

Aotea Great Barrier Island: Connectivity study

*Version 5
As at 24 July 2018*

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1. Executive Summary:

At a high level, connectivity on Aotea Great Barrier is of fair to poor quality compared with the mainland. This is constraining business activities on the island. It is also limiting the utility for residents of living on Aotea Great Barrier, and is hampering the experience of tourist visitors.

Most telecommunications infrastructure on the Barrier can be characterised as one or more of the following:

- Fragile, ageing and fault-prone (for example, Customer Multi-Access Radio services for landlines);
- Not fit for purpose compared with modern customer needs (e.g. microwave backhaul, copper broadband); and
- Limited in coverage (e.g. cellular mobile, fixed wireless broadband).

Looking at the island overall, *Figure 1* is a summary of Aotea's connectivity. This assessment uses as "green" the standard of service which would be available in a small town in mainland New Zealand, that is:

- Broadband via fibre or VDSL, and
- Mobile via multiple operators, typically 4G.

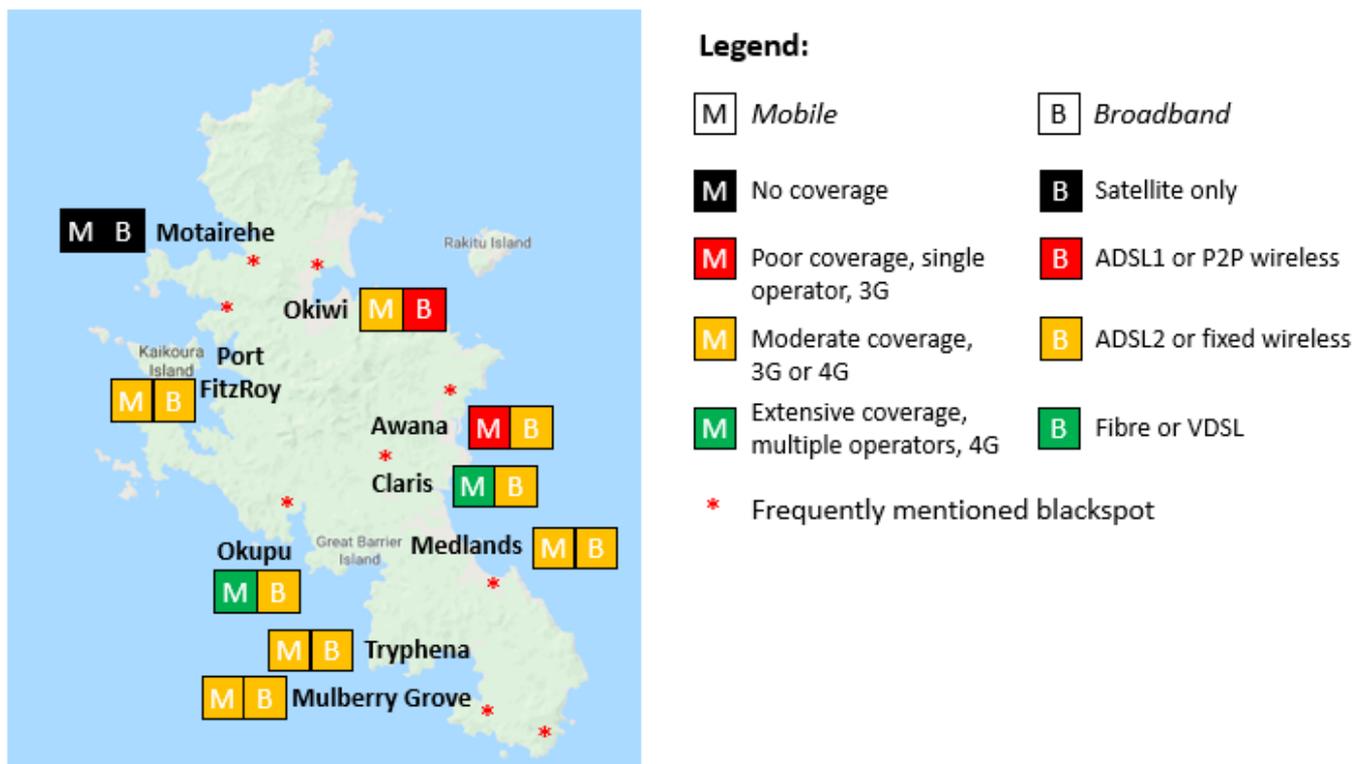


Figure 1: Summary of telecommunications accessible on Aotea Great Barrier today.

Importantly, this map may not represent the experience of individual households, particularly those at the fringe of coverage areas. We note in this paper the issues associated with coverage data from major telecommunications companies.

It is a concern to note that connectivity on Aotea Great Barrier is only improving slowly. Upgrades in recent years such as Medlands cellular & broadband coverage (2014) and Okiwi cellular & low speed data coverage (2016), while very welcome, have been modest in geographic area covered and in terms of the service delivered. Meanwhile, both urban and rural telecommunications networks on the mainland are improving at a steady rate due to Government investment programmes such as Ultra Fast Broadband and the Rural Broadband Initiative, as well as technology advances from industry such as 4G and 700 MHz spectrum.



The contracts let so far under phase 2 of the Rural Broadband Initiative (**RB12**) are particularly important, as these are the major new investment in rural broadband expected in the period 2018-21. Thus far, contracts will see around 450 new towers built around Aotearoa for mobile services and fixed wireless broadband. None of these towers are expected to be built on Aotea Great Barrier. The only potential benefit Aotea may derive from the current RB12 contracts is a small amount of additional mobile service which may reach Cape Barrier from a proposed site at Port Charles in the Coromandel peninsula.

By contrast, urban areas with fibre can already get “Gig” downstream speeds (1 gigabit per second/ 1000 Megabits per second (**Mbps**)). Areas with VDSL (high speed copper broadband), including many rural areas on the mainland, are receiving speeds over 100 Mbps due to network upgrades from Chorus. And in the offing are further technology advances which are set to take urban mobile services to 5G technology from 2020.

As a result, it appears the island is getting further behind the mainstream.

The cost of addressing these issues is likely to be material as coverage gaps are extensive and the population is widely dispersed.

An analysis of the **retail market** shows Aotea Great Barrier residents are charged higher prices for lower quality services than are available on the mainland. Choice is limited. This is exacerbated by the limited household incomes on Aotea Great Barrier (median income around two-thirds of Auckland), and makes telecommunications less affordable on the Barrier than on the mainland.

Many residents and even major businesses have experienced long leadtimes for **faults** to be repaired. For landlines and copper broadband, it is clear that fault restoration times are much longer than those experienced on the mainland.

Finally, a number of instances of **incorrect planning and coverage data** have been identified. This data is used by both industry and central Government. This results in further confusion of telecommunications users on Aotea Great Barrier, and contributes to low satisfaction with the quality of services on island as described in the community survey and interviews.



2. Mobile:

Mobile availability:

Mobile coverage on Aotea Great Barrier is highly variable, ranging from high-quality 4G services in locations such as Okupu and Claris to no coverage at all in communities such as Motairehe/ Kawa in the north. In between are many communities with poor or marginal coverage, including outlying households in Cape Barrier and those centrally located in Awana. *Appendix 1* provides a detailed map of the current coverage offered by Spark and Vodafone. Generally speaking, Vodafone has better coverage in the north and Spark in the south, with both companies offering coverage in the centre of the island.

The following table sets out the location, owner, mobile technology and spectrum used on the cellular towers located on Aotea Great Barrier.

Tower	Location	Owner	Service provider	Mobile generation	Spectrum (MHz)	Govt support	Colocation available?
1	Tryphena		Spark	3G, 4G	700, 850	No	No
2	Okupu		Vodafone	3G, 4G	700, 900, 1800	RBI1	Yes
3	Medlands		Vodafone	3G	900	Akld Council	No
4	Okiwi		Vodafone	3G	900	Akld Council	No
5	Kaikoura Island		Vodafone	3G	900	No	No
6	Kaikoura Island		Spark	3G, 4G	700, 850	No	No
Colocation in operation:							
	Okupu	Vodafone	Spark	3G, 4G	700, 850	RBI1	n/a

Table 1: Mobile tower locations and descriptions. Source: Wollemi.

Vodafone's sites other than Okupu offer 3G only, and do not use the highest quality spectrum available, 700MHz (the lower the spectrum frequency, the greater distance the mobile signal will travel and the higher its speed).

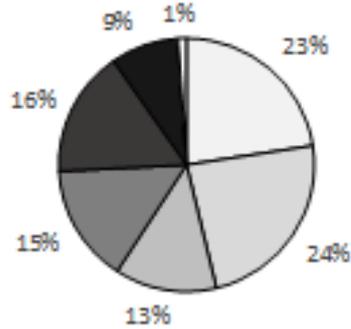
Only one tower has a second operator "co-located" on it: the Vodafone tower at Okupu. As a condition of RBI1 funding from central Government, Vodafone were required to offer colocation at agreed rates to competing operators. The other towers on Aotea Great Barrier do not have this requirement, and Vodafone and Spark may choose to offer colocation or not, making it more difficult for second and subsequent operators to add their own infrastructure.

Mobile uptake:

Unsurprisingly, most respondents to the survey (98%) have a mobile phone. However, almost one quarter of respondents (23%) say they have no coverage at home, while a further 37% say coverage is poor or very poor (*Figure 2*). Just one in four respondents said coverage was good or excellent.



How is the mobile coverage at your home?



None / zero bars
 Very poor / 1 bar
 Poor / 2 bars
 Average / 3 bars
 Good / 4 bars
 Excellent / 5 bars
 Not applicable / don't know

Figure 2: Mobile coverage at home. N = 93

How is the mobile coverage at your place of work (if different from home)?

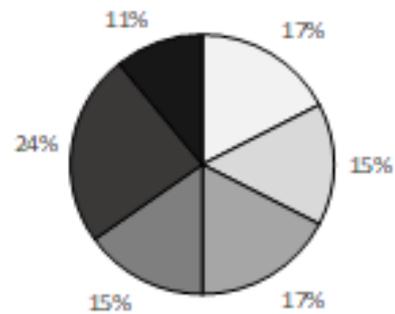


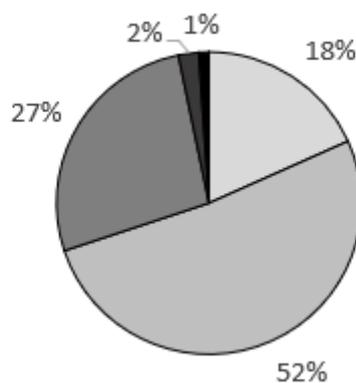
Figure 3: Mobile coverage at work. N = 46

By contrast, at a national level Vodafone claims to offer mobile service to 98.5% of the NZ population, while Spark claims 97%. In 2017, the Government said over 90% of the total NZ population had access to 4G.

A smaller number of survey respondents provided information on mobile coverage at their place of work, where that is different from their home (Figure 3). Here the picture is a little better, with fewer saying they have poor coverage or none at all, and a higher proportion (35%) describing coverage as good or excellent.

Thinking about Aotea Great Barrier as a whole, 70% of survey respondents believe mobile coverage is poor or very poor, while just 3% stated coverage is good or excellent (Figure 4).

How would you rate mobile coverage across the Barrier as a whole?



Very poor
 Poor
 Average
 Good
 Excellent

Figure 4: Mobile coverage across the island. N = 93



Mobile blackspots:

A range of locations on Aotea Great Barrier have poor or no mobile connectivity. The places most commonly named in the community survey are:

- Motairehe and Kawa
- Awana
- Claris (often referring to the golf club, social club, area around the cross-roads)
- Whangaparapara
- Medlands (often referring to the south end)
- Tryphena and Tryphena Wharf
- Mulbery Grove; and
- Cape Barrier.

Mobile providers:

Most residents responding to the survey (84%) are with Vodafone or Spark, who have the lower customer satisfaction than smaller providers (*Figure 5*). Twelve per cent are with 2Degrees while 4% are with Spark's discount brand Skinny which typically has higher customer satisfaction.

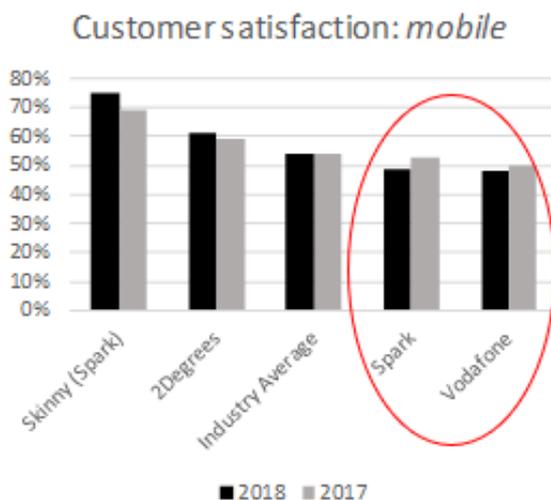


Figure 5: Mobile customer satisfaction, NZ. Consumer NZ Jan 2018.



3. Broadband:

Broadband availability:

The difference in broadband available on Aotea Great Barrier compared with the mainland is shown in *Table 2*. We selected Coromandel town as an example of a small North Island town which has some characteristics in common with Aotea Great Barrier. As you can see, the Barrier lags well behind the connectivity available in Coromandel. Auckland is well ahead of both.

Broadband technology:	Available in Auckland?	Available in Coromandel town?	Available on GBI?
Satellite	Yes	Yes	Yes
Fixed wireless (cellular)	Yes	Yes	In some areas
Fixed wireless (P2P)	Yes	Unknown	In some areas
Fixed wireless (unlicensed)	Yes	Yes	No
ADSL1	Yes	Yes	In some areas
ADSL2	Yes	Yes	In some areas
ADSL2+	Yes	Yes	No
VDSL	Yes	Yes	No
Fibre 100	Yes	By 2020	No
Fibre Gigabit	Yes	By 2020	No

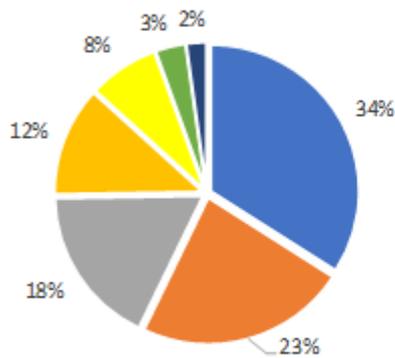
Table 2: Auckland vs Coromandel town vs Aotea broadband availability.

Importantly, Coromandel town is one of ~390 urban and peri-urban areas around Aotearoa which are seeing deployment of fibre broadband (Ultra Fast Broadband/ **UFB**). As a result, Coromandel is assured of a further technology upgrade by 2020. Aotea is not so fortunate.

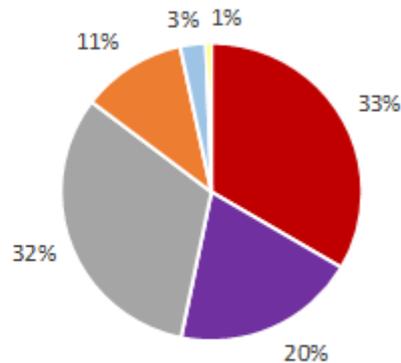
Broadband uptake:

The community survey reveals a completely different mix of technologies are used to access the internet on Aotea compared with the mainland, as shown in *Figure 6*.

How does your house get its internet?



NZ Broadband: March 2018



- Mobile
- Wireless
- Copper (ADSL)
- No internet
- Satellite
- Don't know/ other
- Copper (dial-up)
- Fibre
- Cable
- Copper (VDSL)

Figure 6: Aotea internet access (July 2018, n = 91) vs NZ Broadband market. Wollemi estimates

The most commonly reported form of internet access on the Barrier is via a mobile phone. The Commerce Commission does not even track mobile internet access as one of its broadband categories, as most urban



residents use a mobile phone as a secondary, complimentary means of internet access rather than the primary access for the household.

More than half the broadband services on the mainland are technologies which are not available at all on Aotea: Fibre (Ultra Fast Broadband/ UFB), VDSL (high speed copper) and Cable.

One in every eight respondents (12%) to the Aotea Great Barrier reported they have no internet access in the home. By contrast, the World Internet Project NZ reported¹ in early 2018 that only 6% of New Zealanders do not regularly access the internet. As the Barrier survey was self-selected, it may be assumed that the sample is made up of people with a higher interest in telecommunications or propensity to purchase broadband. As a result, the true discrepancy between Aotea Great Barrier and the mainland may be higher.

Data caps:

Most services on Aotea Great Barrier have a data cap, in contrast to the mainland where broadband is usually unlimited (without any limitation on data usage) – see *Figure 7*. On the mainland, unlimited plans have taken hold since 2014 alongside the rollout of faster broadband technologies such as fibre/ UFB and VDSL, which tend to be associated with higher data usage.

Data caps are a very reasonable response from industry seeking to ration a scarce resource. However, they act to constrain activity which is encouraged on the mainland. More importantly, the data caps applicable for many households on Aotea Great Barrier are so small that even a very modest level of usage (by urban standards) would incur a sizeable overage fee in the monthly bill.

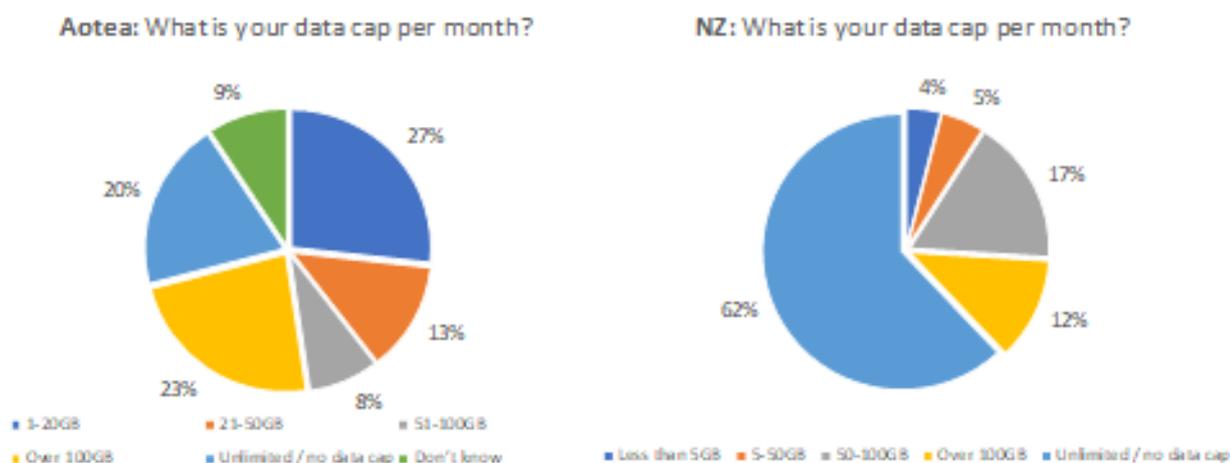


Figure 7: Aotea data caps (July 2018, n = 86) vs NZ (Stats NZ, June 2017). Wollemi estimates

Data usage:

As above, data caps are very modest on Aotea compared with the mainland. So perhaps it is not surprising that around 40% of respondents to the community survey said they “occasionally” or “often” exceed their data cap. This means Barrier residents are paying steep overage bills while still using much less than mainlanders in the city and rural areas alike.

Across New Zealand, the Commerce Commission reported average data usage in the year to June 2017 was 117 GB per month. Usage is growing at around 50 per cent every year. On Chorus’s copper and fibre networks, average usage in the month of June 2018 reached 210 GB.

¹ Source: World Internet Project NZ, AUT, May 2018.



This means only a small fraction of Barrier residents could use the average amount of internet data consumed in a NZ household without blowing their data cap.

Broadband price comparison:

It is clear that Barrier residents are paying more for comparable services than those in urban areas. *Table 3* sets out example plans which are available to Aotea Great Barrier households, compared with those available in Auckland.

Available in	Technology	Provider	\$/month	Data/ month	Speed
Aotea	Satellite	Farmside	\$139	10GB peak, 20GB offpeak	Up to 10 Mbps downstream, 2 Mbps upstream
Aotea	Satellite	Farmside	\$190	20GB peak, 40GB offpeak	Up to 16 Mbps downstream, 2 Mbps upstream
Aotea	Satellite	Farmside	\$269	40GB peak, 60GB offpeak	Up to 16 Mbps downstream, 2 Mbps upstream
Aotea	Fixed wireless - rural (P2P)	Farmside	\$102	20GB	Up to 5 Mbps downstream, 1 Mbps upstream.
Aotea	Fixed wireless - rural (P2P)	Farmside	\$125	50GB	Up to 8 Mbps downstream, 2 Mbps upstream.
Aotea	Fixed wireless - rural (P2P)	Farmside	\$217	100GB	Up to 10 Mbps downstream, 2 Mbps upstream
Aotea	Fixed wireless - rural (RBI)	Vodafone	\$106	120GB	26Mbps typical peak downstream speed, 5 Mbps upstream
Aotea	Fixed wireless - rural (RBI)	Vodafone	\$166	200GB	26Mbps typical peak downstream speed, 5 Mbps upstream
Aotea	ADSL2	Orcon	\$42.50*	Unlimited	Up to 10 Mbps downstream, 1 Mbps upstream
Auckland	Fixed wireless - urban	Vodafone	\$50	40GB	26Mbps typical peak downstream speed, 5 Mbps upstream
Auckland	Fixed wireless - urban	Spark	\$85	120GB	26Mbps typical peak downstream speed, 5 Mbps upstream
Auckland	Fixed wireless - urban	Spark	\$90	240GB	26Mbps typical peak downstream speed, 5 Mbps upstream
Auckland	ADSL2+	Orcon	\$42.50*	Unlimited	13Mbps typical peak downstream speed, 1 Mbps upstream
Auckland	VDSL	Orcon	\$42.50*	Unlimited	40Mbps typical peak downstream speed, 10 Mbps upstream
Auckland	Fibre	MyRepublic	\$75	Unlimited	100 Mbps downstream, 20 Mbps upstream
Auckland	Fibre	MyRepublic	\$100	Unlimited	1000 Mbps downstream, 500 Mbps upstream

Table 3: Broadband price comparison. Prices shown inclusive of GST. Note: * indicates a promotional offer.

As both copper and fibre networks around New Zealand are “open access” (that is, network owners do not sell directly to customers, and a range of service providers can offer service), competition in retail telecommunications is stronger for customers with access to copper and/ or fibre than those who can only access fixed wireless services. Around 90 Retail Service Providers offer service on copper and fibre today. Retail competition is what drives promotional offers such as the Orcon plan listed in *Table 3*. These are attractive to consumers but can only be accessed by Aotea Great Barrier residents in the ADSL coverage area.

Aotea Great Barrier residents also pay more for landline services than those on the mainland. On the mainland a landline with local and national calling included is frequently priced at \$5 or \$10 per month with your broadband plan. On Aotea Great Barrier, by contrast, a landline costs an extra \$20 per month with a Farmside satellite plan, or an extra \$40 per month for those using Araneo P2P wireless broadband.

Broadband providers:

Based on the survey, around 80% of broadband services are with just two companies: Spark and Vodafone. These are also the two largest providers on the mainland, but across Aotearoa they have lower share (around 71%) and more competition. Vodafone is the larger of the two on Aotea Great Barrier, whereas on the mainland Spark has the higher market share. Vodafone’s share on the island has increased recently with its acquisition of Farmside, which sells both its own satellite services as well as reselling Vodafone fixed wireless.

The 3rd largest national service provider, Vocus (owner of brands like Orcon and Slingshot) appears to have a limited interest in Aotea Great Barrier, with just a single customer in the community survey. The nation’s 4th and 5th largest providers, Trustpower and 2Degrees, did not have a single customer responding to the survey.

A small but material proportion (7%) are with Ultimate Broadband, a smaller operator which has been active on the island, while Wireless Nation and Netspeed had customers responding to the survey.

It is notable that Aotea’s largest and second broadband providers have the lowest customer satisfaction in recent Consumer New Zealand surveys – see *Figure 8*.



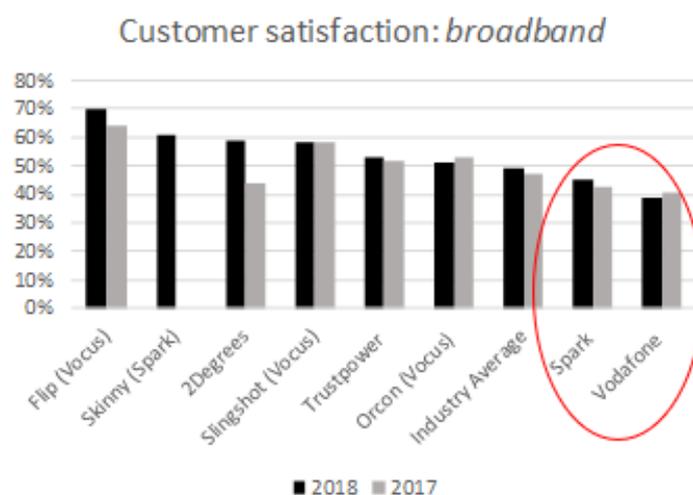


Figure 8: Broadband customer satisfaction, NZ. Consumer NZ Jan 2018.

Link to Government objectives in broadband policy:

Central Government has several overlapping goals for broadband connectivity:

- Closing the digital divide by 2020 (noting that what this means in practice has yet to be specified);
- Making ICT second largest contributor to GDP by 2025; and
- 99% of the population to have access to high speed broadband (being downstream speeds of 100 Mbps); by 2025, with the remaining 1% having access to at least 10 Mbps (this is the goal of the previous National Government and may yet be revisited).

Broadband at Okiwi:

The funding agreement between Vodafone and Auckland Council back in 2013 stated that a desired outcome of the 2 new sites was to “provide wireless voice and broadband to Medlands and Okiwi areas where there is currently no mobile telecommunications”.

Later in the document the service for Okiwi is described as “3G mobile voice and data services (slow data speed capability)” and as a “best efforts” service.

Since the Okiwi tower went live in mid-2016, both Vodafone and Farmside (as a reseller, prior to its acquisition by Vodafone) have offered fixed wireless broadband off the Okiwi tower to customers in the Okiwi valley.

As noted above, the Commerce Commission publishes stats on broadband in NZ, and they don’t count internet service to a mobile phone as a broadband connection.

The Funding Agreement also stated that Vodafone should offer service in the same way it does with the rest of its network. In fact, Vodafone offers its rural broadband pricing, which as above is higher than urban prices – see *Broadband price comparison* above.



4. Landline:

Landline availability:

Much of Aotea Great Barrier has a copper landline available, capable of offering voice service. As above, only in two small areas around Claris and Tryphena are copper broadband (ADSL) services available on these lines.

Under historical regulatory settings, properties built before 2001 can request a new copper “lead-in” to their premises from Chorus, and a legacy landline service (known as the “PSTN”) from Spark. However, the “lead-in” is deployed at a material cost to the household. As a result, very few if any new copper lead-ins are being built on Aotea Great Barrier at present.

As fibre to the premises has not been deployed on Great Barrier, fibre landlines are not available.

Landline uptake:

Across New Zealand, four in every five households had a landline in 2017², down from 90% a decade ago. A further update will be available later this year in the 2018 census results. By contrast, of respondents to the survey on Aotea Great Barrier, only 55% had a landline.

Many residents on Aotea use their landlines as a mainstay of everyday communication, in a way rapidly becoming rare on the mainland. Given this, it is interesting to note that the proportion of households who use a landline is actually smaller than the mainland.

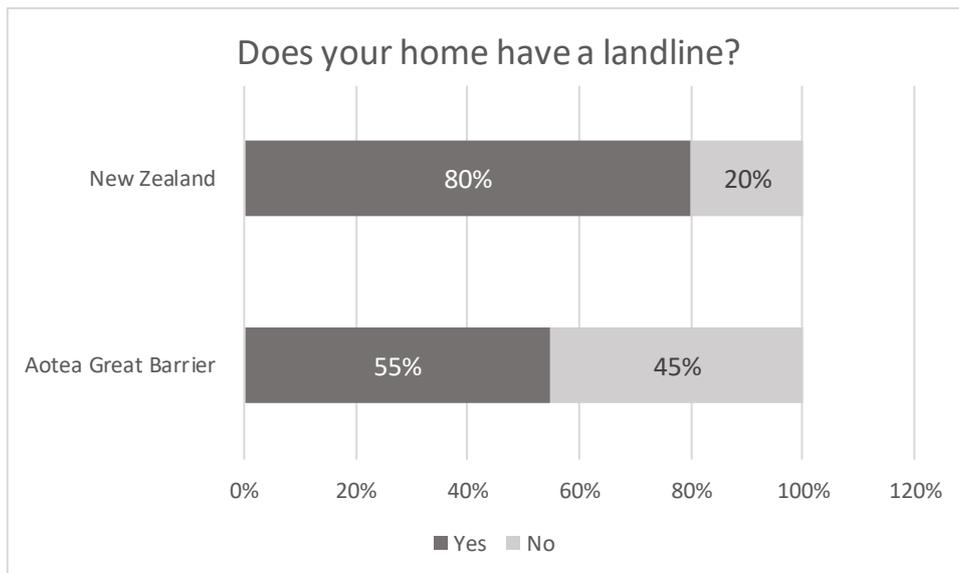


Figure 9: Landlines in the home, NZ vs Aotea Great. Canstar Blue 2017; Wollemi survey 2018.

Performance issues are common with landlines on Aotea Great Barrier. Some comments from the community survey and interviews are as follows:

- “We’re sick to death of landlines! Reporting a fault takes forever and they never seem to know what to do about it anyway.”
- “Landlines are terrible, they are notoriously unreliable. Issues can be caused by water ingress up the hill, hardware needing to be rebooted, etc.”
- “Landline calling to local numbers often has problems, such as buzzing and squeaking on the line. However, we haven’t had many actual landline outages.”

² Source: Canstar Blue 2017: https://www.nzherald.co.nz/nz/news/article.cfm?c_id=1&objectid=11810607



A further issue with landlines is the need for a power source. Most modern telephone handsets require power in the home, and a consistent power source is also needed to run the network. As Aotea has no electricity grid, a range of non-grid power sources are used to run telephony on the island, and issues with these contribute to the overall poor performance of the Barrier’s telecommunications.

Accordingly, it was interesting to see that survey respondents are more favourable regarding landline performance than mobile services (Figure 10). One in five rated their service as “good” or “excellent” compared with one in 10 for mobile coverage in the home.

How would you rate your landline service?

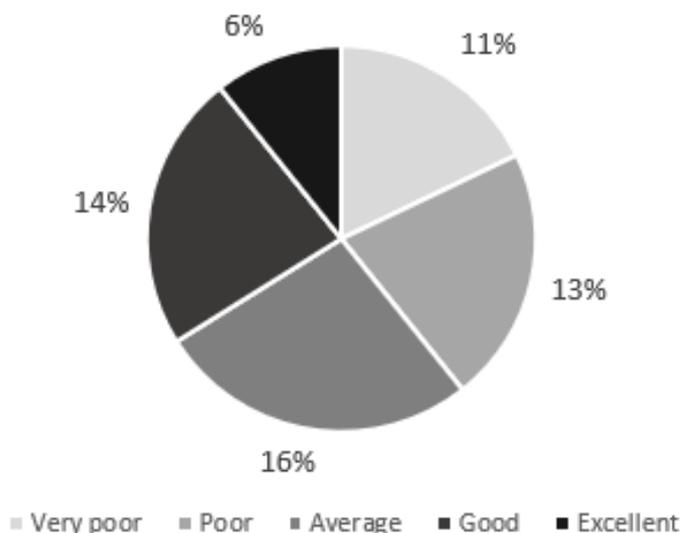


Figure 10: Rating your landline service. N = 56

One may surmise that respondents with the most negative landline experience have already disconnected their service and remaining users are more satisfied.

Again, Spark and Vodafone are the dominant providers. Spark alone accounts for more than 6 in every 10 services. Inclusive of Farmside (now owned by Vodafone) these two companies deliver more than 90% of landline services on Aotea Great Barrier.



5. Infrastructure Owners and Service Providers

This section describes some of the particular issues and attributes of individual asset owners and service providers operating on Aotea Great Barrier.

Chorus:

As the Local Board are aware, fixed copper lines used for voice services and broadband are owned by Chorus. Over the past year there has been a large volume of faults on the Chorus network on Aotea, especially over the summer.

Residents have reported that logging a fault with Chorus is difficult. Chorus does not provide services directly to customers, while service providers (such as Spark and Vodafone) which do often lack specific information about faults and outage.

More importantly, the time for faults to be restored has been extremely lengthy, as much as 2 or even 3 months in some cases.

The situation appears to have been exacerbated by the recent retirement of Chorus's only technician based on island, although Chorus denies this.

Importantly, the scale of copper network faults and the time taken to resolve them on Aotea appears completely at odds with Chorus's reported performance at a nationwide level. Chorus reports weekly on its nationwide fault restoration performance across both its copper and fibre networks.³

As at 18 July, Chorus reported almost 15,000 had been restored during the month to date, around 830 per day. As at 18th July there were 868 open faults, and the average time to restore a fault was just 22.4 hours. Only 437 faults or 3% of the faults reported so far in the month had been open for more than three days.

In March 2018 Chorus provided the Hon. Nikki Kaye MP and Auckland Council with several letters in response to issues experienced over Christmas/ New Year and early 2018. Chorus says it is making several improvements, including:

- Improving power sources at the Okupu site;
- Trimming trees at Tryphena to improve the microwave "line of sight";
- Replacing a faulty radio antenna;
- Upgrading landline services on Aotea Great Barrier, expected to be complete by the end of 2018.

In relation to information quality, Chorus like a number of major telecommunications companies have issues with legacy data from multiple sources. An example address in Okupu tested on the address checker on the Chorus website returned the result "may be able to get VDSL". This is incorrect as VDSL has not been installed on Aotea Great Barrier. By contrast, the National Broadband map⁴ says for the same address that ADSL is not available. This is also incorrect!

2Degrees:

New Zealand's third mobile operator 2Degrees does not have its own mobile infrastructure on Aotea Great Barrier. Instead its services "roam" on Vodafone's network via an agreement with the latter. However, the roaming agreement does not cover 4G and does not include high-quality 700MHz spectrum. 2Degrees' customers on Aotea must rely on 3G and lower quality spectrum such as 900MHz. This in practice will constrain 2Degrees' customers on Aotea Great Barrier to a downstream speed of less than 1 Mbps.

³ See <https://company.chorus.co.nz/chorus-fault-restoration-performance-7>

⁴ See <https://broadbandmap.nz/>



TeamTalk – Araneo & CityLink:

Araneo, owned by TeamTalk, provides a Point 2 Point wireless service which has been available for some years. Speeds and data caps are modest while prices are high (see *Section 3*); however, the service is superior to satellite. The service is available in and around Mulberry Grove, Kaitoke and Okiwi, and provides internet coverage to the island's 3 schools as well as DOC and some households. Araneo does not sell services directly to customers, so Aotea residents must contact a reseller such as Farmside, previously part of TeamTalk and now owned by Vodafone.

Araneo services are not being “turned off”, at least so far as TeamTalk are stating publicly in response to customer queries. Indeed, as Araneo's service to the 3 schools on Aotea Great Barrier is funded under the Government's Network 4 Learning scheme⁵, it would most likely be unable contractually to exit this service until a suitable replacement is available.

However, the service has the characteristics of a “legacy” service:

- It is not being actively promoted or marketed by Araneo or service providers;
- It is not shown on coverage maps such as the national Broadband Map⁶, and
- Service providers (such as Farmside) are unsure about its extent or capability. In preparing this report, we approached Farmside for a quote on using Araneo in the Okiwi valley, and were given two separate responses: one for Araneo, the other for satellite as “no other broadband options are available”.

It would be reasonable to assume that potential customers for the Araneo infrastructure on island could be confused about this service.

⁵ See <https://www.n4l.co.nz/>

⁶ See <https://broadbandmap.nz/>



6. Household usage:

Households on Aotea Great Barrier use the internet for a diverse range of reasons, as shown in *Figure 11*. Email/messaging (99%), social media (85%) and news/ weather information (77%) were the leading forms of usage selected by respondents, followed by business usage (see *Section 7* below).

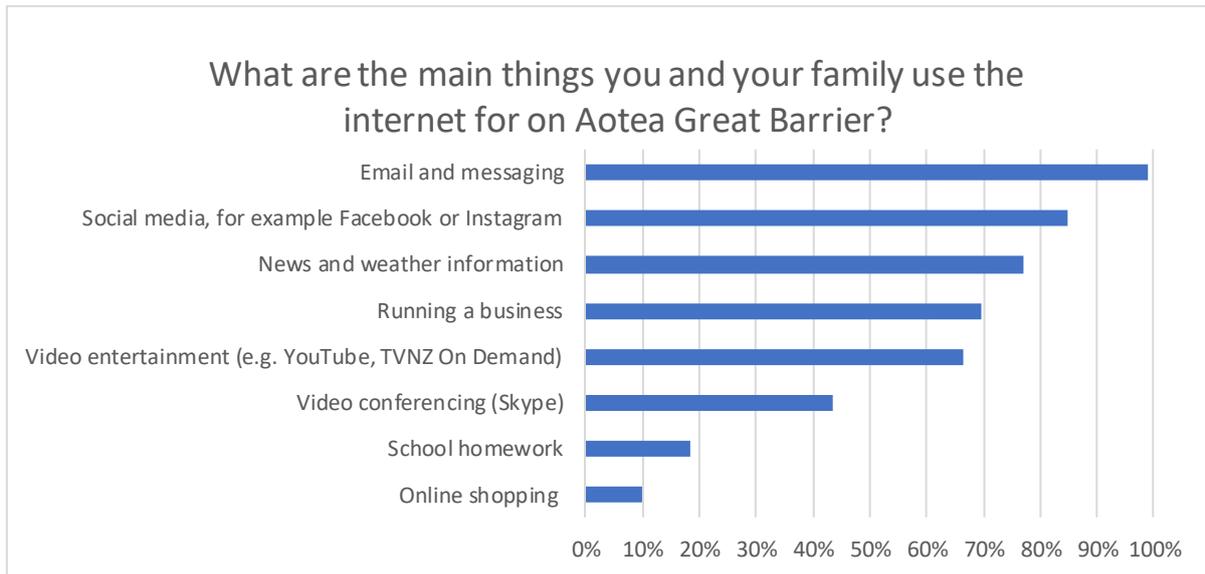


Figure 11: Uses of the internet on Aotea Great Barrier. N = 92

Two-thirds of those responding use the internet for video entertainment such as YouTube or TVNZ On Demand. This is a high figure given the quality of broadband on island, the small data caps on most plans and the data-hungry nature of online entertainment. A number of respondents specifically mentioned Netflix as a service they would like to use on Aotea but are unable to do so due to issues with broadband quality and/ or prices.

One in every 10 respondents specifically mentioned online shopping in their comments (this was not a specific category in the question). Countdown, The Warehouse and vet supplies were all mentioned. Several of these responses came from whanau with very poor connectivity in the north of the Barrier.

The survey received a particularly strong response on the point of services degrading at certain times. Three quarters (76%) of responses indicated services are worse at certain times of the day, during school holidays etc. Some of the comments included:

- "Christmas/ New Year/ Easter;"
- "Seems to be nil coverage at busy times;"
- "School holidays are the worst;"
- "Broadband drops out at peak times. Morning and evening are the worst;"
- "The internet is so slow as to be almost unusable for business skype/zoom forums in the holidays"
- During rain and bad weather.

Asked what services they wish to use but cannot, survey respondents included services such as:

- "Island wide mobile coverage;"
- "To be able to run my business all year round without disruption;"
- "Cloud services, data transfer, large file transfer;"
- Video streaming including Netflix, YouTube;
- Video conferencing including Skype/ FaceTime/ Zoom;
- "Mobile phone connection at home;"
- 4G, WiFi and fibre;
- "Everything is just sooo slow."



Thinking about the reasons why they cannot use such services, respondents to the survey were emphatic that issues with coverage/ access to technology are the main culprit (nominated by 85%), with high prices a distant second with 24% (see *Figure 12*).

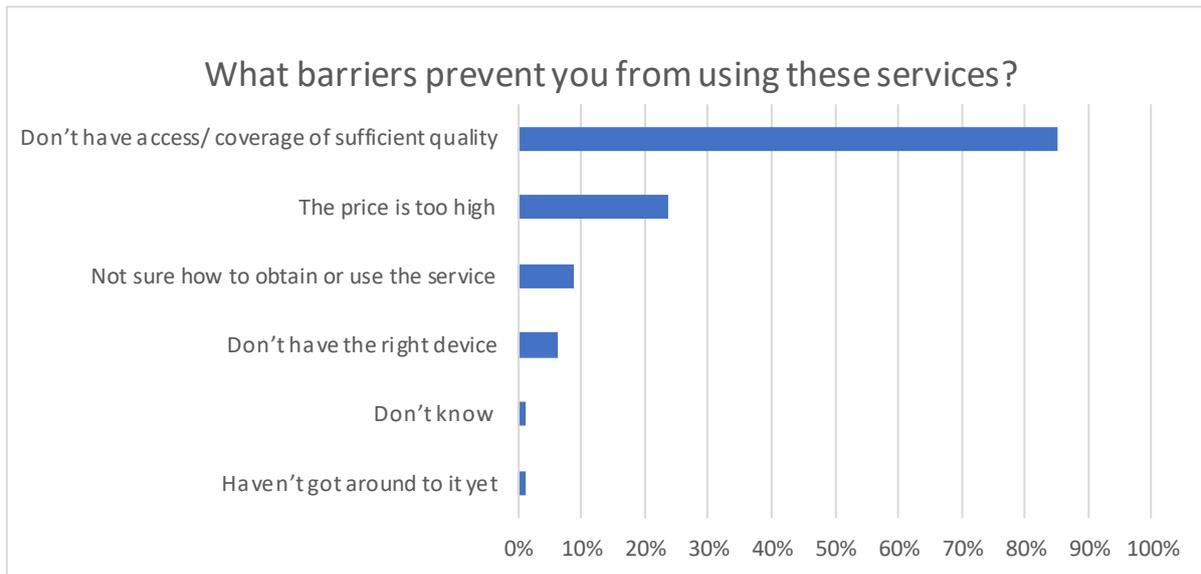


Figure 12: Barriers to using desired services over the internet. N = 80

Health sector:

In terms of health sector usage, Aotea Health at Claris has created an innovative solution to the challenges of staying connected. In return for hosting computer hardware for TeamTalk (Araneo/ CityLink) on its premises, the centre receives a 10 Mbps “symmetric” (same upload as download) broadband service at no charge. The centre has since upgraded to a 20 Mbps symmetric service but only pays the price increment for the upgrade. As a result of having much higher quality service than is available to many Aotea residents, the Claris centre is largely happy with its connectivity at Claris and is positioned to support telemedicine to the mainland as soon as the Auckland District Health Board is ready.

However, for health workers who are on call connectivity at their homes is a key issue due to limited mobile coverage and poor quality broadband to homes. Finally, Aotea Health’s second site at the Nurses’ Cottage, Port FitzRoy has struggled to access health IT systems via Aotea Health’s Virtual Private Network, and has experienced repeated drop-outs in service.

Education sector:

In terms of education usage, interestingly only 18% of community responses indicated that regular internet activities (including those of family members) include school homework. This may be because of the fairly small number of school-aged children on Aotea.

Private learning activities online were also identified by several respondents to the community survey. As well as university and polytech courses, online study via sources such as YouTube and Khan Academy is becoming more and more popular.



7. Business usage

The community survey mostly considered household rather than business usage, but the limited number of questions focussing on businesses produced telling results.

Seventy percent of survey respondents said they use the internet for *“running a business, for example using internet banking, using “cloud” services.”*

Businesses are even less likely to have a landline than households (51% vs 55%). While this is a narrow difference and not statistically significant, it does illustrate the dependence which Aotea businesses have on mobile phones. Yes as we have seen, mobile coverage is also problematic for many on island - residents and businesses alike.

Many businesses are dependent on copper landlines for more than just voice calls. Of 18 respondents who answered the question, 14 run EFTPOS over their landline, 9 run a fax machine and 2 use a monitored security alarm. When the landline is down, these services are unable to work.

We have heard during the project from a number of businesses who have suffered the consequences of poor connectivity. These include:

- A major store running its EFTPOS over a dial-up copper connection because the mobile service is inadequate, in particular because of its congestion at peak trading periods;
- A business whose contractors carry multiple mobile phones with them so they are in contact in both Spark and Vodafone coverage areas – and which still find that staff sometimes have no coverage at all at work sites;
- A tourism operator which takes online bookings and uses Xero for its accounts, but whose business is barely able to function when these are unavailable; and
- Firms whose landlines and broadband have experienced outages for 2, even 3 months at a stretch.

A detailed description of current and potential future usage of the internet by New Zealand businesses is beyond the scope of this paper. However, a short list of some of the exciting technology opportunities is below. Each of these opportunities is enabled by connectivity – typically high speed internet access, but also in some cases lower speed, but high reliability, low cost, ubiquitous access.

Such opportunities include:

- **Cloud computing** – enabling much more effective data exchange and storage across multiple sites, improved resilience and lower costs and carbon emissions.
- **Big data/ machine learning/ Artificial Intelligence** – helping improve decision making by making effective use of the massive amounts of data now being generated by internet-based information exchange and commerce.
- **Virtual reality/ augmented reality** – offering new, richer “virtual” experiences without the need for physical travel.
- **Internet of Things/ Smart Grid** – using mass deployment of small, cheap internet-based sensors to improve management of industries from utilities to agriculture.



8. Civil Defence and other uses:

Civil Defence:

Civil Defence on Aotea Great Barrier uses its own radio communications which are of a good standard. There have been two recent opportunities for Civil Defence to test its capabilities: the North Barrier flooding in mid-2014 and the Claris bushfire of early 2014. From a telecommunications perspective Aotea Great Barrier endured these events fairly well.

Authorities have established an old school “telephone tree” to get emergency messages out to Aotea residents. Keeping this up to date is a challenge as more and more people are moving to mobile services, which have coverage issues in some locations, and some don’t remember to update the list.

Central Government has recently been testing an “emergency mobile alert”⁷ system which could inform Aotea Great Barrier residents of the risks of natural disasters such as tsunamis. However, the system depends on residents having a compatible phone, having it charged and turned on, and having it in a mobile coverage area.

It is not clear what coverage assumptions central Government is making in rolling out the emergency mobile alert system. On Aotea, where mobile coverage is clearly problematic in many locations, Civil Defence authorities are working “on the basis that some people will not get these messages.”

Issues with street numbering on Aotea are also a civil defence challenge.

Much of Aotea’s population and infrastructure is low-lying (e.g. townships such as Tryphena & Claris, as well as roads, health centre, both airstrips etc.). This means Civil Defence needs continuing focus.

Radio:

Commencing back in 2006, Aotea FM now broadcasts on 3 separate frequencies covering the Central & South, Whangaparara, and the North. Three radio masts provide service. These are mostly independent of telecommunications services on Aotea Great Barrier, and the issues thereof.

Internet of Things:

At least six Internet of Things trials have been completed on Aotea Great Barrier, with local start-up EcoNode developing a range of services to manage and implement “Predator Free NZ” initiatives. These use a technology known as LoRaWAN (Long Range Wide Area Network) and unlicensed spectrum. These services are characterised by low bandwidth requirements, low power usage (each device being powered by AA batteries). The main benefit to be gained being from large numbers of devices. LoRaWAN services operate from small antennae which can be mounted to the roof of a building with reasonable line of sight of surrounding areas.

⁷ See <https://www.civildefence.govt.nz/get-ready/civil-defence-emergency-management-alerts-and-warnings/emergency-mobile-alert/>



9. Next steps:

The Government through Crown Infrastructure Partners is currently considering bids to extend RBI2. Minister Curran has said that a further \$105 million is available towards such extensions. I will provide further comments on this verbally at our meeting on 31 July.

Should extensions to the RBI2 programme not deliver a satisfactory outcome for Aotea Great Barrier, the Government's Provincial Growth Fund (**PGF**) provides a further possible means of funding needed infrastructure improvements.

The criteria for the PGF are:

1. **Link to PGF and government policy outcomes:** Potential productivity uplift, job creation, community benefits, improved use of Māori assets, sustainability of natural assets, mitigation of climate change.
2. **Additionality:** Add value by building on what is there already and not duplicating existing efforts, with clear public benefit.
3. **Connected to regional stakeholders and frameworks:** Projects must align with regional priorities, and need to have the support of local stakeholders.
4. **Governance, risk management and project execution:** Project processes, team capacity and capability to deliver, project sustainable in the longer term beyond the PGF's life.

Aotea Great Barrier's needs appear to align well with these criteria.

The PGF is able to provide funding towards feasibility studies.

Some of the options to improve Aotea Great Barrier's telecommunications include:

- Upgrading backhaul links to the mainland;
- Upgrading 3G sites such as Kaikoura and Okiwi to 4G;
- Upgrading the Araneo P2P Wireless network to offer services like a "WISP" (wireless ISP using unlicensed spectrum);
- Remediating the copper network;
- "Cabinetising" the parts of the copper network which do not support broadband, in order to offer ADSL and VDSL broadband to areas outside the current footprint; and
- Fibre to the premises, although as noted in this report this would be very expensive.



Appendix 1: Infrastructure and coverage maps:

Important clarification:

The following maps have been sourced from industry data and “sense-checked” by Wollemi and Telco2.

However, they should be treated as indicative and a level of scepticism should be applied particularly at the fringes of coverage. The community survey and interviews have described a number of areas where mobile coverage (as well as fixed wireless coverage for broadband) is known to be patchy, whereas the coverage maps show a level of coverage is available. This is a common issue and not isolated to Aotea Great Barrier.

Radio coverage planning in particular is an imprecise science. Factors such as trees and cloud cover can influence mobile signal propagation.

Connectivity delivered via cellular mobile or fixed wireless will worsen or “attenuate” the further signal has to travel. For Spark and Vodafone, coverage maps do not show this effect. It should be assumed that areas shown near the fringe of coverage may have poor or limited coverage.

Connectivity delivered via copper broadband also attenuates with distance from the cabinet. For Chorus’s copper broadband network, the coverage map splits available services into two categories:

- Downstream speeds of 5 to 10 Mbps (corresponding to ADSL2), and
- Downstream speeds of 1 to 5 Mbps (corresponding to ADSL1 technology).

While the maps have been pasted into this document as images, they are available for Local Board members to look at in more detail, including particular localities of interest.



Copper broadband:

Copper broadband is confined to 2 small areas around Claris and Tryphena/ Mulberry Grove. ADSL2 is available from these sites with a maximum estimated speed of around 10 Mbps downstream, 1 Mbps upstream. ADSL2+ (up to 24 Mbps downstream) and VDSL (capable of >100 Mbps downstream) are not available. Copper services degrade with distance from the cabinet, so customers further from the cabinet will receive slower speeds.

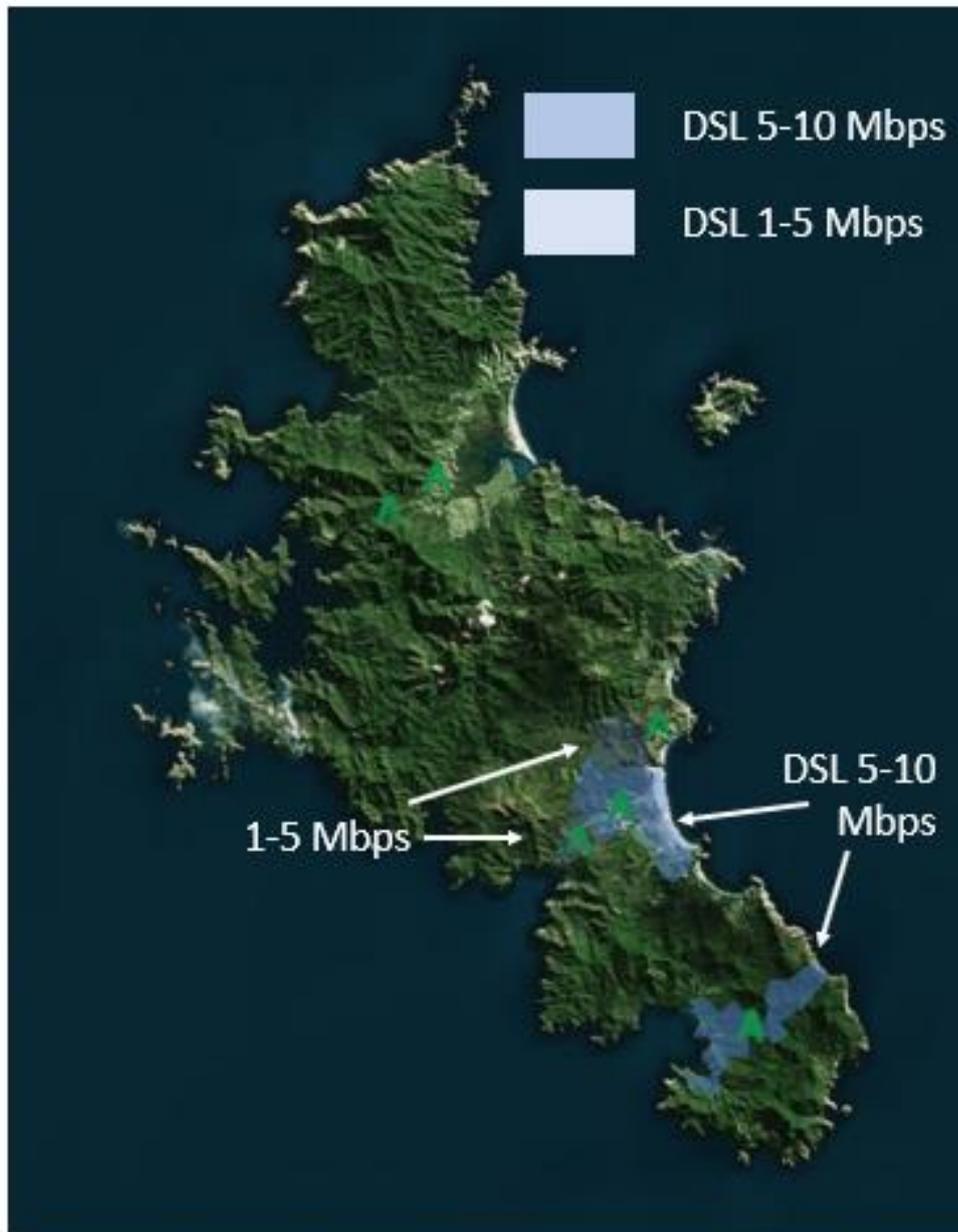


Figure 13: Copper broadband coverage (Chorus DSL)



Vodafone mobile coverage:

Vodafone coverage is strongest in the centre of the island around the Okupu tower, and includes 4G service. This mapping shows no Vodafone coverage in the south, but we are aware that a moderate signal often reaches Tryphena township. By contrast, coverage projections around Medlands (e.g. Mitchener Road) and Awana appear optimistic.

In the north, both Port FitzRoy and Okiwi have service but 3G only. Further north, communities at Orama, Kawa, Motairehe and northern Mabey Road are without service.



Figure 14: Vodafone mobile coverage (3G and 4G/ LTE)



Spark mobile coverage:

Spark coverage is stronger in the south and west of the island. 4G has been installed on each of Spark's sites. Coverage gaps in the north and north-east are similar to those for Vodafone.

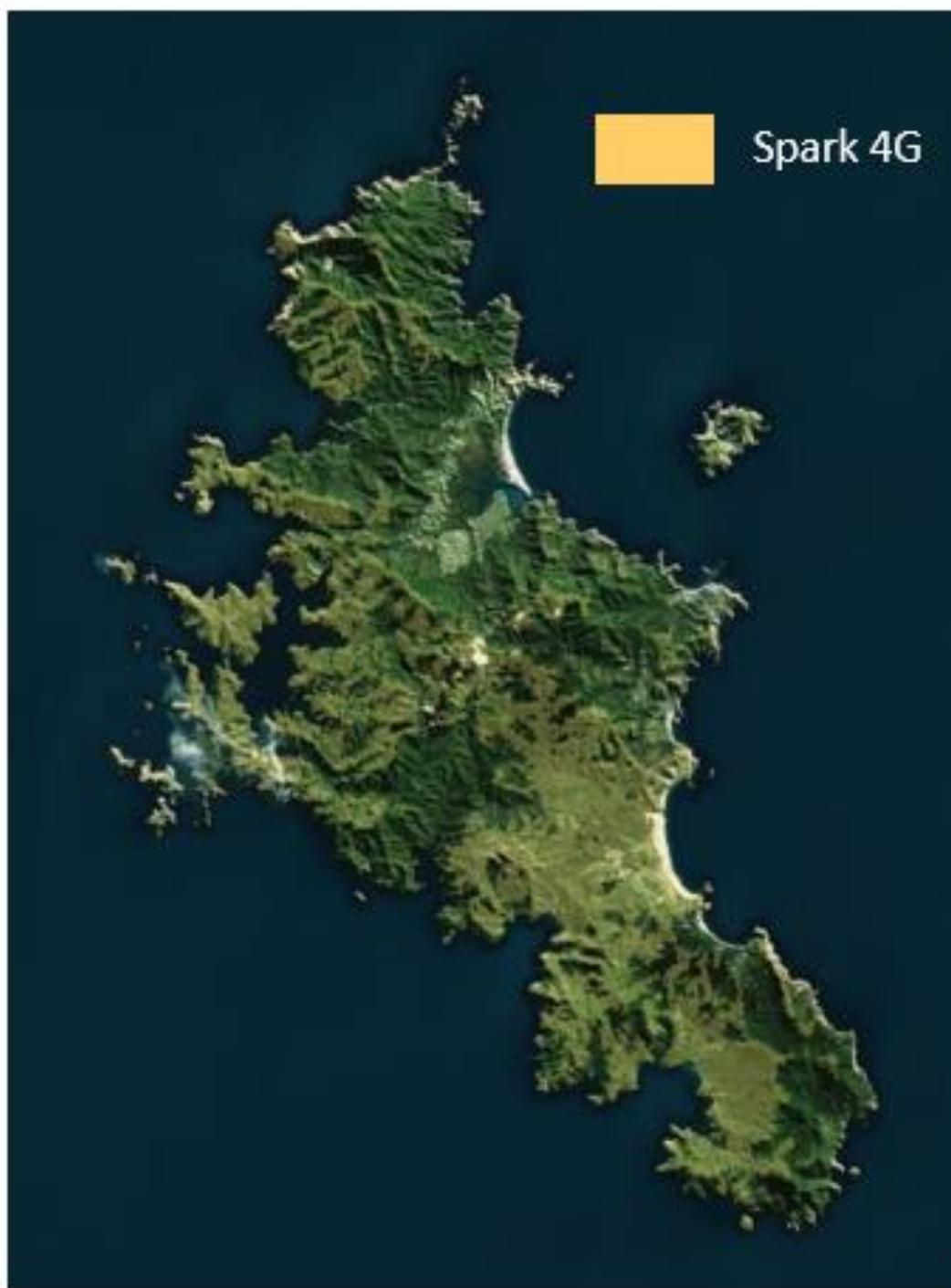


Figure 15: Spark mobile coverage (4G/ LTE)



Eligible End Users under Rural Broadband Initiative Phase 2 (RBI2):

Central Government through its agency Crown Infrastructure Partners (CIP) sought industry bids when seeking to invest the proceeds of the Telecommunications Development Levy into better telecommunications in rural New Zealand.

To do this, CIP used industry and Government (e.g. LINZ) data to form a view of which households and businesses were underserved by their current telecommunications. The RBI2 tender specified that any household or business unable to achieve broadband speeds of 20 Megabits per second downstream would be treated as eligible. These are known as Eligible End Users.

However, the map of Eligible End Users for Aotea Great Barrier shows a number of smaller communities have been omitted from the dataset used in the tender. It is ironic that a project aiming to reach the disconnected should exclude some of the very people it wished to include!

This can be followed up with CIP but in the meantime poses a further risk to Aotea Great Barrier receiving appropriate levels of industry and Government support to improve its telecommunications.

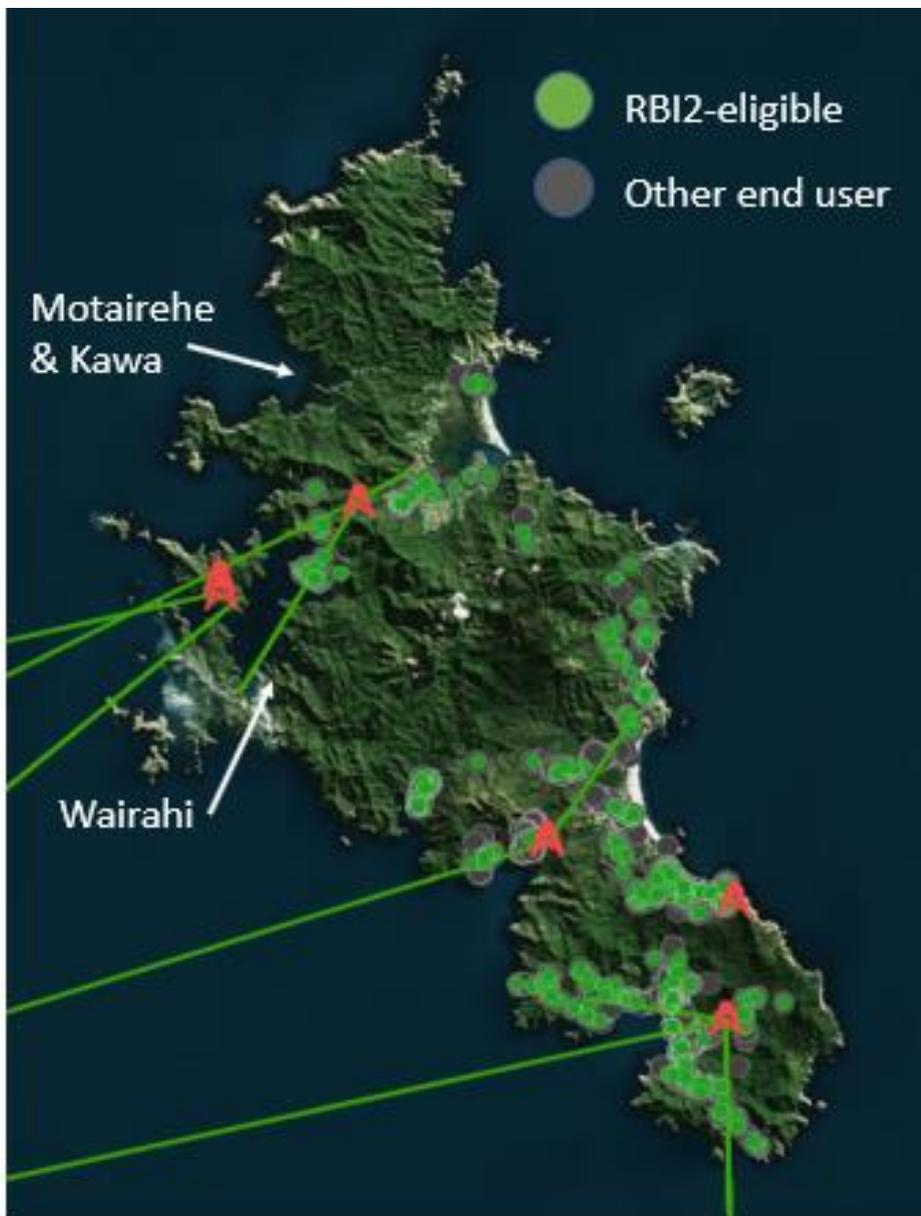


Figure 16: Eligible End Users under RBI Phase 2.



Microwave backhaul:

Chorus's microwave backhaul is used for:

- CMAR landline services island-wide, with very limited capacity;
- Internet services via ADSL broadband in the centre and south; and
- Connecting the Vodafone RBI1 tower at Okupu back to the mainland, with reasonable capacity.

Spark has its own backhaul to its Tryphena and Kaikoura sites, and purchases capacity on the Chorus backhaul running the Vodafone site at Okupu.

Vodafone has its own backhaul to the Kaikoura tower, while Chorus provides the link between this site and the Okiwi tower.

Spark's southern service points back to Coromandel, while all the other links point back to sites around the Leigh and Warkworth area.

A small link between the Okupu tower and the Medlands repeater is not shown on this map. This appears to be an error and will be corrected if possible.



Figure 17: Microwave backhaul links running to and within Aotea Great Barrier.



Fibre backhaul:

A small line of fibre connects the Chorus cabinets at Claris and Tryphena. Being designed for backhaul, this is a “Point 2 Point” service and is not easily able to be repurposed to provide UFB (fibre to the premises).

UFB uses a different network topology known as GPON (Gigabit Passive Optical Network). To reticulate Aotea Great Barrier, or even parts of the island, with UFB would require new cabinets, installation of new hardware in existing cabinets, and a major increase in backhaul capacity available between Aotea and the mainland.



Figure 18: Fibre backhaul



Cellular towers:

As described in *Section 2*, Aotea has 6 cellular towers at present. These are shown in *Figure 19*.

A range of other towers and masts are in use (and in some cases, disuse) around the island. These include:

- Araneo radio masts
- AoteaFM radio
- Civil Defence and DOC radio sites
- Chorus microwave masts
- Long Range Wide Area Network antennae, used for the Internet of Things services described in *Section 8*.



Figure 19: Cellular towers.



Chorus CMAR sites:

Chorus maintains 5 local cabinets for Customer Multi-Access Radio services. These are the points at which copper landlines terminate, with services then hauled via microwave to the mainland.

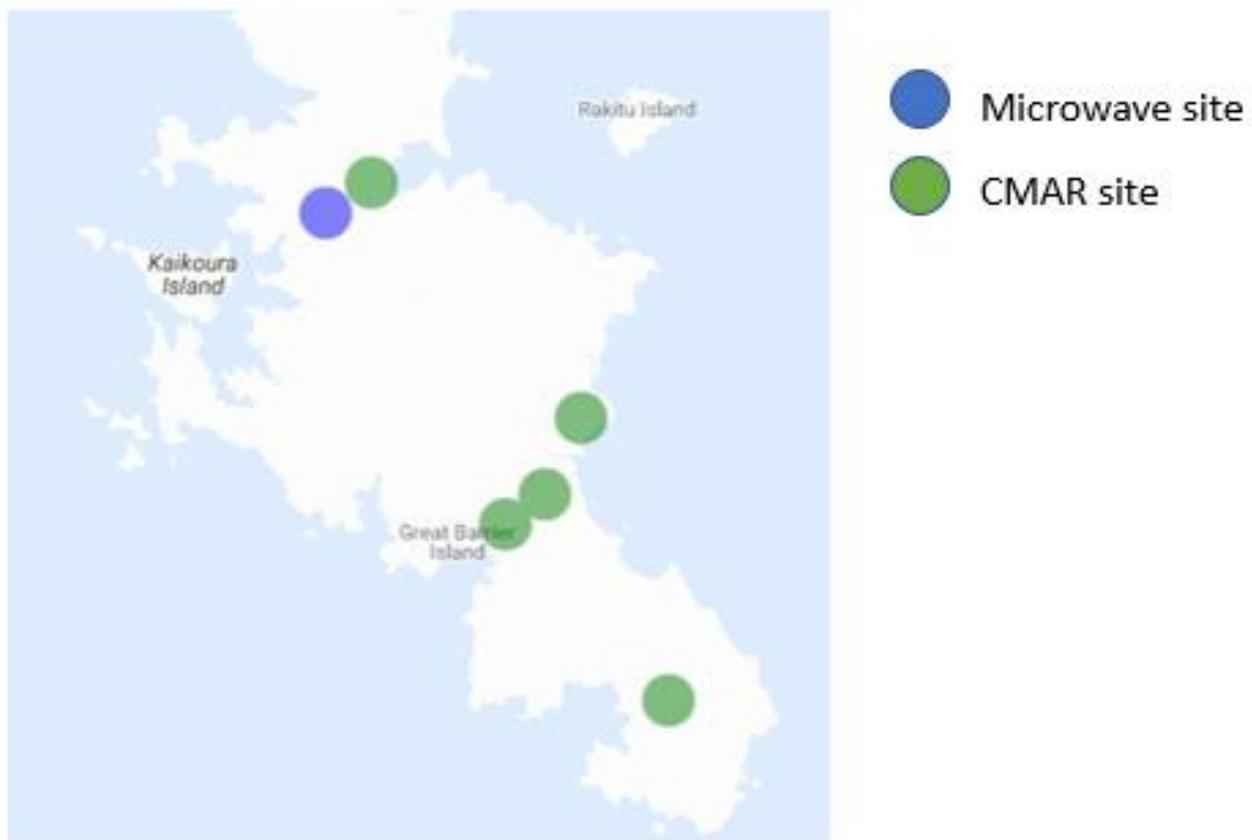


Figure 20: Chorus CMAR sites. Source: Chorus.



Appendix 2:

The following is a “word cloud” of comments received from community members responding to the survey on specific topics:

Blackspots:

Barrier House Island Mobile Phone Kawa Orama Oasis Awana
Whangaparapara Tryphena Claris Bay Southern
Coverage Fitzroy Medlands Depends Mulberry Grove Internet
Spark

Usage - today:

Money Visitors Communicate Quality Live Depending Lines SHIT
Island Infrastructure Pay Say Coverage PRICE
Internet Fibre Landlines Fair Telecommunications Slow
Reliable Business

Usage - desired:

Able Skype Fibre Email Video Wifi Service Needed Internet
4G Voice and Data Mobile Pay Phone Speeds Movies Happy
Vodafone Weather Netflix

Service degradation:

New Year slow Weather Mobile Broadband Summer Service
School Holidays Evenings Peak Okiwi
Coverage Regardless Worse



Appendix 3:

Timeline:

2010	GBI Local Board Expression of Interest regarding rural broadband
2011	UFB1 and RBI1 contracts formed
2013	RBI1 tower at Okupu/ Claris launched
2014	Vodafone repeater site at Medlands launched
2014	Nga Pu Waea (National Maori Broadband working group) study of connectivity to Motairehe and Kawa
Approx. 2015	Spark collocates on Okupu tower
June 2016	Completion of RBI1 programme nationwide
July 2016	Okiwi Vodafone tower launched
2016	Spark upgrades Aotea services to 4G
2016	Chorus upgrades 2 Aotea cabinets to offer ADSL2
2017	4G coverage now reaches 90% of NZ population
August 2017	RBI2 contracts agreed
June 2018	RBI2 deployment schedule and coverage areas released
Dec 2019	75% of NZ population will have UFB access
Dec 2021	Expected RBI2 completion date
Dec 2022	87% of NZ population will have UFB access
2025	Government goal for 99% of NZ population to have high speed broadband access, with the remaining 1% to have access to at least 10 Mbps downstream speeds.



Appendix 4: About the community survey:

- Conducted online via SurveyMonkey website.
- Hard copies available from Claris Store, Council Service Centre and Port FitzRoy Store.
- Promoted via the Barrier Bulletin (twice) and Facebook Barrier ChitChat (twice) as well as email and phone.
- Open from 20 June to 16 July. Late responses accepted.
- 93 responses in total.
- Results are just below the threshold for statistical significance, so should be treated with caution if wishing to rely on detailed breakdowns.
- 86% of respondents live on Aotea Great Barrier; 14% visit Aotea Great Barrier 3 or more time per annum.
- 76 responses (82%) completed online.
- 17 responses (18%) completed in hard copy and hand-coded.
- Hard copy responses were more likely to come from north Barrier residents (especially Motairehe & Kawa) but also included some other areas with poor connectivity e.g. Masons Road, Macmillans Road, Cape Barrier.
- Individual responses including verbatim comments can be examined as needed.
- All data is available to the Local Board on request.

