainment, communications 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 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 solutions.
- Inform State government regional digital policy and program development.

The Plans will be employed in conjunction with, and guide the use of, companion reports and tools:

- The *Regional Digital Plans: Common Themes* report covering state-wide unmet needs and potential solutions
- The State Level Information Management (SLIM) database, an interactive place-based repository of current information on the availability of digital services and key demand drivers across regional Victoria.[1]

1 Access to the SLIM database is currently limited to the State Government, Staged access by local governments and the public is in train.

HOW WERE THE DIGITAL PLANS PREPARED?

Digital Plans were prepared by Government through:

- Extensive face-to-face consultation with the Regional Partnerships and Digital Plan Working Groups
- In-depth interrogation of the SLIM database
- 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.

WHAT ARE THE KEY ELEMENTS OF EACH PLAN?

- A description of the region's geographic, demographic, economic and structural change characteristics
- An overview of current telecommunications services in the Region
- Place- and sector-based analysis of digital services and skills supply and demand and potential solutions to unmet needs – for cities, towns, localities; primary production areas; tourist sites and transport corridors.

Regional Partnership Foreword

It is with great pleasure that we provide our Central Highlands Digital Plan, which has been endorsed and adopted by the Central Highlands Regional Partnership committee.

Through the funding and support of the Victorian Government's Connecting Regional Communities Program, a diverse array of expertise and knowledge was brought together to develop the State Level Information Management database (SLIM). SLIM has allowed us to examine place-based digital infrastructure supply and demand, to explore common digital issues affecting regional communities, and to develop and implement Digital Plans for each of the nine Regional Partnerships.

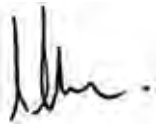
These Digital Plans will empower us both collectively and in our individual Partnership regions, to provide evidence-based proof of where the digital divide lies in our regions. They will allow us to map the impacts and effects, both in its existence and progressively and increasingly, in its closure.

There has never been such a consistent, coordinated and focused initiative in this space by any Government in Australia; one that draws together a uniform approach across the state, but also recognises specific challenges with which each Regional Partnership is faced.

Its value and utility is set only to grow as the SLIM database gets bigger, the Digital Plans are refined, matured and evolved, and the communities and businesses of regional Victoria take full advantage of the unquestionable and transformational benefits of digital connectivity and the digital economy.

The Central Highlands Digital Plan is the first of the nine to be developed for the Partnerships. It has been our privilege to be involved with the teams from Regional Development Victoria, from the Department of Jobs, Precincts and Regions and consultants, in working through the initial design and architecture of the SLIM database and Digital Plans through to their completion.

On behalf of all regional Victorians, and especially those in the Central Highlands, I am grateful to the State Government and especially Ministers Martin Pakula and Jaclyn Symes and their teams, for listening to what we had to say and underwriting this massive and ground-breaking initiative.



George Fong
Chair, Central Highlands Regional Partnership

Executive summary

Central Highlands is a broad, diverse and fast-growing region of almost 200,000 residents located to the north-west of Greater Melbourne.

Just over 100km from Melbourne CBD, Ballarat – the main population centre with over half the region's population – forms a natural gateway to the Central Highlands, a hub for north-west road and rail corridors, the location of a wide range of businesses and (along with nearby Bacchus Marsh) the home of many residents commuting daily to work in Melbourne.

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 comprise potatoes east of Ballarat and broadacre cropping and grazing to the west, intensive livestock north west of Bannockburn; Intensive horticulture east of Beaufort; and forestry between Ballarat and Daylesford. Tourist sites include permanent attractions in and around Ballarat, Daylesford and the Pyrenees, with annual events in remote and town-fringe locations.

The Central Highlands is closer to Melbourne and more urbanised than most other regions. It has higher education and income levels, and its major industries are growing strongly. Many of its citizens and businesses enjoy core digital services (broadband and mobile) that on casual inspection are on par with their Melbourne counterparts. Nonetheless the various dimensions of the digital divide – city-country, urban-rural, town-fringe and 'technology boundaries' within neighbourhoods – continue to limit attainment of the region's aspirations as a prosperous, enjoyable, secure and equitable place to live, work and do business. In particular:

- The broadband needs of digitally-intensive businesses throughout the region are not being met at most locations as effective NBN business grade services cannot be uniformly supported and competing broadband networks capable of supporting effective business grade services do not exist. Mobile coverage for businesses in general meets current needs of town-based businesses, while falling short for extensive farming and forestry areas and some tourist locations.
- The broadband needs of digitally-intensive households in smaller localities (less than 1,000 residents), on the fringe of larger centres and in rural and remote areas are not well met by NBN fixed wireless and satellite technologies, and mobile coverage and performance is unsatisfactory in some places.
- Low bandwidth Internet-of-Things (IoT) coverage for agriculture, and public WiFi for visitors and low income residents, are in short supply – the former risking adoption of next-generation business practices.
- Permanent tourist attractions in cities and towns are in general well served with broadband (for site operator WiFi backhaul) and mobile coverage (visitors). Periodic visitor events (festivals, races) in more remote places face mobile network capacity bottlenecks and inadequate broadband for WiFi backhaul.
- Major roads have good mobile coverage but service is patchy on minor roads. The Ballarat-Melbourne commuter rail link has good mobile coverage and in-carriage reception. Rail links from Ballarat to Ararat and Maryborough have good mobile coverage but there is possible in-carriage reception degradation on Velocity trains.
- 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.

Priority actions to address the Central Highlands digital divide include:

Local Governments use their local presence, insights and planning powers to identify localised fixed and mobile blackspots, influence NBN high performance technology deployment and early business grade service deployment, promote early 5G rollout and facilitate digital literacy training (possibly in local digital hubs).

The Victorian Government continues, reviews and extends its regional telecommunications advocacy, co-investment and pilot programs to address unmet broadband and mobile needs and capitalize on opportunities from IoT and 5G.

The Commonwealth Government continues, reviews and extends its mobile blackspot co-funding program, requires NBNCo to maximise deployment of high performance technologies, mandates industry meets stronger NBN service connection and maintenance requirements and invests in digital skills training programs.

NBNCo restructures it wholesale pricing to allow lower retail prices and encourage greater utilisation of network capacity, and quickly brings to market effective business grade services – high-speed, symmetric with committed information rate performance and strong service level agreements (SLAs).

The telecommunications industry actively considers opportunities to provide competing broadband services to businesses in high demand precincts, particularly if NBNCo fails to restructure its wholesale pricing or does not provide effective business grade services.

Regional Partnership priority actions

The Regional Partnership, in conjunction with the six Central Highlands local governments, has drawn on the evidence base in the Digital Plan to prioritise gaps in digital infrastructure and services and guide upgrade activities to the areas of greatest need.

The Regional Partnership seeks the support of the Victorian and Commonwealth Governments and carriers in this process. The outcomes of the Connecting Regional Communities Program (CRCP) Enhanced Broadband, Public WiFi and Agriculture IoT trials will be monitored for their applicability to Central Highlands locations.

FIXED ACCESS ('BROADBAND')

The locations with significant fixed access 'unmet demand' include Teesdale, Hopetoun Park, Lethbridge, Cardigan Village and Lake Bolac. Localities with populations below 300 people should be reviewed for fixed access unmet needs. Digital hubs (Local Community Connectivity Centres) in each local government area (LGA) should be explored as a means of providing access to high bandwidth services to a range of users.

Fixed access priority actions

The Regional Partnership will:

1. Encourage local governments to work together to engage with NBNCo to ensure local priorities are considered in network rollout planning, including actively engaging with NBN Co with respect to the following:

    1.1 Maximising the deployment of technologies with the highest performance potential in the remaining rollout areas – with assistance from local governments by highlighting areas where demand for high performance is expected to be greatest

    1.2 Considering and obtaining quotes under the NBN Technology Choice program, and considering proposals from alternative service providers, if the access technology proposed for an area is likely to be inadequate for needs of precinct occupants

    1.3 Expeditiously introducing high-speed, business-grade NBN services, including symmetric high bandwidth services with strong service level agreements (SLAs)

    1.4 Restructuring NBN wholesale pricing to align retail service provider incentives with unlocking the maximum potential of the NBN

    1.5 Lowering of the threshold number of premises above which FTTP must be incorporated in greenfields developments

    1.6 Designating business precincts in greenfield locations that will be developed with higher grade connectivity (e.g. fibre optic, high speed wireless), to create preferred locations for businesses critically requiring reliable high bandwidth connectivity.

2. Work with local governments to promote competing provision of fixed broadband for businesses, particularly if NBNCo fails to offer effective business grade services and reset its wholesale pricing.

3. Advocate for stronger service connection and maintenance requirements for NBN services to ensure the interests of residential and business users are adequately served.

MOBILE ACCESS

Localities with populations below 300 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.

Mobile access priority actions

The Regional Partnership will:

1. Encourage local government agencies to:
    - 1.1 Equip their vehicles with coverage monitoring tools to build a strong evidence base of blackspots in their LGA
    - 1.2 Develop a list of 5G priority locations based on the digital requirements of regional industries, and advocate for early 5G rollout to these locations.
2. Advocate for:
    - 2.1 Continued Commonwealth and State Government investment in expanding mobile coverage, coupled with a review of blackspot funding models as investment extends into ever more marginal areas
    - 2.2 The Victorian Government to develop a state-wide schedule of significant visitor events where network capacity problems exist and tender for mobile operators to provide solutions
    - 2.3 Advocate for mobile carriers to provide comparable coverage information that shows probable coverage and quality (areas where streaming, browsing, voice calls, emergency calls/SMS warnings are reasonably predicted to work) – disclosure of 'real' performance.

INTERNET OF THINGS ACCESS

The Regional Partnership will encourage and coordinate local governments' and business groups' engagement with mobile operators on their plans for mobile-supported broadband IoT (Cat-M1) and narrowband IoT (LP-WAN) network rollout across Central Highlands. This will draw on data on existing networks and latent user needs, information from the CRCP agricultural IoT trials and the fieldwork conducted to support the Digital Plans.

Internet of Things priority actions

The Regional Partnership will:

1. Encourage the Victorian and Commonwealth Governments to:
    - 1.1 Include IoT support as a decision criterion in mobile blackspot funding initiatives
    - 1.2 Pilot a low power (LP-Wan) IoT blackspot program
    - 1.3 Advocate for mobile carriers to provide comparable coverage maps that include the type of IoT applications supported.

PUBLIC WIFI

The locations that would benefit most from further public WiFi deployment have not yet been identified in the Digital Plan pending information from the online survey of local governments currently taking place.

Public WiFi priority actions

The Regional Partnership will:

1. Encourage the Victorian and local governments to:

    1.1 Identify value-adding opportunities for public WiFi, using results from digital plan fieldwork, analysis of Smart City proposals, the current CRCP WiFi deployment trials and Jesuit Social Services and ABS data on disadvantaged localities

    1.2 Examine public WiFi co-investment models e.g. the State or Commonwealth Government meeting capital costs and local governments (or carriers) meeting ongoing costs.

DIGITAL SKILLS AND AFFORDABILITY

Little systematic place-based information on the supply of and demand for digital skills and the affordability of digital services has been found for the Central Highlands Digital Plan.

Digital skills and affordability priority actions

The Regional Partnership will encourage the Victorian and Commonwealth Governments to:

1. encourage the Victorian and Commonwealth Governments to:

    1.1 Address the digital skills and affordability information gaps, including through current digital plan field-work and Digital Economy initiatives

    1.2 Examine the benefits and costs of digital literacy training at digital hubs (Local Community Connectivity Centres).

    1.3 Invest in the preparation and delivery of quality digital education and training, adding relevant focus to general initiatives as detailed information on location and sector unmet skills needs are identified.

Regional context: Central Highlands

Population density differs widely across the region – 140 residents per square kilometre for Ballarat LGA, 2 for Pyrenees.

Over half the region's population lives in Ballarat, with a further 20 per cent in the other cities, towns and localities. The remaining 30 per cent live on the fringe of these centres and in rural and remote locations and, reflecting their greater dispersion, experience less favourable digital connectivity than their more urbanised peers.

Farming in the region includes potatoes east of Ballarat and broadacre cropping and grazing to the west; intensive livestock north west of Bannockburn; Intensive horticulture east of Beaufort; wineries in the Pyrenees and forestry between Ballarat and Daylesford. Tourist sites include year-round attractions (e.g. Sovereign Hill and Pyrenees wineries) 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, and repeaters on Velocity trains beyond Ballarat.

PLACE/SECTOR (TYPOLOGY)	CHARACTERISTICS (PLACE/USER)	DIGITAL 'UNMET NEEDS'
CITIES/TOWNS/LOCALITIES		
Businesses	Concentration of public services (education, health, admin), retail, small business in cities, larger towns	Access to business grade broadband, including on town fringes Improved digital skills
Households	High-medium population densities are suitable for NBN fixed line services	Access to affordable, high-capacity broadband Improved digital skills
Communities	Varying digital literacy & ability to afford broadband	Affordability of broadband for disadvantaged groups Increased digital skills
PRIMARY PRODUCTION AREAS		
Farming	Low population density Variety of farming systems – broadacre cropping & grazing, intensive horticulture & livestock Increasing use of digital farming Varying digital literacy	Mobile coverage Customised solutions (e.g. on-farm WiFi) Broadband & narrowband IoT coverage Digital literacy – farmers, farm service providers
Forestry	Remote, unpopulated locations Unmanned forest monitoring Occasional human presence for forest management & harvesting	Narrowband IoT coverage Mobile coverage
TOURIST SITES		
Permanent attractions	Both town & remote locations Visitors with high digital literacy & dependence (e.g. TripAdvisor, GPS, Facebook)	Mobile coverage Public WiFi – general and site-specific High bandwidth fixed broadband for WiFi backhaul
Events	Highly seasonal/periodic	Temporary mobile peak capacity requirements High bandwidth fixed broadband for public WiFi backhaul
TRANSPORT CORRIDORS		
Road	Motorists & freight Mix of major (VicRoads) & minor (local council) roads	Continuous mobile coverage
Rail	Passengers & freight Increased need for high quality mobile 4G (5G) connectivity	Continuous mobile coverage Repeaters on Velocity trains beyond Ballarat

CENTRAL HIGHLANDS POPULATION CENTRES, PRIMARY PRODUCTION AREAS, TOURIST SITES & TRANSPORT CORRIDORS

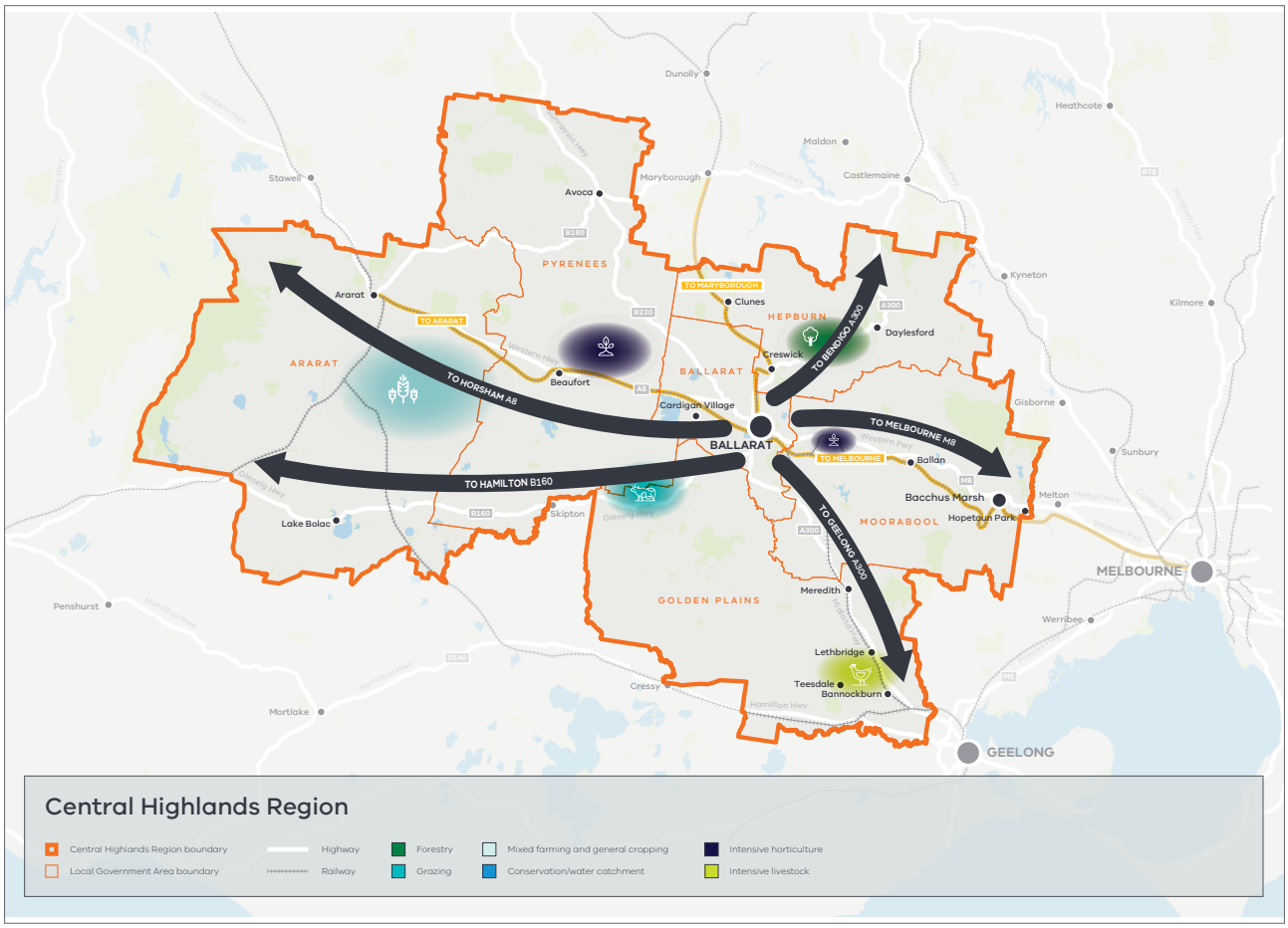


Figure 1 Central Highlands population centres, primary production areas, tourist sites & transport corridors

Key factors considered in the development of the Central Highlands Plan include the following (details on the approach to digital planning are given in the Analytical Framework section):

- Significant regional diversity
- Structural change and trends
- Digital intensity of industry sectors
- Digital divide
- Business grade broadband services
- Competing broadband networks.

SIGNIFICANT REGIONAL DIVERSITY

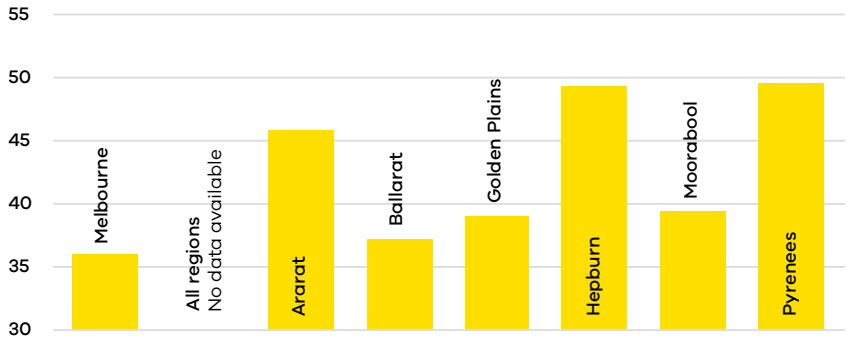
- Population Density – differs widely across the region, from 140 residents per square kilometre for Ballarat LGA down to 2 for Pyrenees LGA
- Median Age – differs significantly across the region from 37 in Ballarat to just below 50 in Hepburn and the Pyrenees
- Industry sectors supporting employment – seven industries make up two thirds of Central Highlands employment with these being dispersed across the region.

Proposed remedy – Apply a place and industry/ sector-based digital planning approach.

These and other key indicators are shown in the bar charts.

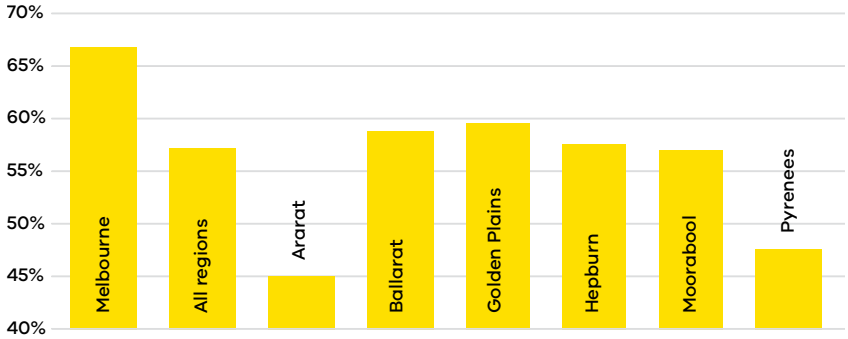
Median Age by LGA

Figure 2



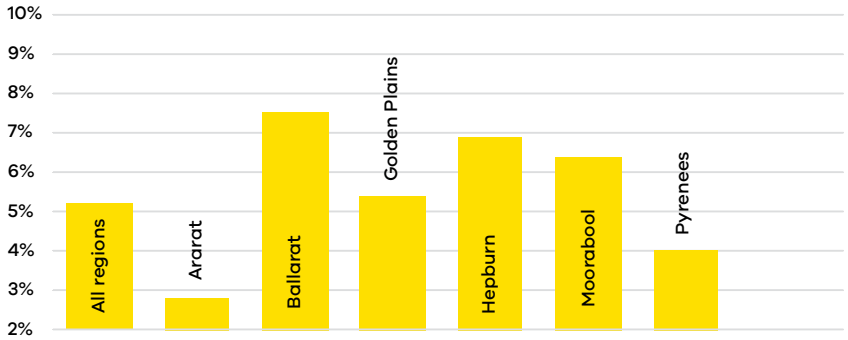
Year 12 completion by LGA

Figure 3



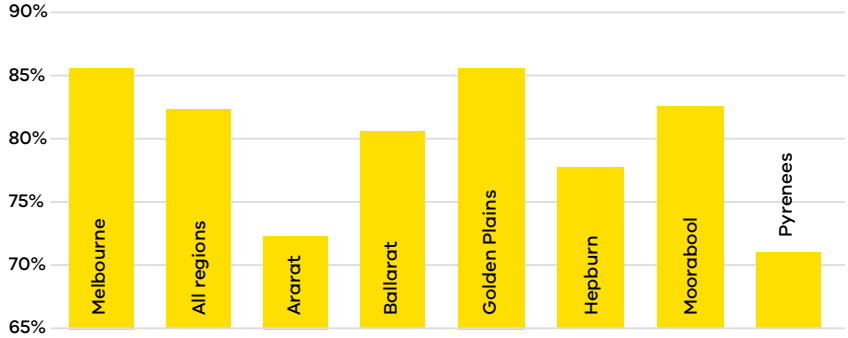
Hi-tech employment by LGA

Figure 4



Home internet access by LGA

Figure 5



STRUCTURAL CHANGE

- Growth in employment – three of the top employment industries have grown strongly over the past 10 years (health care and community assistance, education and training, tourism) and are forecast to continue to do so, warranting priority attention to their digital intensity needs.
- Employment in two industries making up fewer jobs – manufacturing and agriculture – has fallen over the past decade and is forecast to contract or grow only slowly over the next five years.
- However manufacturing and agriculture are major contributors to Central Highlands' Gross Regional Product (GRP) growth, suggesting these industries also warrant particular attention to their digital development.

Proposed remedy – conduct industry/sector-based technology option analysis and apply the outcomes on a place-based approach.

DIGITAL INTENSITY

- Analysis of the digital intensity requirements of the seven industries representing 70 percent of the Central Highlands employment reveals that five of the industries will rely more heavily on digital services over the next 3-5 five years (refer to Figure 6 below).
  These include health care and community assistance, tourism and agriculture/forestry, for which digital intensity needs to rise strongly over the next 3-5 years to retain competitiveness.
- Agriculture and tourism in particular need to shift from their current low to high digital intensity over the next 5 years to be competitive in Australia and internationally, and health and community care needs to digitise quickly for leading-edge effectiveness.

Proposed remedy – Apply an industry/sector based digital planning approach and apply the outcomes on a place-based approach.

Legend Low Medium High

REGIONAL SECTOR	DIGITAL INTENSITY NOW (CURRENT PRACTICE)	DIGITAL INTENSITY NEEDED IN 3-5 YEARS (BEST PRACTICE)
Agriculture/ forestry	Mobile coverage of farming areas	Wide narrowband and broadband IoT access, apps and skills for intensive and broadacre horticulture, cropping & livestock
Tourism	Mobile coverage of tourist hot spots	Mobile road coverage. WiFi & IoT at popular venues. Augmented/virtual reality tours
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 and AI applications
Construction	Fixed and mobile connectivity	Fixed & mobile connectivity, digital models
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

Figure 6 - Summary of digital intensity trends across key Central Highlands industries

THE DIGITAL DIVIDE

The RMIT-Swinburne-Telstra-Roy Morgan Digital Inclusion Index qualifies the metropolitan-rural digital divide.

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 regional 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 mobile service 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.

Digital Inclusion Index – Victoria

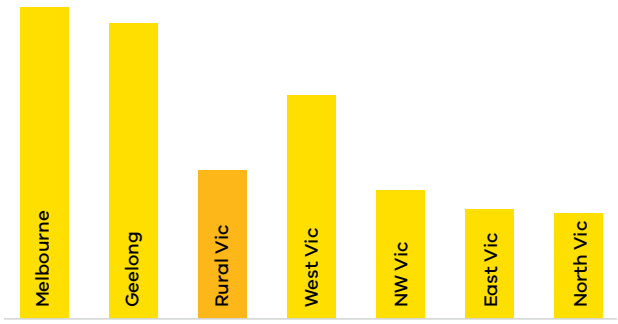


Figure 7

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. It is recognised that the key purpose of the NBN is to provide high-speed broadband to all households and small businesses at affordable nation-wide prices rather than larger business. The necessity for different technology types depending on customer density is also recognised.

The Victorian Government also recognizes and applauds NBNCo for responding to the call from business to provide effective business grade broadband services – high speed (100 mbps+), symmetric and service level agreements on 24/7 committed information rate performance – by 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 in the NBN rollout as long copper loops will not support the Enterprise Ethernet service. There is also 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 committed 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 rollout of 5G wireless technologies as early as 2019 will enhance this capacity. 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.

Regional digital analysis and priorities

Analysis of digital supply and demand is conducted on a place-&-sector basis across the region to provide the evidence base necessary for effective digital planning – high level findings are given in the following table and map.

PLACE/SECTOR TYPOLOGY, DIGITAL NEEDS AND DIGITAL SUPPLY – AN OVERVIEW

'PLACE/SECTOR' TYPOLOGY	DIGITAL NEEDS/ISSUES	DIGITAL OPPORTUNITIES/SOLUTIONS
CITIES, TOWNS, LOCALITIES		
Businesses	• Access to high speed, symmetrical broadband (100Mbps+) services with Service Level Agreements – No NBN business grade services are currently available • Access to near-complete 4G coverage by a least two operators. – Currently relatively well served • Varying Digital Literacy levels	• Enhanced broadband projects to provide business grade high speed fixed line access or wireless services. • Fast-track the availability of NBN business grade services. • Fibre to the premises/node in business parks/precincts to provide business grade services. • Digital literacy capability building through courses, digital festivals and other initiatives.
Households	• Access to NBN fixed line services. – Currently relatively well served • Access to near-complete 4G coverage by a least two operators. – Currently relatively well served • Wi-Fi for disadvantaged residents to reliably access the internet in low income areas • Varying Digital Literacy levels	• Enhanced broadband projects to provide high speed fixed line access or wireless services. • Subsidised free WiFi in areas of disadvantage. • Digital literacy capability building through courses, digital festivals and other initiatives.
Communities	• Access to NBN fixed line services. – Currently relatively well served • Access to near-complete 4G coverage by a least two operators. – Currently well served • Wi-Fi for disadvantaged residents to reliably access the internet in low income areas • Varying Digital Literacy levels	• Enhanced broadband projects to provide high speed fixed line access or wireless services. • Subsidised free WiFi in areas of disadvantage. • Digital literacy capability building through courses, digital festivals and other initiatives. • Create Digital Hubs to support people and businesses to access reliable high speed broadband services and build digital capability and literacy

PRIMARY PRODUCTION		

Businesses	• Access to NBN fixed line services.
	  – Not well served due to predominance of satellite services
	• Access to near-complete 4G coverage by a least two operators.
	  – Currently not well served
	• Access to Internet of Things Coverage
	  – Currently not well served
	• Varying Digital Literacy levels
		• Fast-track the availability of NBN Fixed Wireless Services.
		• Digital literacy capability building through courses, digital festivals and other initiatives.
		• Create Digital Hubs to support people and businesses to access reliable high speed broadband services and build digital capability and literacy
		• Mobile blackspot projects to provide more complete rural coverage
		• Digital literacy capability building through courses, digital festivals and other initiatives.
		• Internet of Things projects to provide more complete coverage, trials and adoption of IoT services

Households	• Access to NBN fixed line services.
	  – Not well served due to predominance of satellite services
	• Access to near-complete 4G coverage by a least two operators.
	  – Currently not well served
	• Access to Internet of Things Coverage
	  – Currently not well served
	• Varying Digital Literacy levels
		• Fast-track the availability of NBN Fixed Wireless Services.
		• Digital literacy capability building through courses, digital festivals and other initiatives.
		• Create Digital Hubs to support people and businesses to access reliable high speed broadband services and build digital capability and literacy
		• Mobile blackspot projects to provide more complete rural coverage
		• Internet of Things projects to provide more complete coverage and adoption of IoT services

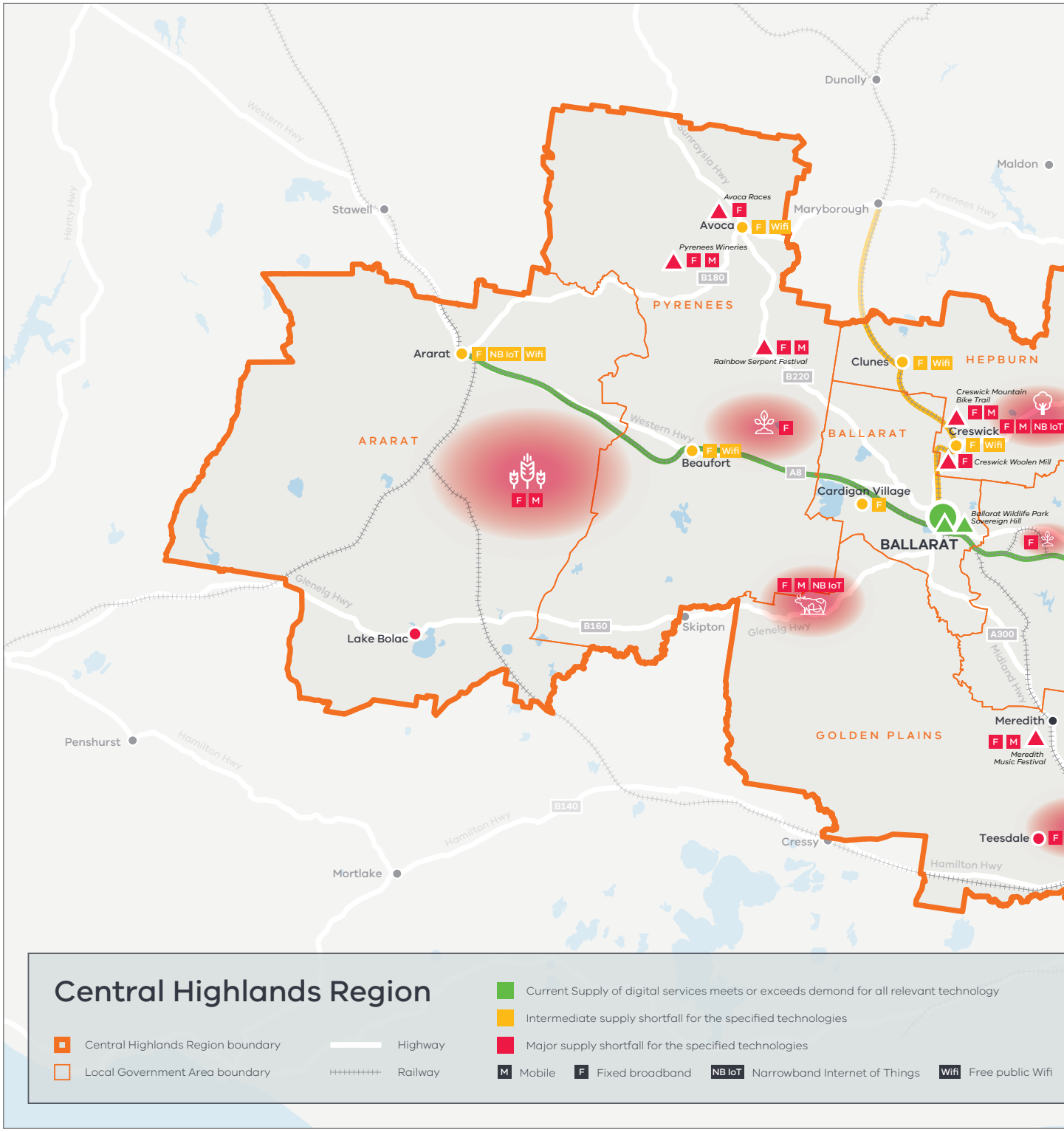
TOURISM (SITES AND EVENTS)		

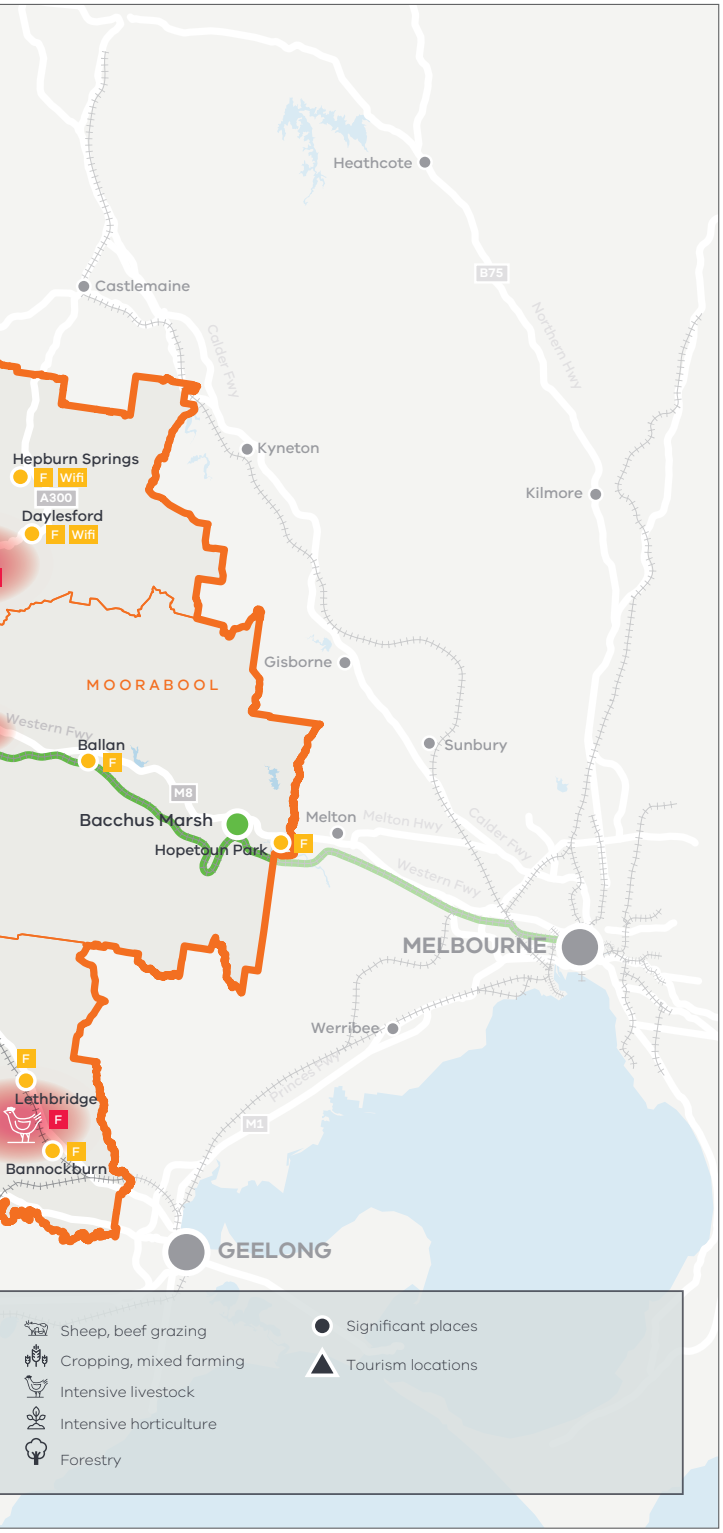
Operators and Visitors	• Access to NBN fixed line services.
	  – Not well served in remote locations
	• Access to near-complete 4G coverage by a least two operators.
	  – Not well served in remote locations
		• Subsidised free WiFi for high traffic tourist sites.
		• Fast-track the availability of NBN business grade services.
		• Cell on Wheels project to make mobile services available at reasonable pricing to operators and make services available to visitors.

TRANSPORT CORRIDORS		
Roads	• Access to near-complete 4G coverage by a least two operators. – Weak coverage on B and C class roads	• Mobile blackspot projects to provide more complete rural coverage
Rail	• Access to near-complete 4G coverage by a least two operators. – Weak coverage on services beyond Ballarat	• Mobile blackspot projects to provide more complete rural coverage • Projects to provide coverage in Velocity trains beyond Bendigo.

CENTRAL HIGHLANDS UNMET NEEDS HOTSPOTS: FIXED, MOBILE, IOT AND PUBLIC WIFI ACCESS

Figure 8 Central highlands unmet needs hotspots: fixed, mobile, IoT and public WiFi access.





Households in population centres down to quite small localities (500 residents) are generally well served with effective fixed and mobile connectivity (and high bandwidth IoT coverage provided by the mobile carriers). The fixed broadband needs of businesses throughout the region are unsatisfactory with no NBN business grade services currently available. Narrowband IoT networks and public WiFi coverage are patchy and warrant careful consideration of how shortfalls are best addressed. What is not shown is 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.

The high-level picture for households and businesses in primary production areas and at more isolated tourist sites is not so rosy, with mobile coverage for farms and tourists lacking and below par fixed connectivity for farm offices and homesteads and tourist site operators. However, limits to widespread remediation exist, as per user costs of fixed line access and blanket mobile coverage rise exponentially with remoteness. Significantly for farms, connectivity for both one-way and two-way IoT is patchy or non-existent for many broadacre farms, limiting future competitiveness of these businesses in the next 3-5 years unless IoT access improves.

Mobile coverage on major roads is good, but less so for more minor roads. Mobile coverage of the Ballarat-Melbourne rail corridor is good, as is in-carriage reception. Mobile coverage is good for trains beyond Ballarat (to Ararat and Maryborough), but in-carriage reception is compromised on Velocity trains without repeaters.

The following section describe the rating methodology used for Fixed and Mobile services, Narrowband IoT and Public WiFi.

FIXED AND MOBILE

Rating methodology

The following ratings standards have been used to analyse the supply and demand of fixed broadband and mobile services.

FIXED ACCESS SUPPLY RATING

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, fixed wireless service only available up to 50 mbps and fixed wireless information rate 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.

FIXED ACCESS DEMAND RATING

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. These rating benchmarks apply for the present and in 3-5 years as the quality of NBN FTTN performance is expected to improve in line with user needs.[2]

2 It is anticipated NBNCo will commence a program of shortening the length of copper loops in FTTN areas once rollout is completed in 2020.

MOBILE SUPPLY RATING

For both businesses and households the same supply ratings are used as access to mobile services is very important for both businesses and households and they have similar mobile service performance needs:

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.

MOBILE DEMAND RATING

- Demand is rated High for all mobile users now and in 3-5 years, reflecting mobile's importance for all.

NARROWBAND (LP-WAN) IOT[3]

Rating methodology

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 required for a High rating in 3-5 years.[4]

Demand by businesses in larger centres and for farms is rated **Medium** at present and **High** in 3-5 years; and **Low** (now) and **Medium** (3-5 years) for businesses in smaller centres and households, reflecting the significant increase anticipated in IoT interest and use.

PUBLIC WIFI

Rating methodology

Rating public WiFi supply and demand: Supply of public WiFi is rated, for now, and in 3-5 years time:

- **High** where it is available in relevant public places and disadvantaged localities.
- **Medium** or **Low** for incomplete or no coverage.

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.[5]

3 Sigfox and Taggle network coverage is considered, NNNCo network coverage is not considered in the Plan analysis as this information is not publicly available.

4 High bandwidth and 2-way IoT are provided by mobile carriers.

5 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

The following colour-coded summary tables provide a snapshot of the current supply-demand balance and unmet needs for each category. See legend below.

Table 1 Significant places: current unmet digital access needs.

			ACCESS							
LGA	NAME	USER TYPE	FIXED		MOBILE		LP-WAN IoT		WIFI	
Ballarat	**Ballarat** (pop. 93,759) City	Business		H/H		H/H		L/M	n.a.	
		Household		H/H		H/H		L/L		M/M
		Community	n.a.			H/H	n.a.			M/M
Moorabool	**Bacchus Marsh** (pop. 17,302) City	Business		H/H		H/H		M/M	n.a.	
		Household		H/H		H/H		M/L		L/L
		Community	n.a.			H/H	n.a.			L/L
Ararat	**Ararat** (pop. 6,925) Town	Business		M/H		H/H		L/M	n.a.	
		Household		H/H		H/H		L/L		L/H
		Community	n.a.			H/H	n.a.			L/H
Golden Plains	**Bannockburn** (pop. 5,001) Town	Business		M/H		H/H		M/M	n.a.	
		Household		H/H		H/H		M/L		L/L
		Community	n.a.			H/H	n.a.			L/L
Hepburn	**Daylesford-Hepburn Springs** (pop. 3,422) Town	Business		M/H		H/H		H/M	n.a.	
		Household		H/H		H/H		H/L		L/H
		Community	n.a.			H/H	n.a.			L/H
Hepburn	**Creswick** (pop. 2,742) Town	Business		M/H		H/H		L/L	n.a.	
		Household		H/H		H/H		L/L		L/H
		Community	n.a.			H/H	n.a.			L/H
Moorabool	**Ballan** (pop. 2,290) Town	Business		M/H		H/H		M/L	n.a.	
		Household		H/H		H/H		M/L		L/L
		Community	n.a.			H/H	n.a.			L/L

LGA	NAME	USER TYPE	ACCESS FIXED		MOBILE		LP-WAN IoT		WIFI	
Golden Plains	**Teesdale** (pop. 1,664) Town	Business	🔴	L/H	🟢	H/H	🟢	L/L	n.a.	
		Household	🟡	M/H	🟢	H/H	🟢	L/L	🟢	L/L
		Community	n.a.		🟢	H/H		n.a.	🟢	L/L
Hepburn	**Clunes** (pop. 1,426) Town	Business	🟡	M/H	🟢	H/H	🟢	L/L	n.a.	
		Household	🟢	H/H	🟢	H/H	🟢	L/L	🔴	L/H
		Community	n.a.		🟢	H/H		n.a.	🔴	L/H
Pyrenees	**Beaufort** (pop.1072) Town	Business	🟡	M/H	🟢	H/H	🟢	L/L	n.a.	
		Household	🟢	H/H	🟢	H/H	🟢	L/L	🔴	L/H
		Community	n.a.		🟢	H/H		n.a.	🔴	L/H
Pyrenees	**Avoca** (pop. 972) Local	Household	🟢	H/H	🟢	H/H	🟢	L/L	🔴	L/H
		Community	n.a.		🟢	H/H		n.a.	🔴	L/H
Moorabool	**Hopetoun Park** (pop. 798) Local	Household	🟡	M/H	🟢	H/H	🟢	M/L	🟢	L/L
		Community	n.a.		🟢	H/H		n.a.	🟢	L/L
Golden Plains	**Lethbridge** (pop. 585) Local	Household	🟡	M/H	🟢	H/H	🟢	M/L	🟢	L/L
		Community	n.a.		🟢	H/H		n.a.	🟢	L/L
Ballarat	**Cardigan Village** (pop. 565) Local	Household	🟡	M/H	🟢	H/H	🟢	L/L	🟢	L/L
		Community	n.a.		🟢	H/H		n.a.	🟢	L/L
Ararat	**Lake Bolac** (pop. 330) Local	Household	🟡	M/H	🟢	H/H	🟢	L/L	🔴	L/H
		Community	n.a.		🟢	H/H		n.a.	🔴	L/H

Legend

🔴 Major supply shortfall

🟡 Intermediate supply shortfall

🟢 Current supply meets or exceeds demand

Commentary

Fixed and mobile

Current fixed and mobile access needs of *households* and the *community* are in general well-served in the cities and larger towns (those above 1,000 people), with the exception of fixed access in Teasdale (NBN fixed wireless). Broadly speaking, a capital city-regional digital divide is not apparent for households and communities.

The supply of fixed broadband for businesses throughout the region relative to their needs are, however, generally unsatisfactory with current (or planned) NBN technology unable to uniformly support the forthcoming Enterprise Ethernet business grade service at all user premises – with the exceptions of the two largest centres, Ballarat and Bacchus Marsh (FTTP), and Avoca (FTTC). Furthermore, behind this general picture there are inevitably individual households, businesses and neighbourhoods with under-par fixed and mobile access (including those on the fringes of towns with fixed wireless access and incomplete mobile coverage). These localized disparities also occur in capital city locations but are likely to be more prevalent and marked in regional population centres and warrant specific attention. Furthermore, Ballarat and Bacchus Marsh have a marked fibre to the premises (FTTP)-fibre to the node (FTTN) fixed access divide, each with a substantial area with FTTP technology juxtaposed with areas not enjoying this 'gold standard' broadband.

For small localities, fixed access supply is compromised by the predominance of fixed wireless technology.

Looking forward 3-5 years, for larger centres in Central Highlands it is anticipated existing FTTP FTTC will continue to support business grade services and the growing needs of households, and long copper FTTN loops will be reduced to provide more uniform access to high bandwidth business and household services – again with specific users and neighbourhoods that experience poor quality service. The 3-5 year outlook for mobile access is less certain as carrier plans for rolling out 5G technology in regional locations are not known, although the largest population centres – Ballarat and Bacchus Marsh – are likely to have 5G coverage first (based on carriers initially targeting large and rapidly growing populations).

Importantly, the introduction of 5G services will at some point create greater competition between mobile and fixed access (and the possibility of 5G fixed wireless), providing a potential solution for individual premises and neighbourhoods with poor fixed access.

Localities of under 1,000 people currently face, and are expected to continue to experience, fixed access supply shortfalls without some form of government 'enhanced broadband' intervention to upgrade these localities to fixed line NBN or alternative fixed line or (superior) fixed wireless access from new 3rd party networks.

Widespread upgrades will however be difficult to achieve based on the raw economics of fixed line networks being increasingly costly to deploy for smaller populations. That is, while 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), there are limits to what can be achieved.

While these small towns are in general currently well served for mobile, it is uncertain whether they will enjoy 5G coverage in the next 3-5 years.

Narrowband (LP-WAN) IoT[6]

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

Looking forward 3-5 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 (use of low-cost spectrum and long signal carrying distances). 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.

6 Sigfox and Taggle network coverage is considered, NNNCo network coverage is not considered in the Plan analysis as this information is not publicly available.

Public WiFi

A key benefit of free public WiFi at present is assisting disadvantaged residents access the internet, and amenity for visitors to the location. At present supply of public WiFi is low in all places considered (with exception of Ballarat), while demand is high in eight of the 15 places considered (reflecting their lower income levels). Accordingly, on the basis of the methodology and limited data available, there appears to be unmet need for public WiFi in around half the places considered – with no clear link between town size and unmet need as income levels are not closely linked to town size.

Looking forward 3-5 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 State 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 – 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. Based on these broad indicators, there appears to be a significant skills shortfall in Central Highlands 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 3-5 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 to digital skills 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.

Detailed priority actions for Central Highlands significant places

Priority actions lie primarily with regional stakeholders (local governments, business and community groups and the Regional Partnership), including encouraging and assisting the Victorian Government make evidence-based representations on needed changes to the Commonwealth Government, NBNCo and other digital service providers. These are listed in the Regional Partnership Priority Actions section 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 actions outlined address current and future unmet digital needs. They draw on analysis in the companion *Regional Digital Plans: Common Themes* report.

The Central Highlands Region high level priority actions include:

1. Local governments and the Regional Partnership prioritise action for each of the access technologies on the basis of business cases to determine which actions provide the greatest benefits – including investigating the feasibility of a combined 5G fixed access/mobile service and alternative market stimulation models to bring the service market.
2. The Regional Partnership educate those in sparsely populated locations that high quality high bandwidth blanket coverage solutions are unlikely to be viable due to cost constraints and those requiring reliable high bandwidth solutions may be best served by bespoke solutions.
3. Local governments and regional businesses consider leveraging available government assets for cost-effective bespoke solutions (for example VicTrack fibre for backhaul or joining up access network components).
4. Use the State Level Information Management database to conduct more detailed analysis of unmet needs and possible solutions.
5. Advocate for the implementation of multipurpose digital hubs (Local Community Connectivity Centres) that can address a range of access, skills and affordability needs (including providing access to reliable high broadband access for those in NBN fixed wireless and satellite footprints).

Specific priority actions recommended by the Central Highlands Regional Partnership based on the significant places analysis include:

Fixed access

1. Local governments engage with NBNCo to ensure it understands local priorities – to influence NBNCo's technology boundary decisions where the NBN has not yet been rolled out, and where technology upgrades (including shortening FTTN copper loops) should be focused once rollout is completed. The Victorian Government could assist local governments (and the Regional Partnership) in identifying and prioritizing unmet needs by developing a web-based application through which users could register their need for improved fixed (and other) access service.
2. Local governments obtain quotes under the NBN Technology Choice program for underserved current and planned business precincts, and investigate funding models including contributions by precinct tenants.
3. Local governments, the Regional Partnership and the Victorian Government work in unison to determine if there are cost effective non NBN solutions that address current and future fixed access shortfalls (informed by current CRCP Enhanced Broadband demonstration projects).
4. The Victorian Government encourage the Commonwealth Government to require NBNCo to deploy technologies with the highest performance potential in the remaining rollout areas, aided by information from local governments on where demand for high performance is expected to be greatest.
5. The Victorian Government advocate for a lowering of the mandatory threshold above which FTTP must be incorporated in new developments.
6. The Victorian Government advocate for a restructuring of NBN wholesale pricing to ensure the maximum potential of the NBN is unlocked (including revising CVC pricing).
7. The Victorian Government make submissions to the current ACCC Domestic Transmission Capacity Services (DTCS) inquiry in relation to backhaul routes where its market insights indicate regional users are adversely impacted by high backhaul pricing.
8. The Victorian Government advocate for the immediate introduction in the region of the forthcoming NBN Enterprise Ethernet business grade services with symmetric high bandwidth options and robust 24/7 service level agreements (SLAs) including committed information rates.

Local governments, businesses and community groups work in unison to better understand the incidence and impact of fixed technology boundary issues (the 'have nots' next door to the 'haves'), and the feasibility of public network and bespoke solutions that address serious anomalies.

Mobile access

1. Local government agencies equip their service vehicles with mobile coverage monitoring tools to build a strong evidence base on specific gaps in coverage – to inform future blackspot programs and discussions with mobile service providers on more immediate localized solutions through antennae directional tuning, low-cost small cell towers and other bespoke work-arounds.
2. The Victorian Government advocate for continued Commonwealth investment in blackspot programs, coupled with a review of funding models to ensure maximum investment efficiency as mobile coverage extends into ever more marginal areas and supports a range of voice, emergency alert, data and IoT needs.
3. The Victorian Government commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas where service availability from any provider may stand ahead of competition considerations.
4. Local governments and the Regional Partnership seek to influence 5G rollout by creating a list of high-demand priority locations.
5. The Victorian Government examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand areas.

IoT access

1. The Regional Partnership coordinate local governments' and business groups' active engagement with all mobile operators on their plans for mobile-supported Cat-M1 and narrowband IoT deployment across central Highlands armed with their own intelligence on existing deployments and latent user needs, information provided by the Victorian Government from its agricultural IoT trials and the fieldwork conducted to support the digital plans.
2. The Regional Partnership coordinate local governments' and business groups' discussion with LP-WAN network operators on their plans for network deployment across Central Highlands, including what information they can provide and actions they can take to assist the network operators in their deliberations.
3. The Victorian Government include IoT support as a decision criterion in its mobile blackspot initiatives, and advocate the Commonwealth do the same in its future blackspot programs.
4. The Victorian Government consider an LP-WAN network rollout market facilitation model, including the feasibility and net benefits of state-wide blanket deployment of LP-WAN access.

Public WiFi access

1. The Regional Partnership coordinate the collection and sharing of information from local governments on the location, footprint, target audience and use trends of their public WiFi networks, and their ambitions for wider WiFi coverage in their LGAs – to inform local government decision-makers and Victorian Government policy considerations.

3. The Victorian Government fast-track the compilation and distribution of information on its public WiFi trials currently being conducted in Shepparton and Geelong.

3. The Victorian Government investigate the feasibility, net benefits and possible market facilitation models for deployment of public WiFi networks in smaller regional towns and localities, to meet local social needs and attract visitors.

Skills

1. As the supply of and demand situation for digital skills is not well understood at present, a key action needed is purpose-specific data collection. A start on this has been made with questions in the local government online survey currently being conducted and in the onsite fieldwork to follow.

2. Looking forward, as a general point, it is anticipated there will be local solutions for 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.

3. At the local level, digital access infrastructure and services addressed in the Plan potentially provides an array of tools to remediate skills shortages – for example, using YouTube, MOOCs (massive online, open courses), and interactive training providers. However, learning needs to start with baseline skills in the region so that people can find and engage with those materials. Access to this foundational education also needs to be effective and affordable. This is likely to be most effective when initiated at the local level, Multipurpose digital hubs can play an important focal point in this regard, including good online access where for example young people can teach older citizens and workers basic digital literacy skills.

Options to address Central Highlands 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

Table 2 Primary production areas: current unmet digital access needs

			ACCESS					
LAND USE	LOCATION	USER TYPE	FIXED		MOBILE		NB-IoT	
Sheep & beef grazing	Between Ballarat & Lake Bolac	Business	🔴	L/H	🟡	M/H	🔴	L/H
		Household	🔴	L/H	🟡	M/H	🟢	L/L
Cropping/ mixed farming	Between Ararat & Lake Bolac	Business	🔴	L/H	🟡	M/H	🟡	L/M
		Household	🔴	L/H	🟡	M/H	🟢	L/L
Potatoes	East of Ballarat	Business	🔴	L/H	🟢	H/H	🟡	L/M
		Household	🟡	M/H	🟢	H/H	🟢	L/L
Intensive livestock	North-west of Bannockburn	Business	🟡	M/H	🟢	H/H	🟡	L/M
		Household	🔴	L/H	🟢	H/H	🟢	L/L
Intensive horticulture	East of Beaufort	Business	🔴	L/H	🟢	H/H	🟡	L/M
		Household	🔴	L/H	🟢	H/H	🟢	L/L
Forestry	Between Ballarat & Daylesford	Business	🔴	L/L	🔴	L/H	🔴	L/H

Legend 🔴 Major supply shortfall 🟡 Intermediate supply shortfall 🟢 Current supply meets or exceeds demand

Commentary

The unmet needs picture is mixed within each of these primary production areas. Fixed access generally has a major supply shortfall for both businesses and households due to the predominance of NBN satellite services. Mobile supply is inadequate for grazing, cropping and forestry areas, while generally meeting business and household needs in the more closely-settled potato growing and intensive livestock and horticultural areas. Low power IoT supply-demand balance is in transition – supply is generally poor, but demand is only now starting to rise and is generally rated medium.

Fixed access

Current situation – fixed access in the primary production areas across regional Victoria comprises a mix of NBN fixed wireless and satellite technologies. For Central Highlands, the rural area served by NBN fixed wireless rather than satellite is relatively high – Hepburn (55% of landmass), Moorabool (55%) and Golden Plains (50%), with only Ararat and Pyrenees LGAs primarily served by satellite (60% and 90% satellite respectively). However, fixed wireless does not meet the needs of digitally-intensive businesses as it does not support business grade services, and there is substantial cropping, grazing and forestry areas with NBN satellite service only. Business and household demand is, however, uniformly high, meaning at least major unmet demand for fixed access across the region's rural areas.

Looking forward 3-5 years – It is anticipated fixed access supply will change little in the next 3-5 years without policy intervention. With demand inexorably rising, this means the current unmet demand situation for fixed access will become even more 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 Central Highland is also relatively high, although with clear expanses of inadequate service in the extensive cropping, grazing and forestry area due to coverage and technology (3G) limitations. With demand for mobile services high, significant areas of substantial shortfall are apparent.

Looking forward 3-5 years – there is likely to be little market driven improvement on coverage in the extensive farming and forestry areas, and it is uncertain whether 5G technology will replace 4G. 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.

Narrowband IoT

Current situation – Narrowband IoT coverage is currently low across Central Highlands primary production areas, with broadacre farmers in particular facing moderate but widespread unmet needs for in-paddock coverage.

Looking forward 3-5 years – Demand for such coverage is expected to grow strongly, as is supply with the supply-demand balance unclear. That said, there may be a valid role for government market stimulation where more acute supply shortfalls become apparent.

Detailed priority actions for Central Highlands primary production

The Central Highlands Region high level priority actions are similar to those identified for Significant Places and include:

1. Local governments and the Regional Partnership prioritise action for each of the access technologies on the basis of business cases to determine which actions provide the greatest benefits.
2. The Regional Partnership educate those in sparsely populated locations that high quality high bandwidth blanket coverage solutions are unlikely to be viable due to cost constraints and those requiring reliable high bandwidth solutions may be best served by bespoke solutions (or possible relocation).
3. Local governments and regional businesses consider leveraging available government assets for cost-effective bespoke solutions.
4. Use the State Level Information Management database to conduct more detailed analysis of unmet needs and possible solutions.
5. Advocate for the implementation of multipurpose digital hubs that can address a range of access, skills and affordability needs (including providing access to reliable high-speed broadband for those in NBN fixed wireless and satellite footprints).

Specific priority actions include:

Fixed access

1. Local governments engage with NBNCo to ensure it understands local priorities – to influence NBNCo's technology boundary decisions where the NBN has not yet been rolled out, and where technology upgrades should be focused once rollout is completed. The Victorian Government could assist local governments (and the Regional Partnership) in identifying and prioritizing unmet needs by developing a web-based application through which users could register their need for improved access services.
2. The Victorian Government encourage the Commonwealth Government to require NBNCo to deploy technologies with the highest performance potential in the remaining rollout areas, aided by information from local governments on where demand for high performance is expected to be greatest.
3. The Victorian Government advocate for a restructuring of NBN wholesale pricing to ensure the maximum potential of the NBN is unlocked (including revising CVC pricing).
4. The Victorian Government make submissions to the current ACCC Domestic Transmission Capacity Services (DTCS) inquiry in relation to backhaul routes where its market insights indicate regional users are adversely impacted by high backhaul pricing.
5. The Victorian Government advocate for the immediate introduction of effective NBN business grade services with symmetric high bandwidth options and robust service level agreements (SLAs).

Mobile access

1. Local government agencies equip their service vehicles mobile coverage monitoring tools to build a strong evidence base on specific gaps in coverage – to inform future blackspot programs and discussions with mobile service providers on more immediate localized solutions through antennae directional tuning, low-cost small cell towers and other bespoke work-arounds.

2. The Victorian Government advocate for continued Commonwealth investment in blackspot programs, coupled with a review of funding models to ensure maximum investment efficiency as mobile coverage extends into ever more marginal areas and supports a range of voice, emergency alert, data and IoT needs.

3. The Victorian Government commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas where service availability from any provider may stand ahead of competition considerations.

4. Local governments and the Regional Partnership seek to influence 5G rollout by creating a list of high-demand priority locations.

5. The Victorian Government examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand areas.

IoT access

1. The Regional Partnership coordinate local governments' and business groups' active engagement with all mobile operators on their plans for mobile-supported Cat-M1 and narrowband IoT deployment across central Highlands armed with their own intelligence on existing deployments and latent user needs, information provided by the Victorian Government from its agricultural IoT trials and the fieldwork conducted to support the digital plans.

2. The Regional Partnership coordinate local governments' and business groups' discussion with LP-WAN network operators on their plans for network deployment across Central Highlands, including what information they can provide and actions they can take to assist the network operators in their deliberations.

3. The Victorian Government include IoT support as a decision criterion in its mobile blackspot initiatives, and advocate the Commonwealth do the same in its future blackspot programs.

4. The Victorian Government consider an LP-WAN network rollout market facilitation model, including the feasibility and net benefits of state-wide blanket deployment of LP-WAN access.

TOURIST LOCATIONS ANALYSIS

Table 3 Tourist locations: current unmet needs

				ACCESS					
TYPE	LOCATION	LGA	TYPE	FIXED		MOBILE		PUBLIC WIFI	
Permanent	**Sovereign Hill** (450,000 visitors p.a.)	Ballarat	Operator	🟢	H/H	🟢	H/H		n.a.
			Visitor		n.a.	🟢	H/H	🟢	M/M
	Ballarat Wildlife Park (2 million+ visitors p.a.)	Ballarat	Operator	🟢	H/H	🟢	H/H		n.a.
			Visitor		n.a.	🟢	H/H	🟡	L/M
	Creswick Woollen Mill (140,000 visitors p.a.)	Hepburn	Operator	🔴	L/H	🟢	H/H		n.a.
			Visitor		n.a.	🟢	H/H	🟡	L/M
	Creswick Mountain Bike Trail (80,000 visitors p.a.)	Hepburn	Operator	🔴	L/H	🟢	M/H		n.a.
			Visitor		n.a.	🟢	M/H	🟡	L/M
	Pyrenees wineries (130,000 visitors p.a.)	Pyrenees	Operator	🔴	L/H	🟡	M/H		n.a.
			Visitor		n.a.	🟡	M/H	🟡	L/M
Events	**Rainbow Serpent Festival** (12,000 visitors)	Pyrenees	Operator	🔴	L/H	🔴	L/H		n.a.
			Visitor		n.a.	🔴	L/H	🔴	L/H
	Meredith Music Festival (12,000 visitors)	Moorabool	Operator	🔴	L/H	🟡	M/H		n.a.
			Visitor		n.a.	🟡	M/H	🔴	L/H
	Avoca Races (6,000 visitors)	Pyrenees	Operator	🔴	L/H	🟢	H/H		n.a.
			Visitor		n.a.	🟢	H/H	🟡	L/M

Legend

🔴 Major supply shortfall

🟡 Intermediate supply shortfall

🟢 Current supply meets or exceeds demand

Commentary

Here only fixed and mobile access technologies are the most relevant – fixed for WiFi backhaul, and mobile for both visitors and operators. Public WiFi is of limited relevance given the scope for operators to provide site-specific WiFi. Two types of tourist locations are considered, permanent tourist attractions and periodic events such as an annual music festivals.

Present situation: Based on the sample of events and permanent tourist sites examined, the unsurprising finding is that at present both fixed and mobile access are likely to be poor for events and permanent tourist attractions that are a significant distance from a population centre. Town-based events and sites are better served, but the lack of business grade service offerings restricts the effectiveness of fixed services for event/site operators. Looking forward 3-5 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 event organisers, they and the visitors will be better served with relevant digital services the closer they are to a town.

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

In 3-5 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.

Priority actions for tourist locations

The Central Highlands Region high level priority actions for tourist locations are similar to those identified for Significant Places and include:

1. Local governments and the Regional Partnership prioritise action for each of the access technologies on the basis of business cases to determine which actions provide the greatest benefits.
2. The Regional Partnership educate those in sparsely populated locations that high quality high bandwidth blanket coverage solutions are unlikely to be viable due to cost constraints and those requiring reliable high bandwidth solutions may be best served by bespoke solutions (or possible relocation).
3. Local governments and regional businesses consider leveraging available government assets for cost-effective bespoke solutions.
4. Use the State Level Information Management database to conduct more detailed analysis of unmet needs and possible solutions.
5. Advocate for the implementation of multipurpose digital hubs that can address a range of access, skills and affordability needs (including providing access to reliable high-speed broadband for those in NBN fixed wireless and satellite footprints).

Specific priority actions include:

Fixed access

1. Local governments engage with NBNCo to ensure it understands local priorities – to influence NBNCo's technology boundary decisions where the NBN has not yet been rolled out, and where technology upgrades should be focused once rollout is completed. The Victorian Government could assist local governments (and the Regional Partnership) in identifying and prioritizing unmet needs by developing a web-based application through which users could register their need for improved fixed (and other) access service.
2. The Victorian Government encourage the Commonwealth Government to require NBNCo to deploy technologies with the highest performance potential in the remaining rollout areas, aided by information from local governments on where demand for high performance is expected to be greatest.
3. The Victorian Government advocate for a restructuring of NBN wholesale pricing to ensure the maximum potential of the NBN is unlocked (including revising CVC pricing).
4. The Victorian Government make submissions to the current ACCC Domestic Transmission Capacity Services (DTCS) inquiry in relation to backhaul routes where its market insights indicate regional users are adversely impacted by high backhaul pricing.
5. The Victorian Government advocate for the immediate introduction of NBN business grade services with symmetric high bandwidth options and robust service level agreements (SLAs).

Mobile access

1. Local government agencies equip their service vehicles with mobile coverage monitoring tools to build a strong evidence base on specific gaps in coverage – to inform future blackspot programs and discussions with mobile service providers on more immediate localized solutions through antennae directional tuning, low-cost small cell towers and other bespoke work-arounds.
2. The Victorian Government advocate for continued Commonwealth investment in blackspot programs, coupled with a review of funding models to ensure maximum investment efficiency as mobile coverage extends into ever more marginal areas and supports a range of voice, emergency alert, data and IoT needs.
3. The Victorian Government commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas where service availability from any provider may stand ahead of competition considerations.
4. Local governments and the Regional Partnership seek to influence 5G rollout by creating a list of high-demand priority locations.
5. The Victorian Government examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand areas.
6. Local governments and the Regional Partnership should compile a list of significant regional events where capacity problems exist and tender for one mobile operator to provide a region-wide multi-carrier mobile solution.

Public WiFi access

1. The Regional Partnership coordinate the collection and sharing of information from local governments on the location, footprint, target audience and use trends of their public WiFi networks, and their ambitions for wider WiFi coverage in their LGAs – to inform local government decision-makers and Victorian Government policy considerations.

2. The Victorian Government fast-track the compilation and distribution of information on its public WiFi trials currently being conducted in Shepparton and Geelong.

3. The Victorian Government investigate the feasibility, net benefits and possible market facilitation models for deployment of public WiFi networks in smaller regional towns and localities, to meet local social needs and attract visitors.

TRANSPORT BLACKSPOTS ANALYSIS

Here only mobile access is relevant.

Table 4 Transport blackspots: current unmet needs

ROAD CLASS	ID	FROM	TO	COMMENT	RATING	
A				Coverage by 1-2 carriers on all A-level roads	🟢	H/H
B	B180	Ararat	Maroona	Coverage by 1 carrier only	🟡	M/H
	B180	Ararat	Avoca	Major gaps	🔴	L/H
C	C216	Halls Gap	South	Little coverage	🔴	L/H
Rail		Ballarat	Melbourne	Full coverage by 3 carriers	🟢	H/H
		Ballarat	Ararat	Full coverage by 3 carriers	🟢	H/H
		Ballarat	Maryborough	Full cover by 2 carriers, 90% by 1 other, but some 3G	🟡	M/H

Legend 🔴 Major supply shortfall 🟡 Intermediate supply shortfall 🟢 Current supply meets or exceeds demand

Table 4 for summarises the limited analysis of mobile coverage supply and demand on major and more minor roads a rail link in Central Highland conducted to demonstrate the place-and-sector approach for transport corridors and note any preliminary patterns.

Commentary

The tentative pattern from the small indicative sample of Central Highlands roads is good mobile coverage on major (Class A) thoroughfares, weaker coverage on intermediate (Class B) roads and poor coverage on minor (Class C) roads. However, examination of more roads is required to confirm this pattern.

Findings from the examination of the region's rail links show that passenger demand is well met for the Ballarat-Bacchus Marsh-Melbourne track, and for the Ballarat-Ararat link. 3G coverage on parts of the Ballarat-Maryborough track means passenger needs are not fully met on this link. Furthermore, for passenger trains on both the Ararat and Maryborough links, mobile signal blockage may occur in certain types of carriages, degrading the quality of on-train mobile service.

Looking forward 3-5 years, this tentative pattern is expected to continue, with intervention required to lift mobile coverage on more minor roads where warranted, and possible attention required for in-carriage coverage on rail links beyond Ballarat.

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 will be expensive.

Priority actions for transport blackspots

The Central Highlands Region priority actions for transport blackspots are similar to those identified for Significant Places and include:

Mobile access

1. Local government agencies equip their service vehicles with mobile coverage monitoring tools to build a strong evidence base on specific gaps in coverage – to inform future blackspot programs and discussions with mobile service providers on more immediate localized solutions through antennae directional tuning, low-cost small cell towers and other bespoke work-arounds.
2. The Victorian Government advocate for continued Commonwealth investment in blackspot programs, coupled with a review of funding models to ensure maximum investment efficiency as mobile coverage extends into ever more marginal areas and supports a range of voice, emergency alert, data and IoT needs.
3. The Victorian Government commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas where service availability from any provider may stand ahead of competition considerations.
4. Local governments and the Regional Partnership seek to influence 5G rollout by creating a list of high-demand priority locations.
5. The Victorian Government examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand areas.
6. Local governments and the Regional Partnership should compile a list of significant regional events where capacity problems exist and tender for one mobile operator to provide a region-wide multi-carrier mobile solution.

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 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 blackspots
- 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 travelers). 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 3-5 years – where supply is expected to be without further state government intervention relative to where the region needs to be in 3-5 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 and 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 on 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 Central Highlands digital plan relates to the high-level city-country digital divide and simply acknowledges and discusses the locally-based digital divide issue.

The digital divide between regional Victorian 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 RMIT-Swinburne-Telstra-Roy Morgan Digital Inclusion Index (DII) which measured these aspects in different locations. This shows a substantial gap between regional Victoria and Melbourne – rural Victoria rated 49 and Melbourne 60. The DII also shows substantial variation between and within regions.

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 the 'digital haves'.

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 available at all premises in Australia 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/copper-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 kerb (FTTC – short copper loops to premises with effective performance close to that of FTTP) and fibre to the node (FTTN – long copper loops for some customers which result in reduced service quality and inability to support the forthcoming NBN Enterprise Ethernet business grade service).[7]

What this high-level analysis does not show are 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 TFFN within fixed line technology) for network cost reasons, 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). It also includes the types and placement of modems in customer premises.

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 issues, for example through NBNCo extending its technology boundaries at the margin (possibly through co-investment initiatives) and retail service providers purchasing sufficient data capacity.

7 It is anticipated NBNCo will commence a program of shortening the length of copper loops in FTTN areas once rollout is completed in 2020.

Mobile networks provide 'untethered – on-the-move' internet access from three major and one nascent networks (TPG). 4G mobile technology is predominant in the region, but some pockets of 3G coverage remain where mobile services will fall short of household and business user needs. 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 carriers as the starting point for analysis – better data held by the carriers 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 carriers 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 carriers 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.

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 or 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.[8] Free public WiFi is typically provided by local governments for, disadvantaged citizens, the wider public and visitors in larger cities and towns.[9] Local government WiFi networks also support Smart City applications.

8 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.

9 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.

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 every-day 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 needed 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 NBNCo 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 may not provide the same value-for-money as an equivalent fixed line NBN service.

Similarly, an equally-priced mobile service will be lower value-for-money for regional users that frequently experience blackspots and service degraded service.[10]

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 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.

10 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.

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, carriers. 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. The options for action listed draw on analysis in the companion *Common Themes* report.

Options for addressing skills shortfalls are not developed in detail in this version of the Digital Plan due our 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.[11]

Affordability solutions are not addressed in this first-generation digital plan with collection and analysis and analysis of data 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 state government use 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.

11 Involving the Department of Education and Training.

Glossary

ABS: Australian Bureau of Statistics

ACCC: Australian Competition and Consumer Commission

Cat-M1: [See RE note 2/8/18]

CPCP: Victorian Government $45 million Connecting Regional Partnerships Program

DEDJTR: Department of Economic Development, Jobs, Transport and Resources (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 kerb NBN fixed line technology – also 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 connective 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

NBNCo: 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

VMP3: Victoria Mobile Program: Round 3i

WiFi: Free public WiFi service – for resident and visitor mobile access in public places and some neighbourhoods

1 Central Highlands General Characteristics

1.1 THE LAND AND THE PEOPLE

Key features are:

- West of and adjoining Greater Melbourne
- Approximately 15,000 km^2 (relatively small)
- Population 195,000 (2017) – population density 13 residents /km^2 (high for regional Victoria)
- Six local government areas (LGAs) – Ballarat (population 106,000), Moorabool (33,000), Golden Plains (22,000), Hepburn (16,000), Ararat (12,000) and Pyrenees (7,000)
- Main cities and towns: Ballarat (100,000, over half of the region's population), Bacchus Marsh (20,000), Ararat (8,000), Bannockburn (5,000) – 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: 31% of population <25 years, 51% 25-64, 18% 65+ – relatively young (30:50:20 average)
- Education: 36% of the population have post-secondary qualifications – higher than regional average (34%)
- Income: average income for workers $41,000 – close to regional Victoria average of $40,000
- Unemployment: 6.3% total, 12.9% youth – higher than regional average (5.9% total, 11.5% youth)
- Digital inclusion: mid-ranked on the RMIT-Swinburne-Telstra Digital Inclusion Index[12]
- Overall socio-economic disadvantage: second least disadvantaged region on ABS SEIFA score[13].

Some of the more noteworthy variations across the region are demonstrated in the charts on page 49 – orange denotes the stand-out LGAs.

Notably, the residents of the Ararat and Pyrenees LGAs are on average older, 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 and are at risk of being left behind on digital development.

1.3 THE ECONOMY

Gross Regional Product (GRP) $8 billion (mid-sized), with relatively strong growth over the past 10 years (1.6% p.a., in line with population growth) compared to 0.5% p.a. for total regional Victoria.

Seven industries make up two-thirds of Central Highlands employment:

- Health/social care (15% of jobs), education & training (10%), construction (10%)
- Tourism (9%), manufacturing (8%), public administration & safety (7%)
- Agriculture/forestry (5%).

Central Highlands residents are employed across occupational categories as follows:

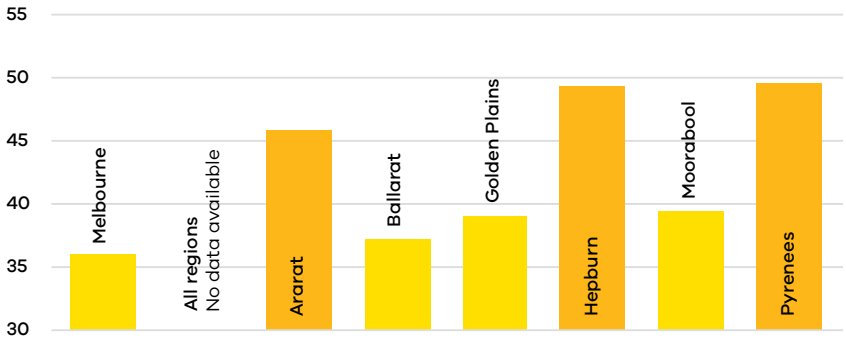
- Professional (19% of residents), technical & trades (15%), managers (13%)
- Clerical & administration (13%), Community & personal services (12%)
- Labourers (11), sales (10%), machinery operators & drivers (7%)

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

12 Measuring Australia's Digital Divide – the Australian Digital Inclusion Index 2017
13 ABS Socio-economic Index for Australia: SEIFA

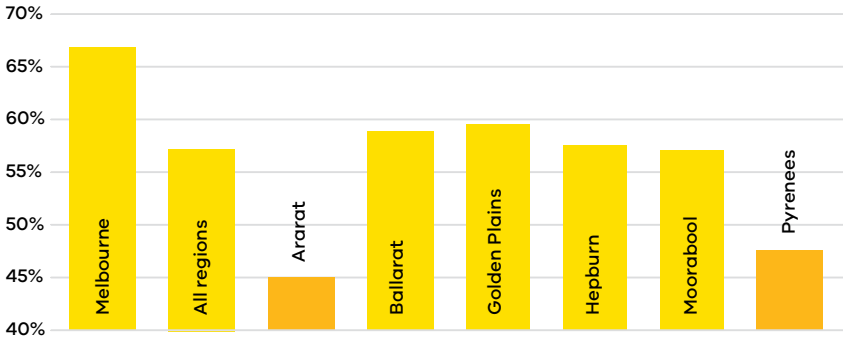
Median Age by LGA

Figure 9



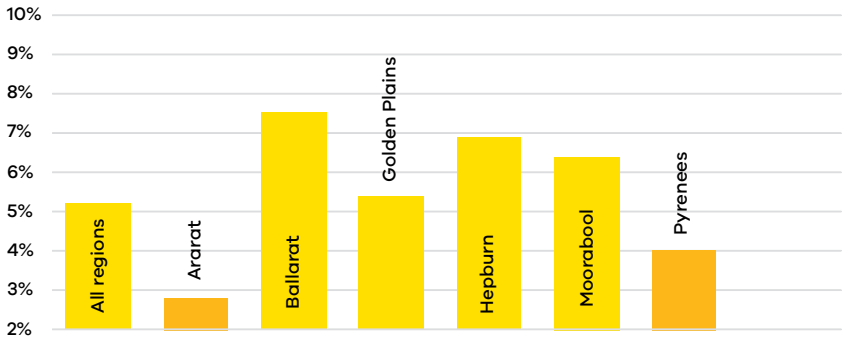
Year 12 completion by LGA

Figure 10



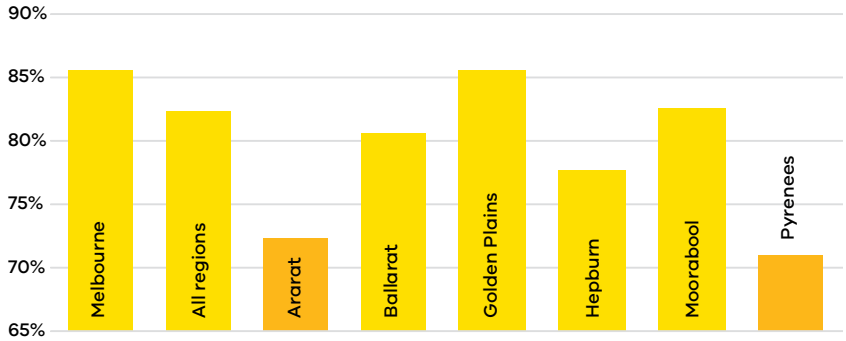
Hi-tech employment by LGA

Figure 11



Home internet access by LGA

Figure 12



1.4 STRUCTURAL CHANGE

Three of the top employment industries have grown strongly over the past 10 years and are forecast to continue to do so – health, education and tourism. Conversely, employment in two industries making up fewer jobs has fallen over the past decade and is forecast to contract or grow only slowly over the next 5 years – manufacturing and agriculture. This suggests the more important industries to embrace digital opportunities are health, education and tourism – to step up to a higher level of digital intensity over the next 5 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 are amongst the leading sectors, suggesting these industries being capital rather than labor intensive 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 5 years to be competitive in Australia and internationally.

1.5 DIGITAL INTENSITY – NOW AND IN 3-5 YEARS[14]

INDUSTRY	DIGITAL INTENSITY NOW (CURRENT PRACTICE)		DIGITAL INTENSITY NEEDED IN 3-5 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 and mobile connectivity	🟡	Fixed & mobile connectivity, digital models
Tourism	🔴	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	🟢	Wide narrowband and broadband IoT access, apps and skills for intensive and broadacre horticulture, cropping & livestock

Legend 🔴 Low 🟡 Medium 🟢 High

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

1.6 GENERAL CHARACTERISTICS INFORMING DIGITAL PLANNING

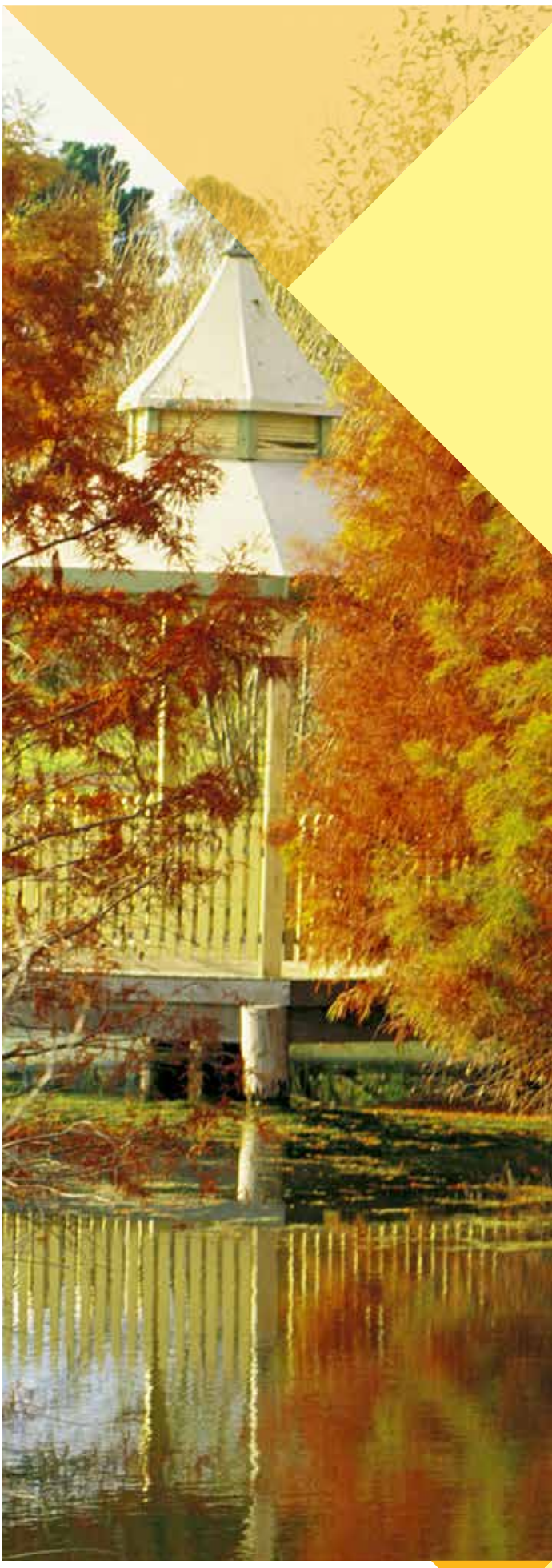
The Central Highlands region has substantial LGA diversity in size, population, population density, age and industry sectors supporting employment. This diversity is further revealed from analysis of more specific region and LGA characteristics including:

- LGA area and population – Ballarat LGA has a population of 106,000, over half the region's population although it is the smallest LGA in the region covering 743 km^2. In contrast, the Pyrenees LGA has a population of 7,000 and is one of the largest LGAs in the region covering 3,433 km^2.
- Population density – differs widely across the region from 140 residents per square kilometre for Ballart LGA down to two for Pyrenees LGA.
- Median Age – differs significantly across the region from 37 in Ballart to just below 50 in Hepburn and the Pyrenees.
- Industry sectors supporting employment – seven industries make up two thirds of Central Highlands employment with these being dispersed across the region.

Analysis of the digital intensity requirements of the seven industries supporting 70 percent of the Central Highlands workforce reveals that five of the industries will rely more heavily on digital capability 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 Central Highlands 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 (Figure 13) shows NBN coverage of the Central Highlands region as advised by NBNCo in September 2018.

Areas served with NBN Fixed Line technologies (FTTP, FTTC, FTTB and FTTN) represent less than 2% of the land area in the region. Many of these locations are discussed in Section 3.

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 NBNCo's access technologies – satellite coverage.

Also visible at this scale are the areas where Fixed Wireless has been deployed (spotted/dark purple) or will be deployed (spotted/brown) and some of the larger population centres where FTTP, FTTN, FTTB or FTTC is due to be deployed (also spotted/brown).

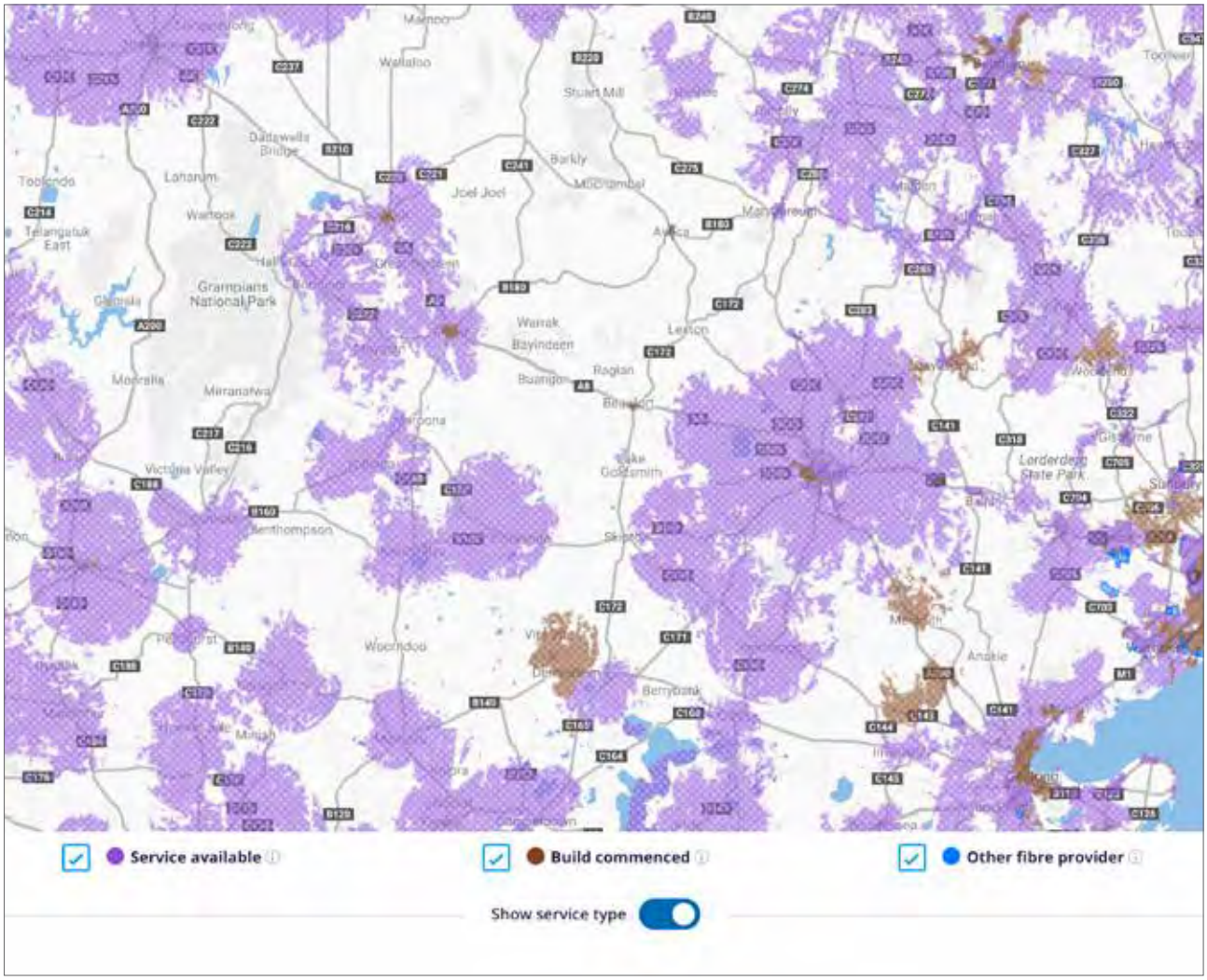
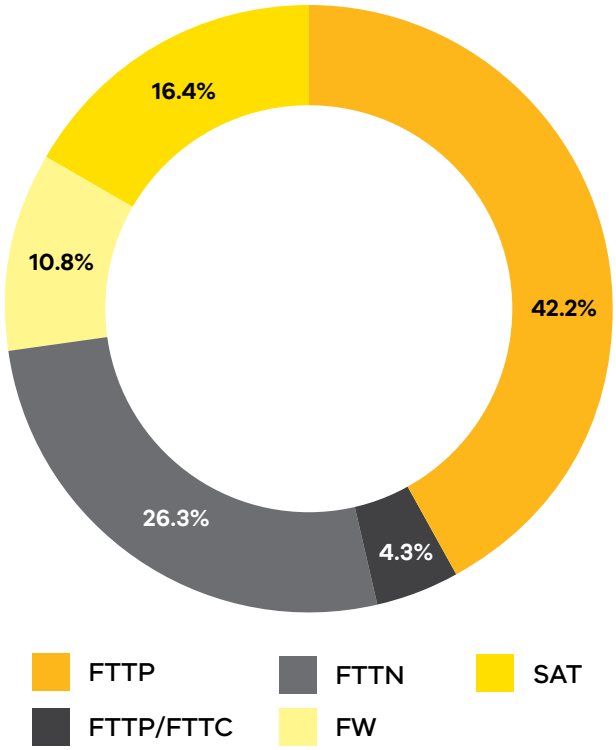


Figure 13 An Overview of NBN Technology Coverage of the Central Highlands Region (NBNCo)

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 NBNCo's present or planned use of these technologies for each LGA (noting the figures for Ballarat are distorted (favourably) by the comparatively small size of the region; and the Pyrenees LGA has very little fixed wireless coverage.

LGA	AREA (KM²)	NBN TECHNOLOGY (% AREA) FW	SAT
Ararat	4,230	20.31	79.45
Ballarat	740	32.22	55.64
Golden Plains	2,704	18.28	81.26
Hepburn	1,470	16.62	81.87
Moorabool	2,110	21.30	77.48
Pyrenees	3,433	0.71	99.09
Region (km²)	**14,687**	**2,310**	**12,210**

Figure 14 Businesses served by different NBN technologies



Coverage of businesses

Across the Central Highlands region, there are 5,882 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. The distinction between FTTP/FTTC and FTTN is relevant for businesses as not all premises served by FTTN will have access to the forthcoming NBN Enterprise ethernet business grade service due to loop lengths.

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

LGA	NO. BUS.	APPROXIMATE COVERAGE (%) FTTP	FTTB FTTC	FTTN	FW	SAT
Ararat	434	0.92	15.21	41.01	19.35	80.7
Ballarat	3,313	58.77	3.62	27.56	5.55	36.6
Golden Plains	468	0.21		20.09	30.98	81.4
Hepburn	524	13.55		45.23	16.79	31.3
Moorabool	898	51.4		9.35	14.92	26.8
Pyrenees	245		27.76	15.92	0.41	99.6
Region (no.)	**5,882**	**2,484**	**254**	**1,545**	**636**	**963**

Coverage of dwellings

NBNCo's use of different technologies to service particular residential areas can be 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[15] addresses *(see important qualification in footnote)* that lie within residential-zoned areas. The key technology distinctions here are between fixed line (FTTP/FTTC and FTTN), fixed wireless and satellite NBN access as household access to any fixed line technology places them on par with their metropolitan counterparts while access by NBN fixed wireless or satellite would provide these regional households with below-par service quality.

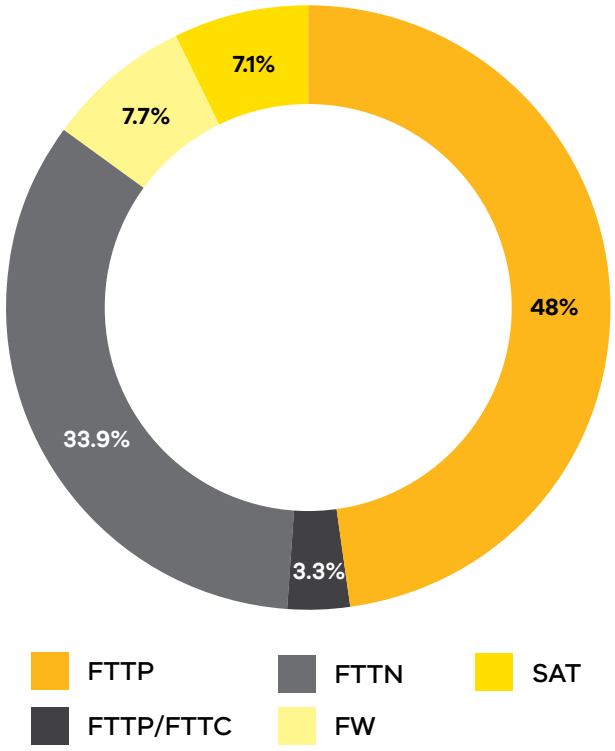


Figure 15 GNAF addresses served by different NBN technologies

		APPROXIMATE COVERAGE (%)				
LGA	NO. RES.	FTTP	FTTB FTTC	FTTN	FW	SAT
Ararat	4,113	0.29	17.82	67.18	12.42	2.29
Ballarat	53,342	56.01	2.77	35.67	2.30	3.25
Golden Plains	6,708	8.11		26.28	40.0	25.61
Hepburn	6,689	21.38		49.65	12.42	16.55
Moorabool	12,579	72.67		11.51	10.06	5.76
Pyrenees	2,011		30.88	33.17	2.64	33.31
Region (no.)	**85,542**	**41,004**	**11**	**2,821**	**28,989**	**6,047**

Whilst NBNCo's satellite solution is intended to service the most remote 3% of the population, a very much higher proportion will be reliant on it in the Golden Plains, Hepburn and Pyrenees LGAs. The overall percentage (7.1%) is also higher than the national average and could possibly be higher if the additional dwellings in farming areas were to be included.

General Notes

An important "companion" to this document is an overarching *Unmet Digital Needs: Common Themes* report that discussions common problems and potential solutions observed across regional Victoria.

The overarching report outlines the strengths and weaknesses of NBNCo's various delivery technologies. In summary:

- users in satellite areas suffer the greatest performance limitations and are most likely to find their digital future constrained by performance limitations; for such users, access to higher performing connectivity in nearby population centres may be particularly valuable; and
- some business users in FTTN areas, and all business users in fixed wireless and satellite areas will be unable to receive the forthcoming NBN Enterprise Ethernet business grade service which may limit their competitiveness, especially as needs grow into the future.

15 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.

2.1 MOBILE COVERAGE

Public Coverage Maps

Access to better mobile coverage data is currently under discussion between DEDJTR 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.

Telstra's public coverage map (Figure 16) 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% of the region. Within this coverage, the distinction between 3G and 4G technology is important as the network demands of user applications increasingly demand 4G technology for full functionality.

The Optus public coverage map (Figure 17) 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% of the landmass, comparable to Telstra.

The most noteworthy gap evident in both Telstra and Optus coverage is in the area of the Grampians. Smaller coverage gaps are scattered across the region, most commonly in areas of hilly terrain.

As for Optus, Vodafone's public coverage map (Figure 18) is based on using a nominated device, and for comparison with the Optus map, an iPhone6 has been assumed.

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.

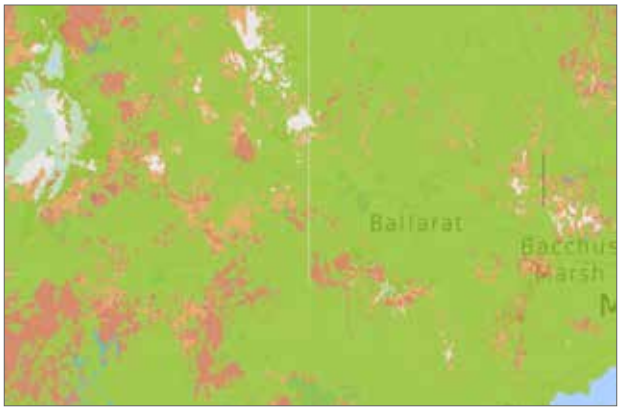


Figure 16 Telstra Public Coverage Map of Central Highlands Region

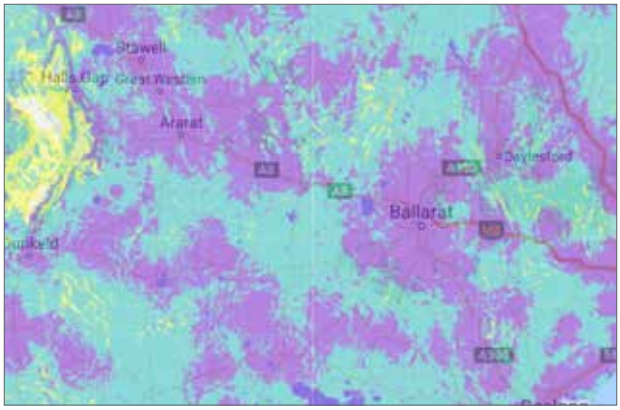


Figure 17 Optus Public Coverage Map of Central Highlands Region

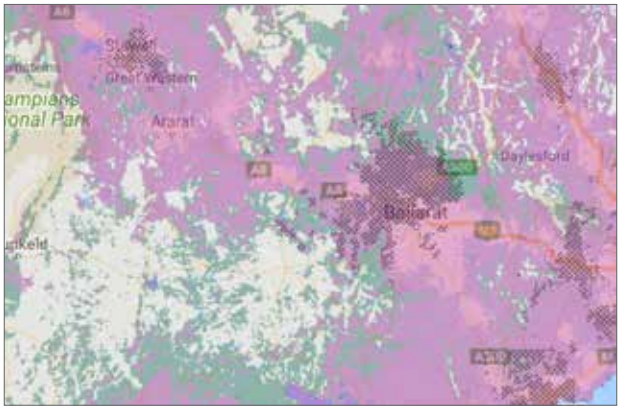


Figure 18 Vodafone Public Coverage Map of Central Highlands Region

Crowd-sourced Coverage Information

In practice, the public coverage maps provided by the carriers 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[16] application and database, and a sample of the maps produced from these sources (in this case, in the area of Ararat) see (Figure 19). These applications can provide useful insights into (especially) transport blackspots – but are less useful in assessing wide area coverage because of the difficulties of testing everywhere.

The use of these applications by stakeholders (such as local government staff) may be valuable in building evidence of transport 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 Governments Blackspot Programs (Victorian Mobile Project).

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

Figure 19 OpenSignal Mapping of Coverage around Ararat

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 and new features of particular relevance to "Internet of Things" (IoT) applications. These capabilities are discussed more fully in the overarching report.

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 5 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 Australian Government responded with the NBN initiative to a growing divide between urban and rural areas. In urban areas, high population densities and concentrated consumer spending attracted network investment and competition. In addition, Telstra was required to grant other carriers 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 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% – as a consequence of comparatively high population densities.

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

It is not realistic to expect 100% coverage of Australia's vast land-mass. 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; and
- as a supplement (or alternative) to a fixed broadband service, especially in areas served only by NBNCo'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 carriers.

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 challenges of extending mobile coverage into areas that don't deliver adequate investment returns to the MNOs are discussed in the overarching report – along with potential solutions that highlight the benefits of establishing a monopoly provider in "uneconomic" areas.

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 that 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.

2.2 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 three main providers of LP-WAN technology coverage are:

- NNNCo, with LoRaWAN technology; LoRa is a two-way protocol; at this stage, no information about coverage is 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 the three main 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.

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.

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 are 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[17]. The map (Figure 20) shows coverage in the Central Highlands Region in blue. In contrast to the Taggle map (Figure 21), the Sigfox map appears to take account of topographic occlusions – as evidenced by the irregular patterns of coverage at the fringes of coverage areas.

Based on this map, there may be some coverage around the fringes of the Central Highlands 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.

2.3 OTHER CONNECTIVITY OPTIONS

Due to data constraints, the digital supply analysis documented in the subsequent sections of this Digital Plan does not systematically cover the presence of access networks that compete with the NBN, and in particular have the capacity to deliver business grade services equivalent to the NBN Enterprise Ethernet business grade service. Anecdotal evidence suggests, however, that competing networks with this capability do not exist to any material extent in the Central Highlands.

Regarding backhaul infrastructure, 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 others may be able to offer connectivity solutions for a wide range of purposes. Details of their infrastructure are currently not available in SLIM.

2.4 SLIM ANALYSIS

Whilst various 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.

Figure 20 Sigfox Coverage of Central Highlands Region.

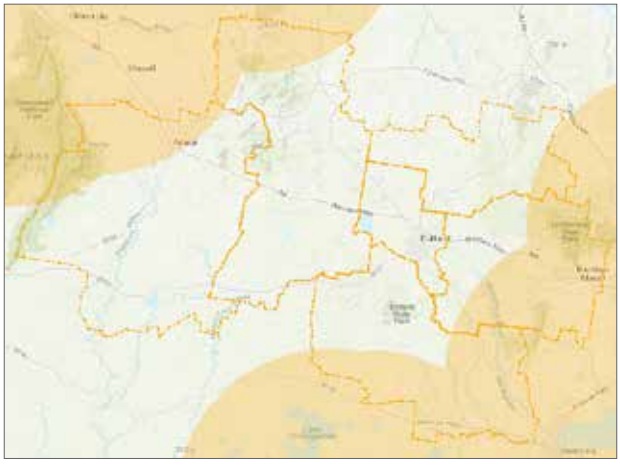


Figure 21 Taggle Coverage of the Central Highlands Region (SLIM)

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

3 Significant Places

The 15 places selected for analysis in this section include all cities (population[18] > 10,000), all towns (population > 1,000) and the larger localities (population <1000) in each LGA that makes up the region.

In combination, the 15 places accommodate 71.6% of the region's population of 192,562 individuals). 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 region is home to another 13 localities with populations of between 185 and 1,000 – in combination representing another 2.8% of the population in the region.

Whilst these places are not covered in the analysis, the model provided can guide further selective analysis on a case-by-case basis.

The balance of the region's population (25.6%) 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[19], this equates to an estimated 18,960 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 BALLARAT

Overview

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

- Australia's third largest inland city.
- Occupies approximately 10% of the land area of the Ballarat LGA, but its population of 93,759 represents 90.6% of the LGA's population.
- 43,988 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 52.8% being in full-time employment and 34.6% in part-time employment.
- 10.4% of the labour force classified themselves as managers, 21.9% as professionals and 12.5% as clerical and administrative workers.
- Ballarat's growth plan envisages substantial expansion, mostly to the West over coming years.
- The city is home to Federation University and one of Victoria's ten technical schools (only four of which are in regional Victoria).
- Many of the LGA's 46 Primary and Secondary schools are located in the city.
- The city has three hospitals (two public and one private).
- Ballarat is home to a large number of commercial and industrial businesses, government agencies and small to medium enterprises.
- With a median age of 37, Ballarat has one of the youngest populations in regional Victoria.
- The ABS reports a median annual household income of $59.1K for Ballarat City, significantly below the $80.4K reported for Greater Melbourne.
- Data in SLIM on businesses registered with WorkCover indicates approximately 3,000 businesses in the city or its near surrounds.
- In 80.2% of dwellings, at least one person accessed the internet from home.

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

19 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).

Skills

ABS Census data indicates:

- 27.3% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.5% have completed level III or IV trade certificates; and
- another 13.9% have completed year 12.

On the Digital Inclusion Index, the Ballarat LGA was awarded an overall digital ability score of **47.1** based on the following two components:

- a score of **49.2** for attitudes[20]; and
- a score of **53.4** for basic skills[21].

A score for Ballarat (the City as opposed to the LGA) is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that Ballarat (the LGA) had 7.5% employment in the industry sectors with strong technology exposure[22] – the highest in regional Victoria.

Fixed Broadband

Ballarat was one of the first areas to be targeted in the NBN rollout, and large areas of the city benefited from the deployment of FTTP[23] prior to the change of Government in 2013 and the decision to adopt additional technologies in the NBN deployment – the "Mixed Technology Mode".

The map (Figure 22) shows the status of the NBN rollout in Ballarat as advised by NBNCo 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 reveals that Ballarat will receive a mix of NBN FTTP, FTTN, FTTC with Fixed Wireless and pockets of Satellite surrounding the city. Generally, NBN FTTP will service premises in the CBD and east and south of the city. NBN FTTN will service premises in the cities west. NBN FTTP will also service Ballarat's new developments generally on the perimeter of the town. Based on simple estimation, approximately 60% of the city is serviced by FTTP technology; and 40% of the city is serviced by FTTN technology (including some small pockets of FTTC).

With the coverage of Ballarat split into two distinct technology classes, there is clearly potential for a "digital divide" to form between those parts of the city served by FTTP/FTTC technology, and those parts served by FTTN technology.

The abundance of FTTP/FTTC areas within the city means that users with more demanding requirements than can be met on a long-run FTTN connection have alternatives – albeit at the potential cost of moving to a new location.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX 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.

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20 **Attitudes** encompasses notions of control, enthusiasm, learning and confidence.

21 **Basic Skills** includes accessing content, communication, transactions, commerce, media and information.

22 The percentage with strong technology exposure is based on employment percentages in the information media & telecoms sectors, and the professional, scientific & technical sectors.

23 An overarching report discusses the strengths and limitations of the various access technologies used in the NBN deployment.

LP-WAN Coverage

LP-WAN coverage by either Taggle or Sigfox does not extend to Ballarat. LoRaWan coverage is unknown.

Optus is involved in agricultural trials being conducted as part of the CRCP in an area to the North. The coverage footprint does not extend to Ballarat.

More information on IoT coverage may be possible in the future from discussions with the providers not examined in the analysis here, most obviously NNNCo.

Public WiFi Coverage

Free public WiFi services are provided in the central business district of Ballarat and around Lake Wendouree (see map Figure 23 for WiFi base station locations).

Other

VicTrack has optical fibre connections to Ballarat from both Melbourne and Geelong. Their route into the city is shown in blue on the map (Figure 24).

Power transmission networks also transit through the city (shown in green on the map).

Of note, the power transmission network includes connections between Ballarat, Bendigo, Horsham and Geelong – four of NBNCo's regional POI locations. This creates the technical potential to aggregate NBN end-user connections from these POIs.

No details are available of optical fibre connectivity provided by other carriers between Ballarat and major centres (notably Melbourne). However, NBN POI locations were chosen to ensure the availability of at least two backhaul providers, and it is expected that a large population centre such as Ballarat would have attracted reasonable investment by additional carriers.

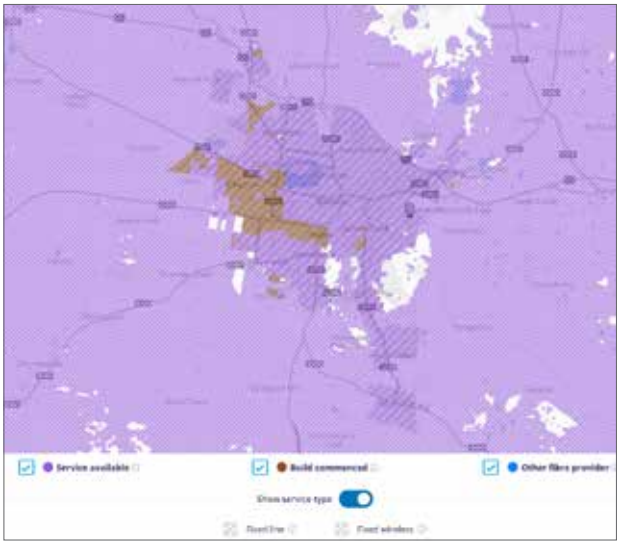


Figure 22 NBN Coverage of Ballarat (NBNCo)

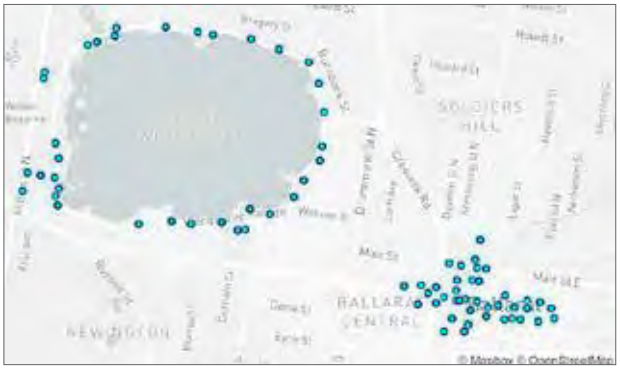


Figure 23 Location of Public WiFi Zone Base Stations

Figure 24 VicTrac Fibre (blue) and Power Transmission Networks transiting Ballarat (SLIM)

3.2 CITY OF BACCHUS MARSH

Overview

From its origins as a traditional market garden area, Bacchus Marsh has evolved to become the main commuter town in the Melbourne-Ballarat corridor

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

- The population of Bacchus Marsh grew by 34.6% over a decade to 17,302 in 2016.
- 8,318 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 58.8% being in full-time employment and 29.8% in part-time employment.
- 10.5% of the labour force classified themselves as managers, 16% as professionals and 14.3% as clerical and administrative workers.
- 7.2% of the labour force cited their industry of employment as hospitals (other than psychiatric hospitals).
- One public hospital is located in the city.
- The city has three Government and one Catholic primary schools, one Government secondary school and one independent primary/secondary school.
- With a median age of 37, Bacchus Marsh has one of the youngest populations in regional Victoria.
- The ABS reports a median annual household income of $71.7K for Bacchus Marsh, one of the highest in the region but still below Melbourne's $80.4K.
- Data in SLIM on businesses registered with WorkCover indicates approximately 500 businesses in the city or its near surrounds.
- In 83.2% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 22.6% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 20.4% have completed level III or IV trade certificates; and
- another 13.9% have completed year 12.

On the digital inclusion index, the Moorabool LGA was awarded an overall digital ability score of **44.5** based on the following two components:

- a score of **48.1** for attitudes; and
- a score of **49.6** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Moorabool LGA had 6.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 25) shows the status of the NBN rollout in Bacchus Marsh as advised by NBNCo 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 reveals that Bacchus Marsh city area will predominantly receive NBN FTTP with Fixed Wireless and pockets of Satellite west and north of the city.

Examining a satellite map of the same area shows a substantial number of premises outside the FTTP area, with some serviced by Fixed Wireless and some in the Satellite footprint.

Whilst residents in Bacchus Marsh 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 broadband coverage limiting. In addition, recent publicity has highlighted performance issues with the NBN Fixed Wireless service, culminating in NBNCo's decision to discontinue plans for a 100/40 Mbps service, at least for the time being.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX 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* and *indoor* coverage across the entire city, with new 4G 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

The network maps for both Taggle and Sigfox show Bacchus Marsh falling within coverage footprints. The availability of LoRaWAN coverage is unknown.

The NB-IOT coverage provided by Optus for an agricultural IOT trial to the North does not extend to Bacchus Marsh.

Public WiFi Coverage

There are no known public WiFi zones in Bacchus Marsh but, free WiFi access is available at the Lerderderg Library during library hours (five and a half days a week).

Access to WiFi services may be valuable for those living just a short distance from the city for whom NBN satellite connectivity is the only fixed broadband option.

Other

VicTrack fibre transits the Southern fringe of the city, following the route of the train line (see map Figure 26). Utilising spare capacity on this fibre could enable high-speed connectivity to Melbourne to the South-East or Ballarat to the South-West.

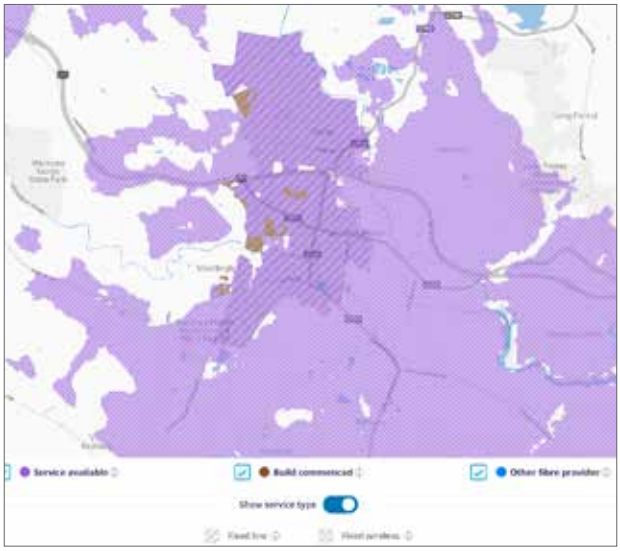


Figure 25 NBN Coverage of Bacchus Marsh (NBNCo)

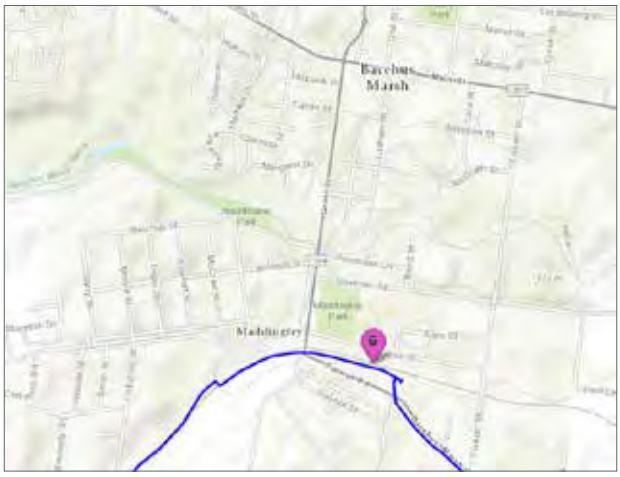


Figure 26 VicTrack fibre transiting Bacchus Marsh (SLIM)

3.3 TOWN OF ARARAT

Overview

Originally a boom town in the gold rush era, Ararat's population steadily declined from the turn of the 20th century, but has shown a small but steady increase since
the turn of the 21st century

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

- With a population of 6,925, Ararat is home to more than half of the population of the Ararat LGA.
- 3,102 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 53.8% being in full-time employment and 33.8% in part-time employment.
- 9.2% of the labour force classified themselves as managers, 13% as professionals and 8.2% as clerical and administrative workers.
- 7.3% of the labour force cited their industry of employment as correctional and detention services, 6% in meat processing, 6% in hospitals (except psychiatric hospitals) and 4.8% in electrical cable and wire manufacturing.
- One public hospital is located in the town.
- Ararat has four Government schools (three primary and one secondary) and two Catholic schools (one primary and one secondary).
- The median age of Ararat's population is 46.
- The ABS reports a median annual household income of $50.4K for Ararat, one of the lower figures in the region and well below Melbourne's $80.4K.
- Data in SLIM on businesses registered with WorkCover indicates approximately 250 businesses in the city or its near surrounds.
- In 70.1% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 17% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.9% have completed level III or IV trade certificates; and
- another 11.9% have completed year 12.

On the digital inclusion index, the Ararat LGA was awarded an overall digital ability score of **45.1** based on the following two components:

- a score of **46.8** for attitudes; and
- a score of **51.7** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that Ararat (the LGA) had 2.8% employment in the industry sectors with strong technology exposure, the lowest in the region.

Fixed Broadband

The map (Figure 27) shows the status of the NBN rollout in Ararat as advised by NBNCo in September 2018. The NBN Fixed Line deployment has not yet reached Ararat. The brown/striped areas show the locations where NBN Fixed Line services are planned or under construction, the purple/spotted areas show locations serviced by NBN Fixed Wireless services and white areas locations serviced by NBN Satellite.

Our analysis reveals that Ararat will receive a mix of NBN FTTN, FTTC and some FTTP which is planned for the precinct surrounding the golf course. NBN Fixed Wireless and small pockets of Satellite is currently servicing premises surrounding the town.

Examining a satellite map of the same area shows a large number of premises in the fixed wireless footprint.

The prospective availability of an FTTP precinct creates the possibility for those with demanding connectivity requirements to obtain a superior service – albeit at the possible cost of moving premises.

Mobile Coverage

Based on public coverage maps:

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

Network maps provided by Taggle show Ararat located at the fringe of the Taggle coverage footprint. Sigfox coverage does not appear to be available, and LoRaWAN coverage is unknown.

The coverage footprint of an Optus NB-IOT service supporting agricultural trials to the North does not extend to Ararat.

Public WiFi Coverage

There are no known public WiFi zones in Ararat, but free WiFi access (lasting a year from registration) is available at the library (open two and a half days a week). Some of the accommodation venues also offer free WiFi to guests.

Other

Power transmission networks also transit to the North of the city (shown in green on the map Figure 28).

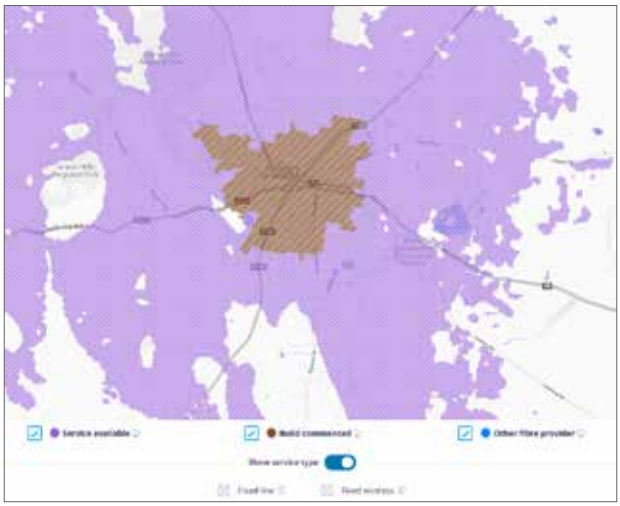


Figure 27 NBN Coverage of Ararat (NBNCo)

Figure 28 Power Transmission Network near Ararat (SLIM)

3.4 TOWN OF BANNOCKBURN

Overview

Originally a coaching stop on the route from the port of Geelong to the goldfields, Bannockburn is now a growing population centre on the outskirts of Geelong and within commuting distance of Melbourne.

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

- The town has a population of 5,001, with a further 282 in the near surrounds.
- 2,420 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 58.6% being in full-time employment and 31.7% in part-time employment.
- 19.6% of the labour force classified themselves as managers, 14.7% as professionals and 13.3% as clerical and administrative workers.
- 5% of the labour force cited their industry of employment as hospitals, 2.9% in local government administration and 2.8% in primary education.
- The town has no hospital.
- Bannockburn has a Government school. catering for primary and secondary education.
- The median age of Bannockburn's population is 34.
- The ABS reports a median annual household income of $86.1K for Bannockburn, one of the highest figures in the region, above Melbourne's $80.4K.
- Data in SLIM on businesses registered with workcover indicates approximately 150 businesses in the city or its near surrounds.
- In 89.2% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 23.1% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 25.3% have completed level III or IV trade certificates; and
- another 13.7% have completed year 12.

On the digital inclusion index, the Golden Plains LGA was awarded an overall digital ability score of **44.0** based on the following two components:

- a score of **47.4** for attitudes; and
- a score of **49.2** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that Golden Plains LGA had 5.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 29) shows the status of the NBN rollout in Bannockburn as advised by NBNCo 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 the bulk of Bannockburn is serviced with FTTN technology, with pockets of FTTP in new development areas on the fringes of the town. Fixed Wireless coverage exists to the south-east and is planned for the north-west. Premises in the immediate surrounds of the town are provided with satellite coverage only.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX coverage (with a typical download speed of 2-75 Mbps) across the entire town and its surrounds.
- Optus shows 4G Plus *outdoor* coverage most of the town, with some parts of the town and much of the surrounding area limited to outdoor 3G coverage.
- Vodafone shows 4G *indoor* and *outdoor* coverage across much of the 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

The network maps for both Taggle and Sigfox show Bannockburn falling towards the fringes of current coverage footprints, so field testing may be required to confirm connectivity. The availability of LoRaWAN coverage is unknown.

The coverage footprint of an Optus NB-IOT service supporting agricultural trials to the North does not extend to Bannockburn.

Public WiFi Coverage

There are no known public WiFi zones in Bannockburn, but free 24/7 WiFi access is available to members at the Bannockburn library (open five and a half days a week).

Other

Bannockburn is not on the VicTrack fibre route. However, the power transmission network passes the Southern fringe of the town (route shown in green in the satellite image Figure 30).

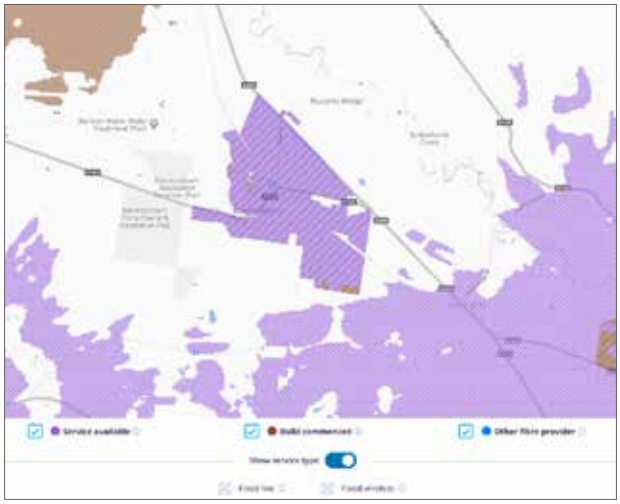


Figure 29 NBN Coverage of Bannockburn (NBNCo)

Figure 30 Power Transmission Network (SLIM)

3.5 TOWN OF DAYLESFORD-HEPBURN SPRINGS

Overview

Originally a gold mining town, Daylesford (108 km to the North-West of Melbourne) is now a well-known tourist destination featuring numerous spas, restaurants, galleries and B&B accommodation options.

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

- The broader area, including Hepburn Springs to the North, is known for its natural mineral spring spas and is the location of over 80% of Australia's effervescent mineral water reserve.
- The town has a population of 3,422, with a large number living in the near surrounds.
- 1,548 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 44.7% being in full-time employment and 43.5% in part-time employment.
- 15.4% of the labour force classified themselves as managers, 19.5% as professionals and 9.4% as clerical and administrative workers.
- Highlighting the strength of the tourism industry, 8.3% of the labour force cited their industry of employment as accommodation, 4.8% as restaurants and cafes and 3.3% as pubs, taverns and bars – cumulatively 16.4% of the employment base.
- 4.5% work in hospitals (except psychiatric hospitals) and another 3.3% in allied health services.
- Daylesford has a public hospital that serves the region.
- Government primary schools are located in Daylesford and Hepburn, and a government secondary school in Daylesford. Daylesford is also host to one catholic and one independent primary school.
- The median age of Daylesford-Hepburn Springs's population is 51 – substantially higher than many other locations.
- The ABS reports a median annual household income of $50.0K for Daylesford-Hepburn Springs, well below Melbourne's $80.4K.
- Data in SLIM on businesses registered with workcover indicates approximately 210 businesses in the Daylesford-Hepburn Springs or the near surrounds.
- In 76.5% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 34.2% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 13.3% have completed level III or IV trade certificates; and
- another 11.7% have completed year 12.

On the digital inclusion index, the Hepburn LGA was awarded an overall digital ability score of **45.1** based on the following two components:

- a score of **47.7** for attitudes; and
- a score of **51.1** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Hepburn LGA had 6.9% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 31) shows the status of the NBN rollout in Daylesford-Hepburn Springs as advised by NBNCo 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/spotted areas show the locations where NBN Fixed Wireless services are planned or under construction.

Our analysis shows the bulk of Daylesford-Hepburn Springs serviced entirely with FTTN technology. Fixed Wireless coverage is planned for the area to the south-east, with Satellite coverage to the north-west.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX coverage (with a typical download speed of 2-75 Mbps) across the entire town and its surrounds.
- Optus shows 4G Plus *outdoor* coverage across the entire town and its surrounds.
- Vodafone shows 4G *indoor* coverage over some parts of the town only (Figure 32).

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

Neither Taggle and Sigfox network maps show LP-WAN coverage of Daylesford-Hepburn Springs, though both appear to have marginal coverage around 25 kms to the East.

The coverage footprint of an Optus NB-IOT service supporting agricultural trials to the North does not extend to Daylesford-Hepburn Springs.

Public WiFi Coverage

There are no known public WiFi zones in Daylesford-Hepburn Springs, but many of the accommodation venues offer free WiFi to guests as part of their tariff.

Other

Daylesford-Hepburn Springs is not on the VicTrack fibre route, and the power transmission network passes to the West of the town.

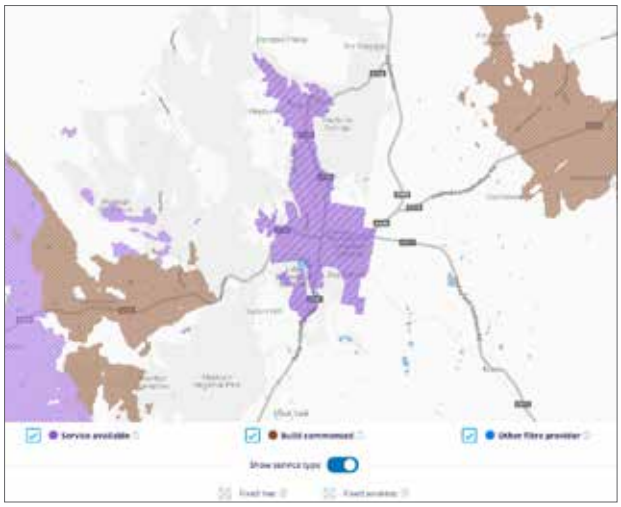


Figure 31 NBN Coverage of Daylesford-Hepburn Springs (NBNCo)

Figure 32 Vodafone Coverage of Daylesford-Hepburn Springs

3.6 TOWN OF CRESWICK

Overview

Originally a gold mining town with a peak population of 25,000, Creswick (129 km to the North-West of Melbourne) is the centre of an agricultural area.

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

- The town has a population of 2,742, with large number living within a few kilometres of the town boundaries in small hamlets or on small acreages.
- 1,029 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 51.3% being in full-time employment and 33% in part-time employment.
- 10% of the labour force classified themselves as managers, 14.5% as professionals and 12.4% as clerical and administrative workers.
- 6.6% work in hospitals (except psychiatric hospitals) and another 4.3% in aged care residential services – a combined total of 10.9% of employment.
- Creswick has a public hospital that serves the region.
- Creswick has three primary schools – two Government and one Catholic; the nearest secondary schools are in Ballarat some 20 kms to the South.
- The median age of Creswick's population is 49 –higher than many other locations.
- The ABS reports a median annual household income of $48K for Creswick, well below Melbourne's $80.4K.
- Data in SLIM on businesses registered with workcover indicates approximately 65 businesses in the Creswick or the near surrounds.
- In 73.5% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 22.7% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 19.3% have completed level III or IV trade certificates; and
- another 9.5% have completed year 12.

On the digital inclusion index, the Hepburn LGA was awarded an overall digital ability score of **45.1** based on the following two components:

- a score of **47.7** for attitudes; and
- a score of **51.1** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Hepburn LGA had 6.9% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 33) shows the status of the NBN rollout in Creswick as advised by NBNCo 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 the entire town of Creswick is served by FTTP technology. Fixed Wireless is deployed around the town, but coverage to the south-east (where there is low population density) is patchy.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX 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 town, and 4G outdoor coverage in the town.

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

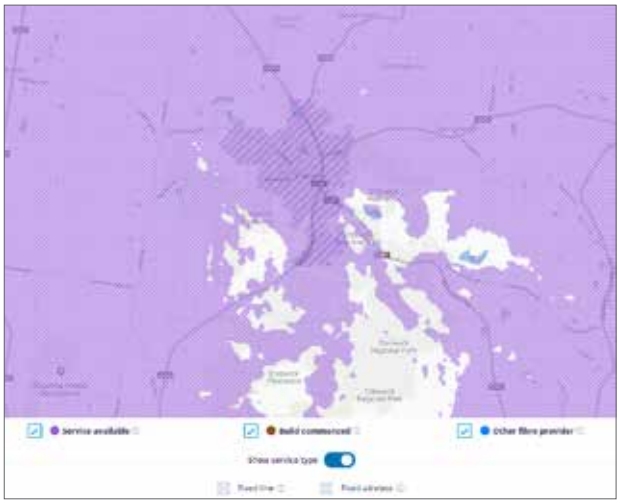


Figure 33 NBN Coverage of Creswick (NBNCo)

LP-WAN Coverage

None of the three key LP-WAN network providers currently offers coverage of Creswick.

Optus is involved in agricultural trials being conducted as part of the CRCP, but its coverage footprint does not extend to Creswick.

Public WiFi Coverage

There are no known public WiFi zones in Creswick, but some of the bed-and-breakfast venues offer free WiFi to guests as part of their tariff. Free WiFi is also available at the Creswick library (open five and a half days a week).

Fieldwork that is being undertaken may ascertain the availability and extent of publicly accessible WiFi options.

Other

Creswick is not on the VicTrack fibre route, and the power transmission network passes approximately 20kms to both the East and the West of the town.

3.7 TOWN OF BALLAN

Overview

During the Victorian Gold Rush era, Ballan (78 kms to the North-West of Melbourne) was a staging post for coaches travelling to the Ballarat goldfields.

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

- The town has a population of 2,290, with another 695 living within a few kilometres of the town boundaries in small hamlets or on small acreages.
- 1,348 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 55.5% being in full-time employment and 31.8% in part-time employment
- 12.5% of the labour force classified themselves as managers, 18.2% as professionals and 14.4% as clerical and administrative workers.
- 5.3% work in hospitals (except psychiatric hospitals), 3.4% in local government administration and 3.0% in primary education.
- Ballan has a public hospital that serves the region.
- Ballan has Government and one Catholic primary school; the nearest secondary schools are in Bacchus Marsh some 24 kms to the South-East.
- The median age of Ballan's population is 43.
- The ABS reports a median annual household income of $65.6K for Ballan, below Melbourne's $80.4K.
- Data in SLIM on businesses registered with workcover indicates approximately 515 businesses in Ballan or its near surrounds.
- In 75.9% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 22.7% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 19.3% have completed level III or IV trade certificates; and
- another 9.5% have completed year 12.

On the digital inclusion index, the Hepburn LGA was awarded an overall digital ability score of **45.1** based on the following two components:

- a score of **47.7** for attitudes; and
- a score of **51.1** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Moorabool LGA had 6.9% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 34) shows the status of the NBN rollout in Ballan as advised by NBNCo 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 the entire town of Ballan is served by FTTN technology except for a very small pocket of FTTP in a small housing development estate. The availability of some FTTP provisioned housing does potentially give residents with demanding connectivity needs a high-performance option, albeit at the expense of relocating to a new home.

The area surrounding Ballan has some patchy Fixed Wireless coverage to the west and south of the town. Further Fixed Wireless coverage is planned in the Ballan area, but it is likely that coverage will be also patchy. As a result, many of those living just outside the FTTN footprint will be covered and have access to NBN Satellite.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX 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 town.

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

Ballan sits at the very limits of Sigfox and Taggle coverage to the South East. Field tests may be needed to confirm connectivity (having regard to topographic occlusions).

The availability of LoRaWAN coverage is unknown at this stage.

Optus is involved in agricultural trials being conducted as part of the CRCP, but its coverage footprint does not extend to Ballan.

Public WiFi Coverage

There are no known public WiFi zones in Ballan, but some of the bed-and-breakfast venues offer free WiFi to guests as part of their tariff. Free WiFi is also available at the Ballan library (open Fridays, and mornings on Wednesday and Saturday).

Fieldwork that is being undertaken may ascertain the availability and extent of publicly accessible WiFi options.

Other

Ballan is on the VicTrack fibre route, creating the potential for enhanced connectivity to both Melbourne and Ballarat (Figure 35).

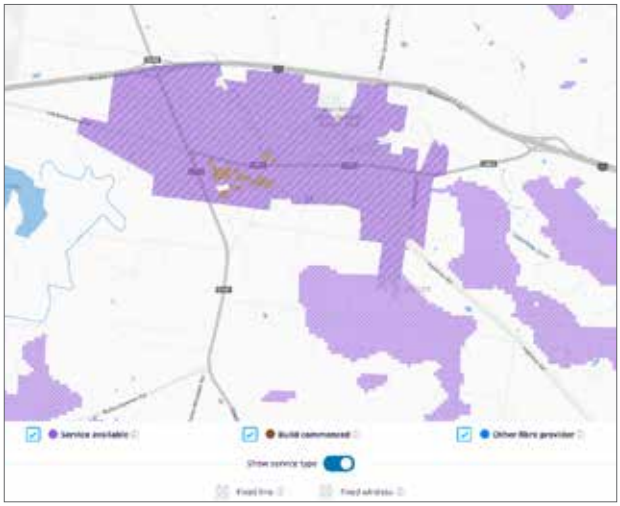


Figure 34 NBN Coverage of Ballan (NBNCo)

Figure 35 VicTrack Fibre Route to the South of Ballan (SLIM)

3.8 TOWN OF CLUNES

Overview

Clunes (36 kms north of Ballarat) is an historical gold-mining village, the site of the first registered gold discovery in Victoria in 1851. It has a strong tourism sector with historical buildings, bushwalking, prospecting, fine wining and dining, as well the annual, internationally recognised, *Booktown Festival*.

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

- The town has a population of 1,426, with another 302 living in the immediate surrounds.
- The median age of Clunes's population is 50, above the Melbourne median of 36.
- The ABS reports a median annual household income of $46.6K for Clunes, well below Melbourne's $80.4K. Their median expenditure on mortgages and rents are 60% and 57% of Melbourne's.
- 534 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 41.8% being in full-time employment and 40.6% in part-time employment.
- 10.7% of the labour force classified themselves as managers, 19.7% as professionals and 10.3% as clerical and administrative workers.
- The top three industries identified in the Census shows 5.5% worked in hospitals (except psychiatric hospitals), 4.5% in Aged Care Residential Services, and 6.2% in education (primary and secondary).
- There is a medical centre in Clunes, but the nearest hospitals are in Creswick (18km) and Ballarat (36km).
- Clunes has one Government primary school, with a 10Mb/s service for their 143 students; the nearest secondary schools and university campuses are in Ballarat (36km).
- Data in SLIM on businesses registered with workcover indicates approximately 43 businesses in Clunes or its near surrounds.
- In 86.9% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 22.7% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 16.4% have completed level III or IV trade certificates; and
- another 12.9% have completed year 12.

On the digital inclusion index, the Hepburn LGA was awarded an overall digital ability score of **45.1** based on the following two components:

- a score of **47.7** for attitudes; and
- a score of **51.1** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Hepburn LGA had 6.9% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 36) shows the status of the NBN rollout in Clunes as advised by NBNCo 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 (Figure 37).

Our analysis shows the main town area of Clunes is provisioned with NBN FTTN. There is some very sparse Fixed Wireless coverage to the south-east of Clunes. No other NBN technologies appear to be planned for that area.

Other areas surrounding the Clunes township will rely on NBN Satellite services. A cluster of dwellings immediately to the north-west of Clunes appear to miss out on FTTN, despite their proximity to the town.

Mobile Coverage

Based on public coverage maps:

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

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

Taggle's coverage to the South-East does not extend to Clunes, and maps published by Sigfox also indicate no coverage.

The public coverage maps provided by Sigfox indicate that Clunes is outside their current coverage area.

The availability of LoRa coverage is unknown at this stage.

Public WiFi Coverage

There are no known public WiFi zones in Clunes, but some of the bed-and-breakfast venues offer free WiFi to guests as part of their tariff. Free WiFi is available at the Clunes library (open most weekdays, and parts of the weekend, subject to volunteer availability).

Other

Clunes has a Victorian Police communications tower which could be used to provide dedicated high-speed point-to-point wireless links to key locations within the locality. There is also a "Clunes Data Centre" identified in SLIM, served with a 50Mb/s service.

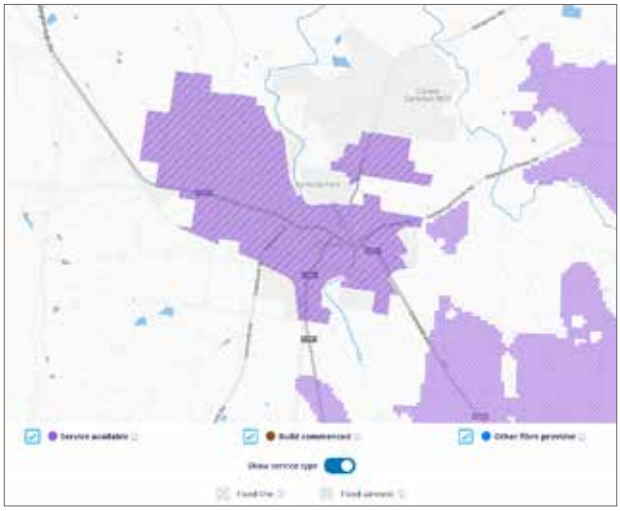


Figure 36 NBN Coverage of Clunes (NBNCo)

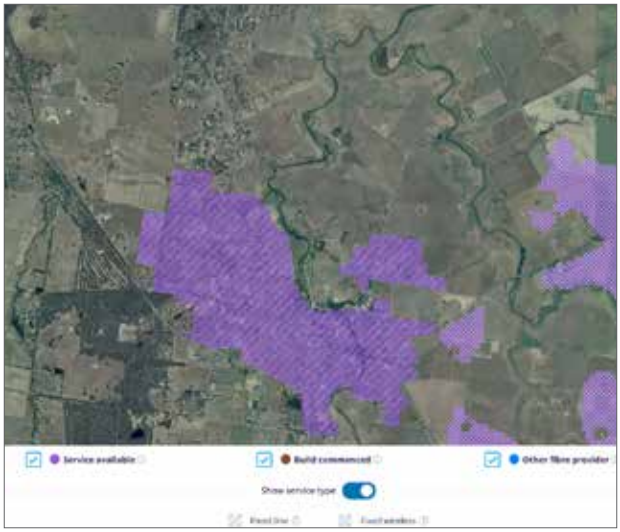


Figure 37 NBN Satellite Coverage of Clunes (NBNCo)

3.9 TOWN OF TEESDALE

Overview

Located around 35 kilometres West of Geelong Teesdale has gained popularity among young homebuyers prepared to commute to Geelong Geelong, with larger rural parcels of land adding to its popularity.

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

- The town has a population of 1,664, with another 57 on the fringes of the town.
- 895 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 55.8% being in full-time employment and 34.2% in part-time employment
- 11.5% of the labour force classified themselves as managers, 16.8% as professionals and 11.4% as clerical and administrative workers.
- 5.3% work in hospitals (except psychiatric hospitals), 4.2% in each of local government administration road freight transport, and 3.2% in primary education.
- The nearest hospitals to Teesdale are located in Geelong.
- Teesdale has a government primary school; the nearest secondary schools are in Bannockburn (about 13 kms to the East) or Geelong.
- The median age of Teesdale's population is 39
- The ABS reports a median annual household income of $84.5K for Teesdale, above Melbourne's $80.4K.
- Data in SLIM on businesses registered with workcover indicates approximately 22 businesses in Teesdale or its near surrounds.
- In 89.9% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 24.4% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 25.9% have completed level III or IV trade certificates; and
- another 11.8% have completed year 12.

On the digital inclusion index, the Golden Plains LGA was awarded an overall digital ability score of **44.0** based on the following two components:

- a score of **47.4** for attitudes; and
- a score of **49.2** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Golden Plains LGA had 5.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 38) shows the status of the NBN rollout in Teesdale as advised by NBNCo in September 2018. The purple/spotted areas show locations serviced by NBN Fixed Wireless 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 (Figure 39).

The NBN has not arrived at Teesdale yet, but the town is due to be serviced with NBN Fixed Wireless. There is some Fixed Wireless coverage to the south-east of the town.

NBNCo's Fixed Wireless service will extend through north-east Teesdale, eventually establishing coverage most of the way to Lethbridge. However, topographic features of the surrounding land limit coverage to the North, West and South. As a result, many properties just a few kilometres out of town will be limited to NBN Satellite coverage (see example below for the nearby village of Shelford, just 4 kilometres from the fringe of Teesdale and with a population of 253).

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX coverage (with a typical download speed of 2-75 Mbps) in the surrounds of Teesdale, there is marginal 3G *outdoor* coverage over some parts of the town and an area of no handheld coverage to the east (Figure 40).
- Optus coverage broadly mirrors Telstra's coverage poor coverage, with new 4G coverage under construction.
- Vodafone shows 3G and 4G *outdoor* coverage over the entire town.

In summary, there appear to be mobile coverage in the town, with the three major mobile network operators all offering service and two operators to offer full 4G coverage.

LP-WAN Coverage

Teesdale sits at the fringe of Taggle coverage to the South East. Field tests may be needed to confirm connectivity (having regard to topographic occlusions). The town appears to be outside the Sigfox coverage footprint. LoRaWAN coverage is unknown.

Public WiFi Coverage

There are no known public WiFi zones in Teesdale, and no hotels or B&B facilties offering WiFi were identified.

Other

Teesdale is not on a VicTrack route, but the power transmission network passes about 4 kms to the South of the town.

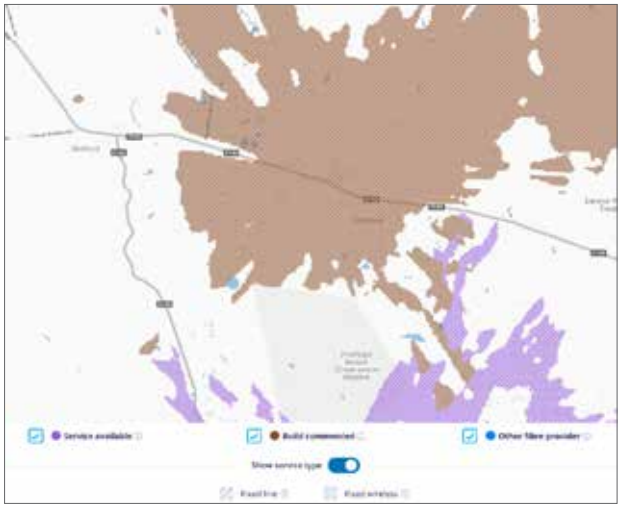


Figure 38 NBN Coverage of Teesdale (NBNCo)

Figure 39 NBN Satellite Coverage of Shelford (NBNCo)

Figure 40 Telstra coverage areas of 4GX outdoor (green), 3G outdoor (dark orange) and no handheld coverage (light orange) around Teesdale

3.10 TOWN OF BEAUFORT

Overview

Beaufort is at the heart of a small but strong agricultural, pastoral and timber district.

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

- The town has a population of 1,072, with another 467 on the fringes of the town.
- 366 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 49.2% being in full-time employment and 39.6% in part-time employment.
- 10.9% of the labour force classified themselves as managers, 9.5% as professionals and 10.1% as clerical and administrative workers.
- 8.1% work in each of local government administration and hospitals (except psychiatric hospitals), 3.9% in aged care residential services and 3.5% in correctional and detentional services.
- Beaufort has a public hospital, with larger hospitals some 45 kms to the West at Ararat or 50 kms to the East at Ballarat.
- Beaufort has two state schools (one primary and one secondary) and some adult education programs are run from the Beaufort Community House and Learning Centre.
- The median age of Beaufort's population is 56, with approximately 36% aged 65 or older.
- The ABS reports a median annual household income of $37.9K for Beaufort, less than half Melbourne's $80.4K.
- Data in SLIM on businesses registered with workcover indicates approximately 55. businesses in Beaufort or its near surrounds.
- In 61.9% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 14.9% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 16% have completed level III or IV trade certificates; and
- another 11.1% have completed year 12.

On the digital inclusion index, the Pyrenees LGA was awarded an overall digital ability score of **49.4** based on the following two components:

- a score of **51.6** for attitudes; and
- a score of **55.8** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Pyrenees LGA had 4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 41) shows the status of the NBN rollout in Beaufort as advised by NBNCo in September 2018. The NBN Fixed Line deployment has not yet reached Beaufort. The brown/striped areas show the locations where NBN Fixed Line services are planned or under construction and white areas the locations serviced by NBN Satellite (Figure 42).

The NBN has not arrived at Beaufort yet, but most of the town is due to be serviced with NBN FTTN. There is also one small area in Beaufort due to receive NBN FTTC.

There is no fixed wireless coverage surrounding the town, and many properties within a few kilometres of the town boundary will have access only to NBN Satellite.

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, with a small area of no handheld coverage to the northeast of the town.
- Optus shows 4G Plus *outdoor* coverage across the entire town, with new coverage under construction in the area not covered by Telstra.
- Vodafone shows 4G *indoor* and *outdoor* 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

Neither Sigfox nor Taggle show coverage of Beaufort. LoRaWAN coverage is unknown.

Public WiFi Coverage

The Beaufort Community Resource Centre offers a free WiFi connection, and several of the hotels/ motels and B&B facilities offer wireless internet access.

Other

Beaufort is on the rail route from Ballarat to Ararat, but VicTrack does not report having any optical fibre over this route. The power transmission network generally follows the highway between Ballarat and Ararat, passing along the Southern boundary of the town.

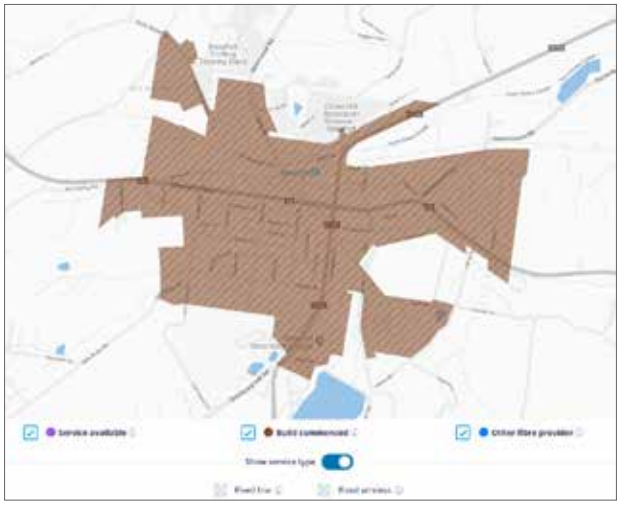


Figure 41 NBN Coverage around Beaufort (NBNCo)

Figure 42 NBN Satellite Coverage of Beaufort (NBNCo)

3.11 LOCALITY OF AVOCA

Overview

During the gold rush, Avoca's population peaked at 16,000 – but as the gold fever subsided, it transitioned to agriculture. Today Avoca (along with Beaufort) is one of the two major population centres in the Pyrenees LGA. Since the 1970s the wine industry has grown to become one of the area's most significant economic drivers.

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

- The town has a population of 972, with another 221 on the fringes of the town.
- 435 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 50.3% being in full-time employment and 33.8% in part-time employment.
- 18.6% of the labour force classified themselves as managers, 10.3% as professionals and 10.8% as clerical and administrative workers.
- 7.5% work in the wine industry, 4.9% in sheep farming, 4.6% in road freight transport and 4.3% in primary education.
- Avoca has a small public hospital, with another hospital 27 kms away at Maryborough.
- Avoca has one state primary school; the nearest secondary schools are at Maryborough.
- The median age of Avoca's population is 52, with approximately 30.1% aged 65 or older.
- The ABS reports a median annual household income of $40.4 for Avoca, approximately half Melbourne's $80.4K.
- Data in SLIM on businesses registered with workcover indicates approximately 55 businesses in Avoca or its near surrounds.
- In 66.2% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 16.2% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 15.8% have completed level III or IV trade certificates; and
- another 15.9% have completed year 12.

On the digital inclusion index, the Pyrenees LGA was awarded an overall digital ability score of **49.4** based on the following two components:

- a score of **51.6** for attitudes; and
- a score of **55.8** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Pyrenees LGA had 4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 43) shows the status of the NBN rollout in Avoca as advised by NBNCo in September 2018. The NBN Fixed Line deployment has not yet reached Avoca. The brown/striped areas show the locations where NBN Fixed Line services are planned or under construction and white areas the locations serviced by NBN Satellite (Figure 44).

The NBN has not arrived at Avoca yet, but most of the town is due to be serviced with NBN FTTC. This is a "near FTTP" solution and should assure all residents access to high speeds should they require them.

Areas immediately surrounding the town will receive NBN Satellite, creating a strong digital divide between those in the town and those just out of it.

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 no coverage across the entire town (Figure 45).

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

Taggle's coverage does not quite extend as far as Avoca from a large network footprint to the North-West. Sigfox has no coverage, and LoRaWAN coverage is unknown.

Public WiFi Coverage

The Avoca Information and Community Centre offers free WiFi (open 9:30am – 4:30pm Monday to Friday and 11am-2:00pm Saturday) as do several accommodation venues in the area.

Other

Avoca is on the rail route from Maryborough to Ararat, but VicTrack does not report having any optical fibre over this route. The power transmission network passes well to the South of Avoca.

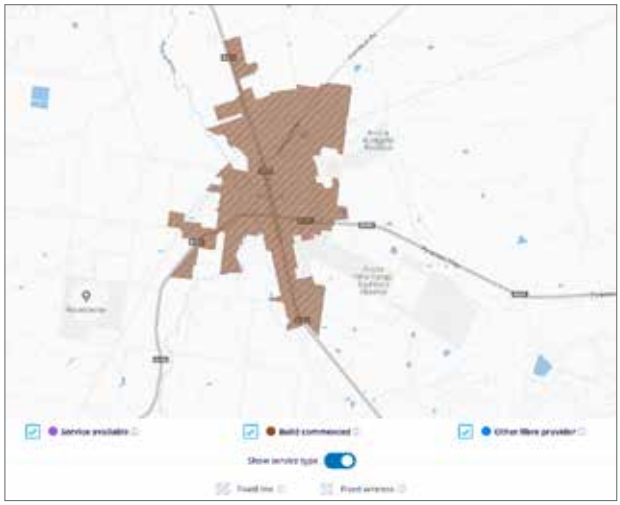


Figure 43 NBN Coverage of Avoca (NBNCo)

Figure 44 NBN Satellite Coverage of Avoca (NBNCo)

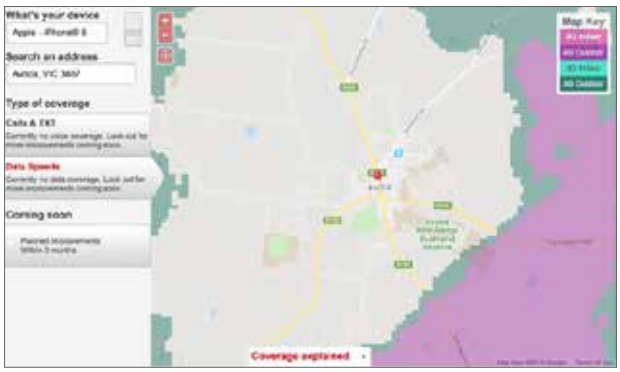


Figure 45 Vodafone coverage at Avoca

3.12 LOCALITY OF HOPETOUN PARK

Overview

Hopetoun Park is a rural-residential area between Bacchus Marsh and Melton, around 50km west of Melbourne.

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

- The locality has a population of around 798.
- The median age of Clunes's population is 35, just below the Melbourne median of 36.
- The ABS reports a median annual household income of $106K for Hopetoun Park, well above Melbourne's $80.4K. Their median expenditure on mortgages and rents are 111% and 99% of Melbourne's.
- 412 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 61.7% being in full-time employment and 29.4% in part-time employment.
- 11.5% of the labour force classified themselves as managers, 10.2% as professionals and 19.4% as clerical and administrative workers
- The top three industries identified in the Census shows 7.4% worked in Road Freight Transport, 4.1% in Takeaway Food Services, and 3.8% in Supermarket and Grocery Stores. However, only 75 people (out of the 412 indicating being in the labour force) provided a response to this topic for the Census.
- There is no medical centres or hospitals in Hopetoun Park, the nearest are in Bacchus Marsh and Melton (5km).
- Hopetoun Park has no schools or other educational facilities. The nearest schools are in Bacchus Marsh and Melton (5km), with the nearest university and TAFE campuses in Melbourne (50km).
- Data in SLIM on businesses registered with workcover indicates approximately 20 businesses in Hopetoun Park.
- In 90.1% of dwellings, at least one person accessed the internet from home, above the Melbourne average of 85.6%.

Skills

ABS Census data indicates:

- 37% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 12.8% have completed level III or IV trade certificates; and
- another 17.2% have completed year 12.

On the digital inclusion index, the Moorabool LGA was awarded an overall digital ability score of **44.5** based on the following two components:

- a score of **48.1** for attitudes; and
- a score of **49.6** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Hepburn LGA had 6.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 46) shows the status of the NBN rollout in Hopetoun Park as advised by NBNCo in September 2018. The purple/spotted areas show locations serviced by NBN Fixed Wireless services and white areas locations serviced by NBN Satellite.

Hopetoun Park and surrounds are provisioned only with NBN Fixed Wireless, with an NBN tower placed just on the northern edge of the locality. For comparison, Bacchus Marsh (5km west) has FTTP. No other NBN technologies appear to be planned for the area.

Mobile Coverage

Based on public coverage maps:

- Telstra shows 4GX 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 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's coverage maps indicate Hopetoun Park is well within reach of this technology.

Some Sigfox coverage appears to be available in the area, albeit with some topographic challenges. It may be necessary to conduct testing or to install additional base stations to assure reliable connectivity.

Public WiFi Coverage

There are no known public WiFi zones in Hopetoun Park, but some of the bed-and-breakfast venues in the region offer free WiFi to guests as part of their tariff.

Other

Hopetoun Park is less than 1km away from VicTrack fibre (blue line, Figure 47), although reaching it would require crossing the Werribee River and connecting at a suitable access point.

Figure 46 NBN Coverage of Hopetoun Park (NBNCo)

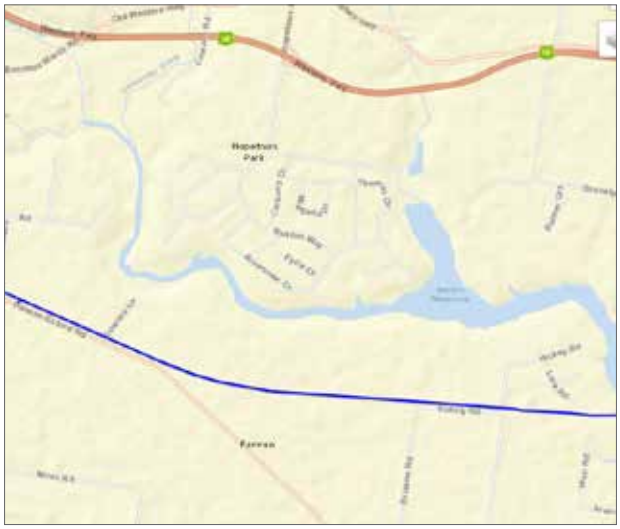


Figure 47 VicTrack fibre near Hopetoun Park (SLIM)

3.13 LOCALITY OF LETHBRIDGE

Overview

Lethbridge (30 kms northwest of Geelong) is a rural locality, famous for supplying Melbourne with some of its iconic bluestone for major buildings. It is surrounded by mixed farming and grazing, and several wineries. There is also a significant privately owned airport to the north (6km) which includes a flying school, joy flights, aircraft maintenance facilities and aviators clubs.

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

- The town has a population of 585, with another 429 living in the immediate surrounds.
- The median age of Lethbridge's population is 38, slightly above the Melbourne median of 36.
- The ABS reports a median annual household income of $71.3K for Clunes, somewhat below Melbourne's $80.4K. Their median expenditure on mortgages and rents are 82% and 71% of Melbourne's.
- 288 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 56.9% being in full-time employment and 33.7% in part-time employment.
- 6.6% of the labour force classified themselves as managers, 11.4% as professionals and 12.5% as clerical and administrative workers.
- The top three industries identified in the Census shows 7.0% worked in hospitals (except psychiatric hospitals), 6.4% in Aged Care Residential Services, and 5.9% in Local Government Administration.
- There is no hospital or medical centre in Lethbridge, the nearest medical centres are in Bannockburn (14km) and Teesdale (10km), and nearest hospital is in Geelong (30km).
- Lethbridge has one Government primary school, with a 10Mb/s service for their 133 students; the nearest secondary school is a P-12 in Bannockburn (opened in 2018), and nearest university campuses are in Geelong.
- Data in SLIM on businesses registered with workcover indicates approximately 27 businesses in Lethbridge or its near surrounds.
- In 85.7% of dwellings, at least one person accessed the internet from home, close to Melbourne's average of 85.6%.

Skills

ABS Census data indicates:

- 19.4% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 24.7% have completed level III or IV trade certificates; and
- another 14.0% have completed year 12.

On the digital inclusion index, the Golden Plains LGA was awarded an overall digital ability score of **44.0** based on the following two components:

- a score of **47.4** for attitudes; and
- a score of **49.2** for basic skills.

A separate score for the City is not available It is the lowest scoring LGA in the Central Highlands Region.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Hepburn LGA had 5.4% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 48) shows the status of the NBN rollout in Lethbridge as advised by NBNCo in September 2018. The brown/spotted areas show locations where NBN Fixed Wireless services are planned or under construction and white areas locations serviced by NBN Satellite.

Lethbridge currently has no NBN services. A Fixed Wireless service is planned from a tower to the south of Lethbridge, and another tower in Teesdale. Other residences in the area will have access to NBN Satellite. No other technologies appear to be planned for the area.

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.

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's coverage maps indicate Lethbridge is within coverage, and maps published by Sigfox also indicate some coverage. In both cases it is towards the edge of the largely-computed coverage zones so actual performance would need to be assessed on the ground.

The availability of LoRa coverage is unknown at this stage.

Public WiFi Coverage

There are no known public WiFi zones in Lethbridge, but some of the bed-and-breakfast venues offer free WiFi to guests as part of their tariff.

Other

Lethbridge lies about 5km west of a major high-voltage power transmission line.

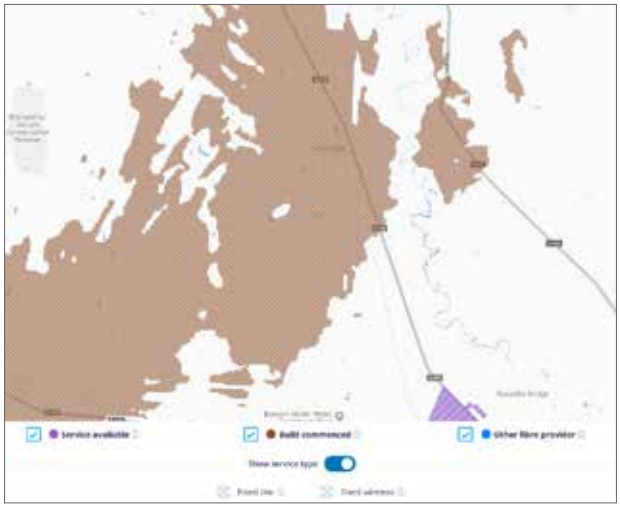


Figure 48 NBN Coverage of Lethbridge (NBNCo)

3.14 LOCALITY OF CARDIGAN VILLAGE

Overview

Cardigan Village (14 kms north-west of Ballarat) is a small locality between Ballarat and Lake Burrumbeet.

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

- The locality has a population of 565, with another 191 living in the immediate surrounds.
- The median age of Cardigan Village's population is 34, slightly younger than the Melbourne median of 36.
- The ABS reports a median annual household income of $77.8K for Cardigan Village, only slightly below Melbourne's $80.4K. Their median expenditure on mortgages and rents are 89% and 72% of Melbourne's respectively.
- 259 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 59.8% being in full-time employment and 30.1% in part-time employment.
- 9.9% of the labour force classified themselves as managers, 14.8% as professionals and 20.2% as clerical and administrative workers.
- The top three industries identified in the Census shows 12.1% worked in hospitals (except psychiatric hospitals), 7.3% in State Government Administration, and 4.8% equally in Aged Care Residential Services and Road Freight Transport.
- There are no hospitals or medical centre in Cardigan Village, the nearest facilities are in Ballarat (14km).
- Cardigan Village has no schools or other educational facilities, apart from a kindergarten. The nearest schools and university campuses are in Ballarat.
- Data in SLIM on businesses registered with WorkCover indicates approximately 17 businesses in Cardigan Village and its near surrounds.
- In 87.6% of dwellings, at least one person accessed the internet from home, slightly above the average for Melbourne of 85.6%.

Skills

ABS Census data indicates:

- 28.5% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 22.9% have completed level III or IV trade certificates; and
- another 12.3% have completed year 12.

On the digital inclusion index, the Ballarat LGA was awarded an overall digital ability score of **47.1** based on the following two components:

- a score of **49.2** for attitudes; and
- a score of **53.4** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Ballarat LGA had 7.5% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 49) shows the status of the NBN rollout in Cardigan Village as advised by NBNCo in September 2018. The purple/spotted areas show locations serviced by NBN Fixed Wireless services.

The area of Cardigan Village, and its surrounding district is provisioned only with NBN Fixed Wireless, with an NBN tower on the immediate western side of the village. The NBN FTTP and FTTN deployments in Ballarat reach to, or are planned to reach, within 3km of Cardigan Village. No other technologies appear to be planned for the area.

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 3G and 4G Plus *outdoor* coverage across the entire town, with new coverage under construction.
- Vodafone shows 4G *indoor* and *outdoor* 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

Taggle's coverage to the South-East and North-West does not extend to Cardigan Village, and maps published by Sigfox also indicate no coverage.

Public WiFi Coverage

There are no known public WiFi zones in Cardigan Village, but the hotel offers free WiFi to guests as part of their tariff.

Other

There is neither VicTrack fibre or power transmission lines in the near vicinity of Cardigan Village.

Figure 49 NBN Coverage of Cardigan Village (NBNCo)

3.15 LOCALITY OF LAKE BOLAC

Overview

The historic locality of Lake Bolac (90 km west of Ballarat and 50km south of Ararat) sits adjacent to the large (1460ha) freshwater lake of the same name, a major centre for fishing and camping and celebrates an abundance of eels in the annual autumnal Eel Festival.

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

- The town and immediate surrounds has a population of around 330.
- 151 people aged 15 and over reported being in the labour force in the week preceding the 2016 Census, with 52.3% being in full-time employment and 31.8% in part-time employment.
- 37.4% of the labour force classified themselves as managers, 8.6% as professionals and 7.2% as clerical and administrative workers.
- Farming dominates employment, with Specialised Sheep Farming at 17.1%, Grain-Sheep/Beef Farming at 16.2%, and Grain Growing at 11.7%.
- Healthcare is supported through the Lake Bolac Bush Nursing Centre providing a range of local health care services, with support from weekly visiting professionals, reducing the need to travel 50km to Ararat.
- Lake Bolac has one Government school, Lake Bolac College, for primary and secondary students – approximately 90 students, served by a 20Mb/s link. The nearest university and TAFE campuses are in Ballarat, Ararat, Hamilton and Warrnambool, all around 50-100km distant.
- The median age of Lake Bolac's population is 53, well above the Victorian median of 37.
- The ABS reports a median annual household income of $46.9K for Lake Bolac, well below Melbourne's $80.4K, but households there also spend significantly less on mortgages (45% of Melbourne's median) and rents (22%).
- Data in SLIM on businesses registered with workcover indicates approximately 26 businesses in Lake Bolac or its near surrounds.
- In 69.3% of dwellings, at least one person accessed the internet from home.

Skills

ABS Census data indicates:

- 24.7% of people aged 15 and over having gained a diploma, advanced diploma, bachelors degree or higher educational qualification
- another 17.5% have completed level III or IV trade certificates; and
- another 10.0% have completed year 12.
- 14.6% of respondents did not state their level of attainment.

On the digital inclusion index, the Ararat LGA was awarded an overall digital ability score of **45.1** based on the following two components:

- a score of **46.8** for attitudes; and
- a score of **51.7** for basic skills.

A separate score for the City is not available.

These scores compare to an ability score of **51.0** for Melbourne (sub-components of **49.1** and **53.7**).

ABS Industry employment data from 2016 indicated that the Ararat LGA had 2.8% employment in the industry sectors with strong technology exposure.

Fixed Broadband

The map (Figure 50) shows the status of the NBN rollout in Lake Bolac as advised by NBNCo in September 2018. The purple/spotted areas show locations serviced by NBN Fixed Wireless services.

Lake Bolac, and immediate surrounds, are provisioned with NBN Fixed Wireless. People living outside of this area will receive NBN satellite broadband (whiate areas in Figure 50).

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 some 3G and 4G outdoor coverage in the area, with no coverage in the balance (Figure 51).

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

The network maps of Taggle and Sigfox indicate no coverage of the Lake Bolac areas. The availability of LoRaWAN coverage is unknown.

Optus is involved in agricultural trials being conducted as part of the CRCP. That coverage footprint does not extend to Lake Bolac.

Public WiFi Coverage

There are no known public WiFi zones in Lake Bolac, although the Lake Bolac Library (open seven days a week) offers Internet Access. Some of the bed-and-breakfast venues offer free WiFi to guests as part of their tariff.

Other

Lake Bolac has a Victorian Police communications tower which could be used to provide dedicated high-speed point-to-point wireless links to key locations within the locality.

Figure 50 NBN Coverage of Lake Bolac (NBNCo)

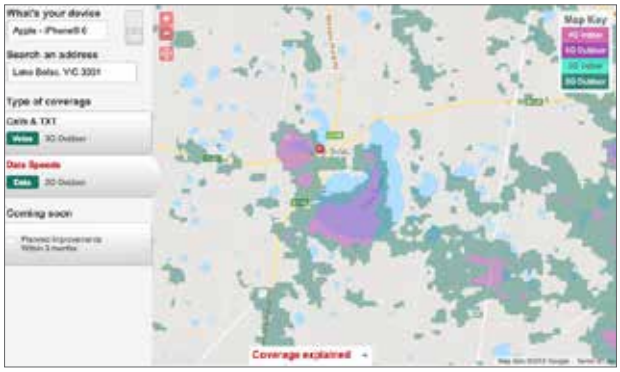


Figure 51 Vodafone coverage at Lake Bolac showing 3G and 4G outdoor coverage.

4 Primary Production

4.17 LAND USE CLASSIFICATION

The Victorian Land Use Information System sub-classifies primary production land use in the following nine categories, each of which is depicted with different colours in SLIM:

50=Native Vegetation (dull green)

51=Cropping (yellow)

52=Livestock Grazing (green)

53=Mixed Cropping & Grazing (light blue)

54=Livestock – special purpose fencing, enclosures, cages etc (brown)

55=Horticulture – fruit & vegetable crops (purple)

56=Horticulture – special purpose structures (lime green)

57=Forestry (khaki green)

58=Aquaculture (dark blue)

As is evident from the land use map following, the overwhelming categorization of land across the Central Highlands region is classified as Mixed Cropping and Grazing (the light blue). LGA boundaries are overlaid in yellow.

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 make the difference between life and death.

In the 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*).

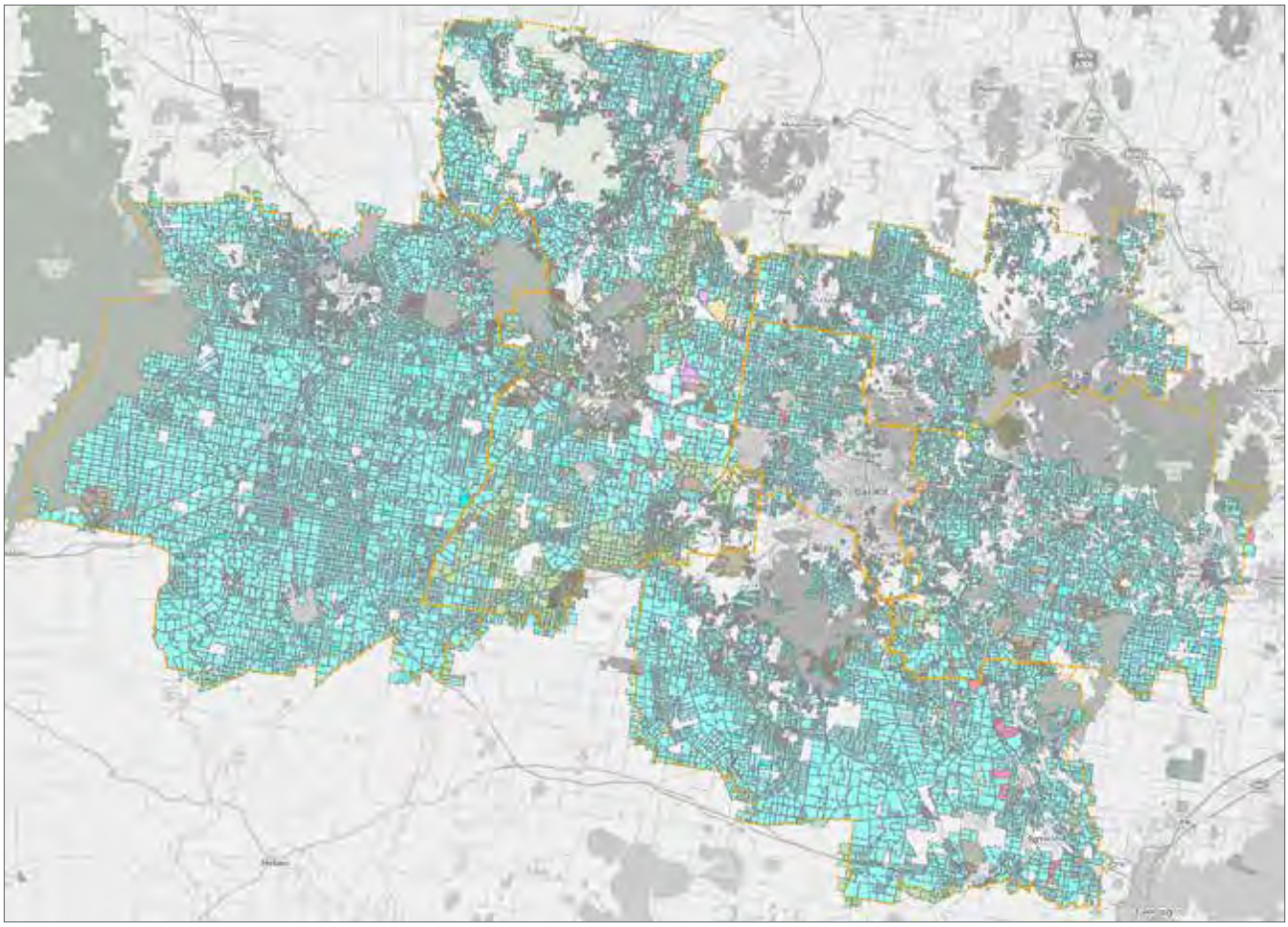


Figure 52 Primary production land in the Central Highlands Region (SLIM)

4.18 FIXED BROADBAND SUPPLY

NBN Services

The map (Figure 43) shows NBN coverage of the Central Highlands region.

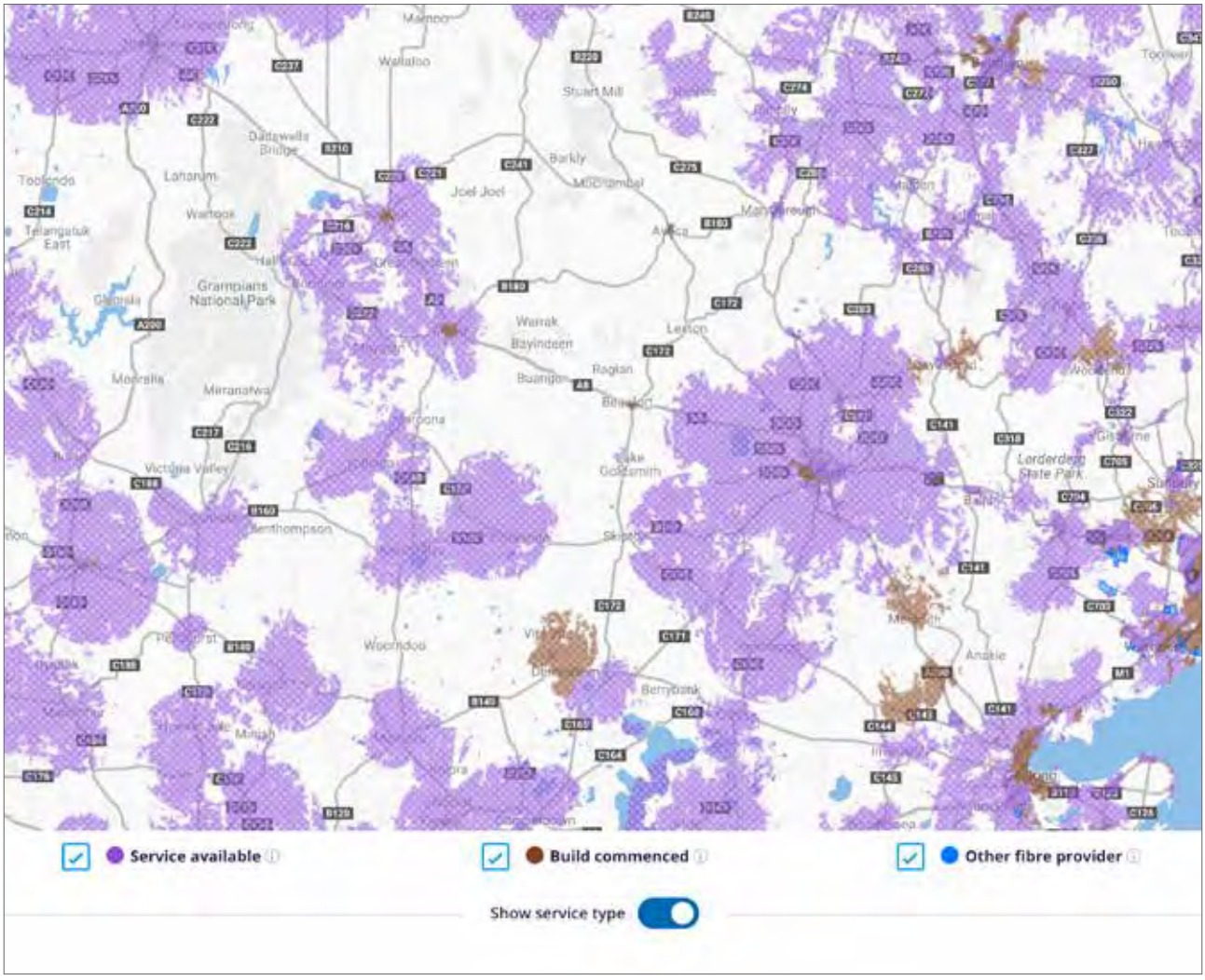


Figure 53 NBN Coverage of the Central Highlands Region (NBNCo)

The most significant feature is the split between Fixed Wireless coverage (spotted/purple) and the areas with NBN Satellite coverage (no colour). Technologies such as FTTP, FTTC and FTTN 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 50% of rural land in the Central Highlands has access to NBN Satellite, 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 shown in the table following.

LGA	POPULATION IN RURAL LAND[24]	ESTIMATED AREA OF SATELLITE COVERAGE
Ararat	4,204	60%
Ballarat	10,683	10%
Golden Plains	12,642	50%
Hepburn	8,078	45%
Moorabool	10,362	45%
Pyrenees	4,995	80%

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

Grazing

- *Beef, sheep meat and wool combined*
- *The area between Ballarat & Lake Bolac*

The map (Figure 54) shows limited NBN Fixed Wireless coverage in the area, with most farms in the area serviced by NBN Satellite.

Farms located closer in proximity to Ballarat, Westmere and Streatham have NBN Fixed Wireless coverage.

Cropping

- *Cereal grains, oilseeds legumes and mixed farming/grazing*
- *The area between Ararat & Lake Bolac*

The map (Figure 55) shows limited NBN Fixed Wireless coverage in the area, with most farms in the area serviced by NBN Satellite.

Farms located closer in proximity to Ararat, Willaura and Streatham have NBN Fixed Wireless coverage.

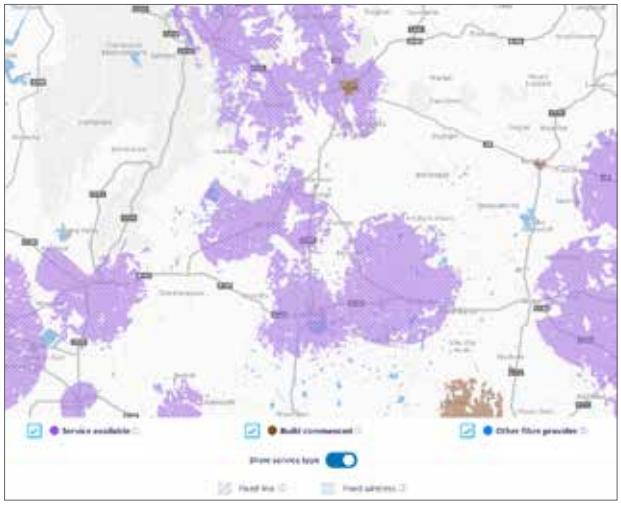


Figure 54 NBN Coverage of the farming area between Ballarat & Lake Bolac (NBNCo)

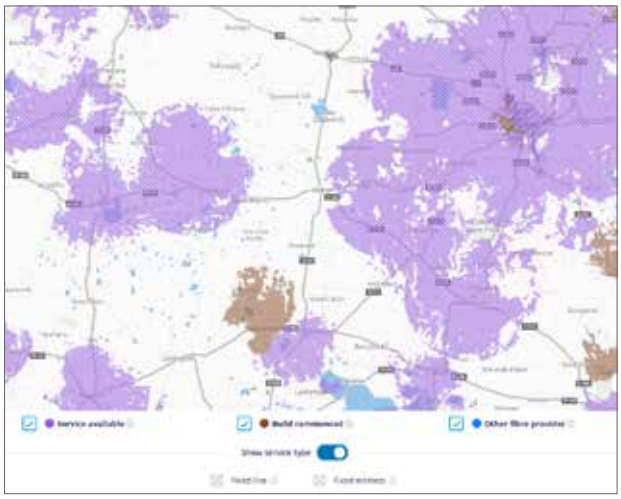


Figure 55 NBN Coverage of the farming area between Ararat & Lake Bolac (NBNCo)

24 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.

Potatoes

- *The area to the east of Ballarat*

The map (Figure 56) shows that most farms in the area have NBN Fixed Wireless coverage.

Farms located closer in proximity to Ballarat have NBN Fixed Wireless coverage but as you move further east towards Bacchus Marsh there a large areas of farming and national parkland serviced by NBN Satellite.

Intensive livestock

- *Pigs and poultry*
- The area to the north west of Bannockburn

The map (Figure 57) shows limited NBN Fixed Wireless coverage in the area, with most farms in the area serviced by NBN Satellite.

Farms located closer in proximity to Rokewood have NBN Fixed Wireless coverage. Farms located closer in proximity to Teesdale, Meredith and Lethbridge will have NBN Fixed Wireless coverage at some time soon as the network is in planning or under construction.

Intensive horticulture

- *Orchards, plantations, market gardens and nurseries*
- The area east of Beaufort

The map (Figure 58) shows limited NBN Fixed Wireless coverage in the area, with many farms in the area serviced by NBN Satellite.

Farms located closer in proximity to Ballarat have NBN Fixed Wireless coverage, however those farms located closer to Beaufort have NBN Satellite.

Forestry

- The area between Ballarat and Daylesford

The map (Figure 59) shows that most farms in the area have NBN Fixed Wireless coverage with the national park lands to the west and south of Daylesford serviced by NBN Satellite.

Large areas surrounding Daylesford will eventually have NBN Fixed Wireless coverage as the network is in planning or under construction.

Our analysis reveals that the Creswick township is currently serviced with NBN FTTP. Creswick must have received its NBN FTTP services very early in the roll out, but the surrounding national parkland has either NBN Fixed Wireless coverage or serviced by NBN Satellite.

Examining aerial imagery of the same area shows that most of the national park lands to the west and South of Daylesford are in the NBN Satellite footprint (Figure 60).

Other Fixed Connectivity Options

For those living in rural areas where satellite is the only technology supported by NBNCo, 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 (Figure 61) showing the area around Ararat.

In this map:

- green areas show individual agricultural land parcels;
- purple areas show NBN fixed wireless coverage;
- 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.

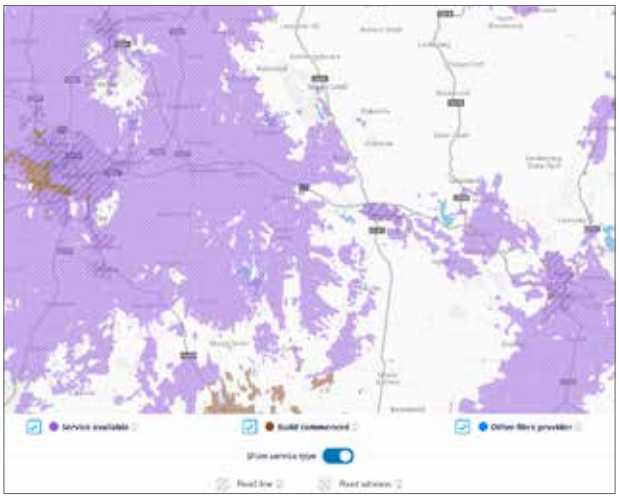


Figure 56 NBN Coverage of the potatoes farming area between east of Ballarat (NBNCo)

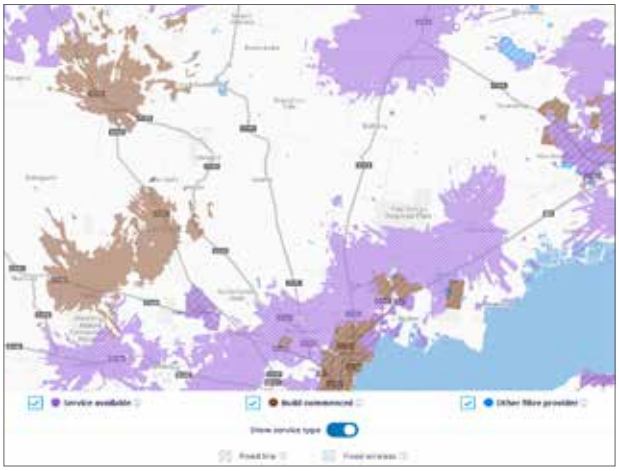


Figure 57 NBN Coverage of the intensive livestock farming area north west of Bannockburn (NBNCo)

Figure 58 NBN Coverage of the intensive horticulture farming area east of Beaufort (NBNCo)

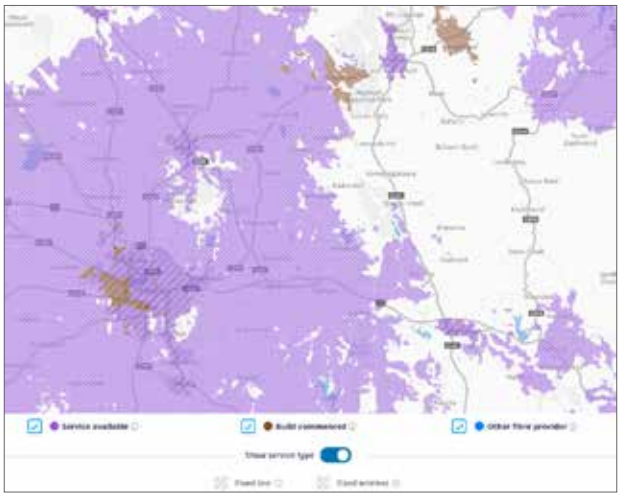


Figure 59 NBN Coverage of the forestry area between Ballarat and Daylesford (NBNCo)

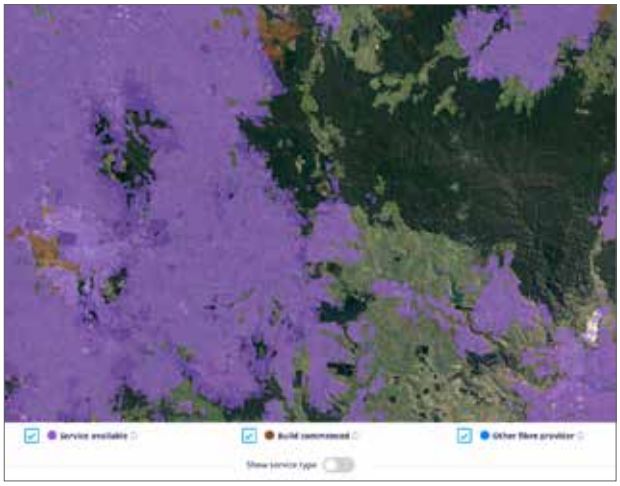


Figure 60 Aerial imagery showing NBN Coverage of the forestry area between Ballarat and Daylesford (NBNCo)

Figure 61 SLIM outputs at a more detailed level (SLIM)

4.19 MOBILE COVERAGE

Coverage maps published by each of the three major mobile network operators are provided in Section .

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

- Beef sheep meat and wool combined
- The area between Ballarat & Lake Bolac

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 3G and 4GX *outdoor* handheld device coverage (with a typical download speed of 2-75 Mbps) across most of the region, with some 3G external antenna coverage across the balance.
- Optus shows 4G Plus and 3G *outdoor* coverage across the entire region, with new 4G Plus coverage under construction near Skipton.
- Vodafone shows 4G and 3G *outdoor* coverage near Ballarat only.

In summary, there appear to be no mobile coverage issues in the region, with the two mobile network operators offering some level of service.

Cropping

- Cereal grains, oilseeds legumes and mixed farming/grazing
- The area between Ararat & Lake Bolac

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 3G and 4GX *outdoor* handheld device coverage (with a typical download speed of 2-75 Mbps) across most of the region, with some 3G external antenna coverage and some black spots near Maroona.
- Optus shows 4G Plus and 3G *outdoor* coverage across the entire region.
- Vodafone shows 4G and 3G *outdoor* coverage near Ararat and good highway coverage as far as Maroona only.

In summary, there appear to be good options for coverage in the region from at least two of the three mobile network operators.

Potatoes

- *The area to the east of Ballarat*

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 4GX *outdoor* handheld device coverage (with a typical download speed of 2-75 Mbps) across the region as far as Bacchus Marsh.
- Optus shows 4G Plus and 3G *outdoor* coverage across the entire region as far as Bacchus Marsh.
- Vodafone shows 4G *indoor* and *outdoor* coverage across the region as far as Bacchus Marsh.

In summary, there appear to be good options for coverage in the region from all three mobile network operators.

Intensive livestock

- Pigs and poultry
- The area to the north west of Bannockburn

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 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) in the region bounded by Lethbridge and Teesdale.
- Optus shows 4G Plus and 3G outdoor coverage in the region bounded by Lethbridge and Teesdale.
- Vodafone shows 4G indoor and outdoor coverage in the region bounded by Lethbridge and Teesdale.

In summary, there appear to be good options for coverage in the region from all three mobile network operators.

Intensive horticulture

- Orchards, plantations, market gardens and nurseries
- The area east of Beaufort

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 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) in the region bounded by Lethbridge and Teesdale.
- Optus shows 4G Plus and 3G outdoor coverage in the region bounded by Lethbridge and Teesdale.
- Vodafone shows 4G indoor and outdoor coverage in the region.

In summary, there appear to be good options for coverage in the region from all three mobile network operators.

Forestry

- The area between Ballarat and Daylesford

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 4GX *outdoor* handheld device coverage (with a typical download speed of 2-75 Mbps) in the as far as Creswick.
- Optus shows 4G Plus and 3G *outdoor* coverage in the region as far as Creswick, but with significant black spots near Eganstown and Blampied.
- Vodafone shows 4G *outdoor* coverage in the region as far as Creswick, but with significant black spots near Eganstown and Blampied.
- In summary, there appear to be options for coverage in the region from at least one mobile network operator.

4.20 LP-WAN COVERAGE

Coverage maps for two of three major LP-WAN technologies (Sigfox and Taggle) are provided in Section . Coverage of the third major LP-WAN technology (LoRa) is unknown.

Based on these maps:

- Sigfox coverage appears to be available towards the Eastern and Western fringes of the region; and
- Taggle coverage appears to be available towards the North-Eastern and South-Western fringes of the area.

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 needs, opportunities and barriers in the adoption of IoT technologies.

Grazing

- *Beef sheep meat and wool combined*
- *The area between Ballarat & Lake Bolac*

The SLIM database and public maps for SigFox, Taggle IOT and the Optus NB-IOT trials show no coverage in the area.

Cropping

- *Cereal grains, oilseeds legumes and mixed farming/grazing*
- *The area between Ararat & Lake Bolac*

The SLIM database and public maps for SigFox, Taggle IOT and the Optus NB-IOT trials show no coverage in the area.

Potatoes

- The area to the east of Ballarat

The SLIM database and public maps for SigFox, Taggle IOT and the Optus NB-IOT trials show no coverage in the area.

Intensive livestock

- *Pigs and poultry*
- *The area to the north west of Bannockburn*

The SLIM database shows good Taggle IOT coverage in Bannockburn, Meredith, Lethbridge, Teesdale, Inverleigh and the surrounding areas. Optus NB-IOT and SigFox do not appear to have coverage in the area.

Intensive horticulture

- *Orchards, plantations, market gardens and nurseries*
- *The area east of Beaufort*

The SLIM database and public maps for SigFox, Taggle IOT and the Optus NB-IOT trials show no coverage in the area.

Forestry

- The area between Ballarat and Daylesford

The SLIM database and public maps for SigFox, Taggle IOT and the Optus NB-IOT trials show no coverage in the area.

4.21 SKILLS

No specific information regarding the skill level of those operating businesses or living in agricultural areas is currently available.

An *indirect* indicator of skillsets useful in taking advantage of digital technologies *may* be found in general education levels.

Across the Central Highlands 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.

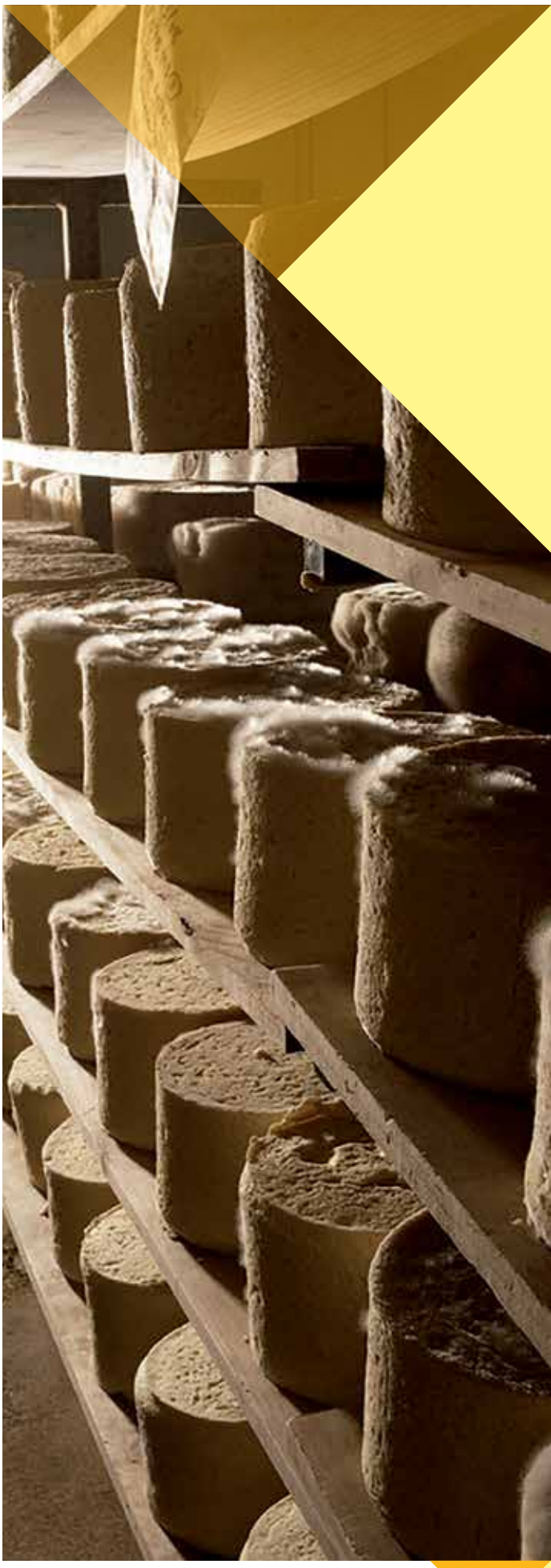
Of some note, the highest educational attainment in the two Western-most local government areas is significantly lower than for other local government areas.

LGA	POPULATION	% YEAR 12+
Ararat	11,600	45.2%
Ballarat	101,686	59.0%
Golden Plains	21,688	59.7%
Hepburn	15,330	57.8%
Moorabool	31,818	57.1%
Pyrenees	7,238	45.0%
Region	**189,360**	**57.3%**

An alternative indicator may be the ability score in the digital inclusion index, shown in the table below.

Table 5 NBN Coverage of Agricultural Land

LGA	ATTITUDES	BASIC SKILLS	SCORE
Ararat	46.8	51.7	45.1
Ballarat	49.2	53.4	47.1
Golden Plains	47.4	49.2	44.0
Hepburn	47.7	51.1	45.1
Moorabool	48.1	49.6	44.5
Pyrenees	51.6	55.8	49.4
Region	**48.6**	**52.1**	**46.1**
Melbourne	**49.1**	**53.7**	**51.0**



5 Tourist Destinations

The Central Highlands Region features numerous additional tourist attractions beyond the special events covered in this Section. In general, these are not prone to significant seasonal peaks (as occurs for example in the snowfields).

For such destinations (such as wine-growing areas), the communication demands tend to comprise:

- the needs of attraction hosts (wineries etc), predominantly comprising fixed broadband connectivity; and
- 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 , and an overview of mobile coverage outside these centres is provided in Section .

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.

5.1 RAINBOW SERPENT FESTIVAL

The Rainbow Serpent Festival is a four day event that takes place annually over the Australia Day weekend, attracting some 12,000 patrons (Figure 62). The next festival is scheduled for January 25-28, 2019.

The festival takes place on rural land a few kilometres out of the small Victorian town of Lexton, with its population of 231. The venue is shown on the map (Figure 63) where a small hand is located, at the end of Jack Smith's Lane. During the festival, the site is transformed from rural land with a scattering of buildings (see aerial image Figure 64) to a community that on size grounds, would qualify for recognition as a city (population greater than 10,000).

Access to the venue is from the road between Beaufort (see Section) and Lexton – approximately 21 kms from Beaufort, or 6 kms from Lexton.

Fixed Broadband

The entire area (including Lexton) is served by NBNCo'S satellite solution. Whilst any residential properties at the location should be eligible to obtain a satellite service, such services would be quite inadequate to provide any meaningful backhaul connectivity to the "pop up" city – both in terms of capacity and latency.

As the festival is organised from Melbourne, broadband options available to the promoters would be adequate to support planning, booking and promotional requirements between events.

Mobile Coverage

The public maps of both Telstra (Fiture 65) and Optus (Figure 66) show marginal 3G coverage at the festival venue. Vodafone's maps show no coverage in the area.

Even though some connectivity may be possible, the baseline capacity of the mobile networks would be inadequate to cope with the explosion of demand generated during the event.

A temporary increase in both capacity and coverage could be achieved during the festival by bringing in one or more "Cells on Wheels" (COWs) to the site. Such options are available from some of the MNOs, but (given the absence of roaming in Australia) would only meet the needs of customers using the provider's network.

WiFi

To support the provision of a WiFi service at the festival venue, an appropriate backhaul arrangement would be needed. Options may include a high-speed microwave link to Lexton, where interconnectivity with optical fibre or other backhaul capacity may be possible via Telstra's Lexton phone exchange.

The SLIM database shows the Victorian Police having a tower in Lexton – this may be suitable for hosting microwave equipment.

Figure 62 Crowds at Rainbow Serpent Festival

Figure 63 Rainbow Festival Location (SLIM)

Figure 64 Aerial View of Rainbow Serpent Festival Venue – near Lexton

Figure 65 Telstra Coverage of Festival Venue

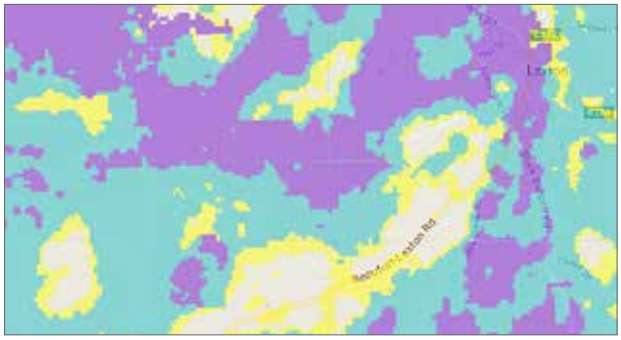


Figure 66 Optus Coverage of Festival Venue

5.2 MEREDITH MUSIC FESTIVAL

The Meredith Music Festival (MMF) is a 3-day outdoor music even held annually in December at a natural amphitheatre on private farming land around 13 kms West of the town of Meredith.

The venue has a permitted maximum capacity of 15,000 patrons, and typically attracts more than 12,000 patrons. As such, the venue becomes a temporary city (population >10,000) for its duration (Figure 67 & 68).

Figure 67 Meredith Music Festival

Figure 68 Aerial image of Festival Site (SLIM)

Fixed Broadband

The festival venue falls in NBNCo's satellite footprint. The nearby town of Meredith is scheduled to receive fixed wireless coverage, but this will not extend to the festival location.

Mobile Coverage

Based on visual examination of the public coverage maps, all three mobile network operators claim general coverage of the area, with coverage quality declining in the depressed land areas that surround a waterway to the West.

However, the festival organisers warn patrons the standard network coverage is unreliable, and for some recent events have contracted an (un-named) mobile network operator to augment coverage with a temporary site.

WiFi

No WiFi coverage is provided at the festival venue. This may be a function of the difficulty in obtaining suitable backhaul connectivity.

Depending on topography, the option may exist to establish a high-speed microwave link from the festival site to Meredith or to one of the towers in the area, but this would need to be supported by high-speed backhaul from that point.

A police tower exists in Meredith and may be suitable for hosting microwave equipment to link to the site. Telstra has an exchange at Meredith and may be able to offer backhaul. Currently NBNCo does not offer products suited to such purposes.

5.3 AVOCA RACES

Each year in October, Avoca hosts the "Blue Pyrenees Avoca Cup" – a horse racing event that attracts around 6,000 visitors.

The racetrack is located a short distance to the South-West of the town (see aerial image Figure 69).

Campsites are made available on the racecourse grounds to cope with the swell in numbers attracted to the event. A range of entertainment events and other activities surround the race itself.

Communication Services

The town's provision of fixed broadband is discussed in Section 3. In summary, the town is due to be serviced with NBNCo's FTTC solution – offering a near equivalent to FTTP.

The proximity of the racetrack to the town will (when NBN services become available) enable easy microwave connection to locations in the town where backhaul can be provided. This would enable WiFi connectivity to be supported at the racetrack.

Good mobile coverage is provided by both Telstra and Optus, but network capacity may be inadequate to cope with the influx of people during the event.

The following analysis covers a number of permanent tourist destinations.

Figure 69 Avoca Race Track (SLIM)

5.4 SOVEREIGN HILL

Sovereign Hill is a major tourist attraction which claims to contribute $260 m and 1,665 to the Victorian economy. The precinct is located within the city near the suburb of Golden Point.

Fixed Broadband

Our analysis reveals that Sovereign Hill is covered by NBN FTTP (Figure 70). A large proportion of the location has FTTP in service and the rest being planned or under construction.

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 precinct.
- Optus shows 4G Plus *outdoor* coverage across the entire precinct.
- Vodafone shows 4G *indoor* coverage across the entire precinct.

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

WiFi

The provision of a public WiFi service at the venue by the site operator is facilitated by the availability of NBN FTTP fixed access for the area. Actual public WiFi provision has not been investigated.

Figure 70 NBN Coverage of Sovereign Hill in Ballarat (NBNCo)

5.5 BALLARAT WILDLIFE PARK

Ballarat Wildlife Park is a privately operated attraction located in natural bushland in Ballarat East.

Fixed Broadband

Ballarat Wildlife Park is located at 250 Fussell Street at the corner of York Street. Our analysis reveals that Ballarat Wildlife Park is serviced by NBN FTTP (Figure 71).

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 precinct.
- Optus shows 4G Plus *outdoor* coverage across the entire precinct.
- Vodafone shows 4G *indoor* coverage across the entire precinct.

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

WiFi

The provision of a public WiFi service at the venue by the site operator is facilitated by the availability of NBN FTTP fixed access for the area. Actual public WiFi provision has not been investigated.

Figure 71 NBN Coverage of Ballarat Wildlife Park (NBNCo)

5.6 CRESWICK WOOLLEN MILLS

Creswick Woollen Mills is a relatively new attraction located in Creswick North.

Fixed Broadband

Creswick Woolen Mills is located on Railway Parade near the corner of William Street. Our analysis reveals that the Creswick Woolen Mills is serviced by NBN FTTP (Figure 72).

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 precinct.
- Optus shows 4G Plus *outdoor* coverage across the entire precinct.
- Vodafone shows 4G *indoor* coverage across the entire precinct.

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

WiFi

The provision of a public WiFi service at the venue by the site operator is facilitated by the availability of NBN FTTP fixed access for the area. Actual public WiFi provision has not been investigated.

Figure 72 NBN Coverage of the Creswick Woolen Mill (NBNCo)

5.7 CRESWICK MOUNTAIN BIKE TRAIL

Construction is expected to begin on a new mountain biking attraction called Hammon Park. When complete, the full system will include more than 100km of trail and hopes to attract 80,000 visitors annually by 2022.

Fixed Broadband

The map (Figure 73) shows that Creswick Mountain Bike Trail has both NBN Fixed Wireless and Satellite coverage. The parts of the Creswick Mountain Bike Trail located in the national parkland are mainly serviced by NBN Satellite.

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 trail head end precinct, with a combination of 3G and 4G coverage over most of the adjoining reserves (Figure 74).
- Optus shows 4G Plus *outdoor* coverage across the trail head end precinct and reserves (Figure 75).
- Vodafone shows 4G *indoor* coverage across the trail head end precinct, with a combination of 4G *indoor* and *outdoor* and 3G outdoor coverage over most of the adjoining reserves (Figure 76).

In summary, there appear to be no mobile coverage issues in the trail head end precinct. Although mobile coverage of the adjoining reserves is relatively weak for two of the three mobile network operators, 000 safety coverage appears available across the entire precinct.

WiFi

To support the provision of a WiFi service at the trial head and festival venue, an appropriate backhaul arrangement would be needed. Options may include a high-speed microwave link to a nearby town where interconnectivity with optical fibre or other backhaul capacity is possible.

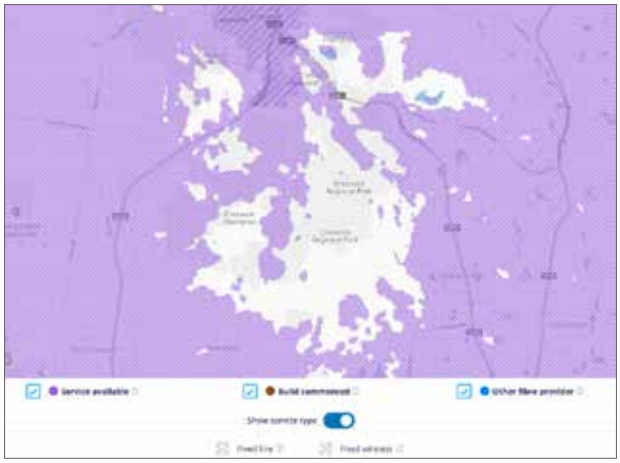


Figure 73 NBN Coverage of the Mountain Bike Trail (NBNCo)

Figure 74 Telstra mobile coverage at Hammon Park and adjoining reserves.

Figure 75 Optus mobile coverage at Hammon Park and adjoining reserves.

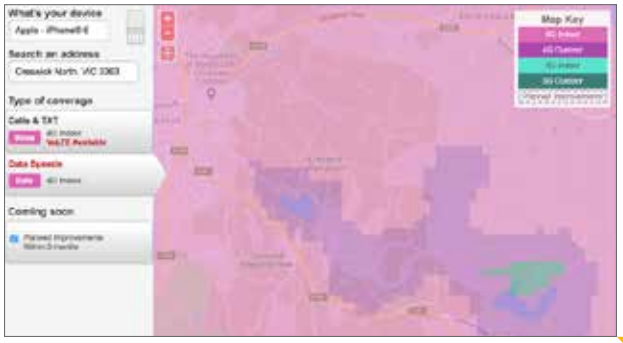


Figure 76 Vodafone mobile coverage at Hammon Park and adjoining reserves.

5.8 PYRENEES WINE REGION

The Pyrenees wine region is a tourist region with between 20-30 wineries participating in tourism activity through private visitors and organised coach tours, linked with accommodation and restaurant businesses (Figure 77).

Fixed Broadband

The map (Figure 78) shows limited NBN Fixed Wireless coverage in the Pyrenees wine region.

The Pyrenees wineries are mainly located outside of the townships which means that they are typically serviced by NBN Satellite.

Mobile Coverage

Due to the wide dispersion of wineries in the region, generalised conclusions about mobile coverage are of limited value without conducting a site-by-site analysis. Based on public coverage maps the following can be observed:

- Telstra shows 4GX outdoor handheld device coverage (with a typical download speed of 2-75 Mbps) across the majority of roads and population centres servicing the wineries (Figure 79).
- Optus shows 4G Plus *outdoor* coverage across the majority of roads and population centres servicing the wineries (Figure 80).
- Vodafone shows 4G *outdoor* coverage across the roads and population centres in southern parts of the region, but no reliable coverage between Moonambel and St Arnaud (Figure 81).

In summary, there appear to be some mobile coverage issues in the precinct with the three major mobile network operators all offering service.

WiFi

Provision of WiFi for visitors to wineries would require an appropriate backhaul arrangement such as a high-speed microwave link to a town where interconnectivity with optical fibre or other backhaul capacity is possible. This is likely to be prohibitively restrictive.

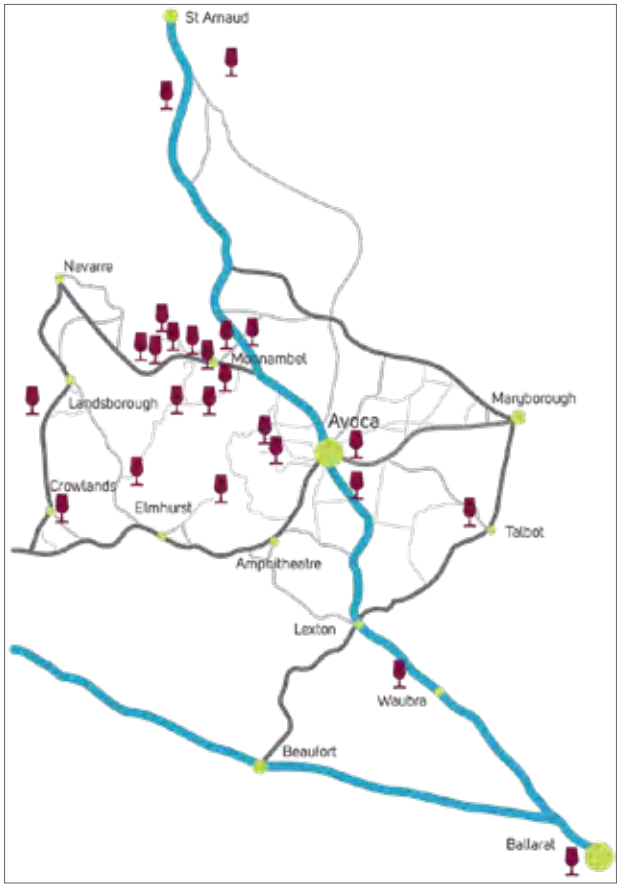


Figure 77 Illustration of Pyrenees wine region (http://pyrenees.org.au/wineries/)

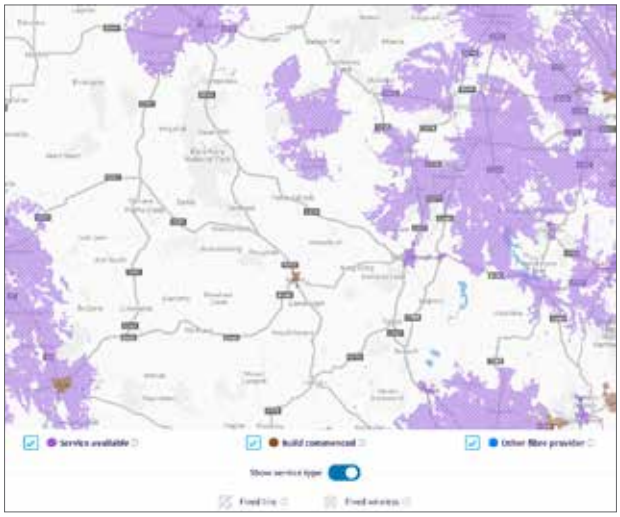


Figure 78 NBN Coverage of the Pyrenees wine region (NBNCo)

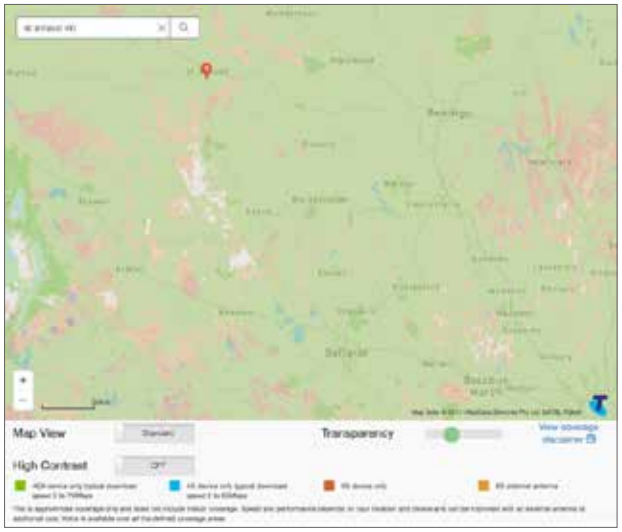
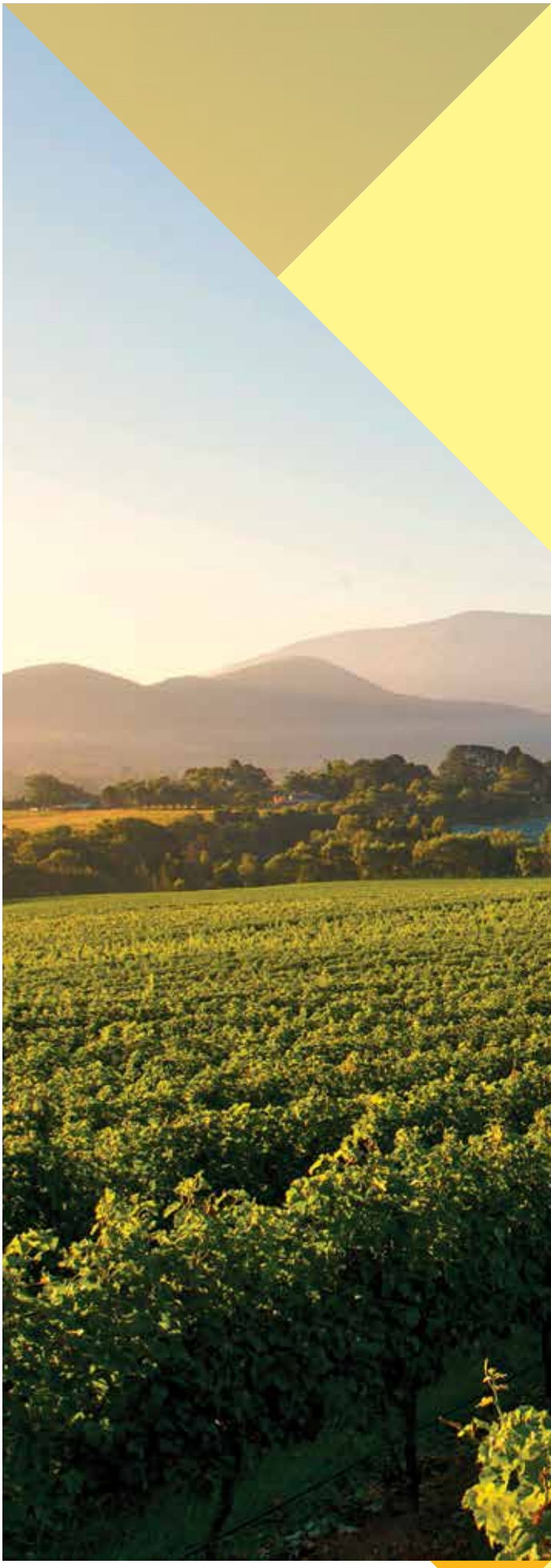


Figure 79 Telstra coverage in Pyrenees wine region

Figure 80 Optus coverage in Pyrenees wine region

Figure 81 Vodafone coverage in Pyrenees wine region



6 Transport Blackspots

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. 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.

In the case of road transport, the main indicator of demand is the road classification (designated M/A, B or C-grade roads)[25]. 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. Local knowledge is the most effective means of identifying such locations.

In terms of rating the severity of blackspots, it is a pragmatic reality that many regional Australians favour Telstra in the belief that it has the best geographic coverage. In practice (and based purely on visual examination of coverage maps), Optus appears to offer comparable coverage in Victoria – though for those travelling nationally, Telstra's lead more broadly may still be a compelling attraction.

This leads to the following 3-level scheme for rating the severity of a transport blackspot:

- where there is no coverage by *any* network.
- where there is neither Telstra nor Optus coverage; and
- where there is no Telstra coverage.

Discussions with the MNOs are underway to explore incorporation of the public coverage information into SLIM for more accurate examination of the date. If and when such information becomes available, it will become more practical to identify and characterise transport blackspots more easily and efficiently.

Fieldwork commencing at the time of preparation of this report may also yield more accurate insights into significant transport blackspots.

6.2 M AND A-GRADE ROADS

No A-level roads without (at least) Telstra coverage were identified from a scan of public maps. However, 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.

6.3 B-GRADE ROADS

B180 – Ararat to Maroona (~6kms)

The location in question is on the road designated B180, travelling South to from Ararat Maroona – an overall distance of 21.5 kms. A blackspot in Telstra coverage appears to commence at a point around 12.5kms from the centre of Ararat and extends for approximately 6 kms – see red marker on map (Figure 82).

Optus appears to have reasonable coverage of this road segment, and Vodafone's coverage appears to be marginal.

One fatal accident and one other accident involving injury are recorded to have occurred in the area of poor coverage (depending on the carrier).

25 "M" routes are primary traffic routes or motor ways. "A" routes are other primary highways and interstate or inter-regional single carriageways. "B" routes are less significant, typically linking smaller population centres to larger regional centres, but without being a major through-route in the region. "C" routes link smaller settlements and towns to the rest of the major road network.

B180 – from Ararat to Avoca (~4kms and ~5kms) – also affecting rail

This route appears to traverse two areas of marginal Telstra coverage.

The first commences some 10 kms North-West of Ararat and continues for about 4 kms through a small range.

The second commences some 40 kms along the route and continues for about 5kms, again through a hilly area.

Both areas are marked on the map (Figure 83).

The Optus public coverage map shows weakness in the same general areas. The Vodafone map suggests coverage of the first blackspot, but patchy coverage around Elmhurst (a few kilometres before the 2nd blackspot), with weakness in the same area as Telstra.

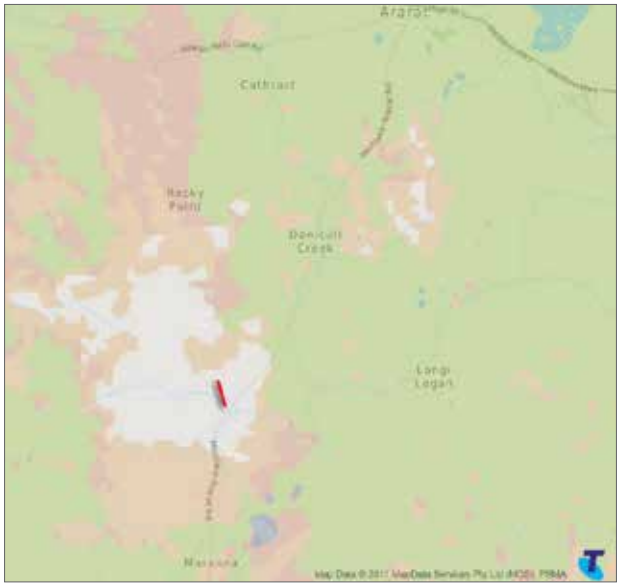


Figure 82 Blackspot between Ararat & Maroona on B180

Figure 83 Blackspots between Ararat & Avoca on B180

6.4 C-GRADE ROADS

C216 –from Halls Gap South (~35 kms)

This road (also known as Grampians Road) runs South through a valley in the Grampians. For much of the route (about 35 kms) there is no Telstra coverage (Figure 84). The road is difficult to discern against the light green background denoting a reserve, but the marker indicates its position in the valley.

Neither Optus nor Vodafone coverage maps indicate service over lengthy road section.

There have been eight mostly serious road accidents along this road in the past 5 years.

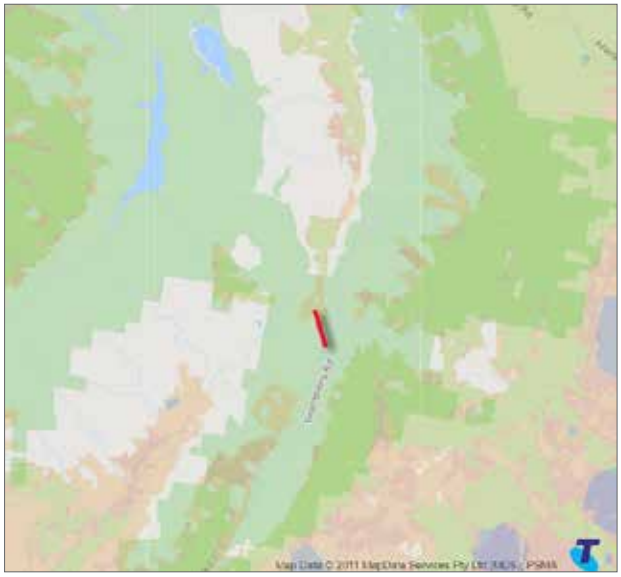


Figure 84 Extended Coverage Gap South from Halls Gap

6.5 RAIL

Melbourne – Ballarat

The Victorian Government is undertaking a program to improve mobile services on rail routes. As a result of this program, coverage from all three MNOs should be available for passengers on all train types on the Melbourne-Ballarat line by the end of the 2018 calendar year.

Ballarat – Ararat

The route length of approximately 70km carries up to 3 return services per weekday. The route is served by older V/Line rolling stock which does not suffer from the radio frequency shielding effect as the newer VLocity rail cars. Consequently, in-train repeater equipment is not required and mobile carrier public coverage maps can be used as a guide to in-train mobile coverage.

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

In summary, there appear to be no mobile coverage issues on the route, with the three major mobile network operators all offering service, noting that localised conditions such as cuttings may temporarily disrupt continuous coverage as the train passes through.

Ballarat – Maryborough

The route length of approximately 70km carries up to 2 return services per weekday. The route is served by older V/Line rolling stock which does not suffer from the radio frequency shielding effect as the newer VLocity rail cars. Consequently, in-train repeater equipment is not required and mobile carrier public coverage maps can be used as a guide to in-train mobile coverage.

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

In summary, there appear to be no mobile coverage issues on the route, with the three major mobile network operators all offering service, noting that localised conditions such as cuttings may temporarily disrupt continuous coverage as the train passes through.

7 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 this report was prepared.
    - Data by Region[26] – providing statistics at the level of Local Government Area (LGA)
    - Quickstats[27] – 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, Esi China (Hong Kong), Esri (Thailand), TomTom, 2012"
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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".

26 See http://stat.abs.gov.au/itt/r.jsp?databyregion

27 See for example http://quickstats.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/UCL211002?opendocument

INFORMATION MADE AVAILABLE BY NBNCO TO SUPPORT DIGITAL PLAN DEVELOPMENT

NBNCo provided DEDJTR with data in a geospatial format (mapinfo shape files) to support the mapping of NBNCo network technologies and roll-out status to a specific location for State Government infrastructure planning purposes. The NBN information was overlaid with current government data sets in SLIM. This resulted in DEDJTR having access to maps that clearly show types of NBN MTM technology available or planned to be available in a specific location.

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.

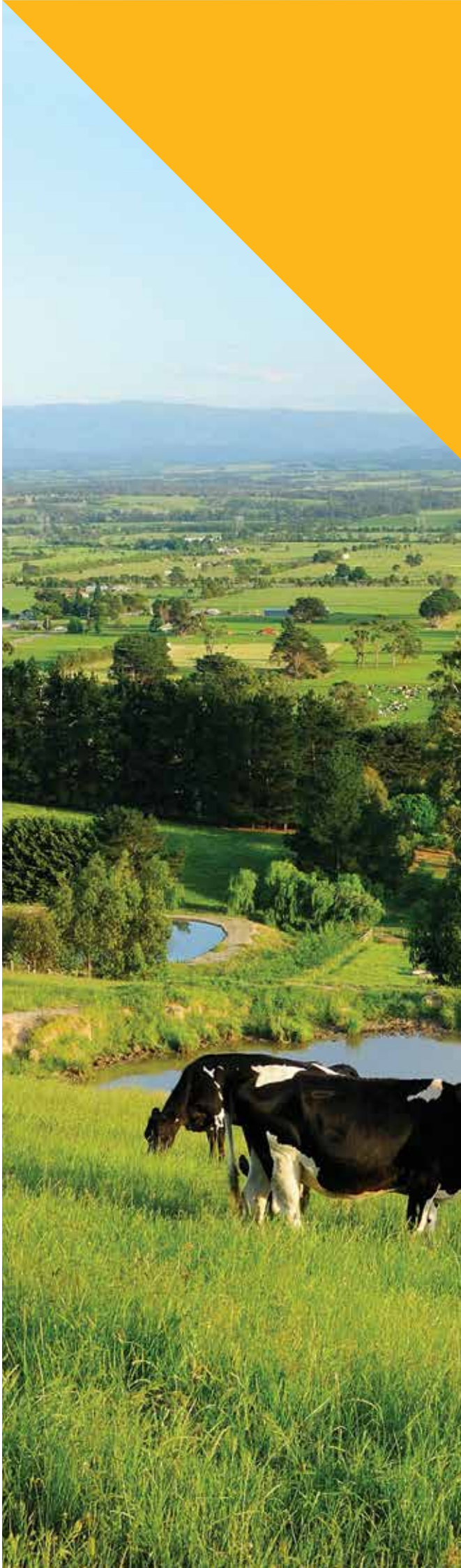
2. Coverage by different network technologies reflects the situation at a point in time. Network operators regularly expand and reconfigure the networks with resulting changes to coverage. Before placing reliance on any information presented in this report, it is prudent to obtain the latest available 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 – is in the process of entering the Australian market. Its coverage intentions are not currently known.

5. At this stage NBN has not approved publication of maps in the Digital Plans derived from SLIM that show clear technology boundaries. Maps in the Digital Plans showing NBNCo coverage have been derived from NBNCo publicly available information.

6. Vodafone's coverage maps only show coverage provided through the Vodafone network. Coverage is still available in all of the 3G regional zones where Vodafone uses a third party network but Vodafone does not guarantee the future availability of those coverage areas.



8 Matrix of Recommendations

HIGH LEVEL PRIORITIES

	SIGNIFICANT PLACES	PRIMARY PRODUCTION	TOURISM DESTINATIONS	TRANSPORT BLACKSPOTS
Local governments and the Regional Partnership prioritise actions for each of the access technologies on the basis of business cases to determine which actions provide the greatest benefits – including investigating the feasibility of a combined 5G fixed access/mobile service and alternative market stimulation models to bring the service to market	●	●	●	
The Regional Partnership educate those in sparsely populated locations that high quality high bandwidth blanket coverage solutions are unlikely to be viable due to cost constraints and those requiring reliable high bandwidth solutions may be best served by bespoke solutions	●	●	●	
Local governments and regional businesses consider leveraging available government assets for cost-effective bespoke solutions (for example VicTrack fibre for backhaul or joining up access network components)	●	●	●	
Use the State Level Information Management (SLIM) database to conduct more detailed analysis of unmet needs and possible solutions (through DEDJTR until 3rd party access is possible)	●	●	●	
Advocate for the implementation of multipurpose digital hubs (Local Community Connectivity Centres) that can address a range of access, skills and affordability needs (including providing access to reliable high broadband access for those in NBN fixed wireless and satellite footprints).	●	●	●	

SPECIFIC PRIORITY ACTIONS – FIXED ACCESS

	SIGNIFICANT PLACES	PRIMARY PRODUCTION	TOURISM DES-TINATIONS	TRANSPORT BLACKSPOTS
Local governments engage with NBNCo to ensure it understands local priorities – to influence NBNCo's technology boundary decisions where the NBN has not yet been rolled out, and where technology upgrades should be focused once rollout is completed. The Victorian Government could assist local governments (and the Regional Partnership) in identifying and prioritizing unmet needs by developing a web-based application through which users could register their need for improved fixed (and other) access service	●	●	●	
Local governments obtain quotes under the NBN Technology Choice program for underserved current and planned business precincts, and investigate funding models including contributions by precinct tenants	●			
Local governments, the Regional Partnership and the Victorian Government work in unison to determine if there are cost effective non NBN solutions that address current and future fixed access shortfalls (informed by current CRCP Enhanced Broadband demonstration projects)	●			
The Victorian Government encourage the Commonwealth Government to require NBNCo to deploy technologies with the highest performance potential in the remaining rollout areas, aided by information from local governments on where demand for high performance is expected to be greatest	●	●	●	
The Victorian Government advocate for a lowering of the mandatory threshold above which FTTP must be incorporated in new residential and business developments	●			
The Victorian Government advocate for a restructuring of NBN wholesale pricing to ensure the maximum potential of the NBN is unlocked (including revising CVC pricing)	●	●	●	
The Victorian Government make submissions to the current ACCC Domestic Transmission Capacity Services (DTCS) inquiry in relation to backhaul routes where its market insights indicate regional users are adversely impacted by high backhaul pricing	●	●	●	
The Victorian Government advocate for the immediate introduction of effective NBN business grade services with symmetric high bandwidth options and robust service level agreements (SLAs)	●	●	●	
Local governments, businesses and community groups work in unison to better understand the incidence and impact of fixed technology boundary issues (the 'have nots' next door to the 'haves'), and the feasibility of public network and bespoke solutions that address serious anomalies	●			

SPECIFIC PRIORITY ACTIONS – MOBILE ACCESS

	SIGNIFICANT PLACES	PRIMARY PRODUCTION	TOURISM DESTINATIONS	TRANSPORT BLACKSPOTS
Local government agencies equip their service vehicles with mobile coverage monitoring tools to build a strong evidence base on specific gaps in coverage – to inform future blackspot programs and discussions with mobile service providers on more immediate localized solutions through antennae directional tuning, low-cost small cell towers and other bespoke work-arounds	●	●	●	●
The Victorian Government advocate for continued Commonwealth investment in blackspot programs, coupled with a review of funding models to ensure maximum investment efficiency as mobile coverage extends into ever more marginal areas and supports a range of voice, emergency alert, data and IoT needs	●	●	●	●
The Victorian Government commit to future funding of blackspot programs, including funding models that support widespread voice, emergency alert, data and IoT coverage in remote areas where service availability from any provider may stand ahead of competition considerations	●	●	●	●
Local governments and the Regional Partnership seek to influence 5G rollout by creating a list of high-demand priority locations	●	●	●	●
The Victorian Government examine the effectiveness of market enhancement models aimed at stimulating the early rollout of 5G in high demand areas.	●	●	●	●
Local governments and the Regional Partnership should compile a list of significant regional events where capacity problems exist and tender for mobile operators to provide region-wide multi-carrier mobile solutions			●	●

SPECIFIC PRIORITY ACTIONS – IOT ACCESS

	SIGNIFICANT PLACES	PRIMARY PRODUCTION	TOURISM DESTINATIONS	TRANSPORT BLACKSPOTS
The Regional Partnership coordinate local government and business group active engagement with all mobile operators on their plans for mobile-supported Cat-M1 and narrowband IoT deployment across Central Highlands, drawing on their own market intelligence on existing deployments and latent user needs, information provided by the Victorian Government from its agricultural IoT trials and the fieldwork conducted to support the Digital Plans	●	●		
The Regional Partnership coordinate local governments' and business groups' discussion with LP-WAN network operators on their plans for network deployment across Central Highlands, including what information they can provide and actions they can take to assist the network operators in their deliberations	●	●		
The Victorian Government include IoT support as a decision criterion in its mobile blackspot initiatives, and advocate the Commonwealth do the same in its future blackspot programs	●	●		
The Victorian Government consider an LP-WAN network rollout market facilitation model, including the feasibility and net benefits of state-wide blanket deployment of LP-WAN access	●	●		

SPECIFIC PRIORITY ACTIONS – PUBLIC WIFI ACCESS

	SIGNIFICANT PLACES	PRIMARY PRODUCTION	TOURISM DESTINATIONS	TRANSPORT BLACKSPOTS
The Regional Partnership coordinate the collection and sharing of information from local governments on the location, footprint, target audience and use trends of their public WiFi networks, and their ambitions for wider WiFi coverage in their LGAs – to inform local government decision-makers and Victorian Government policy considerations	●		●	
The Victorian Government fast-track the compilation and distribution of information on its public WiFi trials currently being conducted in Shepparton and Geelong	●		●	
The Victorian Government investigate the feasibility, net benefits and possible market facilitation models for deployment of public WiFi networks in smaller regional towns and localities, to meet local social needs and attract visitors	●		●	

SPECIFIC PRIORITY ACTIONS – SKILLS

	SIGNIFICANT PLACES	PRIMARY PRODUCTION	TOURISM DESTINATIONS	TRANSPORT BLACKSPOTS
As the supply and demand situation for digital skills is not well understood at present, a key action needed is purpose-specific data collection. A start on this has been made with questions in the local government online survey currently being conducted and in the onsite fieldwork to follow	●	●		
Looking forward, as a general point, it is anticipated there will be local solutions for 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	●	●		
At the local level, digital access infrastructure and services addressed in the Digital Plan potentially provides an array of tools to remediate skills shortages – for example, using YouTube, MOOCs (massive online, open courses), and interactive training providers. However, learning needs to start with baseline skills in the region so that people can find and engage with those materials. Access to this foundational education also needs to be effective and affordable. This is likely to be most effective when initiated at the local level, Multipurpose digital hubs can play an important focal point in this regard, including good online access where for example young people can teach older citizens and workers basic digital literacy skills.	●	●		

DJPR 12463/19

REGIONAL
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