Regional Broadband Strategy

Options & Financials

Prepared for

Alberta SouthWest Regional Alliance

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Executive Summary

This report completes for the Alberta SouthWest Regional Alliance (AlbertaSW), the first three phases of the traditional strategy development process illustrated below: (1) determine where things stand and the assets that can be drawn upon; (2) determine the requirements that need to be met; and then (3) determine and evaluate the options available to move from the current to the desired state. Should the region elect to not go with the status quo, AlbertaSW is well positioned to drive change.

Though information and communications technology (ICT) services in the region are not necessarily more expensive than those in the surrounding communities, current ICT infrastructure is indeed lacking, particularly in the rural areas. At least partially due to its small and dispersed population, incumbent network upgrades in the region typically focus on improving cellular rather traditional wired services. Indeed, wire-based internet services are only available within the more populated centres – rural inhabitants must make due with point-to-multipoint (PMP) wireless services or satellite. Available internet services are generally insufficient to support current data intensive knowledge-based industry requirements, international data reporting requirements, and the cloud-based computing platforms on which small and medium businesses increasingly depend.

	Highest BW Offering; Mb/s		
	Rating	TELUS	Shaw
Cardston County	na	x	x
Municipality of Crowsnest Pass	na	x	x
Blairmore	na	1.5 to 6	up to 100
Coleman	na	1.5 to 6	up to 100
MD of Pincher Creek	na	x	x
Pincher Creek	na	3 to 15	up to 100
MD of Ranchland	na	x	x
Waterton National Park	na	x	x
MD of Willow Creek	na	x	x
Claresholm	na	1.5 to 6	up to 100
Fort Macleod	na	5 to 25	up to 100
Granum	na	x	up to 100
Nanton	na	3 to 15	x
Stavely	na	x	x

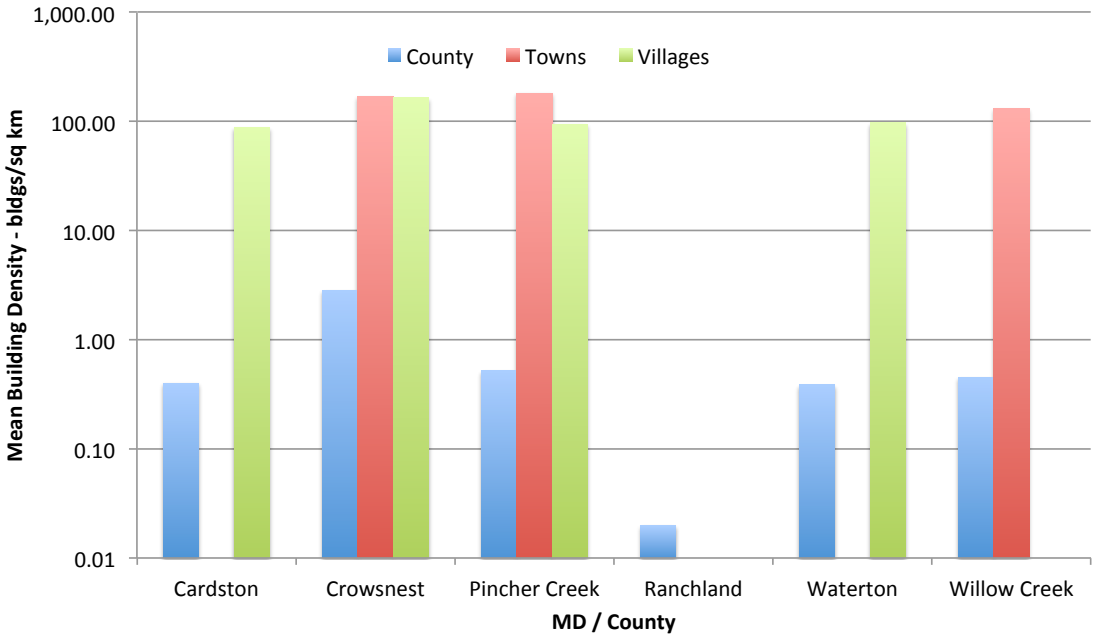
	Point-to-Multipoint Wireless			
	CCI	Platinum	Tough C	ShockWare
Cardston County	√	x	√	x
Glenwood	√	x	√	x
Hill Spring	√	x	√	x
Municipality of Crowsnest Pass	x	x	√	x
Blairmore	x	x	√	x
Coleman	x	x	√	x
MD of Pincher Creek	x	√	√	x
Cowley	x	√	√	x
Pincher Creek	x	√	√	x
MD of Ranchland	x	x	x	x
Waterton National Park	x	x	√	x
MD of Willow Creek	√	√	x	x
Claresholm	√	√	x	x
Fort Macleod	x	√	√	√
Granum	√	√	x	x
Nanton	√	√	x	x
Stavely	√	√	x	x

Within the region, a number of projects are planned and fibre, towers, and other assets are available – though the extent they can be leveraged to support a broadband strategy is as yet unclear. Planned civil works in Fort Macleod, Pincher Creek, Granum, and Waterton together with new developments in Claresholm and Nanton might be leveraged to reduce deployment costs should those communities opt to deploy fibre infrastructure. Similarly, community control of the electrical distribution infrastructure in Fort Macleod and Crowsnest Pass could help facilitate lower cost aerial deployments and water system upgrades in Cardston County and the MD of Pincher

Creek may help reduce deployment costs in their more rural areas.

Access to capable fibre-enabled broadband infrastructure and services is key to economic development and business attraction in the AlbertaSW region. To accommodate exponentially increasing demands for bandwidth, the disruptive impact of cloud-based computing, and meet the reliability requirements associated with health related services, over the next decade, the Alberta SouthWest Regional Alliance would like to facilitate the deployment of infrastructure to support a fully scalable broadband network ubiquitously available throughout the region. This would typically include a combination of an underlying fibre infra-structure supporting a wi-fi overlay in the more urban centres and, where possible, a fibre-rich or at least well-connected rural environment. To preserve market forces and innovation in the services space, the infrastructure will likely be deployed as a utility with open access to services providers interested in utilizing the infrastructure. Regional scale will leveraged where possible to reduce costs and increase operational efficiency.

The 9000-fold difference in population density between the rural and populated areas within the region will necessitate a multi-faceted approach. The overall strategy will be comprised of four components: a fibre strategy for urban areas, a hybrid fibre-wireless strategy for rural areas, a wi-fi overlay strategy for the urban areas and rural community centres, and an inter-urban transit strategy to either reduce SuperNet costs and/or provide redundancy. With sufficient focus and support, fibre-based broadband services could be operational in business centres in, say, three towns by 2017. By 2020, fibre access in those towns could be extended to the residential areas and deployed to the business centres of four more. By 2018, wireless-based services capable of supporting identified minimal acceptable service levels will be available throughout rural areas of the AlbertaSW region. By 2025, AlbertaSW's desired state could be achieved.



A number of options are available to achieve this and preliminary figures indicate a break-even business case for the urban areas at 15 years with a potential capital requirement of some $34M. When these results were presented to members at three regional seminars, it became evident that more detailed work with individual members is required prior to an overall consensus relative to a regional strategy being obtained. Work with member communities will now commence and it is hoped that through this work, the required consensus will be reached and, based on that, a regional scale strategic broadband plan will emerge.

Many options are available and while some may initially seem daunting, help is readily available. Building on the trailblazing efforts in communities such as Olds and Coquitlam, for example, much can now be accomplished in less time, with less risk, and with more impact than ever before. In closing, consider the following video from the OICRD:

http://youtu.be/Uc_plnE3W5U

In it, Olds specifically offers to share their experience and expertise with any community interested in enabling state-of-the art fibre-based services within their communities.

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Objectives

This reports completes for the Alberta SouthWest Regional Alliance, the first three phases of the traditional strategy development process illustrated below: (1) determine where things stand and the assets that can be drawn upon; (2) determine the requirements that need to be met; and then (3) determine and evaluate the options available to move from the current to the desired state.

In this report, the results are presented in five sections followed by concluding remarks and a detailed Appendix in which results for each Regional member are documented:

- ***The Need for Change:*** Landscape issues, environmental considerations, and application trends.
- ***Current State – Services, Infrastructure, & Plans:*** Inventory of regional broadband ecosystem, including existing and planned broadband and civil infrastructure, service footprints, and service levels.
- ***Desired State:*** A vision for regional broadband ecosystem at 3, 5, and 10 years, service requirements, and potential options.
- ***Options Analysis:*** Case studies, issues and constraints, and potential strategies.
- ***Financial Analysis:*** Introduces financial modeling capabilities and provides illustrative results for a variety of urban deployment options.

When these results were presented to members at three regional seminars, it became evident that more detailed work with individual members would be required prior to an overall consensus relative to a regional strategy being obtained. Work with member communities has commenced and it is hoped that through this work, the required consensus will be reached and that a regional scale strategic broadband plan will emerge.

The Need for Change

Broadband

The wealth of nations is changing. While prior centuries were dominated by nations with superior industrial or agricultural capabilities, the innovation age rewards new competencies and strengths. Knowledge – ideas and the people who generate them – is the new coin of the realm. Innovative capacity is the key driver of future economic prosperity… Our ability to remain a global technology (and thereby

economic) leader will depend upon a variety of factors including our ability to maintain a world-class information infrastructure.

With respect to this last point – maintaining a world-class information infrastructure – there may be no element more critical today than ubiquitous and affordable high-speed Internet – broadband. The deployment and usage of broadband networks will significantly impact the global competitiveness of nations and businesses in the 21st Century.[1]

So what is broadband? To many, including the Federal Government, broadband is simply the next step above dial-up services in which you move from having to dial up and establish a connection to the Internet every time you wish to check email or surf – and then hang-up afterwards – to an always-on service in which connections to the Internet can be left up indefinitely. Whereas dial-up connections had bandwidths up to 56 kb/s, initially deployed always-on services typically sported bandwidths of 1.5 to 5 Mb/s in the downstream (Internet to client) direction and 0.2 – 0.5 Mb/s in the upstream or reverse direction. This provisioning of asymmetric bandwidth was intended to accommodate web-surfing and the downloading of software, files, music, and video versus more symmetric communication services such as video conferencing or the uploading of client files.

The step-change from dial-up to these always-on services was and is significant. Though by today's standards, these always-on services are relatively low in bandwidth, they remain widespread and were sufficient to facilitate many of the productivity gains realized in the commercial sectors. Having been around the longest, they provide the basis on which many of the economic impact statistics quoted today were developed. According to these statistics, some 2.7% of GDP in Canada is attributable to the Internet (2009) and 75% of the Internet's impact arises from productivity impacts in traditional (non-ICT) industries.[2]

The impact on businesses that these statistics represent is profound. According to Fred Harmon:[3]

Internet facilitates the move from an industrial to a knowledge-based society, from a society based on physical effort to one based on mental effort, and from reliance on limited material resources to dependence on virtually unlimited intangible resources.

Not only does this enable the acceleration of change, it fundamentally changes the parameters of business.

Economic Impact: Broadband expansion equals economic development

In the old economy, building a billion-dollar fortune required decades of hard work, a powerful host country, thousands of workers, and thousands of storefronts. Today, a kid with a smart idea, a couple of friends, and some luck can make a lot of money… very quickly. – Juan Enriquez[4]

The deep fundamental economic, environmental, and social changes enabled by the Internet have been well documented and are recognized by members of the Alberta SouthWest Regional Alliance. Indeed, broadband initiatives have the potential to dramatically and positively impact the fabric of life

[1] *Understanding Broadband Demand*; US Office of Technology Policy; 2002 11.

[2] Pélissié du Rausas, Matthieu, et al; *Internet Matters: The Net's sweeping impact on growth, jobs, and prosperity*; McKinsey Global Institute; 2011 05.

[3] Harmon, Fred; Business 2010: Positioning Your Company and Yourself in a Rapidly Changing World; Kiplinger Books; 2001.

[4] Juan Enriquez; As the Future Catches You; Crown Business; 2005.

throughout a region by offering exceptional network services; learn-in-place, work-in-place, and age-in-place opportunities for all generations; innovation and diversification in every economic sector; and by positioning a region's brand as dynamic, progressive, and relevant to the future.

The essential value of broadband telecommunications is that it greatly expands access to social and economic opportunity to the great benefit of communities both urban and rural in societies around the globe, and at marginal cost to society and environment. According to recent surveys, fibre-to-the-home (FTTH) communities realize significant economic benefit:[5]

- 11% of FTTH users have a home-based business averaging CDN$10,700 in estimated incremental income enabled by FTTH from outside the community. Assuming 50% of the homes and business in a community take broadband services, community revenue increases by an average of CDN$590 thousand per 1,000 homes to which FTTH services are available (homes passed).
- FTTH drives as many as 65 new traditional jobs per 1,000 homes passed when leveraged. At a more conservative 25 new jobs per 1,000 homes passed and approximately CDN$49,000/job, this implies $1.2 million in new annual salaries to the community per 1,000 homes passed.
- In total, this equals $1.79 million annually per 1,000 homes passed ($1,790 per home).

Rural and remote communities presently have the greatest need for broadband telecommunication services, and the most to gain from it. Broadband creates opportunities to:[6]

- Reduce or eliminate social and economic limitations of isolation.
- Access broad new frontiers of social and economic development.
- Greatly improve the development, retention and attraction of youth, workers, and enterprises.
- Bring balance and vibrancy to urban-rural dialog.
- Improve access to government services and reduce the cost of those services.
- Improve access to ratepayers and responsiveness to local needs and opportunities.
- Reduce municipal operating costs (travel to meetings, etc.).
- Enable fuller participation in economies, societies, and politics of the 21st century and beyond.
- Reduce financial, social, and environmental costs of participation.

From a more personal perspective, broadband enhances opportunity for:

- Socializing (what we do best)
- Earning a living (making money)
- Learning (inside and outside the classroom)
- Health care (inside and outside the clinic)
- Civic engagement (democratic participation)
- Commerce (shopping, e-commerce)
- Recreation (gaming, gambling, puzzle solving, etc.)

[5] Render, Michael; *FTTH and Economic Impact*; RVA LLC; Broadband Summit; 2013 04.

[6] Van Leeuwen, James and Dobson, Craig; *Digital Prosperity: Building the Next Rural Legacy*; Rural Matters Conference; 2008 07 06.

- Security (remotely monitoring shut-ins, livestock, property, etc.)
- Lifestyle (where do you want to live?)

By revolutionizing social and economic communication within and between urban and rural populations, broadband offers a means of permanently reversing social and economic trends that have been hollowing out ecosystems and rural communities for over a century (urbanization). When asked if Olds had seen an increase in business attraction over the past year due to the availability of Gb/s O-Net services, Mitch Thomson, Executive Director of the Olds Institute for Community & Regional Development (OICRD) – the economic development organization behind the fibre initiative – replied:

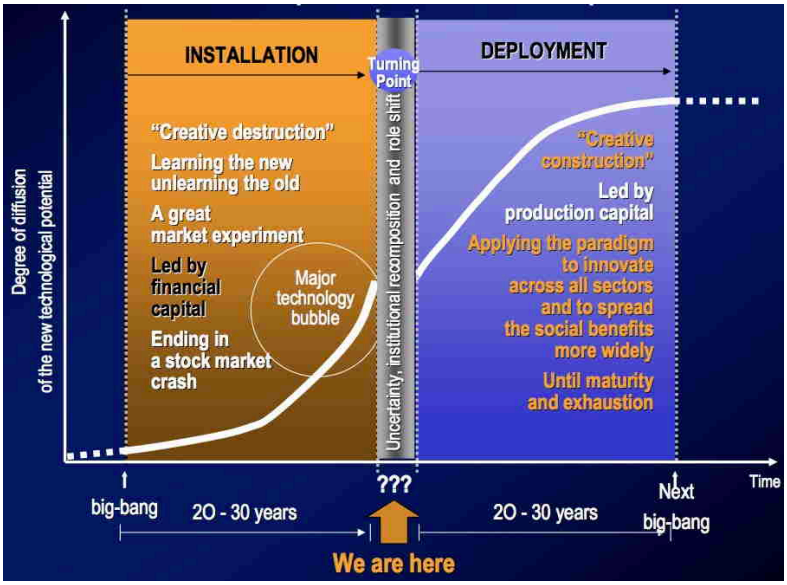
"Yes absolutely, we perhaps could have been better prepared to capitalize on interest. Our lack of serviced available land has hindered some. We are fielding lots of interest."

A Techno-Economic Framework

Over the past three hundred years, the robust links between innovation, technical and institutional change, and economic development have played out in the first four techno-economic revolutions listed below and are currently playing out in the fifth – the Age of Information Technology and Telecommunications.[7]

1771	The 'Industrial Revolution' (machines, factories, and canals)
1829	Age of Steam, Coal, Iron, and Railways
1875	Age of Steel and Heavy Engineering (electrical, chemical, civil, naval)
1908	Age of the Automobile, Oil, Petrochemicals, and Mass Production
1971	Age of Information Technology and Telecommunications
20??	Age of Biotech, Bioelectronics, Nanotech, and new materials?

Each technological revolution lasts between 40 and 60 years and propagates through two strikingly different stages. As illustrated in the figure, events in the first stage are driven by investment capital, market experiments, and entrepreneurs. The resulting maelstrom of activity eventually reaches a climax and ends in a stock market crash.



Industrial/production cap-ital then comes to the table and finances the reasoned deploy-ment of the underlying infra-structure required to enable the full economic and social potential of the new paradigm. In this second stage, innovation occurs across all economic sectors and the social benefits become widespread. As the commercial benefits take hold, the collective interests of the populace at large become part of the equation and state capital comes to table to complete the deployment in commercially

[7] Prof. Perez; *Towards a Sustainable Global Golden Age*; Cisco CUD Conference; 2008 02 21.

unattractive areas.

The congruency here with the development of the Internet and the underlying enabling broadband infrastructure is striking. The crash took place in 2001 and now, some 14 years later, the true benefits of the ICT revolution are impacting every sector of the economy. The externalities[8] are becoming self-evident and governments are stepping in to ensure near ubiquitous deployment. Aligning these events with this timeline indicates that we are about 60% of the way through the ICT revolution.

Political Support

Unfortunately, neither the federal nor provincial governments have yet placed the emphasis on technology policy to address this '*Deployment*' phase to the extent evident internationally. Ottawa's Connecting Canadians[9] component of the Digital Canada 150 Strategy[10] does, though, provide evidence of their growing realization of its importance to the future of Canada. While the funds will support broadband infrastructure deployment, they can only be used to support initiatives in areas where current services are less than 5 Mb/s. Qualifying regions are outlined in the interactive map that can be found at http://www.ic.gc.ca/app/sitt/bbmap/hm.html .

Infrastructure Dependency

While the table-stakes to partake in and benefit from these changes is this always-on access to the Internet platform, in today's world, symmetry and bandwidth matter too – and the higher the speed/bandwidth, the better. Access, so to speak, has not been created equal and in a very fundamental way, not only does bandwidth matter, it matters a lot. Given current application and usage trends, to attract business, minimum access bandwidths of 100 Mb/s are typically required[11].

Speeds Needed by 2013 to:	2–4 Mb/s	10–12 Mb/s	20–25 Mb/s	100–120 Mb/s	500 Mb/s	1 Gb/s	100+ Mb/s
Attract business	17 (8%)	26 (12%)	30 (13%)	43 (19%)	33 (15%)	77 (34%)	68%
Retain business	13 (6%)	35 (16%)	50 (22%)	57 (25%)	33 (15%)	37 (16%)	56%
Make business more competitive	12 (5%)	29 (13%)	53 (23%)	55 (24%)	33 (15%)	44 (19%)	58%
Revive business districts	13 (6%)	34 (15%)	50 (23%)	53 (24%)	34 (15%)	38 (17%)	56%
Revive communities	14 (6%)	40 (18%)	47 (21%)	55 (25%)	27 (12%)	37 (17%)	52%
Improve training	14 (6%)	33 (15%)	48 (22%)	54 (24%)	40 (18%)	33 (15%)	57%

Traditional infrastructure deployed to provide Internet services comes in four flavours: twisted pair copper cable deployed by the telecom carriers, coaxial cable provided by cable television operators, fixed wireless links provided by wireless and satellite Internet Service Providers (ISPs), and wireless mobility infrastructure that supports cellular services.

[8] Externalities relate to side effects or consequences of industrial or commercial activities that affect other parties without this being reflected in the prices or costs of the goods or services involved [Wikipedia].

[9] http://www.ic.gc.ca/eic/site/028.nsf/eng/h_00587.html .

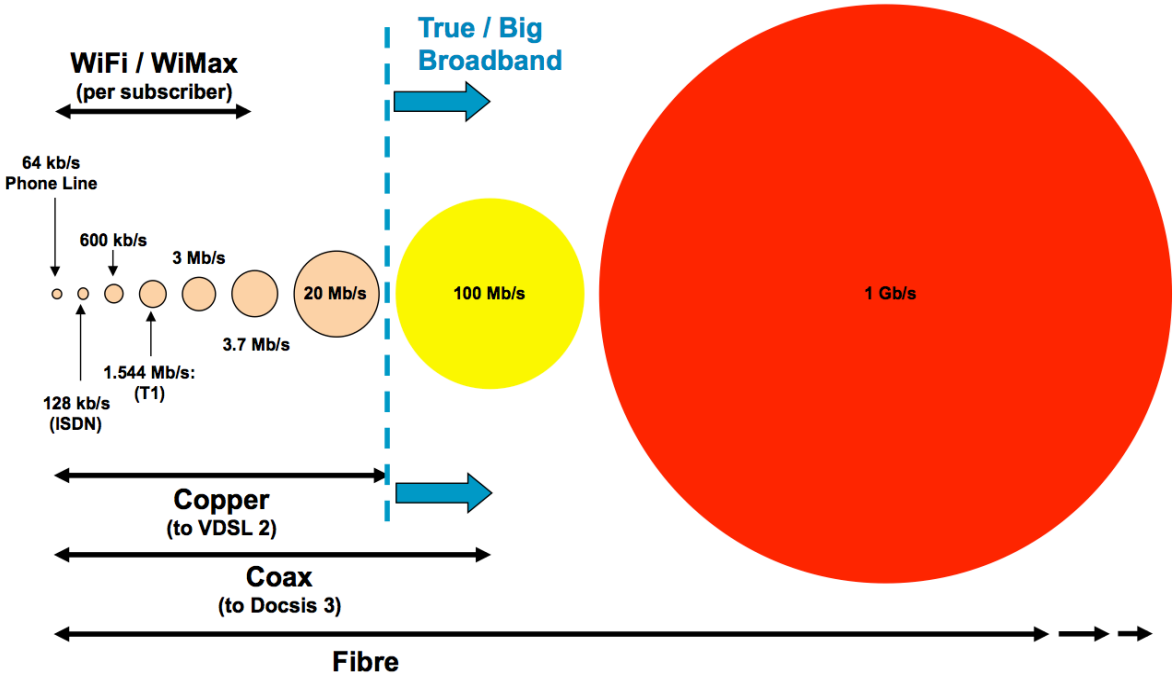
[10] http://www.ic.gc.ca/eic/site/028.nsf/eng/home .

[11] Settles, Craig, *Broadband and Economic Development: The Real Deal*; Broadband Properties, p. 76; 2010 11/12.

Whereas each flavour of infrastructure can be configured to support always-on services, as illustrated in the next figure, the access bandwidths that each can support differs significantly:

- copper access networks support asymmetric services with typical download bandwidths of 20 Mb/s
- coaxial cable networks support asymmetric bandwidths up to 100 Mb/s
- fixed wireless access networks typically limit access bandwidths to 5 Mb/s or less
- 3G cellular networks provide bandwidths ~10 Mb/s

Though network upgrades are enabling bandwidths up to 80 Mb/s on copper and 500 Mb/s on coaxial cable, these upgrades are expensive and significant additional bandwidth upgrades beyond these rates are unlikely. Hence, both the telecom and cable access networks are being augmented with fibre. Current fibre optic cabling supports symmetric access bandwidths of 1 Gb/s (1,000 Mb/s) and sports a theoretical bandwidth capability of several thousand Gb/s. Improved radio technologies and additional spectrum are doubling fixed wireless network capacity and 4G and LTE technologies are providing a 10 to 15-fold improvement in cellular access speeds.



Though minimal desired service requirements can be estimated to help size the initial network capacity, such estimates tend to be of limited utility for a number of reasons, the most significant of which are that they project exponentially from the present and do not account for step changes in requirements due to disruption by new service paradigms such as that exemplified by cloud computing. The answer is to ensure that whatever infrastructure is deployed is scalable from whatever is provided initially to rates in excess of 10 Gb/s. Where possible, that requires fibre and a so-called home-run design (a fibre run to and from the primary office to every endpoint) so that the civil infrastructure never has to be changed. In urban areas, this is straightforward but the associated economics in rural areas require compromises.

Application Trends

According to the Cisco Visual Networking Forecast[12], the number of networked devices in Canada will increase from 167 to 313 million over the 2013 to 2018 period. Internet video traffic is increasing at a compound annual growth rate (CAGR) of 28%. The high definition (HD) component of this will increase from 44.9% to 60.1% while the Ultra-HD[13] component will increase from 0.1% to 10.4%. On a per household basis, the average Internet user generated traffic will increase 152% – some 20%/year over the five year period.

Cloud computing is the delivery of computing as a service rather than a product, whereby shared resources, software, and information are provided to computers and other devices as a utility (like the electricity grid) over a network (typically the Internet).[14] Cloud computing allows firms to lease storage and processing capacity from others, rather than buy and maintain their own servers and data centres – it would be cheaper, would keep software more up-to-date and would encourage more collaboration. Worldwide, the International Data Corporation (IDC) estimates that big companies will spend $100 billion on cloud computing this year. As prices come down and security fears are addressed, this number is expected to grow significantly.

Unlike the asymmetric bandwidth requirements associated with video streaming services – in which the majority of traffic is downstream to the client – to work efficiently cloud computing requires symmetric bandwidth and fibre as files are as likely to be sent upstream for processing and storage as they are downstream for editing and consumption. Whereas video streaming services typified by Netflix and YouTube dominate both overall and aggregate down-stream bandwidth requirements, business services, communication, and, now, cloud computing dominate upstream requirements. These results are supported by the strong response from local business in Olds to the upstream bandwidth offered by O-Net.

Phones for a Six Year-old

Circa 1965

Circa 1990

Circa 2015

As business related services such as remote backup – focused, for example, on backing up home computer-based photo and home-movie libraries – move into the consumer space, upstream requirements on the consumer side will increase as well.

[12] Cisco; *Cisco Visual Networking Index: Forecast and Methodology, 2013-2017*; Cisco; 2014.

[13] http://en.wikipedia.org/wiki/Ultra-high-definition_television

[14] http://en.wikipedia.org/wiki/Cloud_computing

Current State – Services, Infrastructure, & Plans

Local ICT Infrastructure & Services

Overview

As is evident in the adjacent summary table, capable broadband infrastructure throughout the region is spotty at best and does not extend beyond the larger towns. As of January 6th, 2015 Shaw no longer offers the 100 Mb/s services shown – their maximum service speed will be 60 Mb/s. Outside of Fort Macleod, TELUS infrastructure does not appear to have been upgraded beyond the basic ADSL level introduced over a decade ago.

	Highest BW Offering; Mb/s		
	Rating	TELUS	Shaw
Cardston County	na	x	x
Municipality of Crowsnest Pass	na	x	x
Blairmore	na	1.5 to 6	up to 100
Coleman	na	1.5 to 6	up to 100
MD of Pincher Creek	na	x	x
Pincher Creek	na	3 to 15	up to 100
MD of Ranchland	na	x	x
Waterton National Park	na	x	x
MD of Willow Creek	na	x	x
Claresholm	na	1.5 to 6	up to 100
Fort Macleod	na	5 to 25	up to 100
Granum	na	x	up to 100
Nanton	na	3 to 15	x
Stavely	na	x	x

Fixed wireless services up to 10 Mb/s are available from five providers, the two regional operators being Tough Country and ShockWare. ShockWare services in the region are only available in Fort Macleod and details on their service levels are not available.

Excluding mobility services, detailed service tables for each AlbertaSW member may be found in the Appendix. Detailed coverage maps for each fixed wireless provider as well as details on mobility services available in the region have also been placed in the Appendix.

Wireline Providers

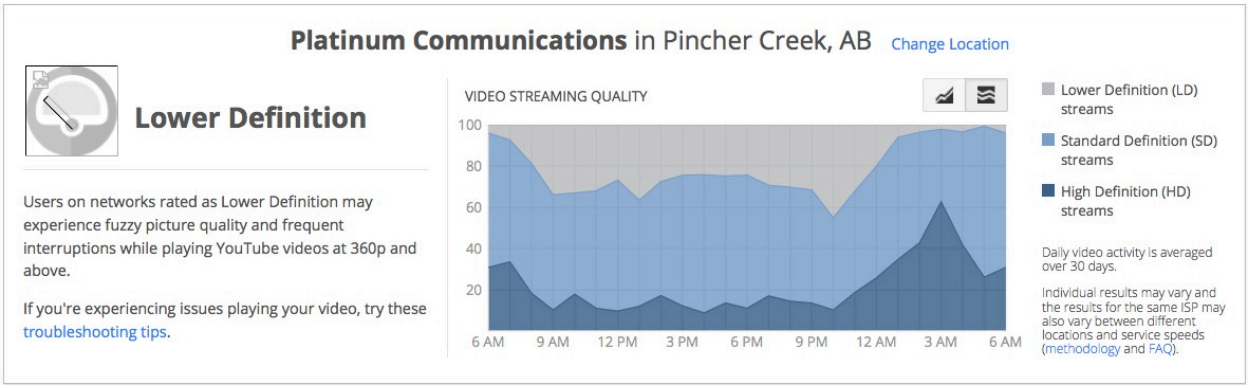
Wire-based internet services are available from TELUS and Shaw. Whereas 100 (now 60) Mb/s services from Shaw are available in most towns, services from TELUS are not – indicating little apparent interest in network upgrades in the region to date.

The Google YouTube video streaming results appearing in the adjacent table indicate Shaw service availability only in Pincher Creek. The video ratings HDV, SD, and LD refer to high definition verified, standard definition, and lower definition signals. Whereas HDV indicates that high definition YouTube video can be streamed at least 90% of the time, an LD rating implies that only lower definition streams can. In this chart, T, TLT, and THT stand for TELUS, TELUS Low Tier, and TELUS High Tier video services. NA indicates that no

	Video Ratings			
	HDV	SD	LD	Not Rated
Cardston County				
Municipality of Crowsnest Pass				
Blairmore	NA			
Coleman	NA			
MD of Pincher Creek				
Pincher Creek	Shaw		Platinum	
MD of Ranchland				
Waterton National Park				
MD of Willow Creek				
Claresholm	TLT	THT, T	Platinum	
Fort Macleod			Platinum	THT
Granum	NA			
Nanton			Platinum	
Stavely	NA			

local service providers were available to rate. Platinum Communications is a fixed wireless network operator.

More detailed rating results are available online and can be made available on request. Such a result for the Platinum video offering in Pincher Creek appears below.



Service pricing is uniform throughout the region. The 25 Mb/s TELUS offering is $65/mo where available and the 100 Mb/s service from Shaw is $90/mo – now 60 Mb/s service for $90/mo.

Though Bell owns the underlying SuperNet fibre assets, only those assets in the so-called base area network (BAN) communities – the 27 largest cities in Alberta – are operated by Bell. The remainder come under what's called the extended area network (EAN) and those assets are operated by Axia. As there are no base rate communities within the region, Bell does not have a wireline presence here.

Axia Connect

As operator of the EAN portion of the Alberta SuperNet on an open access basis, Axia Netmedia is generally precluded from offering retail services such as Internet. Axia Connect was therefore created to provide retail services.

The Service Alberta SuperNet contract with Axia was originally scheduled to end in June, 2015. Wanting to buy time, the original agreement was amended in June, 2012. While the amendments were largely financial in nature and will not come into effect until June, 2015, the amendments did extend the term of the original agreement to June, 2018. Given the possibility that Service Alberta may not renew Axia's operating agreement, through Axia Connect, Axia is looking to work with communities to deploy and operate fibre-to-the-premise (FTTP) networks.

Fixed Wireless Providers

To minimize provider costs, wireless services in rural areas are typically provided using what's termed point-to-multipoint (PMP) equipment. In this configuration a 'host' tower transmits and receives signals to a specified area containing a portion of the client base. Each client has dedicated reception equipment that homes on the host tower. All users in that area share the host signal. A summary of available services appears in the adjacent table.

Higher-end business services may use

	Point-to-Multipoint Wireless			
	CCI	Platinum	Tough C	ShockWare
Cardston County	√	x	√	x
Glenwood	√	x	√	x
Hill Spring	√	x	√	x
Municipality of Crowsnest Pass	x	x	√	x
Blairmore	x	x	√	x
Coleman	x	x	√	x
MD of Pincher Creek	x	√	√	x
Cowley	x	√	√	x
Pincher Creek	x	√	√	x
MD of Ranchland	x	x	x	x
Waterton National Park	x	x	√	x
MD of Willow Creek	√	√	x	x
Claresholm	√	√	x	x
Fort Macleod	x	√	√	√
Granum	√	√	x	x
Nanton	√	√	x	x
Stavely	√	√	x	x

dedicated point-to-point (PTP) systems that are typically engineered to deliver higher quality, higher bandwidth services. Pricing is installation specific and depends on the service parameters and equipment selected.

Wireless services depend on access to spectrum and available spectrum comes in two flavours – licensed and unlicensed. Licensed spectrum tends to be expensive as it's managed and only available to authorized service providers. This eliminates interference issues and increases the quality of the services provided. While both Platinum Communications and XplorNet both operate over licensed bands, only Platinum offers PMP services within the region – XplorNet services are satellite only. The Platinum Pro (up to) 3 down/1 up Mb/s business service retails for $59.95 without a contract. The remaining three wireless internet service providers (WISPs) – CCI Wireless, Tough Country, and ShockWare – utilize shared unlicensed spectrum to deliver services over PMP links.

Detailed coverage maps are available in the Appendix. CCI offers plans from 1.5 to 6 Mb/s for $44.99 to $89.99/mo. Tough Country residential services range from 2 to 4 Mb/s and cost $49 to $79/mo. Tough Country's higher usage 4 to 5 Mb/s business services are priced between $79 and $325/mo. Bandwidths and rates for ShockWare services were not available.

Utility Providers

Fortis

The AlbertaSW Region falls within Fortis' footprint and power infrastructure throughout the region is aerial. If access to the communications space on their pole infrastructure can be arranged for on reasonable terms, fibre infrastructure can be deployed less expensively than with underground deployment. Should the strategies developed target aerial fibre deployment, discussions with Fortis to determine the terms will be required. Issues include whether there is sufficient vertical space available on the pole and whether the pole strength is sufficient to hold the additional cabling. Should the poles need to be replaced, an underground deployment will be less expensive.

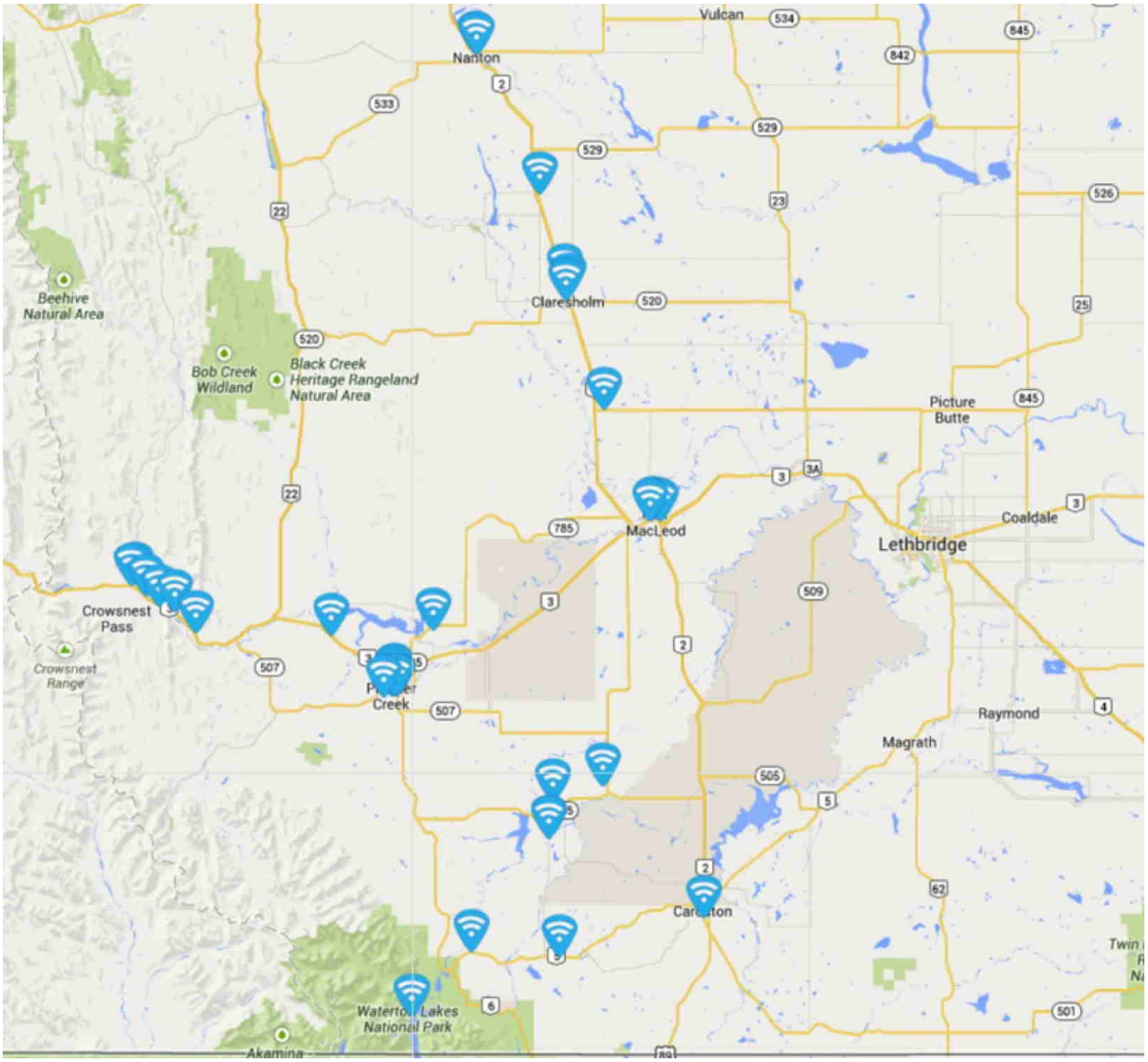
Municipally Owned Wire Utilities

Both the Municipality of Crowsnest Pass and the Town of Fort Macleod operate their own power utilities. In these areas, beneficial arrangements favouring aerial fibre deployments are likely.

Wi-Fi Services

WiFi services are available sporadically in the region from three providers: Shaw, Bell, and the SouthWest Connect initiative of the Alberta SouthWest Regional Alliance. Coverage is summarized in adjacent table. As the SouthWest Connect initiative extends well beyond the nodes listed in the table, a coverage chart is provided below. These results do not reflect the community mesh Wi-Fi deployment project within Waterton Lakes National Park.

	WiFi Services		
	Shaw	Bell	SW Connect
Cardston County			
Municipality of Crowsnest Pass			
Blairmore	18	1	2
Coleman	14		2
MD of Pincher Creek			
Pincher Creek	24	1	10
MD of Ranchland			
Waterton National Park			1
MD of Willow Creek			
Claresholm	11	1	3
Fort Macleod	11	1	4
Granum			1
Nanton			2
Stavely			1

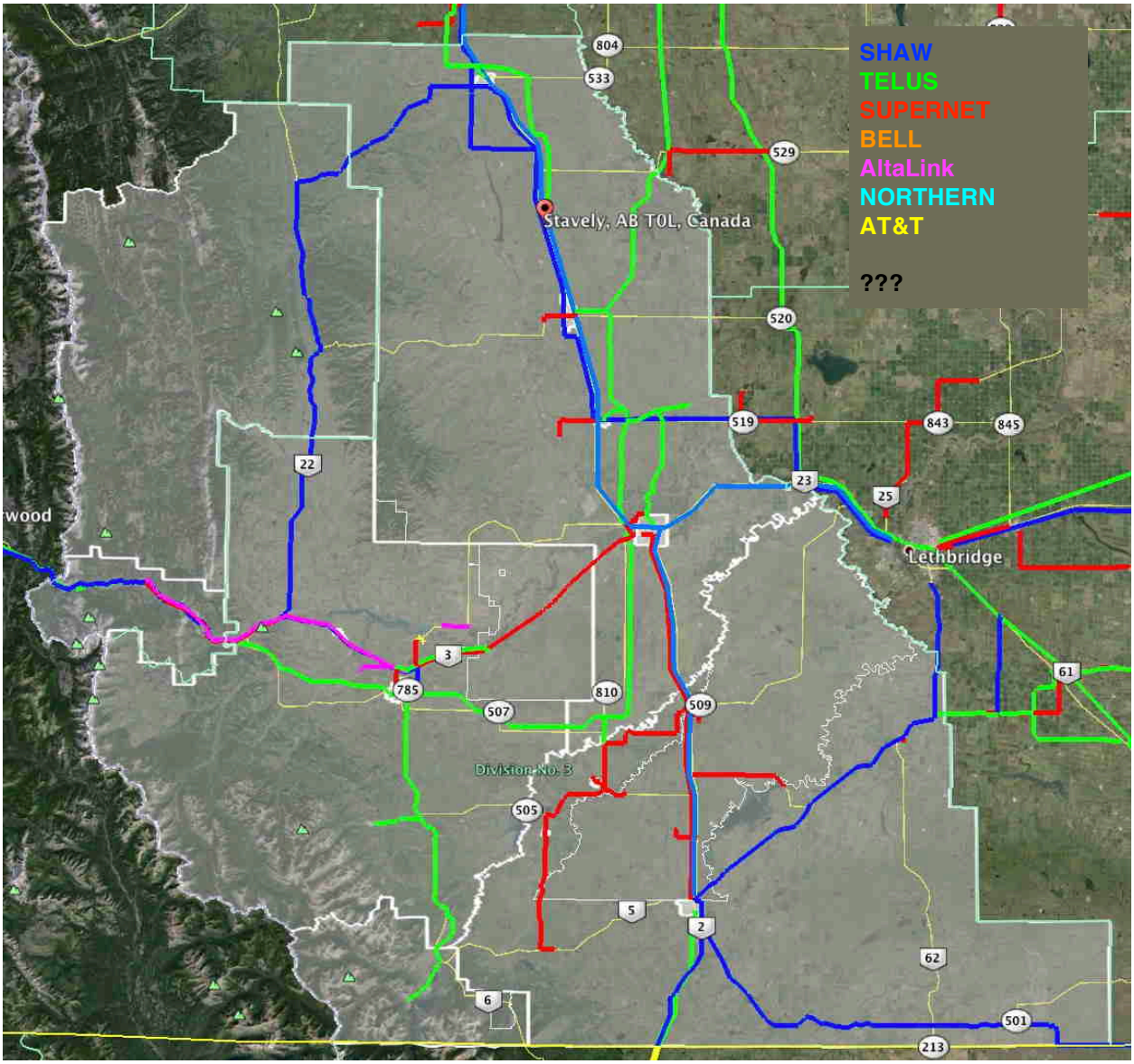


Regional Infrastructure

Fibre

As is apparent in the next figure, the fibre mapping component of this project has revealed abundant transport fibre infrastructure within the region. The extent to which any of this infrastructure can be accessed and under what terms remains to be seen – but knowing it's there will be truly helpful when laying out potential strategic options – particularly with respect to inter-community connectivity. Canada's broadcasting and telecommunications regulatory body, the Canadian Radio-television and Telecommunications Commission (CRTC) is currently studying wholesale fibre regulations and the result may go a long way towards enabling any required access – even though any associated recommendations will not likely come in to effect until spring.

Detailed fibre maps for each regional member have been placed in the Appendix.

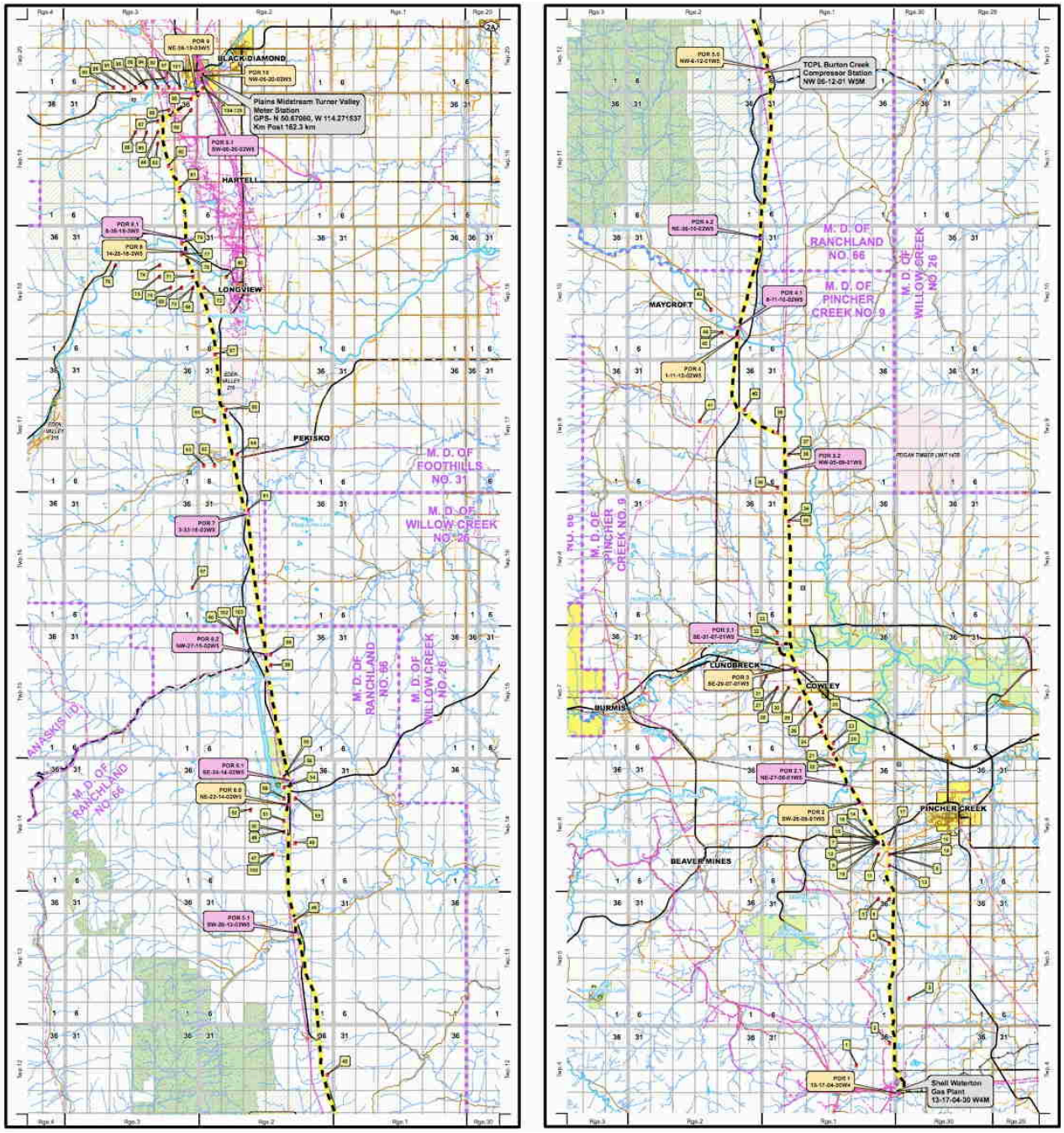


Tower Infrastructure

An inventory of the fixed wireless towers in the region shows 23 towers in the MD of Cardston, 37 in the MD of Pincher Creek, 19 in Willow Creek, and 2 each in Crowsnest Pass and Wateron. Estimated coverage off these towers generally aligns with the coverage map issued with the Connecting Canadian's program.

Unused Pipelines

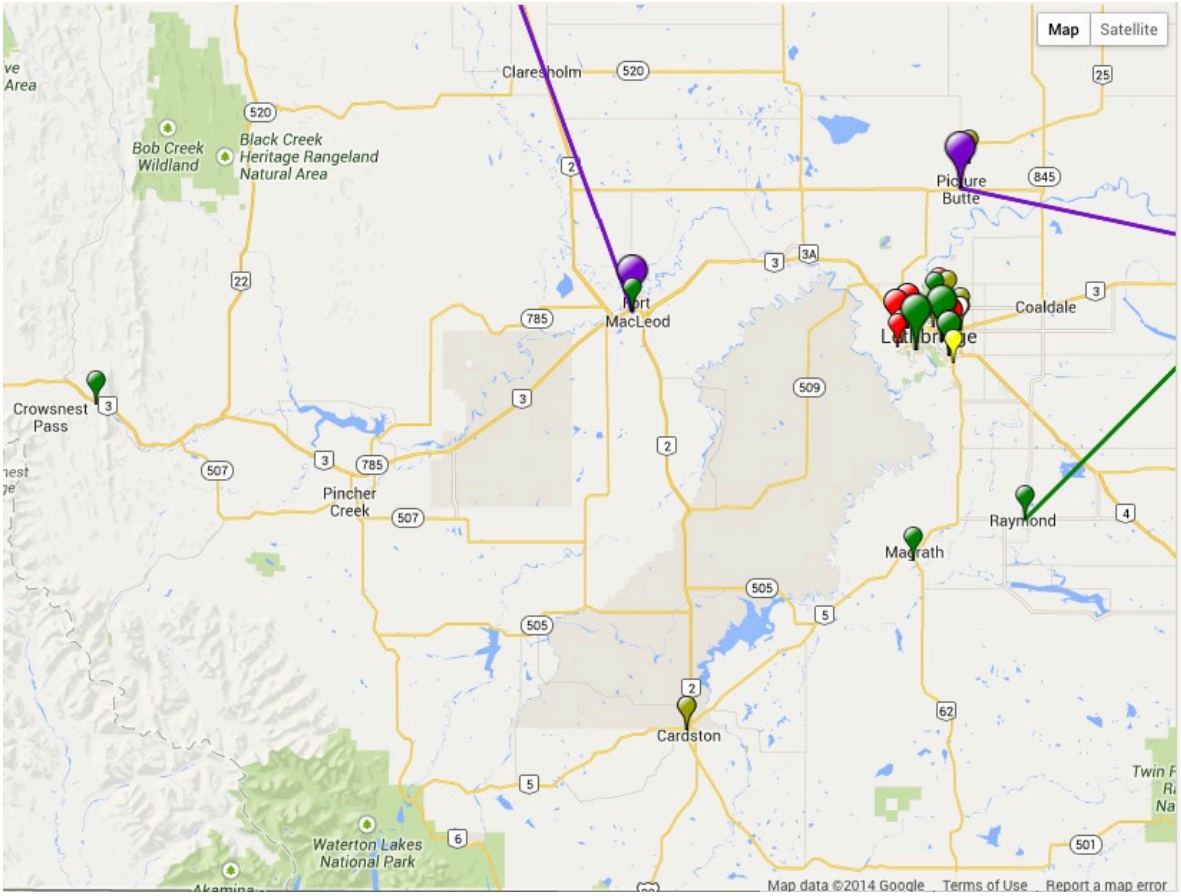
According to information provided by Greg Brkich, CAO, MD of Ranchland, there also exists the potential to obtain access to an empty gas pipeline to run fibre. According to the detailed map provided, the unused pipeline runs from the Shell Gas Plant south of Pincher Creek approximately north to the Black Diamond – the dotted yellow line in the next figure.



Planned Infrastructure

Major Projects

According to the Provincial Major Projects list, no major projects over $5M currently planned or underway in the region are available to be leveraged for broadband deployment. Listed projects appear in the next figure. Those shown in green for Crowsnest Pass and Fort Macleod are institutional /building upgrades and that shown in purple for Fort Macleod is the South Foothills 240kV power transmission line project.



Civil Works Projects

To ensure completeness, key personnel throughout the AlbertaSW footprint were contacted relative to planned and proposed upgrades to municipal water, sewer, road, electrical, tower and other infrastructure that might potentially be leveraged for deployment of optical fibre conduits and wireless access points in the region. At this point, no complementary projects are planned for Cowley, the MD of Ranchland, the MD of Willow Creek, or Stavely. No information from the Municipality of Crowsnest Pass, Glenwood, or Hillspring has been received.

Cardston County

Cardston County will soon be conducting an engineering study for deployment of three water networks. The study will be completed no later than January, 2015 and the report will be shared with Alberta SouthWest at that time. The study will focus on the footprints of Hillspring/Glenwood, Cardston South, and Magrath, each of which is served by a separate water treatment facility.

Town of Claresholm

Civil works projects associated with the large residential development of Harvest Square are planned.

Town of Fort Macleod

The Town of Fort Macleod has a pending deep service project involving the town's sewer systems and collection lines. The project will likely be retendered early this year.

Town of Granum

A stormwater management study was completed in August, 2013. A management plan is now in development, and will include linear excavations that could be amenable to deployment of fibre conduit. The study can be downloaded at http://www.granum.ca/town-office/Public-Information.

Town of Nanton

Preliminary plans have been developed for an expansion of the Town's industrial park. Related information is available to AlbertaSW on the condition of internal use only.

Within its boundaries, the Town owns the right-of-way for the decommissioned CPR line between Aldersyde and Fort Macleod. The title carries an old caveat granting permission for deployment of a conduit specifically for the purpose of carrying optical fibre cable.

Municipal District of Pincher Creek

As shown in the schematic on the next page, the MD is planning to deploy municipal water lines from the Cowley Regional Water Treatment Plant to the hamlets of Beaver Mines and Pincher Station. If there is a cost advantage, Pincher Station could be served from the treatment plant in Pincher Creek.

Discussions are ongoing with Castle Mountain Resort to have secondary Highway 774 paved from Castle River to the Resort. Major infrastructure upgrades for water, power and telecom could be undertaken at the same time. As these upgrades will depend on provincial funding for the upgrade to Highway 774, timing remains uncertain.

The MD has secured funding for deployment of four telecommunication towers, in collaboration with Tough Country Communications: NW 35-9-2-W5M, NW 4-6-2-W5M, SW 19-1-5-W5M, and NE 9-3-29-W4M or NE 15-3-30-W4M

XplorNet recently contacted the MD to express their interest in deploying terrestrial LTE solutions to complement their new satellite coverage.

Town of Pincher Creek

Though not currently approved, the four year capital plan for the Town of Pincher Creek includes budgets for ~21k linear meters of water line replacement, ~10k linear meters of sewer line and ~20k meters of asphalt replacement.

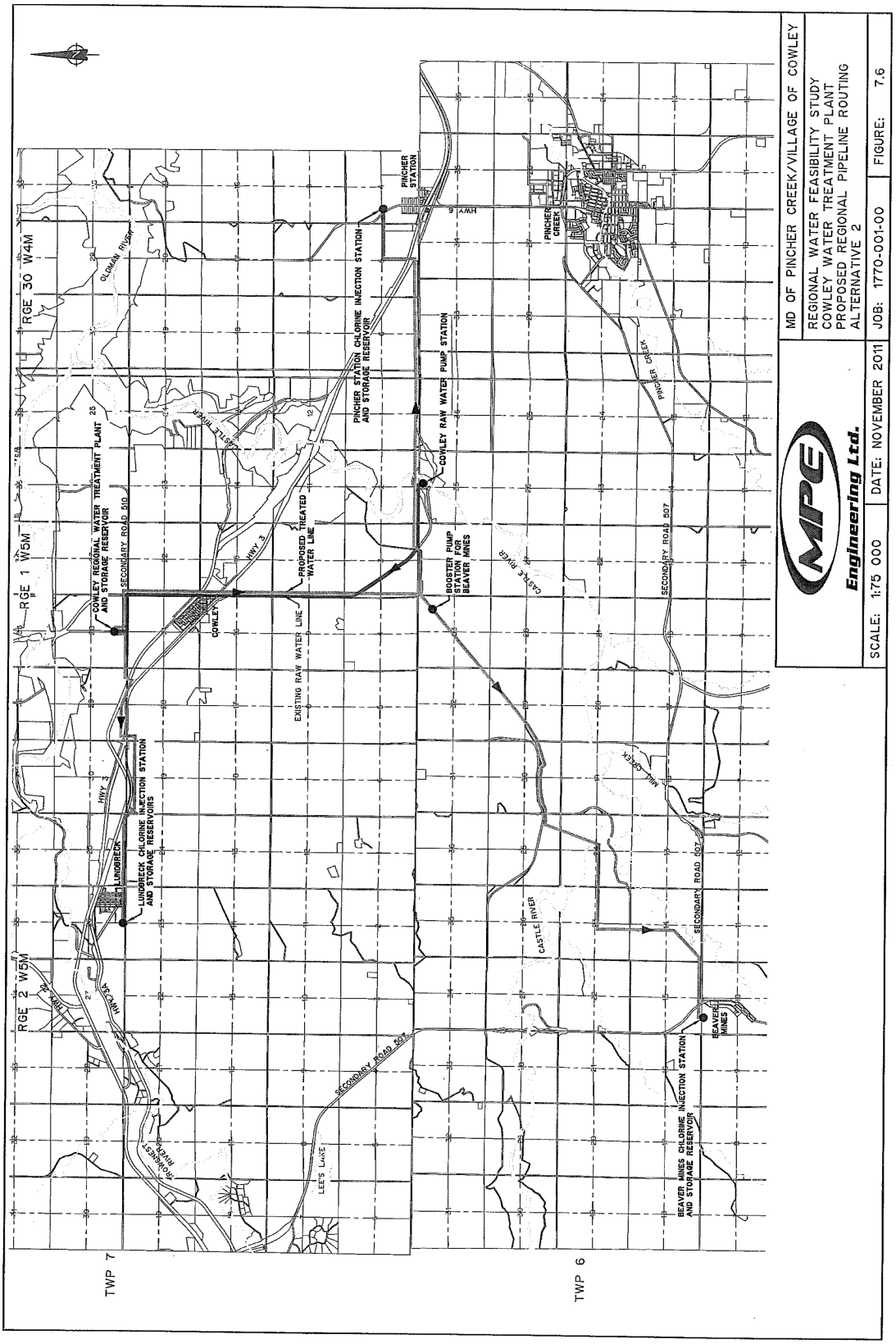
Waterton Lakes National Park

Shared Services Canada is currently laying fibre to connect Park facilities within the town site and discussions are underway to leverage this deployment in support of both their wi-fi and potential future fibre initiatives. Sewer infrastructure throughout the town site will be upgraded commencing fall, 2015.

Incumbent Activity

TELUS is deploying five new cellular towers in Cardston County, mostly in proximity to the US border.

Rogers is deploying four new towers in Cardston County as well as a new cellular tower to service Nanton's industrial park. As well, Rogers is trying to secure access to suitable land for deployment of a cellular tower in the MD of Ranchland.


MD OF PINCHER CREEK/VILLAGE OF COWLEY
REGIONAL WATER FEASIBILITY STUDY
COWLEY WATER TREATMENT PLANT
PROPOSED REGIONAL PIPELINE ROUTING
ALTERNATIVE 2
Engineering Ltd.
SCALE: 1:75 000
DATE: NOVEMBER 2011
JOB: 1770-001-00
FIGURE: 7.6
RGE 1 W5M
RGE 30 W4M
RGE 2 W5M
TWP 7
TWP 6
COWLEY REGIONAL WATER TREATMENT PLANT AND STORAGE RESERVOIR
SECONDARY ROAD 510
PROPOSED TREATED WATER LINE
EXISTING RAW WATER LINE
COWLEY
HWY 3
LUNDBRECK
LUNDBRECK INJECTION STATION AND STORAGE RESERVOIRS
PINCHER STATION CHLORINE INJECTION STATION AND STORAGE RESERVOIR
PINCHER STATION
COWLEY RAW WATER PUMP STATION
BOOSTER PUMP STATION FOR BEAVER MINES
PINCHER CREEK
SECONDARY ROAD 507
BEAVER MINES
BEAVER MINES CHLORINE INJECTION STATION AND STORAGE RESERVOIR
CASTLE RIVER
OLDMAN RIVER
PINCHER CREEK
MILK CREEK
LEE'S LAKE
HWY 6
HWY 22
HWY 3A

Desired State

Overview

Over the next decade, the Alberta SouthWest Regional Alliance would like to facilitate the deployment of infrastructure to support a fully scalable broadband network ubiquitously available throughout the region. This would typically include FTTH infrastructure together with a wi-fi overlay in the more urban centres and a combination of fibre and wireless infrastructure in the more rural areas. Market-wise, the infrastructure would be available on an open access basis to all service providers interested in serving regional businesses and residents. Whereas the Region does not wish to interfere with private enterprise in the services market-place, it will entertain options relative to facilitating the underlying utility infrastructure, whether that be the provisioning of empty ducts, ducts and dark fibre, fibre-fed towers, or a lit open-access fibre infrastructure.

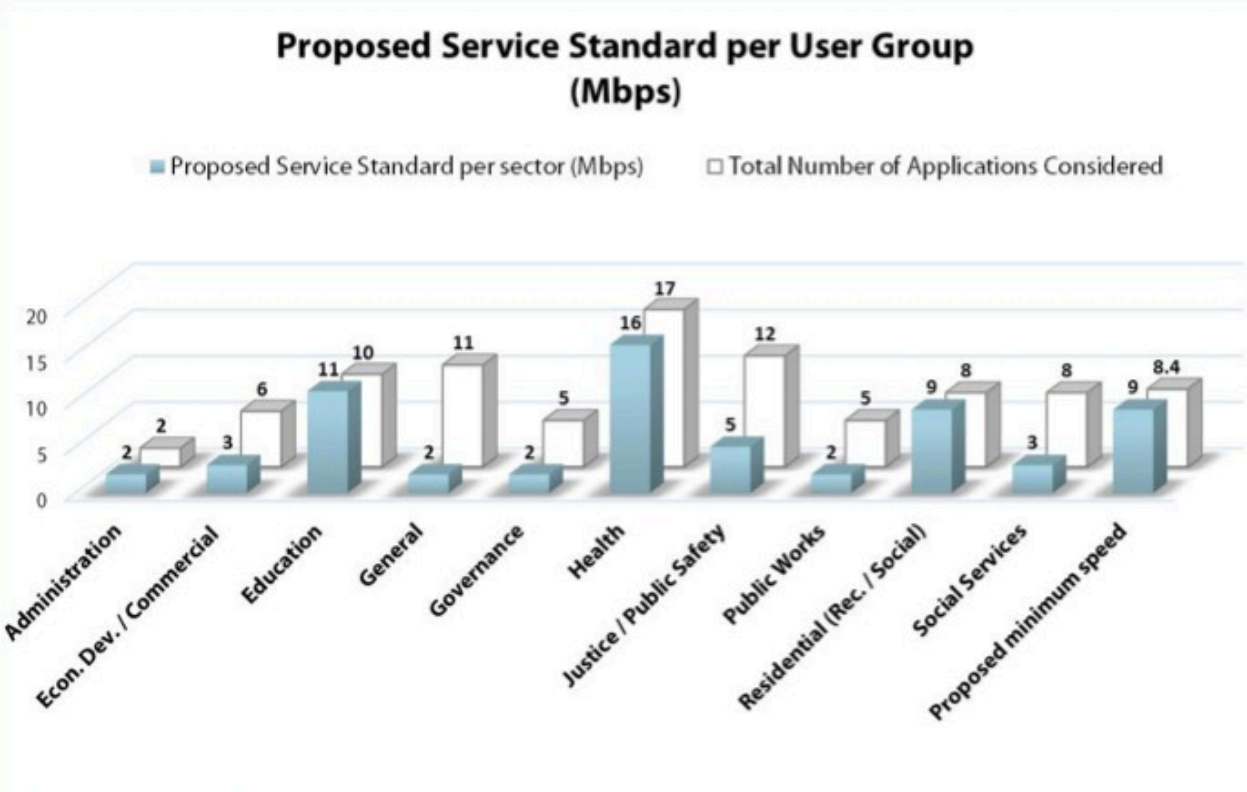
Service Requirements

Where fibre can be justified, designing for scalability is more important than estimating minimal desired service requirements as (1) with fibre connectivity, the cost of providing 1 Mb/s service is only marginally less expensive than providing 100 Mb/s and (2) the impacts of exponentially increasing network loads and disruptive services such as cloud computing quickly render minimal initial service levels obsolete. Minimal service levels do, though, have a role in establishing the initial deployment requirements needed to service sparsely populated areas where fibre cannot be economically deployed.

Nordicity proposed the minimal set of service standards per user group shown in the next chart.[15] According to the chart, for example, seventeen different health applications were considered and 16 Mb/s was determined to be the minimal bandwidth required to support them. These estimates need to be used carefully. Should the 16 Mb/s be required to deliver a particular application to an office in a hospital, and should the hospital have a dozen such offices concurrently using those services, then the

[15] Noridicity; *Northern Connecitivity – Ensuring Quality Communications*; Northern Communications Information Systems Working Group, Government of Yukon; 2014 01.

minimal aggregate bandwidth requirement would actually be ~200 Mb/s. Should this health facility then be out of reach of wired Internet services, custom PTP wireless system would need to be designed as 200 Mb/s is considerably beyond PMP system capabilities. As per the tables in the Appendix, PMP providers do not typically offer services in excess of 6 Mb/s.



With wireless PMP technologies, a fixed bandwidth per antenna is available on a shared basis amongst those homes and businesses within range and opting for the service. To accommodate either additional customers or increasing demand for bandwidth, capacity can be increased by moving from an omnidirectional antenna covering 360° to sectorized antennas. Options include three sector antennas, each covering 120° or six – each covering 60°. Increasing capacity beyond that requires adding equipment operating in a different frequency band, and from there to the expensive option of increasing the number of towers – and then using a larger number of smaller towers to service the same area. Depending on both density and growth projections, on a ten-year basis, bearing the additional cost of fibre upfront may be the less expensive option overall.

A second less obvious design consideration is the reliability of the services to be made available. Best effort is easy. More robust services with 99.9999% availability requirements for say, health services, are more expensive due to the route, power, and equipment redundancy required to achieve it. With PMP systems, availability figures beyond 99.9% are difficult to achieve.

Options

Options to move the members of the Alberta SouthWest Regional Alliance to their desired state include (1) simply embedding fibre network requirements into local and regional planning processes, (2) seeking additional investment from the incumbent carriers in the urban centres, (3) working with WISPs in the rural areas, (4) subsidizing private providers, and (5) establishing a regional broadband network utility and operating it on behalf to the regional membership. Should the latter approach be adopted, a potential path to achieving the desired state would progress in four parts:

(1) Urban Areas: *Blairmore and Coleman communities in Crowsnest Pass, Claresholm, Coleman, Cowley, Fort Macleod, Glenwood, Granum, Hill Spring, Nanton, Pincher Creek, and Stavely.*

Given Shaw offers capable Internet services to most urban areas in the region, significantly improving broadband capability will require fibre. While broadband may bring the world to a community's door, and vice versa, deploying fibre related infrastructure is a very locally focused and typically expensive undertaking. A governance model in which each urban area is responsible for its own passive (duct, fibre, hand-hole, etc.) infrastructure and in which the Region, to benefit from scale, arranges to both light and operate the networks on an open access basis likely makes the most sense. Until the local services eco-system develops, contracts for service provisioning and operations will likely be required.

(2) Rural Areas: *Cardston County, Crowsnest Pass (outside of Blairmore and Coleman), MD of Pincher Creek, MD of Ranchland, MD of Willow Creek, and Waterton Lakes.*

Unless a substantial grant or private financing can be secured, PMP wireless systems will continue to play a significant role in improving services throughout the rural areas of the region. Assuming the Parkland model (see *Parkland* on page 21) is deemed best, the co-operation and support of local WISPs would be sought so that grant funds to extend coverage to un- and under- served areas could be applied for on a regional basis. In exchange for non-exclusive access to the shared towers, the capital WISPs require to service new areas would be reduced. WISPs would be required to provide both the last mile access links and services to end clients.

(3) Wi-Fi:

With the availability of fibre in the urban centres, the potential to substantially and inexpensively extend wi-fi coverage throughout the centres becomes possible and a simple strategy to do so would be in order.

(4) Inter-urban Links & Transit:

While initial services will likely utilize the Alberta SuperNet for interconnection and backhaul, this will prove to be an expensive option over the longer term. Once the Urban and Rural areas are properly served, a strategy to reduce dependence on the Alberta SuperNet or to provide a redundant connection to improve reliability would be beneficial.

Timeline

2018 – Three Years Out

With a concerted and focused effort, fibre services to town-based business centres at rates up to 1 Gb/s will be available in those towns that elect to deploy fibre. 2015 is spent securing municipal and public support, developing the plan, and securing the needed and financing. Deployment begins and completes in two towns in 2016 and a third in 2017. Several of those that do not initially elect to go fibre improve wi-fi offerings. PMP services become available throughout the rural areas.

2020 – Five Years Out

With positive cashflow achieved in the first three towns, fibre is extended to the residential areas and full FTTP services become available to every home and business in those towns. Fibre to the business districts is deployed in four more towns and planning for full fibre deployment in two more commences. Fibre to businesses within the villages and hamlets is considered and wi-fi becomes ubiquitously available throughout all hamlets, villages, and towns.

2025 – Ten Years Out

Full fibre to every home and business, both rural and urban, will be available throughout the region.

Options Analysis

Case Studies

Deployment Trends

To date in Canada, there have been two successful community fibre initiatives, the full service Gb/s offerings in Olds, Alberta and the dark fibre network deployed in Coquitlam, BC (QNet). In addition, The Valley Community Fibre Network (VCFN) in Nova Scotia deployed a fibre backbone network to link a number of small communities in Nova Scotia. Though some fibre has been deployed via the Eastern Ontario Regional Network, ownership reverts to the incumbents after a 5-7 year period. The Rhyzome Network in Stratford is largely wireless. Interest is increasing, though, and a number of communities and regions are now beginning to take a serious look at their options with respect to enabling fibre services within their communities. As Canadian communities have in general been slow to facilitate the deployment of fibre, there is an opportunity for the AlbertaSW Region to gain a differential advantage by positioning to be ahead of the curve.

Capitalizing on this interest, both TELUS and Axia have been actively marketing increased broadband service capabilities to Alberta communities. Communities that have signed on with TELUS include Ponoka, Innisfail, and Didsbury. Vulcan, Drayton Valley, and Lloydminster have signed on with Axia.

Relevant Initiatives

Kainaiwa

As exemplified by the Initiative undertaken by the Kainai Nation in southern Alberta, communities undertaking a do-it-yourself approach directly benefit from both the alignment between their broadband objectives and the interests of their communities as well as from the financial benefits that no longer flow to the shareholders of the incumbent service organizations. With respect to the Kainaiwa Fibre Network, the Blood Tribe claims to have repaid deployment expenses in five years and reduced their telecom expenditures from $50k to $7k per month – an apparent annual savings of $516k that could be reinvested into the community.

Olds

After a decade of work developing a full-service triple-play (telephony, Internet, and television) fibre initiative to every home and business in Olds, in 2013 Olds became the first and only community in Canada to provide Gb/s services.[16] The services are now available to any community in Western Canada that undertakes to deploy a local fibre network. A short video in which they offer to help other communities may be found at:

http://youtu.be/Uc_plnE3W5U

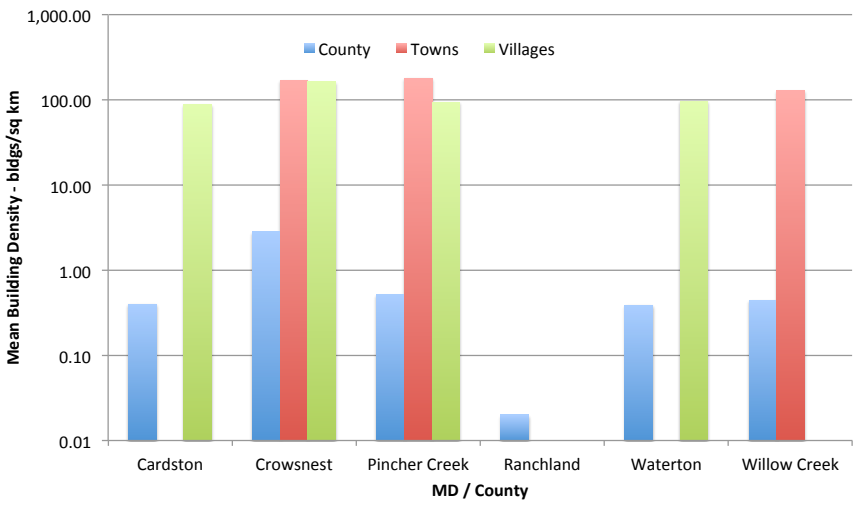
Parkland

To enhance broadband services to the rural areas of Parkland County while preserving market forces amongst the WISPs in the area, Parkland deployed a number of fibre connected primary towers as well as a set of smaller secondary towers with wireless backhaul to the primary towers. WISPs, mobility providers, and first responders can rent space on these towers for their antennas. This brings the capital cost of serving remote areas down and helps enable competitive broadband services in areas which might otherwise go unserved. This option is worth considering for areas within the AlbertaSW footprint where fibre cannot be economically justified.

Issues and Constraints

Regional Density and Scale

Counting Blairmore and Coleman as towns and Bellevue and Frank as villages[17], the AlbertaSW Region consists of six municipal districts and counties, 8 towns, 5 villages, and 20 hamlets. Overall, the 14,654 km² region includes 29,517 people occupying 12,460 of 14,365 buildings.



The total building density distribution across the region is shown in the adjacent chart. Whereas densities in the rural areas run as low as 0.02 buildings /km^2 (1 every 50 km^2) those in the towns and villages reach a high of 181.5 – a 9000-fold difference. From a broadband deployment perspective, this implies that at least two different approaches will be required[18] – one for the towns and villages and one for the lower density rural areas. Whereas fibre-based strategies may be easily justified for the former, wireless may be the only option in the more rural areas.

Whereas the smaller towns and more rural areas may not have the client base needed to sustain network operations individually, a regional scale operation would.

[16] Chung, Emily; *Small Alberta town gets massive 1,000 Mb/s broadband boost*; CBC News; 2013 07 19.

[17] Broadband strategy depends more on population density than official administrative status.

[18] Three, when inter-community connectivity is considered.

Agency Issues

To stimulate innovation and economic development in Alberta and elsewhere, communities require access to open, symmetric, high bandwidth (100+ Mb/s) networks. These requirements continue to go unmet in the region for at least two reasons:

- no universal service requirements have been extended to broadband access
- an agency issue resulting from a conflict of interest between the needs of local communities and the needs of the publicly traded telecom and cable companies (incumbents) to meet the financial returns their shareholders expect.

Fortunately, the solution to both issues for communities such as those in the AlbertaSW region wherein the private sector interests of the incumbents preclude investment in fibre, is straightforward, if not easy. As evidenced in Europe, communities can force a change to the business models by facilitating the deployment of broadband access on a utility (possibly public sector) basis throughout their region and then either allow full service (private sector) competition should the eco-system be sufficiently developed or contract for services until it is. In the Olds example, neither option was available so they established their own services entity (O-Net) to provide services. As our provincial and federal governments gradually come onboard as predicted by the techno-economic model presented earlier, additional funding and more supportive regulation may materialize.

Economic – Retaining ICT Revenue Streams

As exemplified by the Initiative undertaken by the Kainai Nation, communities might directly benefit from do-it-yourself approach in which there is direct alignment between their broadband objectives and the interests of their communities as well as from the financial benefits that would then no longer flow to the shareholders of the network and service organizations. With respect to the Kainaiwa Fibre Network, the Blood Tribe indicates that it was able to repay deployment expenses in five years due to the reduction in their telecom expenditures from $50k to $7k per month – an annual savings of $516k that can be reinvested into the community.

Paul Nelson worked with the Town of Pincher Creek to see if similar savings might be realized in the urban areas of the county. Detailed billing for the three largest departments was examined and if the TELUS packages were replaced by comparable medium business offerings from O-Net, services would be improved and monthly billing would be reduced by ~46%. Given the Town's telecom budget, the annual savings would come to about $12,000.

Similarly, if 40% of the residents in Pincher Creek spend $79/month for internet and the provider is operating with a 15% profit margin, then the equivalent NPV to 2030 is -$728,000 (loss to the community).

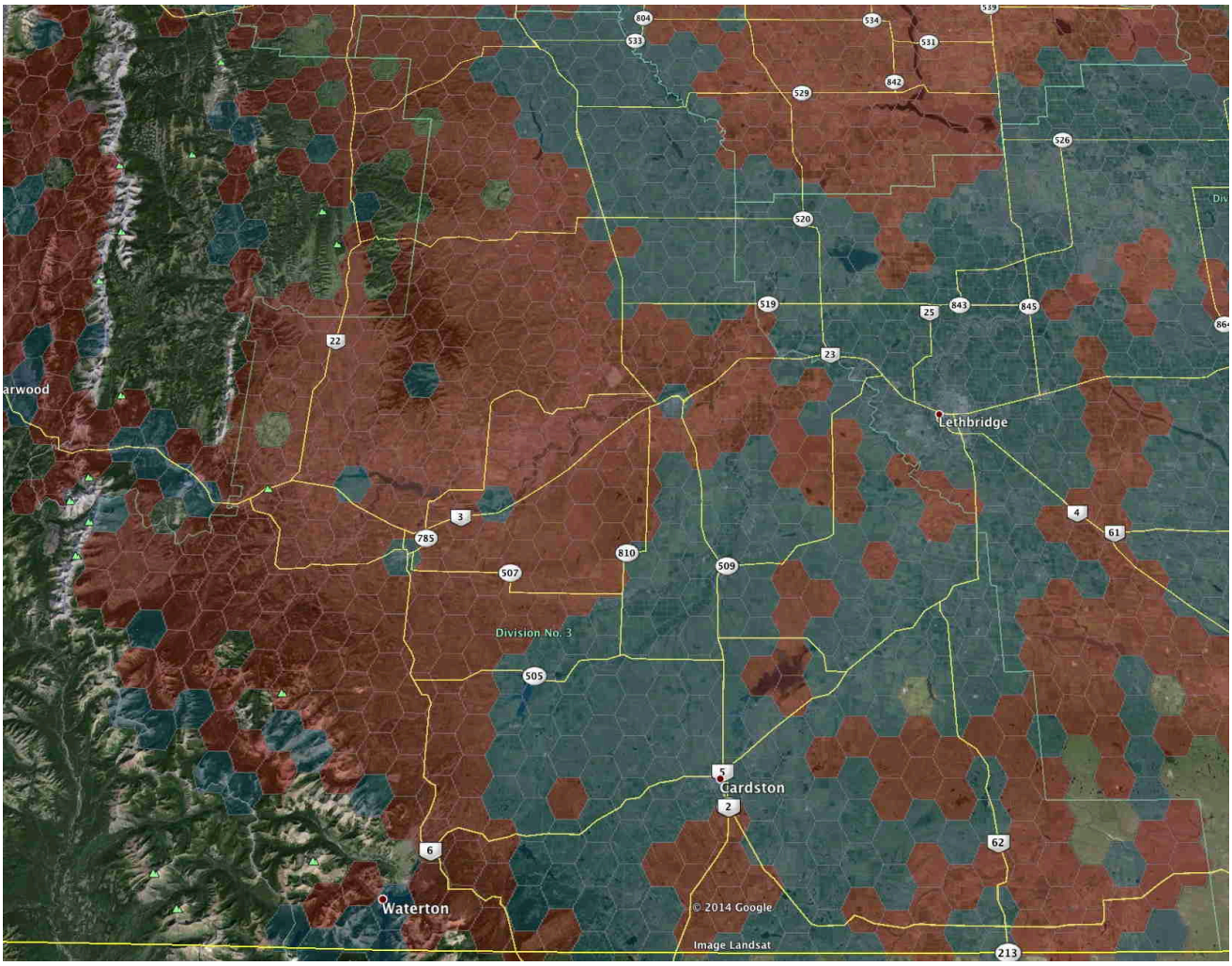
Political – Grant Availability

Neither the federal nor provincial governments have yet placed the emphasis on technology policy to the extent evident internationally. Ottawa's April release of Digital Canada 150[19] program did, though, provide evidence of their growing realization of its importance to the future of Canada. Under the Connecting Canadians portion of this program[20], $305M worth of investment incentives were made available to Internet Service Providers (ISPs) able to furnish solid technical and financial plans associated

[19] http://www.ic.gc.ca/eic/site/028.nsf/eng/home .

[20] http://news.gc.ca/web/article-en.do?nid=869539

with increasing the availability of broadband services in unserved areas should funding be received. Unserved areas were defined as those areas that did not have access to a minimum of 5 Mb/s downstream bandwidth for internet services. A map indicating areas within the AlbertaSW region that were eligible for funding appears below[21]. Areas in red were eligible, areas in blue are not. For scale, each hexagon covers an area of approximately 25 km^2. The call for applications closed January 12, 2015 and the first projects are expected to be announced in spring, 2015.



The New Building Canada Fund announced March 28, 2014 promised[22]:

- $14 billion available for projects of national significance
  - the $4 billion National Infrastructure Component provides provides funding for projects of national significance, with a focus on projects that have broad public benefits, and that contribute to long-term economic growth and prosperity
  - the $10-billion Provincial-Territorial Infrastructure Component supports infrastructure projects of national, regional and local significance that contribute to economic growth, a clean environment, and stronger communities. This fund is divided into two sub-components:

[21] http://www.ic.gc.ca/app/sitt/bbmap/hm.html .

[22] http://www.infrastructure.gc.ca/plan/plan-eng.html .

  - $9 billion for National and Regional projects; and
  - $1 billion for projects located in communities of fewer than 100,000 residents through the Small Communities Fund.
- $1.25 billion in additional funding available for P3 projects
- $2 billion Federal Gas Tax Refund which provides municipalities across the country with additional resources to address their infrastructure priorities

Communities within AlbertaSW may wish to apply for funding under this program to help finance broadband infrastructure related projects. To qualify for Building Canada Funds for projects relating to Connectivity and Broadband, the projects must demonstrate how they provide benefits to Canadians in support of one or more of the following outcomes[23]:

- Increasing in geographical area, to account for industrial/resource development investments, with access to broadband speeds of 1.5 Mbps or higher, contributing to improved economic development in remote areas; or
- Increasing in number of Canadians with access to broadband speeds of 1.5 Mbps or higher, contributing to improving the quality, accessibility and effectiveness of public services.

Under the Federal Gas Tax Refund program, municipalities, towns, and villages with populations under 100,000 are each eligible for a minimum annual grant of $50,000. According to Bev Thornton, Executive Director of AlbertaSW, the qualifying amounts for AlbertaSW members are[24]:

Cardston County	226,457
Town of Claresholm	204,230
Village of Cowley	50,000
MD of Crowsnest Pass	381,992
Town of Fort Macleod	169,395

Village of Glenwood	50,000
Town of Granum	50,000
Village of Hill Spring	50,000
Town of Nanton	115,864
MD of Pincher Creek	171,623

Town of Pincher Creek	196,676
MD of Ranchland	50,000
Town of Stavely	50,000
Waterton Lakes NP	50,000
MD of Willow Creek	277,542

Together the funding totals $2.094 million per year and funds can be pooled toward a multi-year plan. Guidelines for the use of these funds are available at: http://municipalaffairs.alberta.ca/gastaxfund.cfm.

Potential Strategies

Maintain the Status Quo

Should Axia's proposed trial FTTH program or Shaw's 100 Mb/s services (now 60 Mb/s) sufficiently meet the needs of the communities in which they will be deployed, the status quo option in which those towns leave well enough alone, or otherwise continue to pursue their present course, may be best. Indeed, this option is relatively hassle-free. On the other hand, those towns then remain dependent on their service providers and should Axia prematurely terminate their trial program or Shaw unilaterally change their service offerings – as they did on January 6, c'est la vie.

Develop a Broadband Services Strategic Plan

Many options to help facilitate enhanced broadband infrastructure deployment within a community or region are available. Indeed, options range from simply accelerating any planned internal fibre initiatives, to negotiating with the incumbents and potentially subsidizing private operators, to do-it-yourself initiatives as exemplified by O-Net in Olds and Q-NET in Coquitlam. Understanding these

[23] http://www.infrastructure.gc.ca/plan/sc-anna-cp-eng.html .

[24] http://www.municipalaffairs.alberta.ca/documents/LGS/2014_GTF_Allocations_-_For_Website.pdf .

options, together with the benefit, cost, potential payback, and risk trade-offs associated with each, is fundamental to reaching enlightened consensus on the best path for the community or region overall. Even moving forward on the *easy* options such as accelerating currently existing plans will benefit from the context such a plan will bring.

Development of this report is a first step by the Alberta SouthWest Regional Alliance to develop a regional broadband services strategic plan. High level business case numbers and key considerations and options have been developed and, over the next six months, more detailed work with each member community will be completed. The results of this more in-depth work will then be used to develop a regional broadband strategic plan.

Leverage Member Planning Processes

As member communities develop or update their municipal plans, options to embed broadband initiatives might be considered. If it is determined to be appropriate, broadband service policies could be created so that polices can flow through to implementation actions in future area structure plans, development agreements, engineering standards, and development permits. Similarly, some member communities may already have plans to augment their internal IT networks and those spanning the community could potentially be brought forward and leveraged to support enhancing a community broadband initiative.

Leverage the Municipal Approval Process

Member communities could also undertake a Development Approval Process review where broadband services becomes an important component to be incorporated into municipal approval processes and other planning documents. For example, three simple things to consider are:

- Include Fibre Conduit in residential developer agreements.
- Develop a policy and business case for including installation of fibre conduit as part of applicable and appropriate community infrastructure projects, such as road (re)construction and water / wastewater projects.
- Adopt a low voltage inside wiring standard. It doesn't make any sense for a house builder to use Cat 3 wire when fibre is available at the curb.

While education and advocacy, as well as municipal processes, can assist in driving broadband service improvement strategies forward, ultimately the success of the strategy depends on realizing investments from both private and public sector stakeholders in meeting the regional connectivity requirements.

Negotiate with the Service Providers

Seek Service Provider investment

TELUS and Axia are both interested in and indeed installing FTTP networks in several Alberta communities. Talks with TELUS have already commenced and meetings with Axia and Shaw will be arranged in early January. Unfortunately, there is often a 'chicken and egg' dimension to these discussions wherein the carriers only wish to invest when the businesses want to order the service but business are typically not interested in moving to communities where the infrastructure is not yet in place.

Strategically, TELUS and Shaw may view local fibre initiatives as threats to their vertically integrated business models and therefore may accelerate network deployment or upgrade plans in

communities looking to go their own way. Certainly the Olds initiative has benefited the surrounding communities of Innisfail and Didsbury – both of which are the recipients of TELUS FTTP initiatives.

When negotiating with the incumbents for fibre, it is important to ensure that the associated service sets they will offer in the community match the capability of the infrastructure they will be providing. To avoid setting a precedent, once an incumbent deploys fibre within a community, the service sets they make available are typically only those they have made available elsewhere (on copper or coax). You will not, for example, see a residential service offered by TELUS on their fibre in Innisfail or Didsbury comparable to O-Net's 1 Gb/s.

Subsidize a Private Partner

The traditional market driven, private sector led business model is not providing many member communities with the infrastructure they desire due to a lack of financial incentives. By directly subsidizing a private operator, these communities could provide a selected operator with adequate incentive. While this is indeed the approach taken by the Connecting Canadian's program, options in which market forces are preserved are often preferable.

Urban Areas – Develop Community Fibre Networks

Should incumbent telecom and cable operators not come to the table, the Region and its members may wish to consider establishing their own community fibre network. Indeed, with an appropriate and sustainable business model, the Region could establish, either on its own or in partnership, a fibre-based community broadband network and operate it as a fourth utility. Indeed, the CRTC is, through hearings, currently evaluating the need for non-facilities based competition on which such approaches depend.

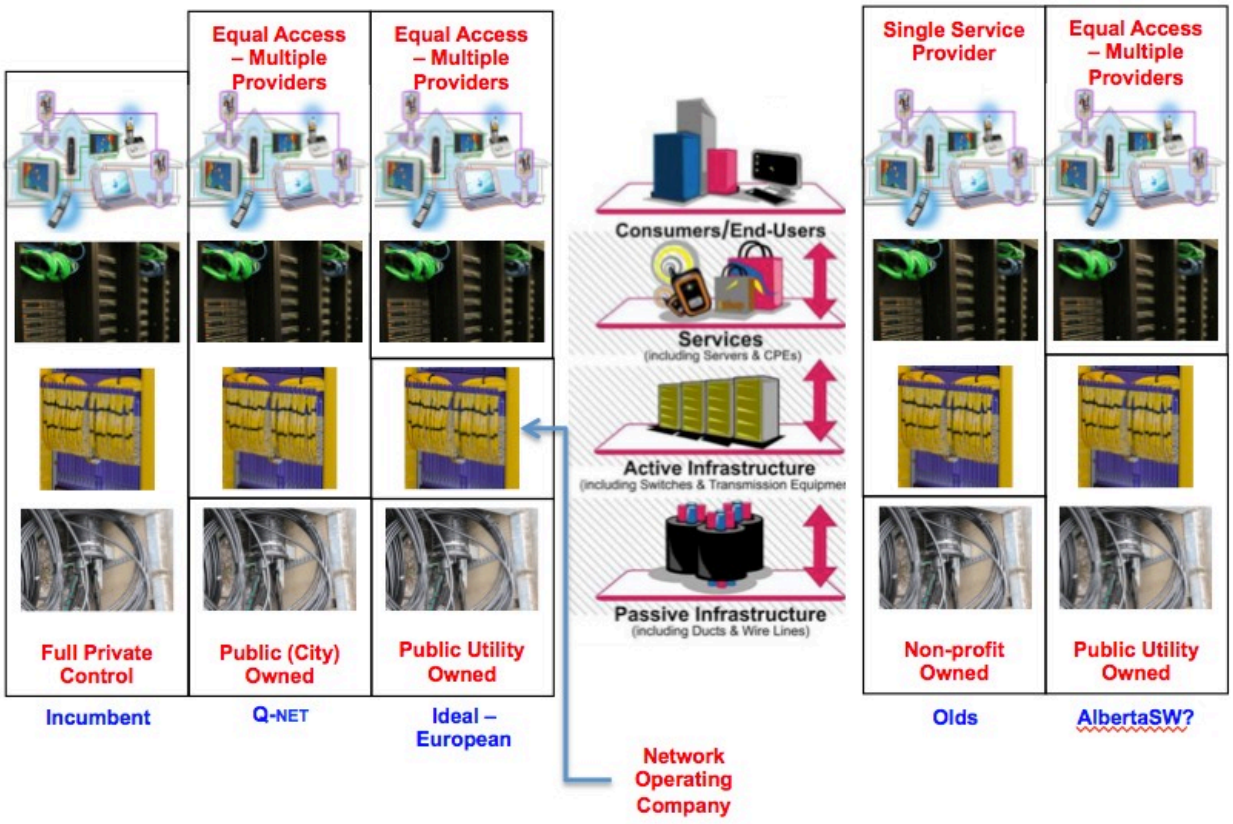
As proven by deployments throughout Europe and the Far East, utility infrastructure could enable the regional communities to provide competitive service providers equal access to unmatched symmetric bandwidth capabilities and thereby enable the delivery of a variety of novel community-based intelligent community services (as well as entertainment services such as HD-TV) to its residents and businesses.

Should the Region and some of its members wish to consider this option, as evident in the next table, a variety of ownership and governance models are possible. Options range from public-private partnerships, cooperatives, and regional alliances, to the establishment of publicly owned utilities and direct subsidization of, or contracts with, private sector organizations. Whichever alternative is selected, local assets, including private operations, should be leveraged to the largest extent possible.

Business Model	Funding	Governance
• Wholesale: dark or lit • Retail: open or closed and with or without service partners	• Co-operative • Utility/Power • Municipality • Gov't grants • Private-public partnerships • Debt, bonds • Private equity • Hybrid	• Co-operative • Municipality • Not-for-profit • Private

As an introduction to the options available, it is useful to consider the evolution of the choices made in Olds as the considerations there were concrete and directly relevant to AlbertaSW. The evolution is depicted in the next figure in which the four key components to broadband service delivery are depicted vertically: the duct and fibre assets; the electronic assets and operations that make the

fibre useful, a services entity for telephony, internet, and television services, and the end-user community, be they business or residential.



On the left-hand side is the vertically integrated **Incumbent** model that currently exists in the region – TELUS on the telecom side and Shaw for cable. The incumbents deploy and operate all network assets and provide services on an integrated basis to the end-users. Costs of upgrading their passive infrastructure relative to their projected incremental revenue streams leads to a negative business case for fibre deployment. To reduce the cost of the passive network deployment, the folks in Olds (technically the Technology Committee of the OICRD) offered to upgrade the infrastructure and then provide the incumbents access to that infrastructure on an indefeasible right of use (IRU) basis. This is the approach taken in Coquitlam, BC and now run commercially by **Q-NET**. So-called dark fibre is available throughout the community for any provider interested in lighting it and then providing services to the end-user community. The terms, though, are on a monthly rental as opposed to a one-time IRU basis.

Once it became evident that neither incumbent (nor any other company) was prepared to leverage the dark fibre to provide enhanced services throughout Olds, the Olds folks approached Axia to negotiate terms under which Axia would light and operate the network for them on an open access basis for use by any service providers willing to play. This moved Olds to the **Ideal** model shown above and which is quite common in Europe. Unfortunately, suitable terms with Axia could not be negotiated and no service companies willing to provide services over the Olds network could be found.

Olds then decided to bite the bullet and set up a triple-play services organization. To simplify operations, they chose to have the services company, Olds Fibre Limited (OFL, which operates under the O-Net brand), act as both a network operator and service provider. Thus, in this model, the OICRD owns the passive network assets on behalf of the community and their wholly owned for-profit subsidiary, OFL, owns and operates all active network and services electronics. This is the **Olds** structure shown in the figure.

As network electronics must be attached directly to the fibre infrastructure, it must be provided locally. Services, however, can be provided from anywhere and any services company with sufficient resources can service any number of networks – as long as suitable (backbone) connectivity to those networks is available. Given OFL operates the network infrastructure in Olds, they also have the resources, as do Axia and others, to monitor and manage networks remotely – so long as there are local 'feet on the ground' to do required installation and maintenance activities. This brings us to the **AlbertaSW** structure in the chart. Under this (potential) arrangement, each town might provide for their own lit fibre network (passive fibre infrastructure plus network electronics) and then contract or outsource the operation of that network to a third party. Contracts with services organizations could then be arranged. For Internet services, local ISPs may be interested, for telephony, the options are fewer, but there are several. For video or triple play service sets, currently, there is only O-Net.

While each community may be required to fund its own infrastructure, regional applications for funding are certainly possible, as are bulk or aggregated outsourced contracts for network operations and services. Locally, 'feet-on-the-ground' will certainly be required, but so will local marketing and sales capabilities, including store-fronts – which could also be done on either a purely local or regional basis. For any business case to work, sales are critical and marketing and sales can be most effectively done through local presence, resources, and programs.

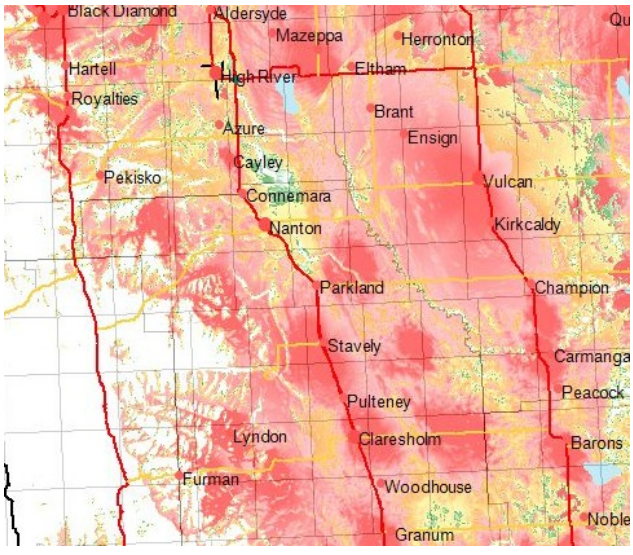
Though the discussion above has focused on fibre-based delivery, the structural or business model considerations apply to point-to-multipoint wireless with minor differences in interpretation. The most significant of these is that the common utility infrastructure would change to fibre or wireless-connected tower infrastructure and the services entities (WISPs) would provide both the wireless access links and services.

Rural Areas – Facilitate Expansion of Wireless Services into Unserved Areas

Coverage versus Capacity

With many road miles between ranches, deploying fibre throughout the most rural areas of the AlbertaSW region cannot be justified by any traditional business case. ISPs therefore serve much of the area via PMP wireless systems. The two issues that arise with these systems relate to coverage and capacity.

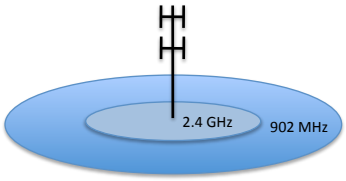
Initially, WISPs provide lower frequency equipment to maximize coverage areas off each tower they deploy – lower frequencies propagate further but their bandwidth is limited. Moving into unserved areas therefore requires that more towers be built. Consider the somewhat dated coverage map for a portion of the MD of Willow Creek. In the map, red areas are well covered. As the colours change to orange to yellow to white, coverage decreases to nothing.



To entice WISPs to deploy equipment to provide services to homes in the yellow and white areas, one could either select a provider and provide the funding for it to build the required towers as per the Connecting Canada approach, or build community towers on which WISPs can simply rent space for their antennas. The latter approach has been used extensively in Parkland County and has the added benefit of preserving market forces.

Once an area is served, the WISP issue becomes one of ensuring the available bandwidth capacity in the area is sufficient to meet client needs. As client needs tend to increase substantially over time (from checking email to downloading music and then to movie files and streaming), this becomes an increasingly expensive proposition over time. Technical options available to the WISP include:

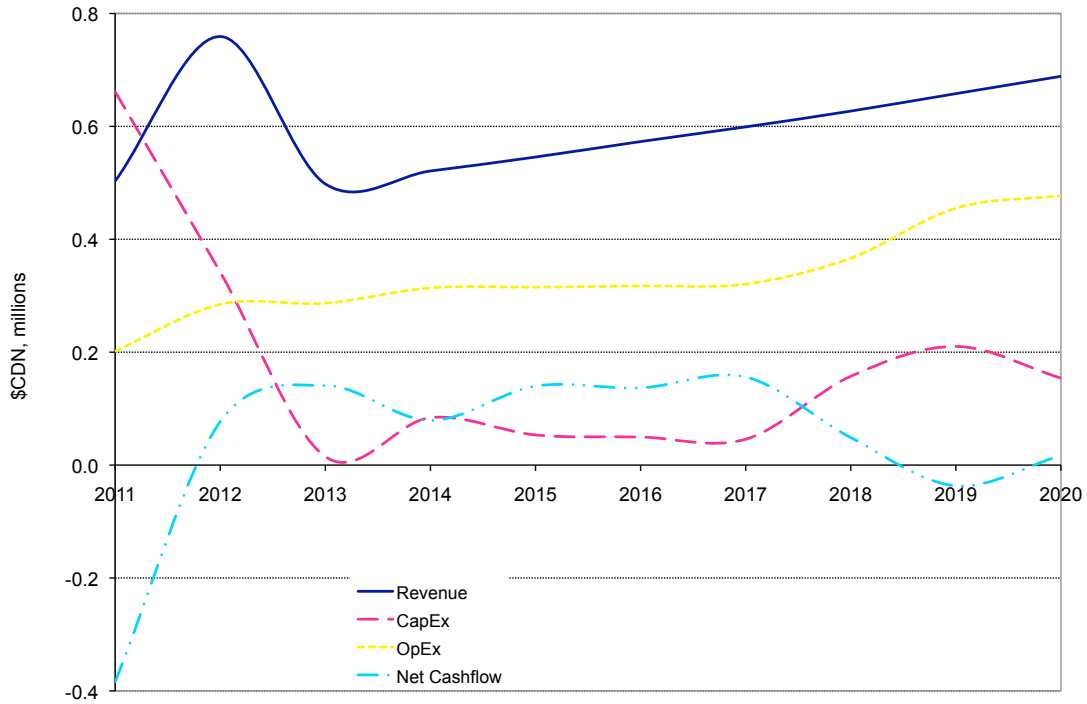
- Sectorizing the antennas – instead of using one omni-directional antenna which shares a given bandwidth over a 360° coverage angle move to sectorized antennas in which six sector antennas could each share a signal over a 60° coverage angle, thereby increasing the available bandwidth by a factor of six.
- Adding radio equipment that operates in a different frequency band – the higher frequency equipment would service nearby clients and the lower frequency equipment would service those further away.



- Increase the number of towers within each area, decrease the coverage area from each, and reuse the available spectrum. The area served by each tower then becomes a cell – hence the term cellular radio systems.
- Use higher bandwidth point-to-point (PTP) links to provide higher reliability, higher capacity links to connect more demanding clients.

Illustrative Financials

To illustrate how this works, example WISP financials for this evolution appear in the chart below. In this example, initial capital (red) is required to deploy 4 towers to complete coverage in an area. In 2014, additional radio equipment is deployed to increase capacity. By 2018, capacity is exhausted and additional towers are deployed. Note that though capital is required to increase the capacity, client revenues are not increasing proportionately – each client is likely still happy with the, say, 3 Mb/s service they ordered years earlier. The fact that they may now be using ten times as much bandwidth isn't something they expect to be billed for. Over time, the ISPs cashflow decreases and the business case becomes unsustainable.



Partnership Options

Aligning with the above, four partnership options are available to enhance broadband services throughout the rural areas in the region:

- Private sector – maintain the status quo
- County or MD option – deploy a county or MD wireless network and outsource operations
- Single partner model – subsidize a private partner sufficiently that the business model to serve the rural areas is positive
- Utility Model – Reduce needed capital and retain market forces
  - Deploy a common tower network to cover the unserved areas and, if possible, site the towers so that they can be used by first responder, mobility, as well as WISP providers.
  - If possible, provide backhaul connections to the main towers on fibre and PTP links to connect secondary towers.
  - Rental space on the towers is used to cover operational expenses.
  - Works best when grant money is available to finance the towers and when first responder and mobility clients move on to the towers (they are more demanding but can pay higher rental fees).

Developing strategic options that leverage existing WISP operations in the region makes sense. Because of the significant conflict of interest CCI Wireless is in relative to AAMDC contracting them to update the WISP coverage maps for the province, one option might be the opportunity to create a trusted forum wherein the local WISPs could mutually work out the unserved areas and then work with the Region to obtain funding for fibre-fed towers in those areas that all WISPs could use at a minimal monthly cost – say rental space on the tower. This is in essence the Parkland model and is favoured by the Alberta Government for good reason. By keeping the towers as a common shared platform, municipalities avoid the serious issues of subsidizing a WISP who may or may not deliver on what the funds they were given were meant for – or partially deliver with substandard services for which the municipalities have no come-back.

The question is, could the local WISPs be convinced to support common use towers that they could compete on in currently un- or under-served areas? With the Region behind them, it would be in everyone's best interest. In un- or under-served, the WISPs would exchange sole access to one or two towers that they might get funding for, for 'equal' access to many towers throughout the region. Part of the deal here would be to build more robust towers than is typical of WISP operators so that the towers are also attractive to high-end clients providing Mobility and First Responder services.

Financial Analysis

Model & Parameters

To set the stage for more detailed work with the individual members of the Alberta SouthWest Regional Alliance, several sets of illustrative financials were developed with the aid of Taylor Warwick's financial models. The accuracy of these models arises from their detail, the careful modeling of deployments across time, and fact that they've been proven via deployment experience. As revenue, capital, and operational data for both wireless and fibre-based deployments ranging from wholesale

open access dark fibre (QNET) to full triple-play services deployment (O-Net) in light of full bore incumbent competition are included, pretty much any option of interest to AlbertaSW can be quantitatively evaluated.

Comparative Results – Regional FTTP Deployment

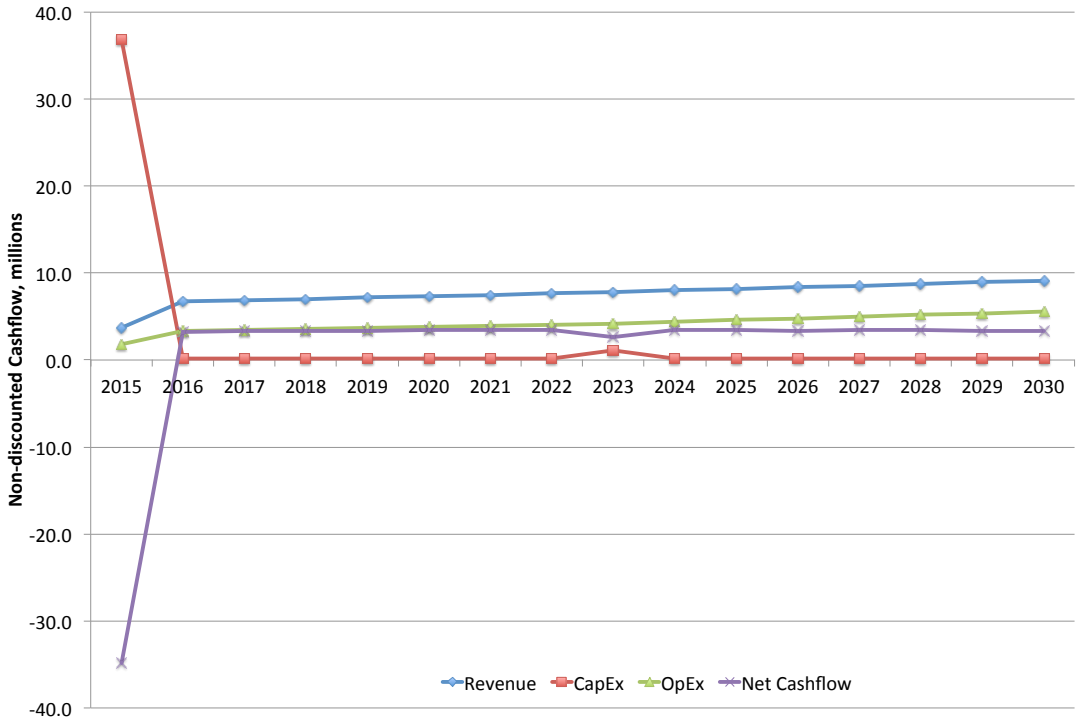
The assumed business model is illustrated below.

Each town deploys a lit fibre optic network and contracts the Region for local marketing and maintenance support. SuperNet is used to backhaul traffic to the Calgary Internet Exchange at which point the towns are connected to O-Net. O-Net is contracted to provide triple-play services to each town and provide back-office and network monitoring and operations support.

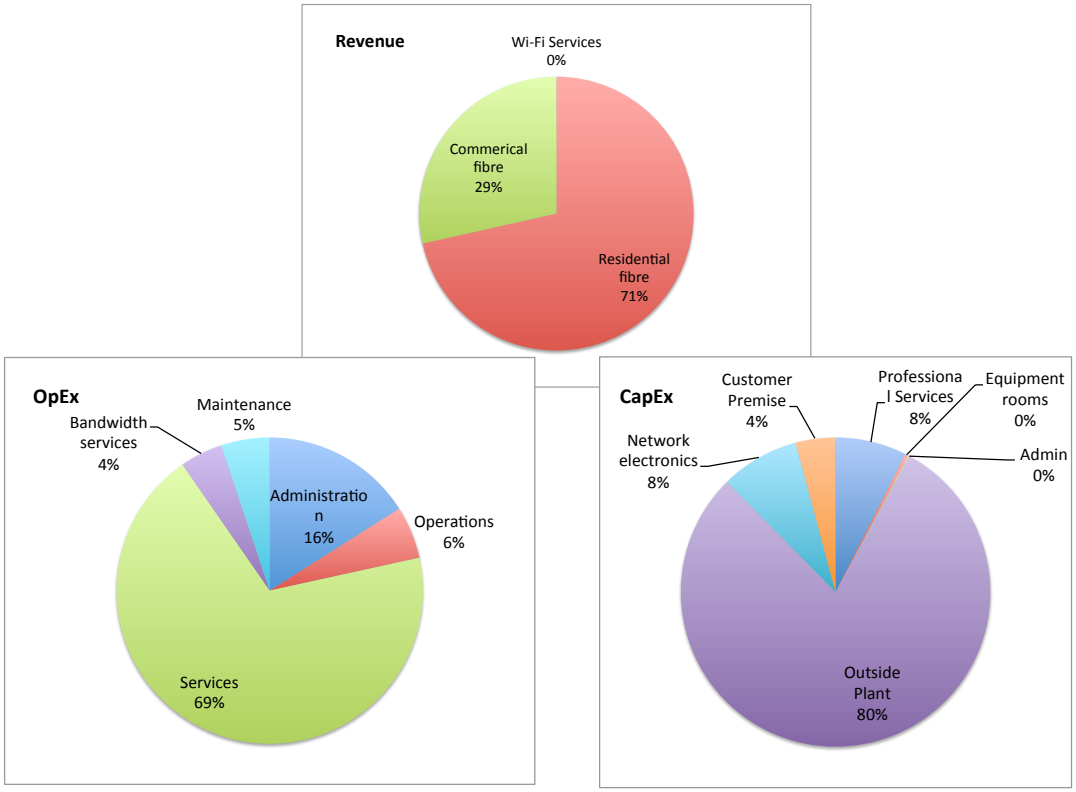
The base scenario assumes that feeder and distribution fibre (fibre to the property line) using a traditional home-run architecture with 80% GPON electronics with a 1:16 split ratio is deployed throughout both the business and residential districts in each of the seven member towns as well as in Blairmore and Coleman in 2015. Drop fibre is only deployed to premises that order services. Grant funding and financing costs are assumed to be zero. Full triple play (Internet, telephony, and television) services are made available, but wi-fi is not. Service installations assume a signup fee only, but to compensate for this, the minimum monthly service fee per premise is $105. Residential and business penetration is assumed to be 40% and 80% respectively. Model timeframe is 15 years (2030).

Estimated cashflow for this base scenario appears in the next chart – overall results appear in the adjacent table. In the cashflow chart, capital expenditures appear in red and peak with the initial deployment in 2015. The bump at 2023 is due to upgrading the electronics. As revenue (blue) remains higher that the operational expenses (green) throughout the model lifetime, the business case is at least operationally sustainable. As the NPV at 15 years is -200k, the scenario, including capital repayment, essentially breaks even.

	Base Scenario 9 Towns
Revenue. 2018	7,009,329
Operating, 2018	3,200,633
Capital, 2015-18	33,830,017
Financial Summary	
Yr to positive cashflow	1
Financing required	34,839,756
NPV, 2030	-200,694
IRR, 2030	0%



A breakdown of the various revenue and expense streams is shown in the pie charts. Though residential revenues significantly exceed commercial revenue, the margins on the commercial revenue are much higher. The high service operational expenditures are largely due to the content charges associated with the acquiring the television content. As the outside plant (fibre) deployment accounts for some 80% of the required capital expenditures, any civil works that can be leveraged to reduce these expenses directly reduce the financing requirements and improve the business case.



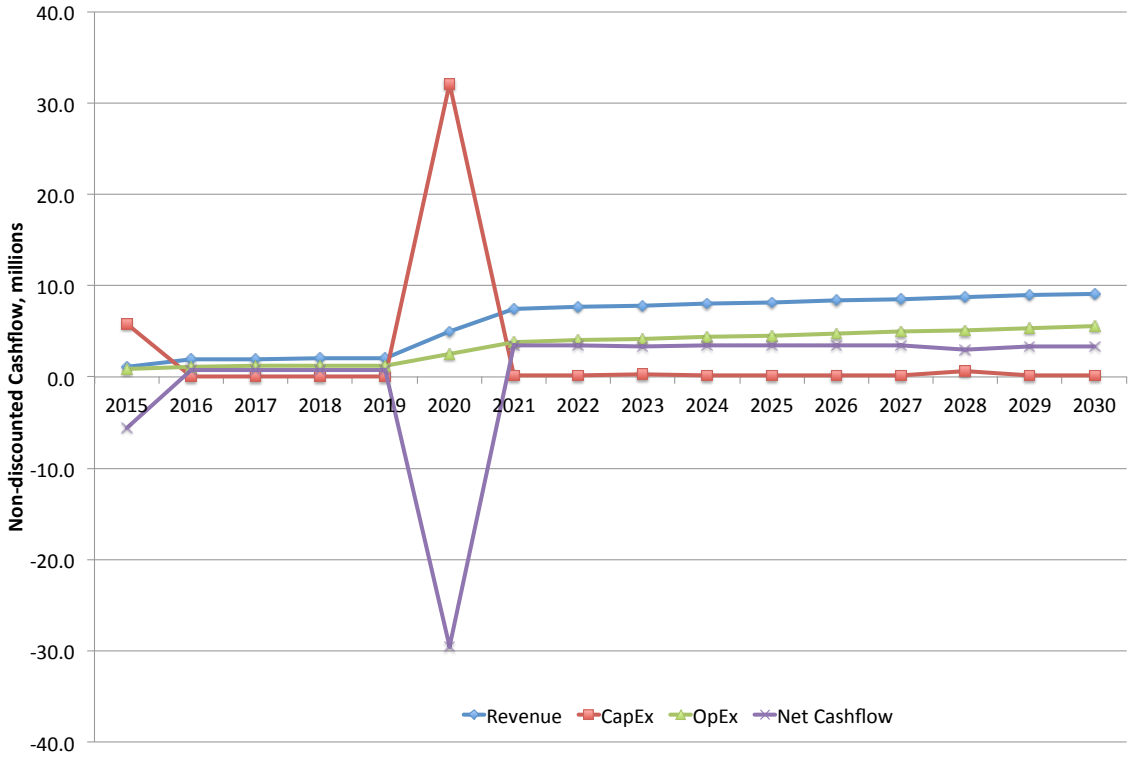
Base Scenario Variations

Financing

If debt financing using long term 15 year, 4% financing from the Alberta Capital Finance Authority is arranged to fund the initiative, required financing increases to $36.3M and the 15 year NPV decreases to -$10.3M.

Delayed Residential Build

Targeting the business districts first and delaying the residential build by 5 years only marginally increases the capital requirements ($35.2M) but significantly decreases the NPV (-$5.48M) due five years less residential revenue. The timing requirements for the peak capital outlays, however, move from 2015 to 2020.



Business versus Residential Deployments

If member towns choose to focus only on deploying fibre to their business districts, the business case becomes quite attractive. However, the remaining business case for the residential areas is then very negative. Should the overall build be a community effort, then staging the business and residential areas separately is a reasonable approach as the community is essentially still basing the decision on the combined build. If, however, a private company offers to do the business area first and then the residential areas when

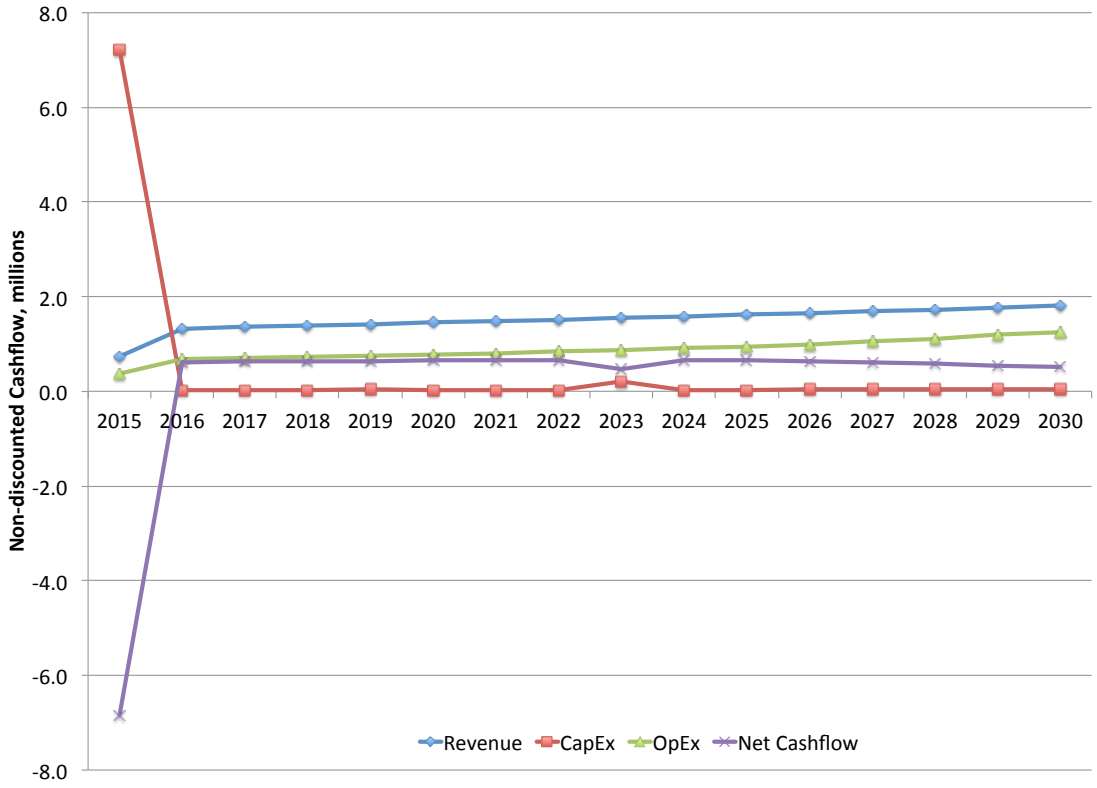
	Base Scenario 9 Towns	Business Only	Residential Only
Revenue. 2018	7,009,329	1,997,773	5,011,556
Operating, 2018	3,200,633	1,097,520	2,807,649
Capital, 2015-18	33,830,017	5,390,883	29,763,405
Financial Summary			
Yr to positive cashflow	1	1	1
Financing required	34,839,756	5,612,259	31,348,451
NPV, 2030	-200,694	2,544,469	-13,633,898
IRR, 2030	0%	5.75%	-7.27%

interest appears to be sufficient, it is unlikely that fibre to the residential areas will ever be deployed.

A Town of 3500 People

Running the model for a hypothetical town of 3500 people yields a slightly negative overall business case at 15 years. Options to turn this into a positive NPV include: altering the assumed service rate schedule, adding wi-fi services, running a more efficient operation, increasing the split ratio, and going with air-blown or aerial deployment.

	Base Scenario $
Revenue, 2018	1,387,962
Operating, 2018	663,318
Capital, 2015-18	6,626,554
Financial Summary	
Yr to positive cashflow	1
Financing required	6,842,446
NPV, 2030	-504,048
IRR, 2030	1.08%

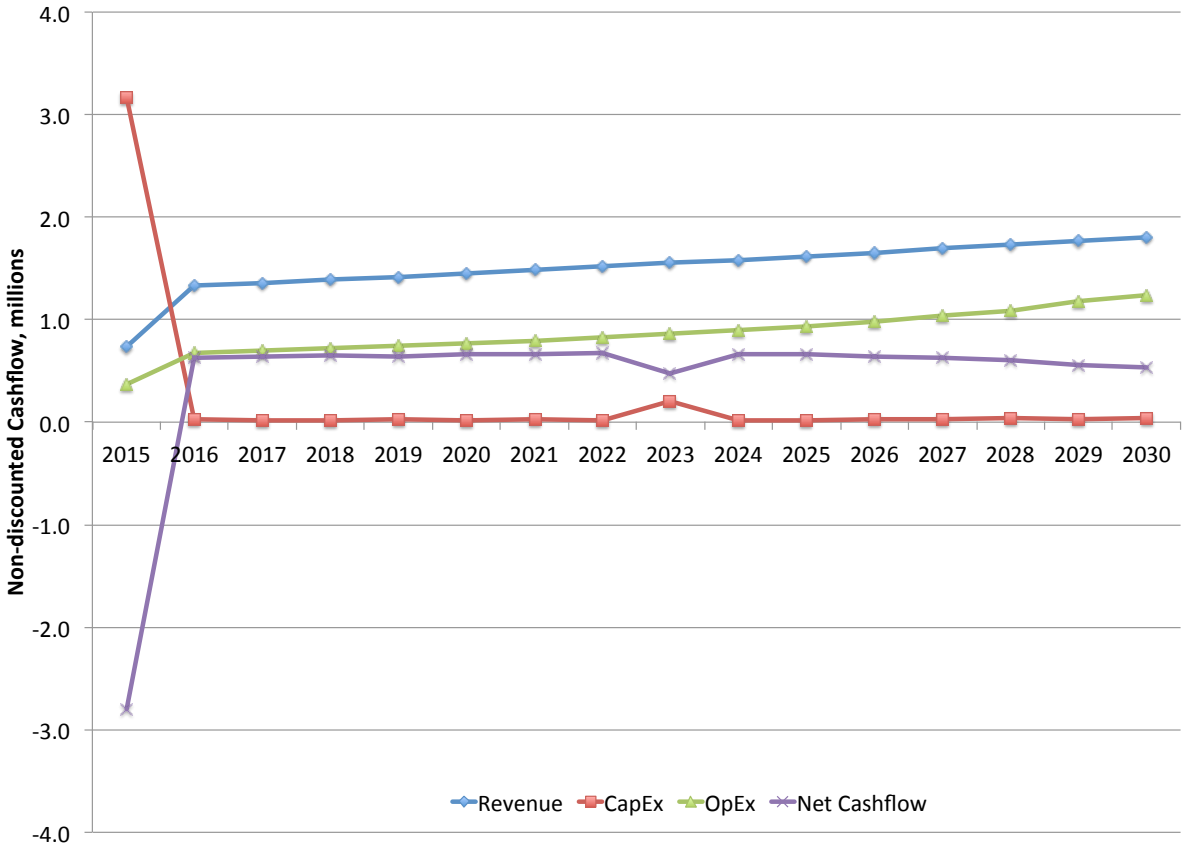


Leveraging Civil Works

A Town of 3500 People – With Civil Works

The impact of leveraging civil works within a town is illustrated in the results for a town of 3500 people by assuming that road, water, or shallow utilities work enables costs of the civil works to be reduced by 2/3rds. This would increase the 15 year NPV to $3.7M and reduces the required capital to $2.9M.

	Civil Build
Revenue. 2018	1,387,962
Operating, 2018	654,538
Capital, 2015-18	2,933,860
Financial Summary	
Yr to positive cashflow	1
Financing required	2,797,514
NPV, 2030	3,710,906
IRR, 2030	16%



Conclusion

Though ICT services in the region are not necessarily more expensive than in the surrounding communities, current ICT infrastructure is indeed lacking, particularly in the rural areas. With its dispersed population, network upgrades do not appear to be high on the incumbent's priority list and available services are generally insufficient to support current data intensive knowledge-based industry requirements, international data reporting requirements, and the cloud-based computing platforms on which small and medium businesses increasingly depend. Regional fibre and other assets are available, but the extent they can be leveraged remains to be seen. The Alberta SouthWest Regional Alliance has a strong planning focus and is well positioned to drive change.

Over the next decade, the Alberta SouthWest Regional Alliance would like to facilitate the deployment of infrastructure to support a fully scalable broadband network ubiquitously available throughout the region. This would typically include a combination of an underlying fibre infrastructure supporting a wi-fi overlay in the more urban centres and, where possible, a fibre-rich or at least well-connected rural environment. Market-wise, the infrastructure would be available on an open access basis to all service providers interested in serving regional businesses and residents. A number of options are available to achieve this and preliminary figures indicate a break-even business case for the urban areas at 15 years with a potential capital requirement of some $34M. More detailed work with

member communities will now commence and the results will be assembled into a regional scale strategic broadband plan.

As outlined in the previous sections, many options are available and while some may initially seem daunting, help is readily available, and building on the trailblazing efforts in communities such as Olds and Coquitlam, much can now be accomplished in less time, with less risk, and with more impact than ever before. In closing, consider the following video from the OICRD:

http://youtu.be/Uc_plnE3W5U

In it, Olds specifically offers to share their experience and expertise with any community interested in enabling state-of-the art fibre-based services within their communities.

Acronyms

AAMDC	Alberta Association of Municipal Districts and Counties
AlbertaSW	Alberta SouthWest Regional Alliance
BAN	base area network
CAGR	compound annual growth rate
CAO	Chief Administrative Officer
CDN$	Canadian dollars
CRTC	Canadian Radio-television and Telecommunications Commission
EAN	extended area network
FTTH, FTTP	fibre to the home; premise
Gb/s	gigabits (10^9 or 1,000,000,000) bIts per second (1,000 Mb/s)
GDP	gross domestic product
GPON	Giga-bit assive optical network
HD	high definition
HDV	high definition verified (video)
ICT	information and communications technology
IRU	indefeasible right of use
ISP	Internet service provider
IT	information technology
kb/s	kilobits (10^3 or 1,000) bits per second
LD	lower definition (video)
LTE	Long Term Evolution (a cellular access standard)
M	million
Mb/s	megabits (10^6 or 1,000,000) bits per second (1,000 kb/s)
MD	Municipal District
OFL	Olds Fibre Limited
OICRD	Olds Institute for Community & Regional Development

PMP	point-to-multipoint
PTP	point-to-point
SD	standard definition (video)
T	TELUS (video services)
THT	TELUS High Tier (video services)
TLT	TELUS Low Tier (video services)
VCFN	Valley Community Fibre Network
WISP	wireless ISP
yr	year

Appendix

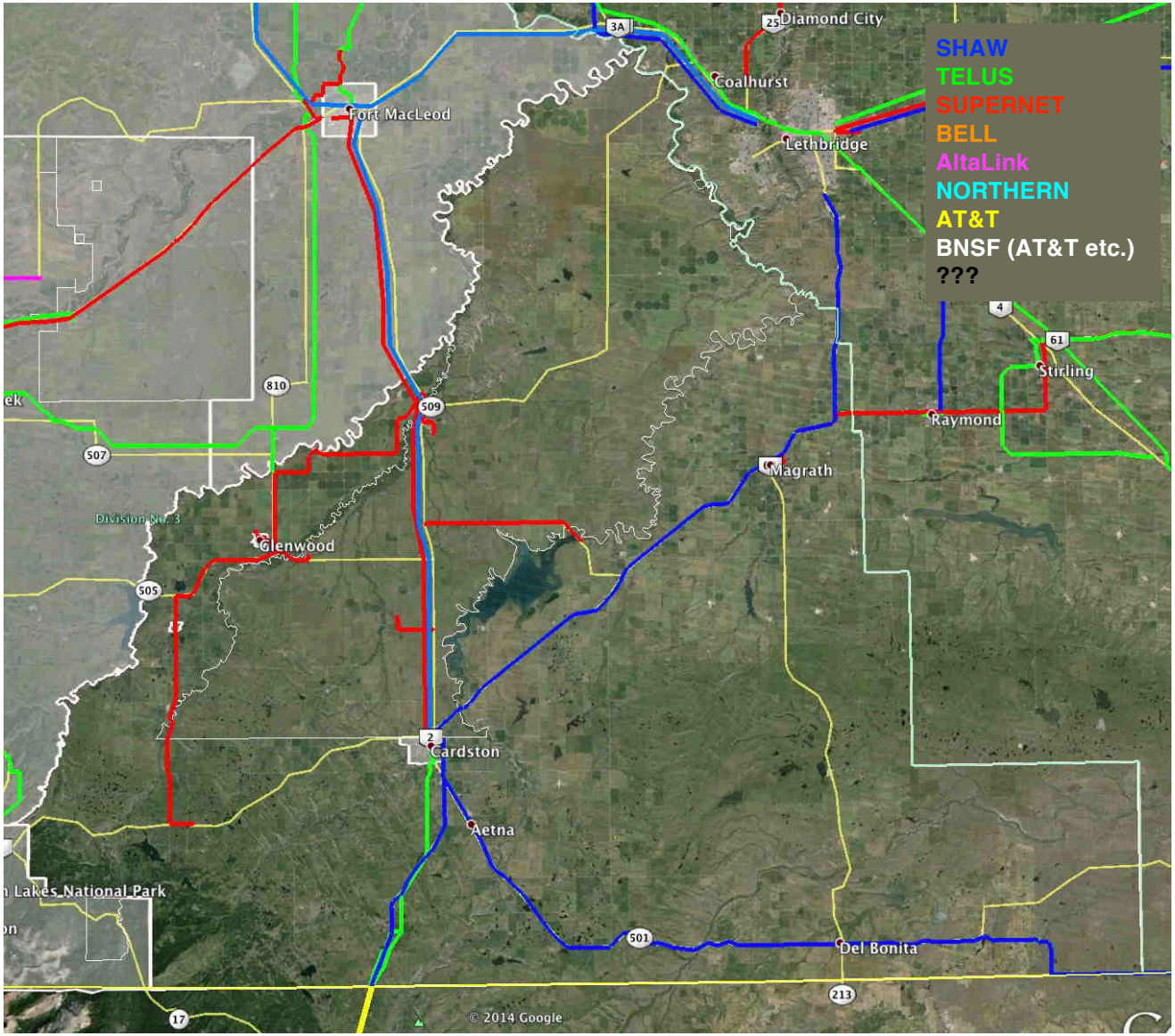
Current Services – by Member

Cardston County

Broadband Service Availability

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Cardston County	√									Satellite		
Residential												
Option 1	44.99	up to 1.5	up to 0.5				49.00	up to 2	up to 0.5	67.99	up to 3	up to 0.128
Option 2	65.99	up to 4	up to 0.75				59.00	up to 3	up to 0.75	87.99	up to 3	up to 0.256
Option 3	89.99	up to 6	up to 1				79.00	up to 4	up to 1.5			
Option 4												
Business												
Option 1	na	up to 6	up to 2				79.00	up to 4	up to 1			
Option 2							125.00	up to 4	up to 2			
Option 3							225.00	up to 4	up to 2.5			
Option 4							325.00	up to 5	up to 3			

Fibre Assets



Town of Claresholm

Broadband Service Availability

	Wireline Providers					
	TELUS (copper)			Shaw (coaxial cable)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up
Claresholm						
Residential						
Option 1	55.00	1.5 to 6	up to 1	55.00	up to 10	up to 0.512
Option 2				60.00	up to 25	up to 2.5
Option 3				80.00	up to 50	up to 3
Option 4				90.00	up to 100	up to 5
Business						
Option 1	55.95	6	up to 1	44.95	up to 5	up to 0.512
Option 2				56.95	up to 15	up to 1
Option 3				82.95	up to 25	up to 2.5
Option 4				104.95	up to 50	up to 3
Option 5				259.95	up to 100	up to 5

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Claresholm										Satellite		
Residential												
Option 1	44.99	up to 1.5	up to 0.5	59.95	up to 3	up to 1				67.99	up to 3	up to 0.128
Option 2	65.99	up to 4	up to 0.75							87.99	up to 3	up to 0.256
Option 3	89.99	up to 6	up to 1									
Option 4												
Business												
Option 1	na	up to 6	up to 2	na	up to 3	up to 1						
Option 2												
Option 3												
Option 4												
Option 5												

Fibre Assets

SHAW
TELUS
SUPERNET
BELL
AltaLink
NORTHERN
AT&T

???

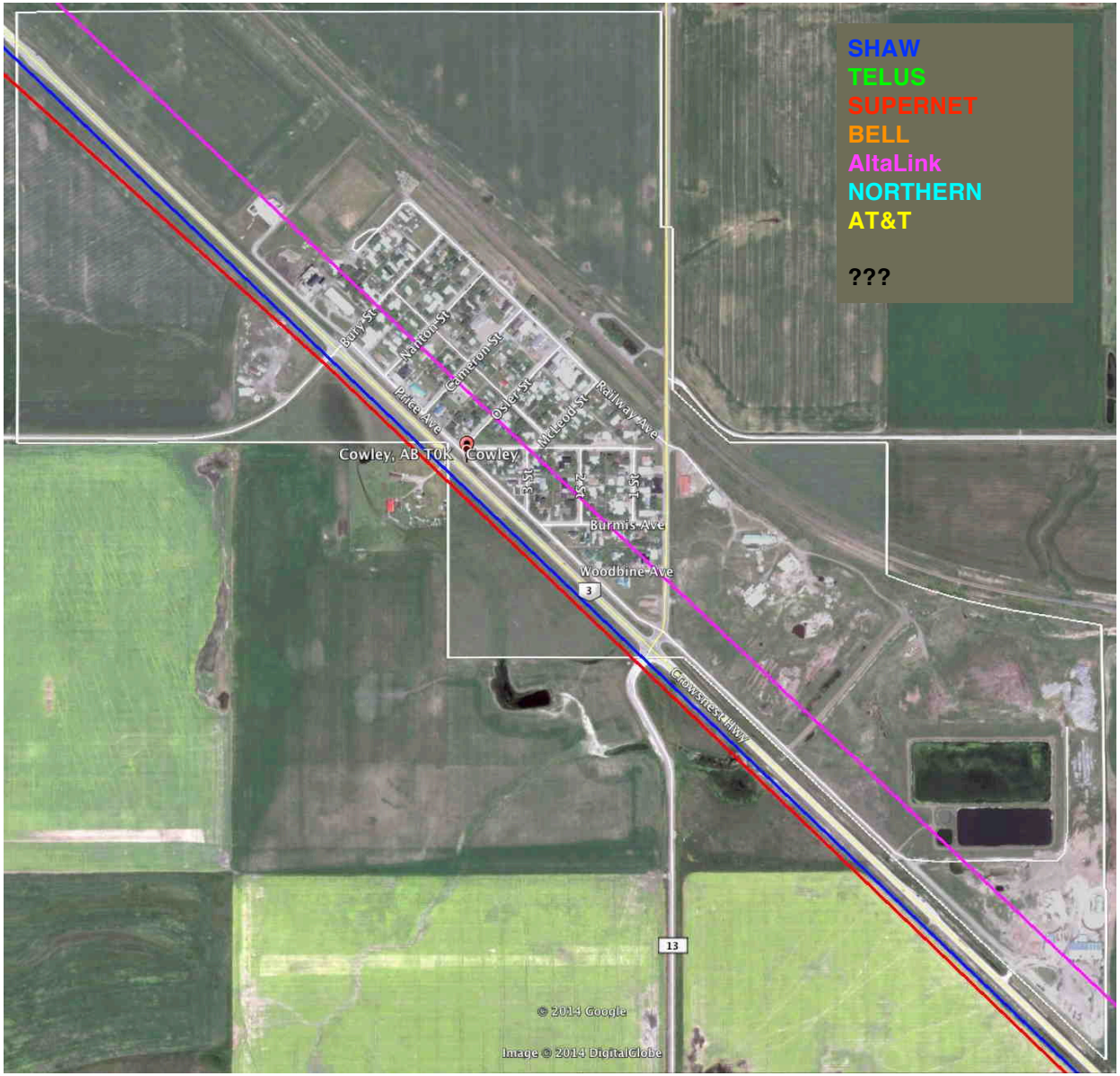
Village of Cowley

Broadband Service Availability

	Wireline Providers					
	TELUS (copper)			Shaw (coaxial cable)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up
Cowley						
Residential						
Option 1				55.00	up to 10	up to 0.512
Option 2				60.00	up to 25	up to 2.5
Option 3				80.00	up to 50	up to 3
Option 4				90.00	up to 100	up to 5
Business						
Option 1				44.95	up to 5	up to 0.512
Option 2				56.95	up to 15	up to 1
Option 3				82.95	up to 25	up to 2.5
Option 4				104.95	up to 50	up to 3
Option 5				259.95	up to 100	up to 5

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Cowley										Satellite		
Residential												
Option 1				59.95	up to 3	up to 1	49.00	up to 2	up to 0.5	67.99	up to 3	up to 0.128
Option 2							59.00	up to 3	up to 0.75	87.99	up to 3	up to 0.256
Option 3							79.00	up to 4	up to 1.5			
Option 4												
Business												
Option 1				na	up to 3	up to 1	79.00	up to 4	up to 1			
Option 2							125.00	up to 4	up to 2			
Option 3							225.00	up to 4	up to 2.5			
Option 4							325.00	up to 5	up to 3			
Option 5												

Fibre Assets

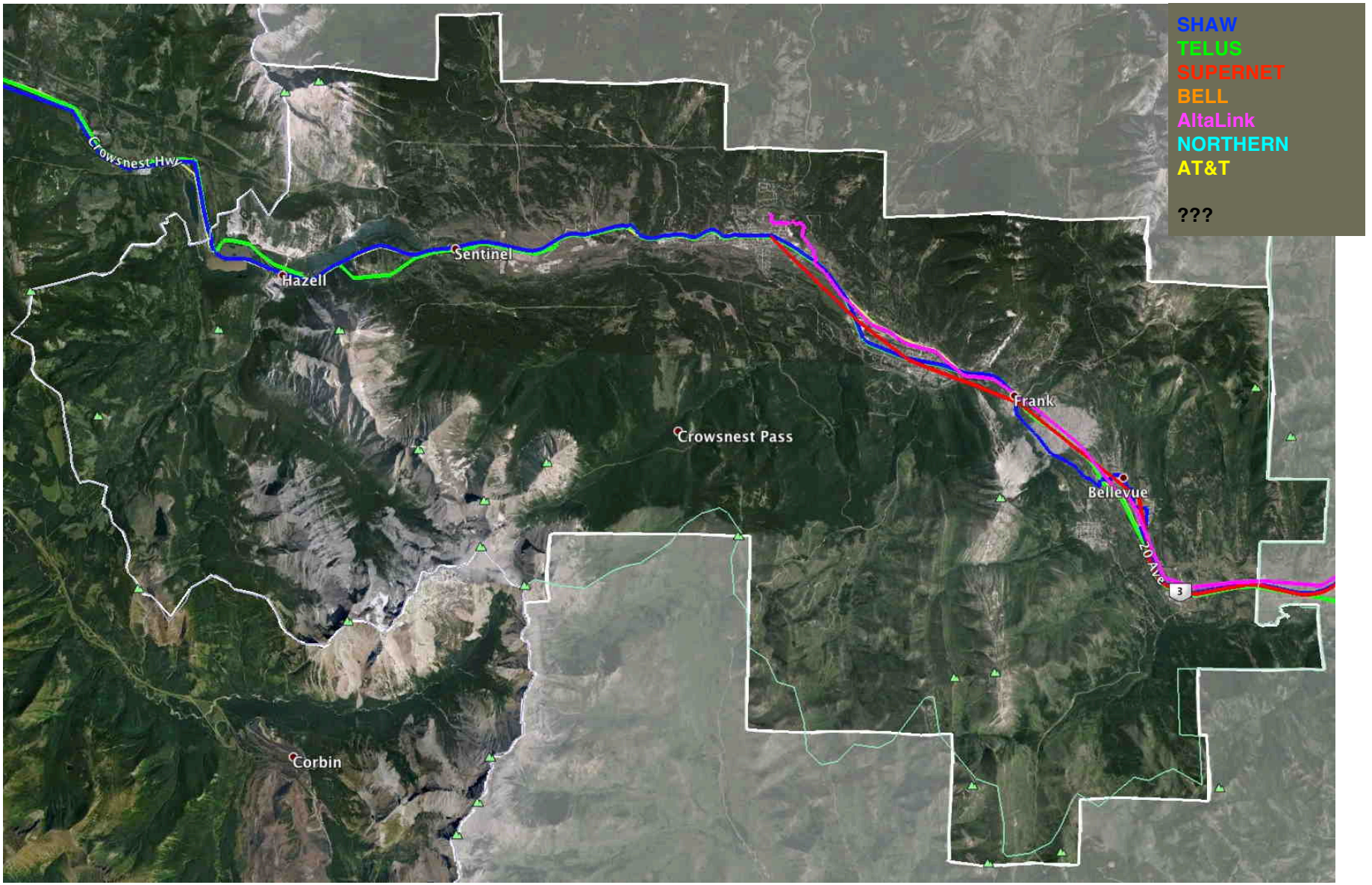


Municipality of Crowsnest Pass

Broadband Service Availability

	Wireline Providers						Fixed Point-to-Multipoint Wireless											
	TELUS (copper)			Shaw (coaxial cable)			CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Crowsnest Pass																Satellite		
Residential																		
Option 1													49.00	up to 2	up to 0.5	67.99	up to 3	up to 0.128
Option 2													59.00	up to 3	up to 0.75	87.99	up to 3	up to 0.256
Option 3													79.00	up to 4	up to 1.5			
Option 4																		
Business																		
Option 1													79.00	up to 4	up to 1			
Option 2													125.00	up to 4	up to 2			
Option 3													225.00	up to 4	up to 2.5			
Option 4													325.00	up to 5	up to 3			
Blairmore																Satellite		
Residential																		
Option 1	55.00	1.5 to 6	up to 1	55.00	up to 10	up to 0.512							49.00	up to 2	up to 0.5	67.99	up to 3	up to 0.128
Option 2				60.00	up to 25	up to 2.5							59.00	up to 3	up to 0.75	87.99	up to 3	up to 0.256
Option 3				80.00	up to 50	up to 3							79.00	up to 4	up to 1.5			
Option 4				90.00	up to 100	up to 5												
Business																		
Option 1	55.95	6	up to 1	44.95	up to 5	up to 0.512							79.00	up to 4	up to 1			
Option 2				56.95	up to 15	up to 1							125.00	up to 4	up to 2			
Option 3				82.95	up to 25	up to 2.5							225.00	up to 4	up to 2.5			
Option 4				104.95	up to 50	up to 3							325.00	up to 5	up to 3			
Option 5				259.95	up to 100	up to 5												
Coleman																Satellite		
Residential																		
Option 1	55.00	1.5 to 6	up to 1	55.00	up to 10	up to 0.512							49.00	up to 2	up to 0.5	67.99	up to 3	up to 0.128
Option 2				60.00	up to 25	up to 2.5							59.00	up to 3	up to 0.75	87.99	up to 3	up to 0.256
Option 3				80.00	up to 50	up to 3							79.00	up to 4	up to 1.5			
Option 4				90.00	up to 100	up to 5												
Business																		
Option 1	55.95	6	up to 1	44.95	up to 5	up to 0.512							79.00	up to 4	up to 1			
Option 2				56.95	up to 15	up to 1							125.00	up to 4	up to 2			
Option 3				82.95	up to 25	up to 2.5							225.00	up to 4	up to 2.5			
Option 4				104.95	up to 50	up to 3							325.00	up to 5	up to 3			
Option 5				259.95	up to 100	up to 5												

Fibre Assets



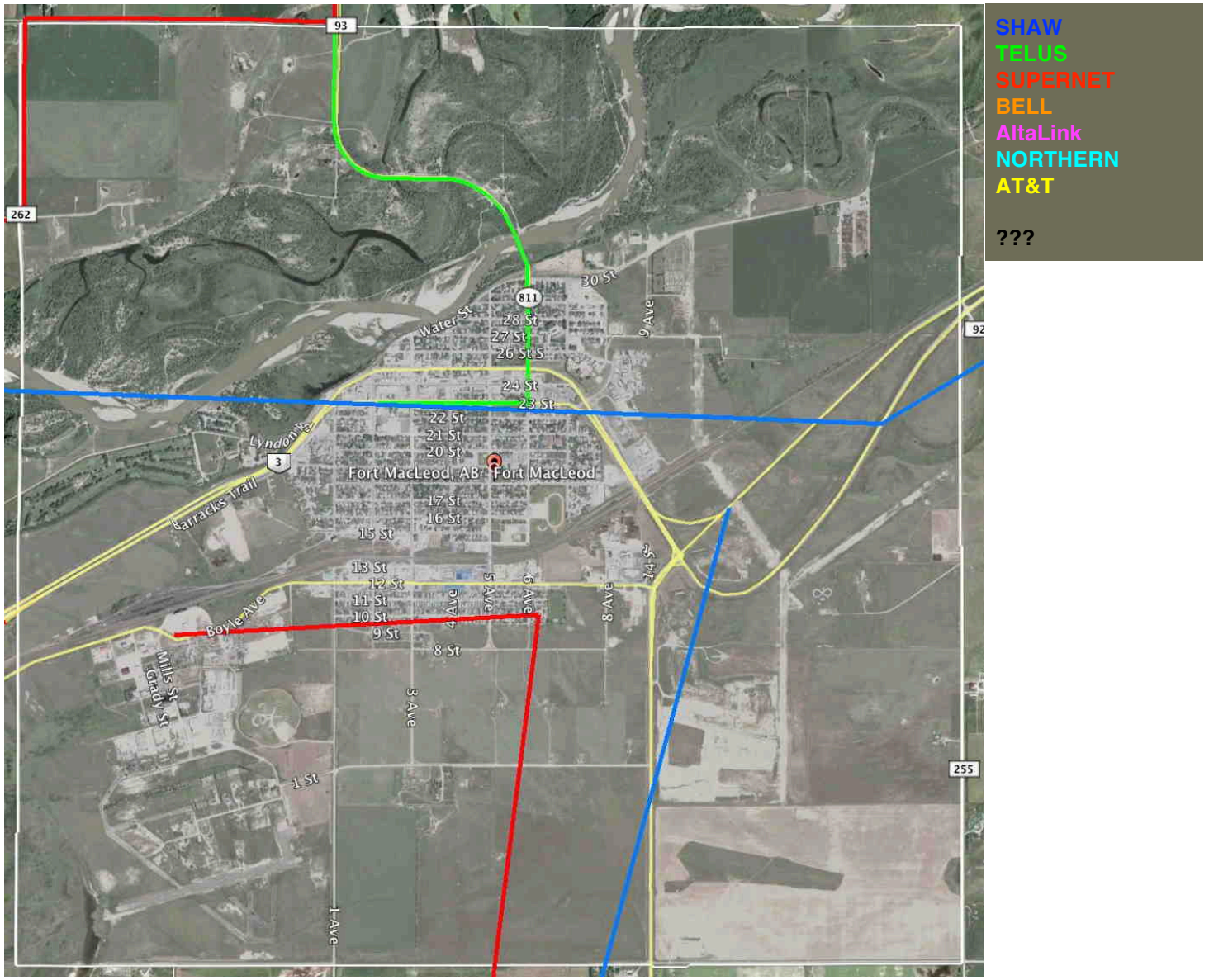
Town of Fort Macleod

Broadband Service Availability

	Wireline Providers					
	TELUS (copper)			Shaw (coaxial cable)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up
Fort Macleod						
Residential						
Option 1	55.00	1.5 to 6	up to 1	55.00	up to 10	up to 0.512
Option 2	60.00	3 to 15	up to 1	60.00	up to 25	up to 2.5
Option 3	65.00	5 to 25	up to 5	80.00	up to 50	up to 3
Option 4				90.00	up to 100	up to 5
Business						
Option 1	55.95	6	1	44.95	up to 5	up to 0.512
Option 2	65.95	up to 15	1	56.95	up to 15	up to 1
Option 3	85.95	up to 25	5	82.95	up to 25	up to 2.5
Option 4				104.95	up to 50	up to 3
Option 5				259.95	up to 100	up to 5

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Fort Macleod										Satellite		
Residential												
Option 1				59.95	up to 3	up to 1	49.00	up to 2	up to 0.5	67.99	up to 3	up to 0.128
Option 2							59.00	up to 3	up to 0.75	87.99	up to 3	up to 0.256
Option 3							79.00	up to 4	up to 1.5			
Option 4												
Business												
Option 1				na	up to 3	up to 1	79.00	up to 4	up to 1			
Option 2							125.00	up to 4	up to 2			
Option 3							225.00	up to 4	up to 2.5			
Option 4							325.00	up to 5	up to 3			
Option 5												

Fibre Assets



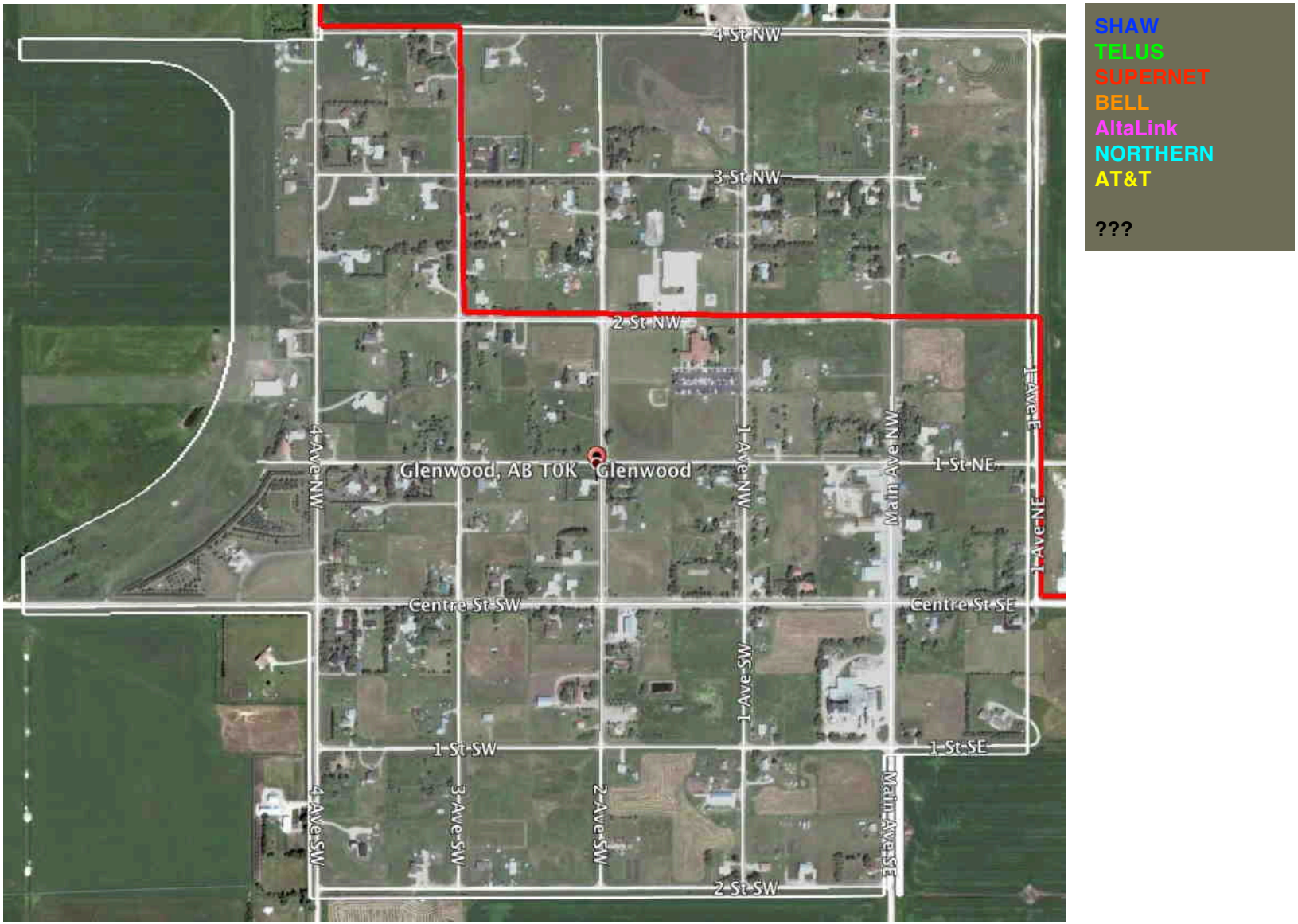
Village of Glenwood

Broadband Service Availability

	Wireline Providers					
	TELUS (copper)			Shaw (coaxial cable)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up
Glenwood						
Residential						
Option 1						
Option 2						
Option 3						
Option 4						
Business						
Option 1						
Option 2						
Option 3						
Option 4						

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Glenwood							√			Satellite		
Residential												
Option 1	44.99	up to 1.5	up to 0.5				49.00	up to 2	up to 0.5	67.99	up to 3	up to 0.128
Option 2	65.99	up to 4	up to 0.75				59.00	up to 3	up to 0.75	87.99	up to 3	up to 0.256
Option 3	89.99	up to 6	up to 1				79.00	up to 4	up to 1.5			
Option 4												
Business												
Option 1	na	up to 6	up to 2				79.00	up to 4	up to 1			
Option 2							125.00	up to 4	up to 2			
Option 3							225.00	up to 4	up to 2.5			
Option 4							325.00	up to 5	up to 3			

Fibre Assets



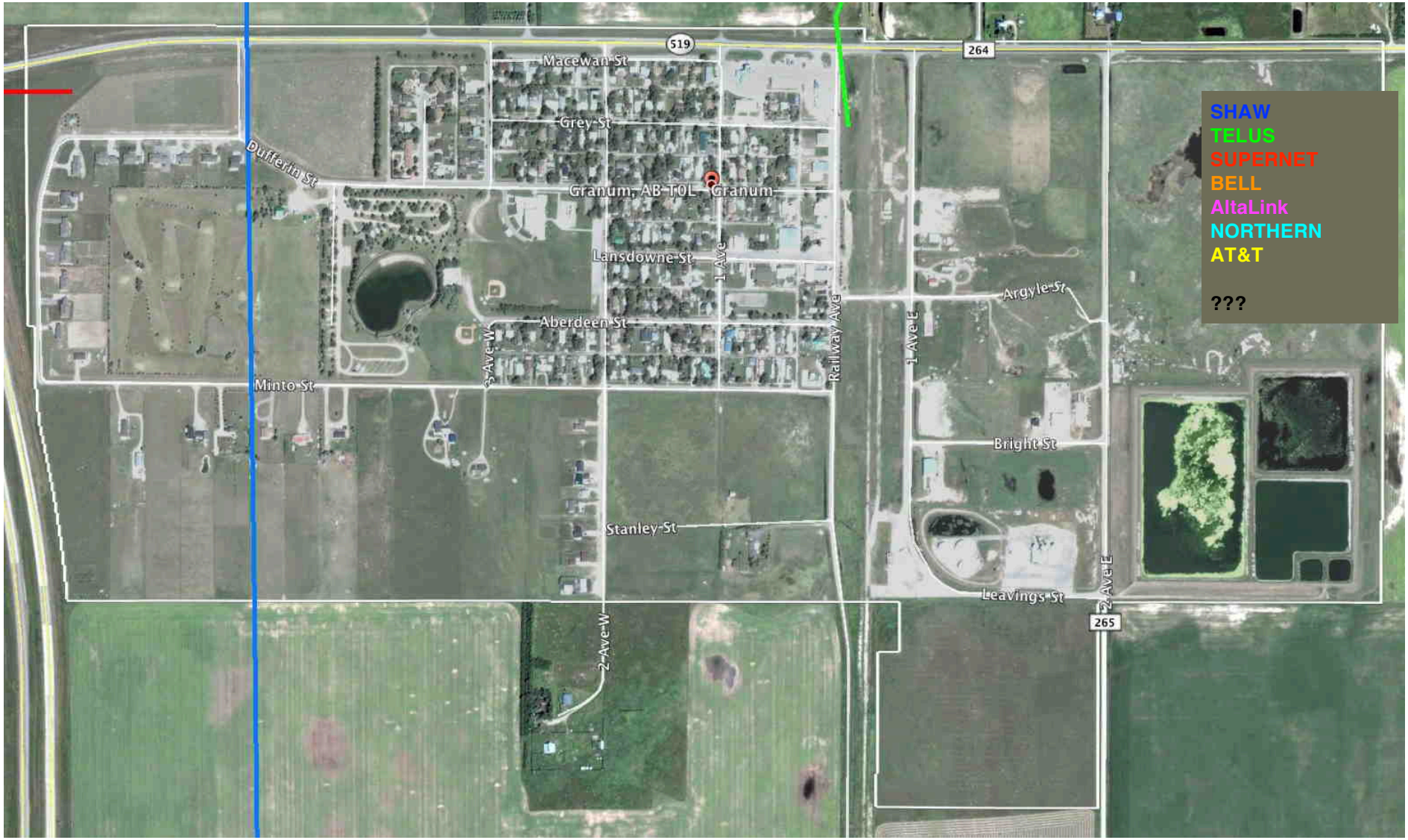
Town of Granum

Broadband Service Availability

	Wireline Providers					
	TELUS (copper)			Shaw (coaxial cable)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up
Granum						
Residential						
Option 1				55.00	up to 10	up to 0.512
Option 2				60.00	up to 25	up to 2.5
Option 3				80.00	up to 50	up to 3
Option 4				90.00	up to 100	up to 5
Business						
Option 1				44.95	up to 5	up to 0.512
Option 2				56.95	up to 15	up to 1
Option 3				82.95	up to 25	up to 2.5
Option 4				104.95	up to 50	up to 3
Option 5				259.95	up to 100	up to 5

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Granum										Satellite		
Residential												
Option 1	44.99	up to 1.5	up to 0.5	59.95	up to 3	up to 1				67.99	up to 3	up to 0.128
Option 2	65.99	up to 4	up to 0.75							87.99	up to 3	up to 0.256
Option 3	89.99	up to 6	up to 1									
Option 4												
Business												
Option 1	na	up to 6	up to 2	na	up to 3	up to 1						
Option 2												
Option 3												
Option 4												
Option 5												

Fibre Assets



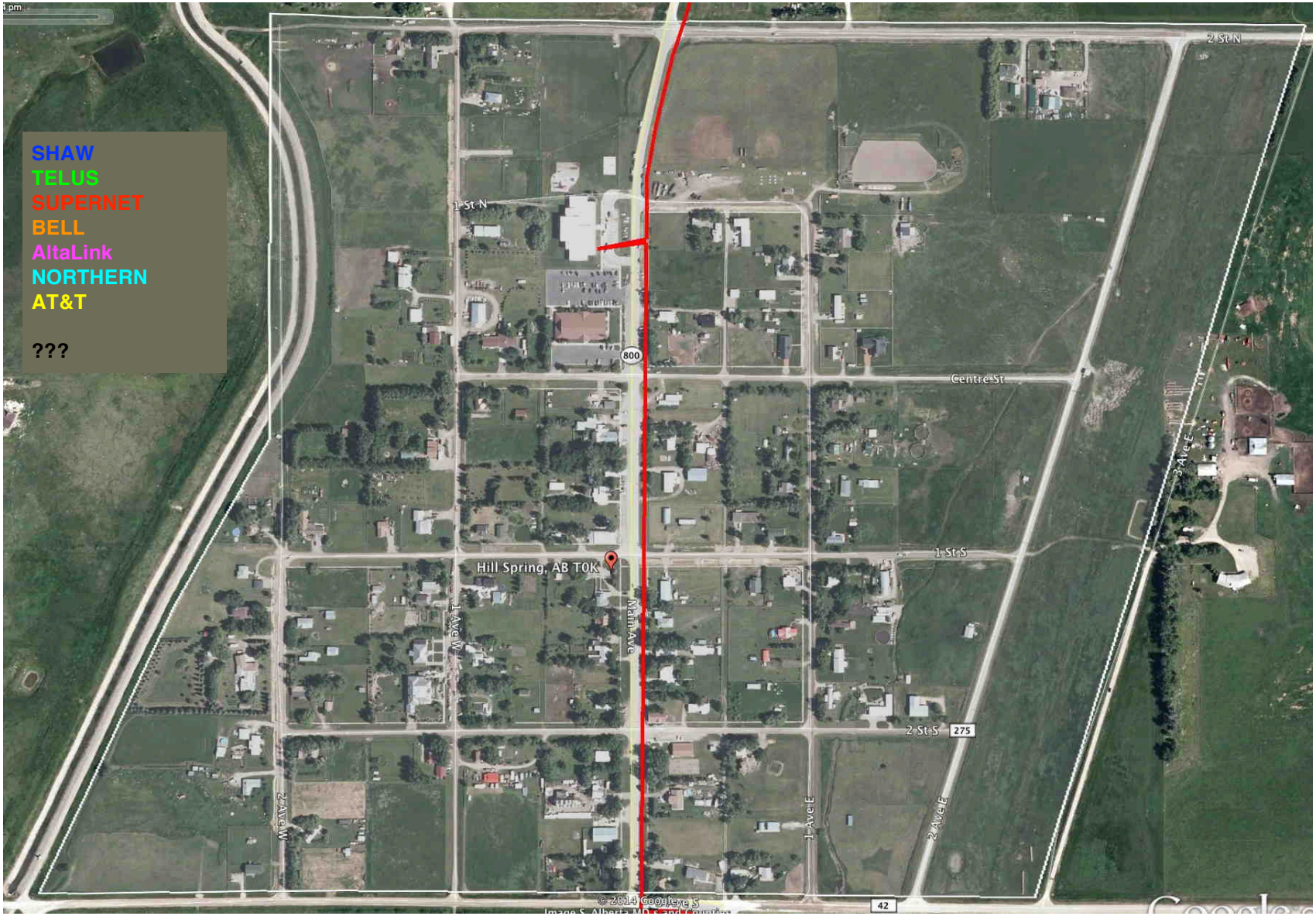
Village of Hill Spring

Broadband Service Availability

	Wireline Providers					
	TELUS (copper)			Shaw (coaxial cable)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up
Hill Spring						
Residential						
Option 1						
Option 2						
Option 3						
Option 4						
Business						
Option 1						
Option 2						
Option 3						
Option 4						

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Hill Spring										Satellite		
Residential												
Option 1	44.99	up to 1.5	up to 0.5				49.00	up to 2	up to 0.5	67.99	up to 3	up to 0.128
Option 2	65.99	up to 4	up to 0.75				59.00	up to 3	up to 0.75	87.99	up to 3	up to 0.256
Option 3	89.99	up to 6	up to 1				79.00	up to 4	up to 1.5			
Option 4												
Business												
Option 1	na	up to 6	up to 2				79.00	up to 4	up to 1			
Option 2							125.00	up to 4	up to 2			
Option 3							225.00	up to 4	up to 2.5			
Option 4							325.00	up to 5	up to 3			

Fibre Assets



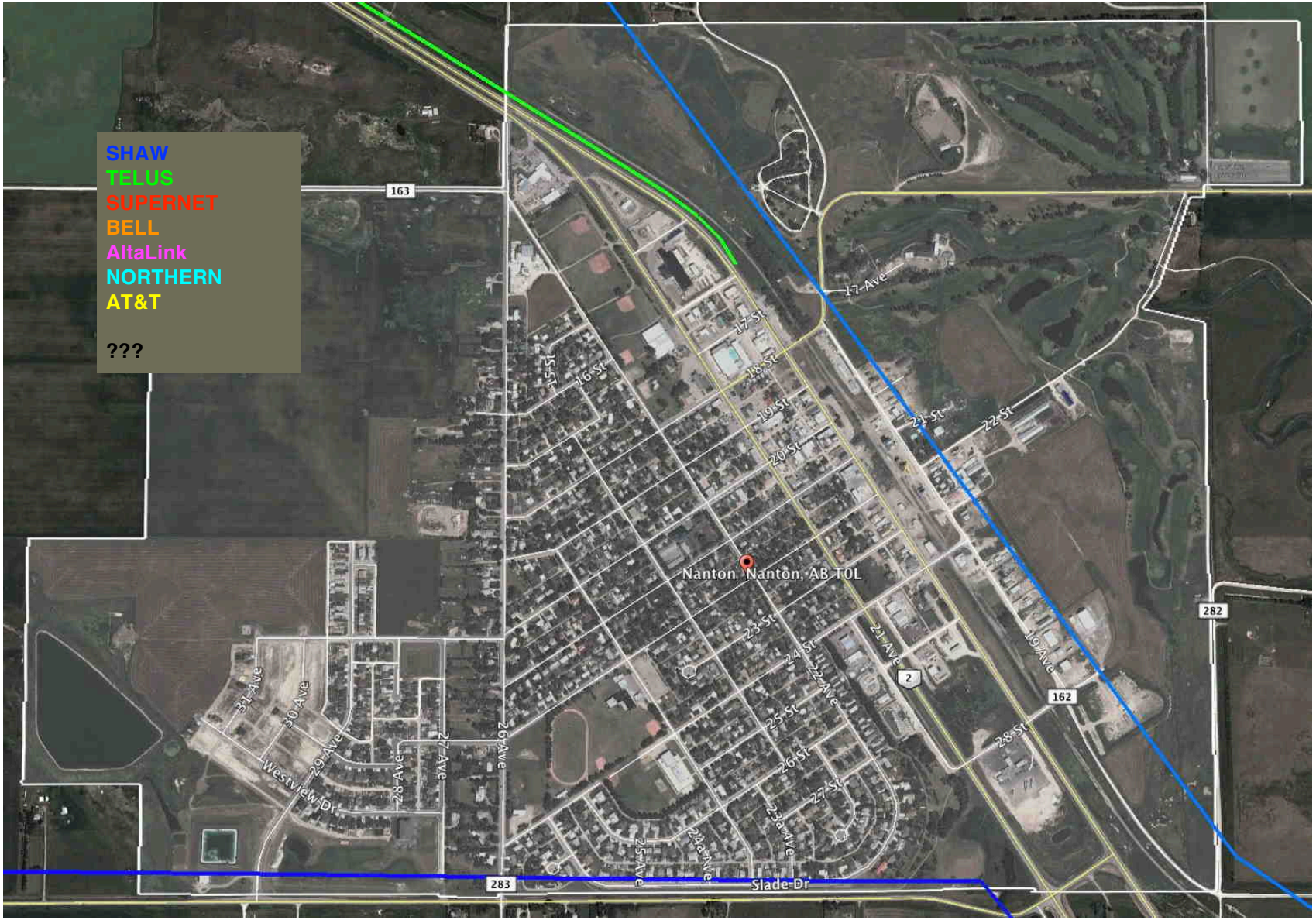
Town of Nanton

Broadband Service Availability

	Wireline Providers					
	TELUS (copper)			Shaw (coaxial cable)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up
Nanton						
Residential						
Option 1	55.00	1.5 to 6	up to 1			
Option 2	60.00	3 to 15	up to 1			
Option 3						
Option 4						
Business						
Option 1	55.95	6	1			
Option 2	65.95	up to 15	1			
Option 3						
Option 4						

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Nanton										Satellite		
Residential												
Option 1	44.99	up to 1.5	up to 0.5	59.95	up to 3	up to 1				67.99	up to 3	up to 0.128
Option 2	65.99	up to 4	up to 0.75							87.99	up to 3	up to 0.256
Option 3	89.99	up to 6	up to 1									
Option 4												
Business												
Option 1	na	up to 6	up to 2	na	up to 3	up to 1						
Option 2												
Option 3												
Option 4												

Fibre Assets

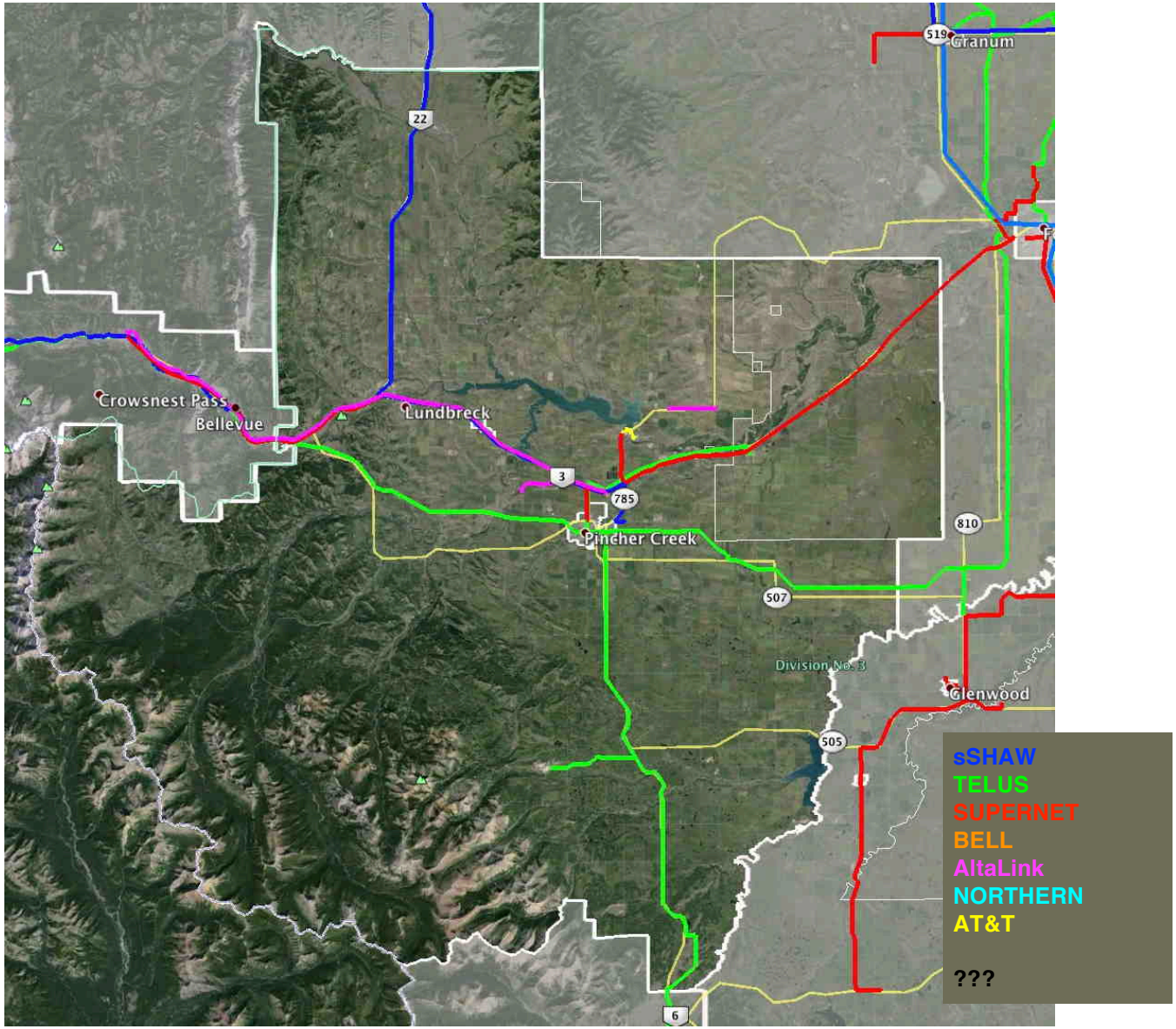


Municipal District of Pincher Creek

Broadband Service Availability

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
MD of Pincher Creek				Partial						Satellite		
Residential												
Option 1				59.95	up to 3	up to 1	49.00	up to 2	up to 0.5	67.99	up to 3	up to 0.128
Option 2							59.00	up to 3	up to 0.75	87.99	up to 3	up to 0.256
Option 3							79.00	up to 4	up to 1.5			
Option 4												
Business												
Option 1				na	up to 3	up to 1	79.00	up to 4	up to 1			
Option 2							125.00	up to 4	up to 2			
Option 3							225.00	up to 4	up to 2.5			
Option 4							325.00	up to 5	up to 3			

Fibre Assets



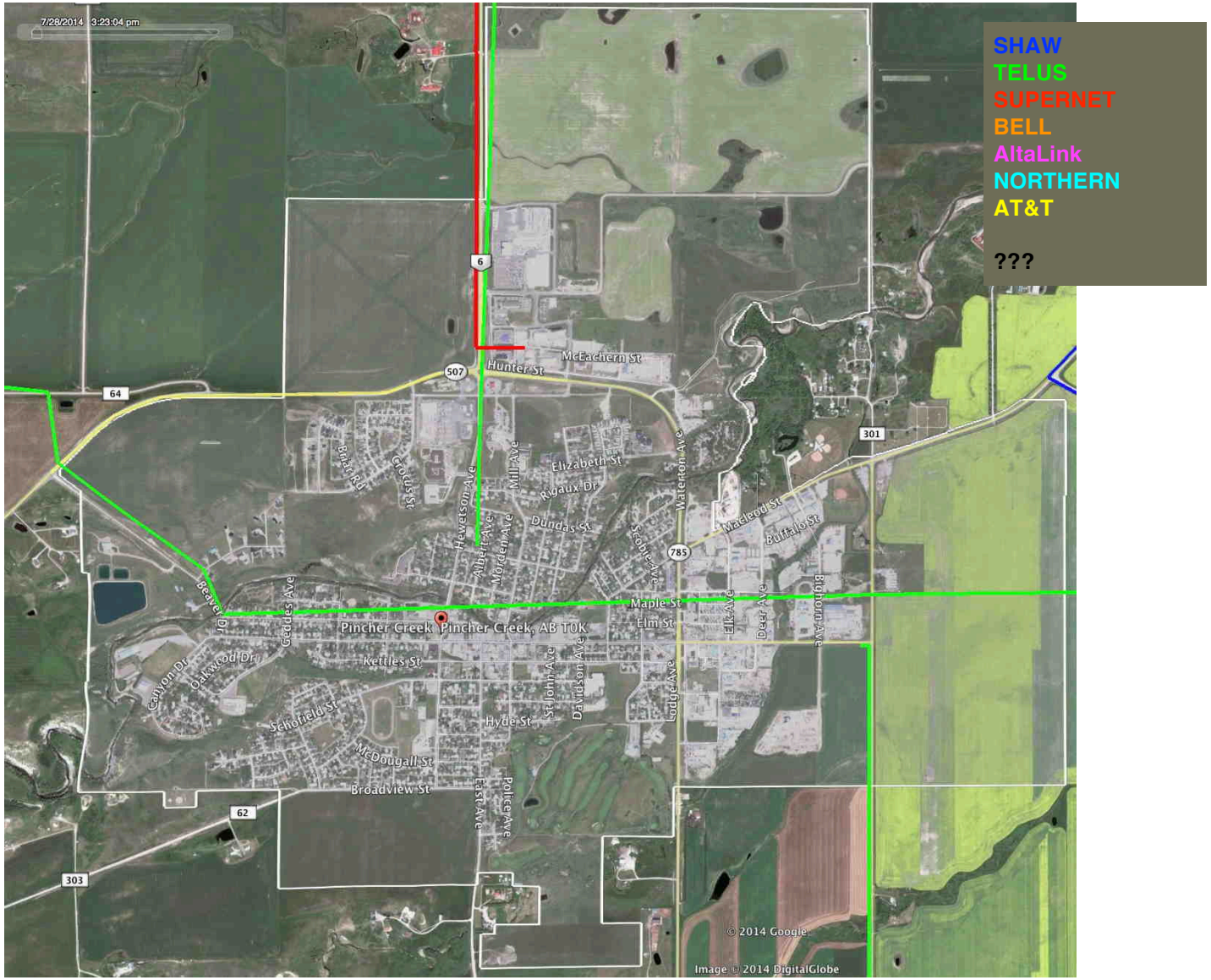
Town of Pincher Creek

Broadband Service Availability

	Wireline Providers					
	TELUS (copper)			Shaw (coaxial cable)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up
Pincher Creek (town)						
Residential						
Option 1	55.00	1.5 to 6	up to 1	55.00	up to 10	up to 0.512
Option 2	60.00	3 to 15	up to 1	60.00	up to 25	up to 2.5
Option 3				80.00	up to 50	up to 3
Option 4				90.00	up to 100	up to 5
Business						
Option 1	55.95	6	1	44.95	up to 5	up to 0.512
Option 2	65.95	up to 15	1	56.95	up to 15	up to 1
Option 3				82.95	up to 25	up to 2.5
Option 4				104.95	up to 50	up to 3
Option 5				259.95	up to 100	up to 5

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Pincher Creek (town)										Satellite		
Residential												
Option 1	44.99	up to 1.5	up to 0.5	59.95	up to 3	up to 1	49.00	up to 2	up to 0.5	67.99	up to 3	up to 0.128
Option 2	65.99	up to 4	up to 0.75				59.00	up to 3	up to 0.75	87.99	up to 3	up to 0.256
Option 3	89.99	up to 6	up to 1				79.00	up to 4	up to 1.5			
Option 4												
Business												
Option 1	na	up to 6	up to 2	na	up to 3	up to 1	79.00	up to 4	up to 1			
Option 2							125.00	up to 4	up to 2			
Option 3							225.00	up to 4	up to 2.5			
Option 4							325.00	up to 5	up to 3			
Option 5												

Fibre Assets

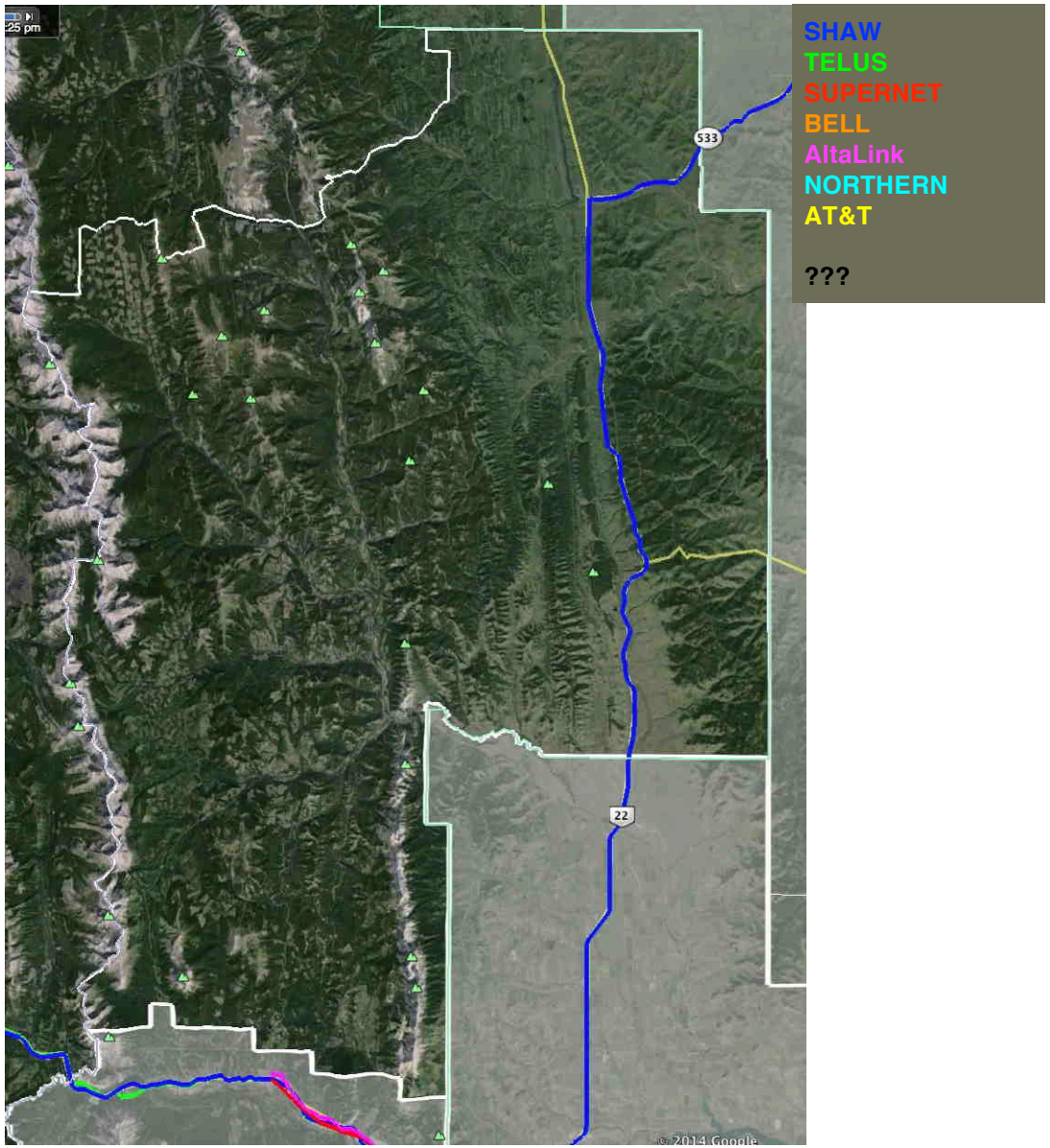


Municipal District of Ranchland

Broadband Service Availability

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
MD of Ranchland										Satellite		
Residential												
Option 1										67.99	up to 3	up to 0.128
Option 2										87.99	up to 3	up to 0.256
Option 3												
Option 4												
Business												
Option 1												
Option 2												
Option 3												
Option 4												

Fibre Assets



Town of Stavely

Broadband Service Availability

	Wireline Providers					
	TELUS (copper)			Shaw (coaxial cable)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up
Stavely						
Residential						
Option 1						
Option 2						
Option 3						
Option 4						
Business						
Option 1						
Option 2						
Option 3						
Option 4						

	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Stavely										Satellite		
Residential												
Option 1	44.99	up to 1.5	up to 0.5	59.95	up to 3	up to 1				67.99	up to 3	up to 0.128
Option 2	65.99	up to 4	up to 0.75							87.99	up to 3	up to 0.256
Option 3	89.99	up to 6	up to 1									
Option 4												
Business												
Option 1	na	up to 6	up to 2	na	up to 3	up to 1						
Option 2												
Option 3												
Option 4												

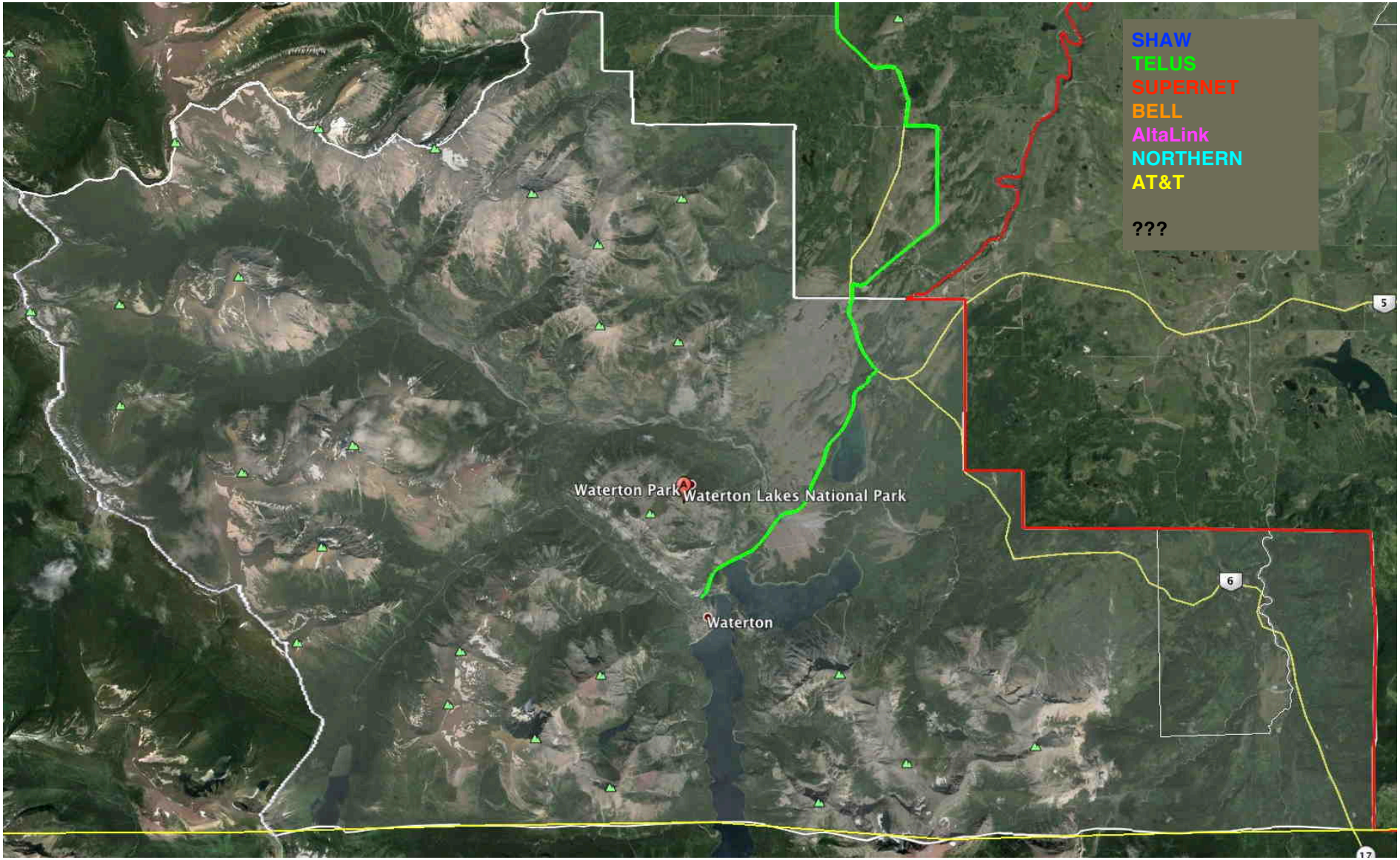
Fibre Assets

Waterton Lakes National Park

Broadband Service Availability

	Wireline Providers			Fixed Point-to-Multipoint Wireless								
	TELUS			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
Wateron Lakes	(Townsite only)									Satellite		
Residential												
Option 1	55.00	1.5 to 6	up to 1				49.00	up to 2	up to 0.5	67.99	up to 3	up to 0.128
Option 2							59.00	up to 3	up to 0.75	87.99	up to 3	up to 0.256
Option 3							79.00	up to 4	up to 1.5			
Option 4												
Business												
Option 1	55.95	6	up to 1				79.00	up to 4	up to 1			
Option 2							125.00	up to 4	up to 2			
Option 3							225.00	up to 4	up to 2.5			
Option 4							325.00	up to 5	up to 3			

Fibre Assets

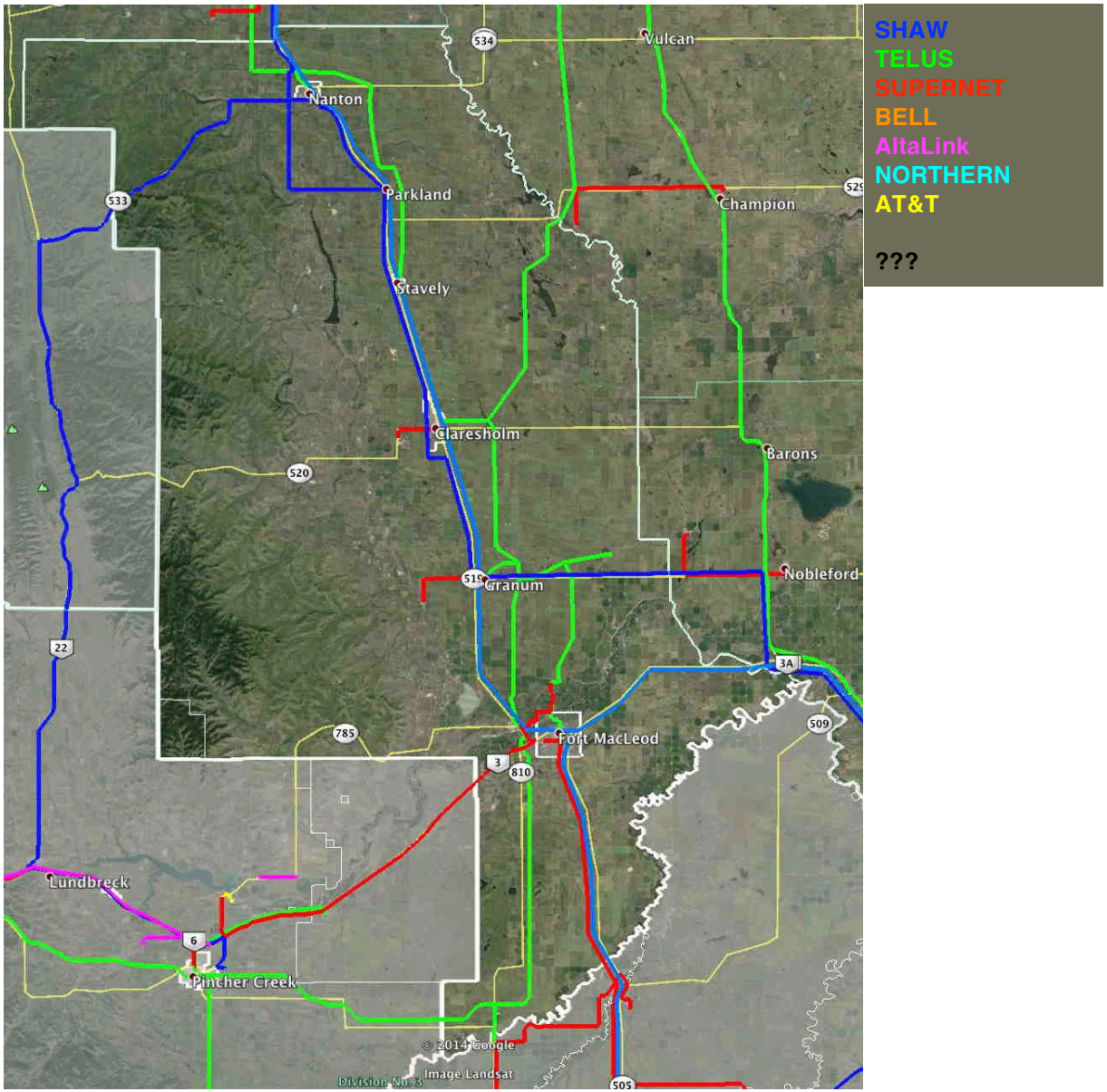


Municipal District of Willow Creek

Broadband Service Availability

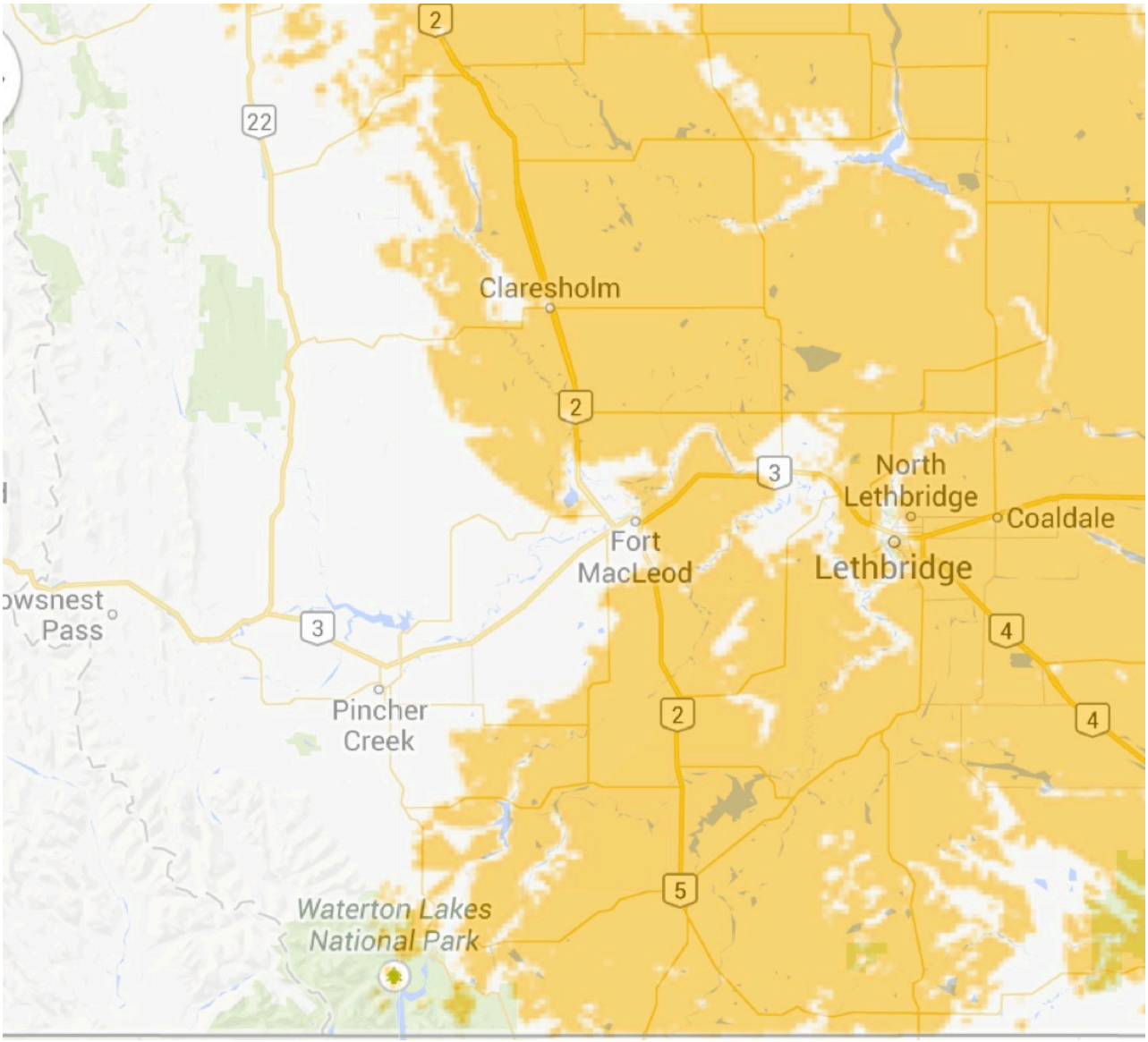
	Fixed Point-to-Multipoint Wireless											
	CCI (unlicensed)			Platinum (licensed)			Tough Country (unlicensed)			XplorNet (licensed)		
	Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s		Cost	Bandwidth - Mb/s	
	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up	$/mo	Down	Up
MD of Willow Creek	Partial			Partial						Satellite		
Residential												
Option 1	44.99	up to 1.5	up to 0.5	59.95	up to 3	up to 1				67.99	up to 3	up to 0.128
Option 2	65.99	up to 4	up to 0.75							87.99	up to 3	up to 0.256
Option 3	89.99	up to 6	up to 1									
Option 4												
Business												
Option 1	na	up to 6	up to 2	na	up to 3	up to 1						
Option 2												
Option 3												
Option 4												

Fibre Assets

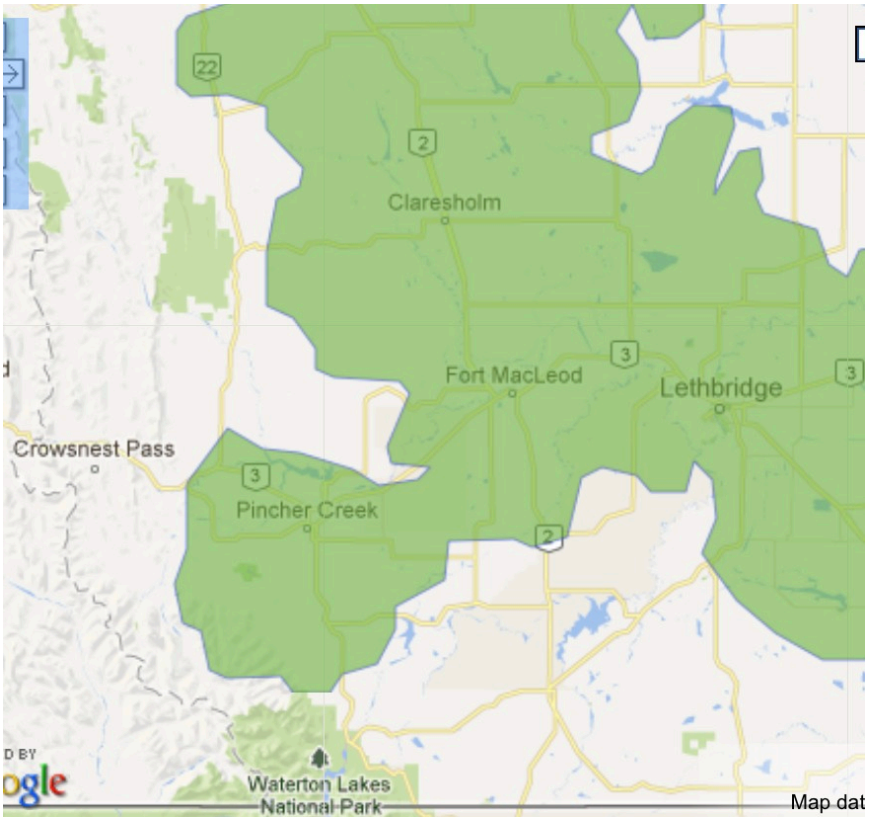


Point-to-Multipoint Provider Coverage Maps

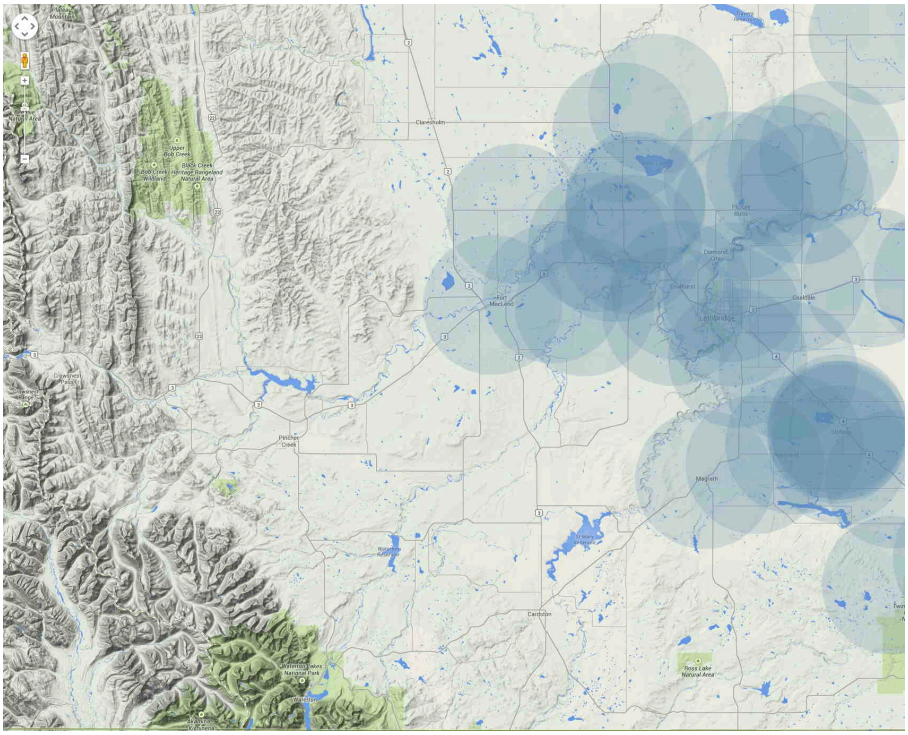
CCI Wireless



Platinum Communications



ShockWare



Tough Country

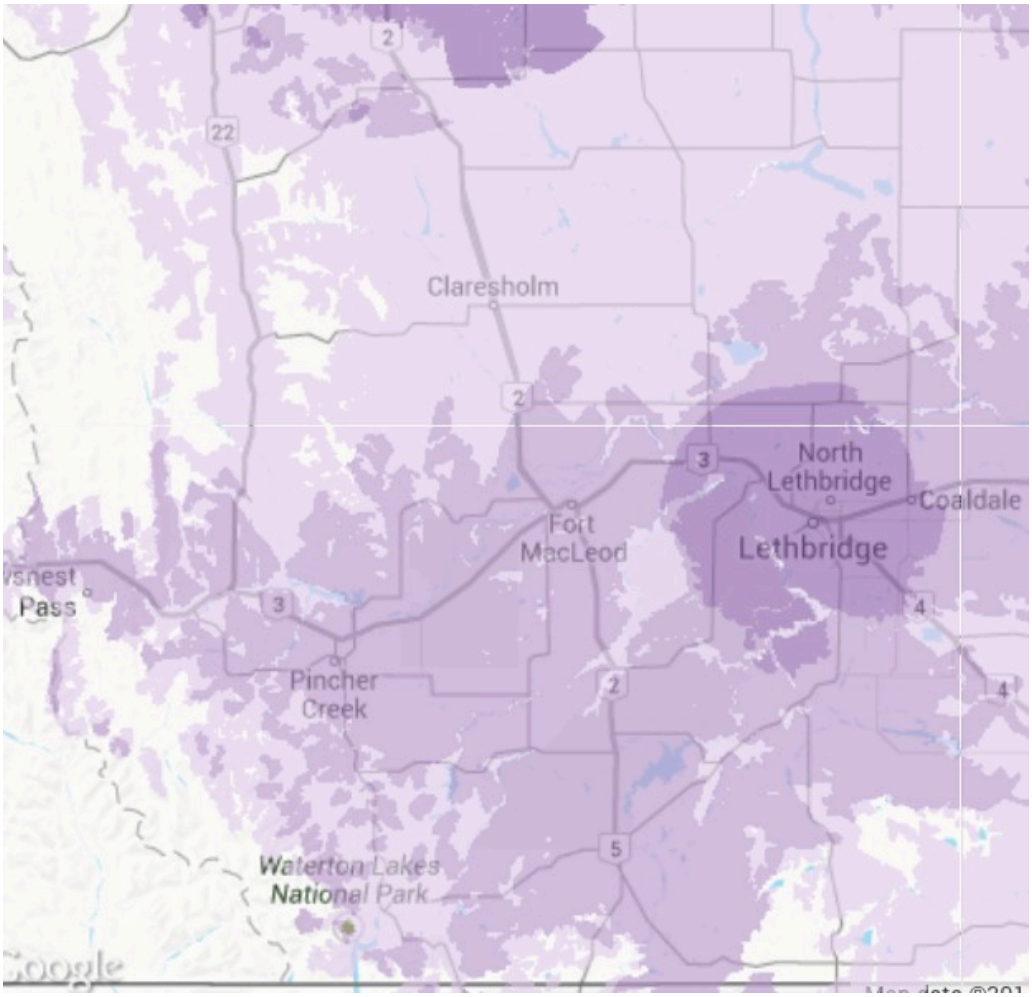
British Columbia	Alberta
Baynes Lake	Aetna
Dicken Road & Area	Beaver Mines
East to Alberta Boarder	Beazer
Elko	Bellevue
Fernie	Blood Reserve
Fernie Ski Resort & Area	Boundary Creek
Gold Mountain & Area	Brocket
Hartley Lake	Burmis
Hosmer & Area	Cardston
Jaffray	Carway
Kragmont	Cowley
Rural Morrissey	Crowsnest Pass & Area
West & East Side of Koocanusa	Del Bonita
West Fernie	Ft. Macleod
	Glenwood
	Hill Spring
	HWY 22 up to Chain Lakes
	Jefferson & Area
	Kimball
	Lavern
	Leavitt
	Lundbreck
	Magrath
	Monarch
	Mountainview & Area
	North Porcupine
	Orton
	Peigan Reserve
	Pincher Creek
	Raymond
	SHELL Plant & Area
	South to Waterton
	Spring Coulee
	St. Henry to Chief Mountain
	Standoff
	Summerview Ridge & Area
	Twin Butte & Area
	Waterton Park
	Welling
	West to B.C. Border
	Willow Valley

Mobility Providers

While 4G LTE services are not generally available in the region, TELUS, Bell, and Rogers do provide substantial 4G HSPA+ coverage. HSPA+ comes in different flavours and bandwidths vary from 1.5 to 42 Mb/s. Wind does not network assets in the region. Cover maps for each operator follow.

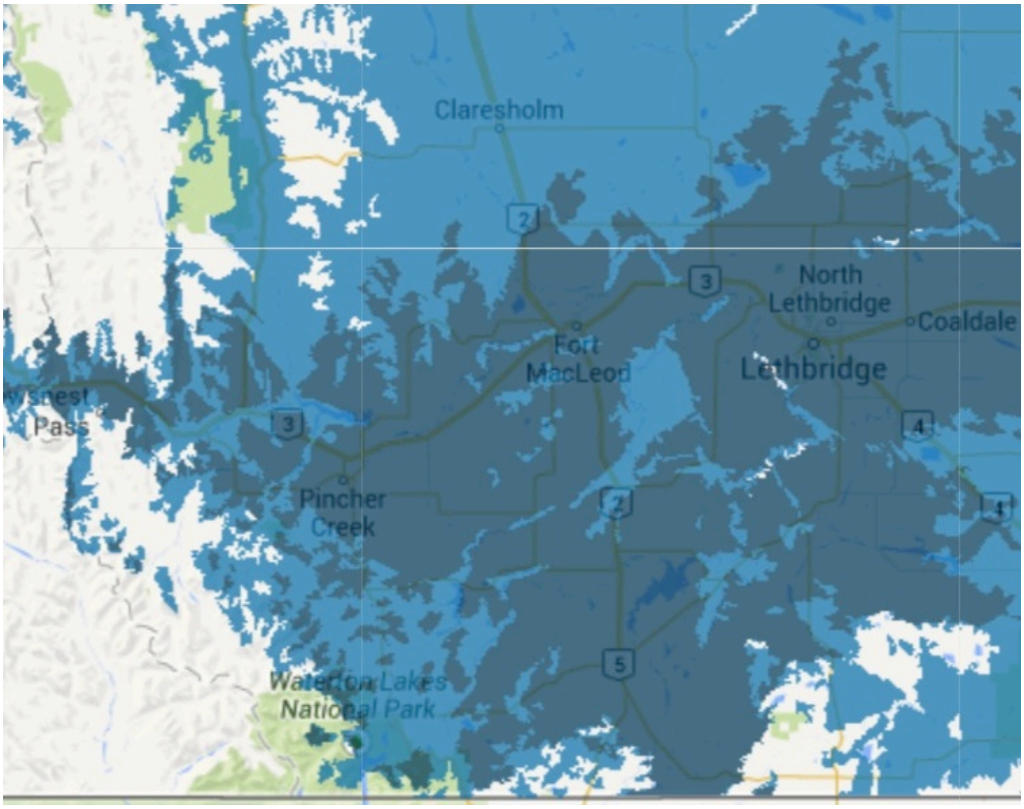
TELUS

The coverage map for TELUS Mobility services appears below.

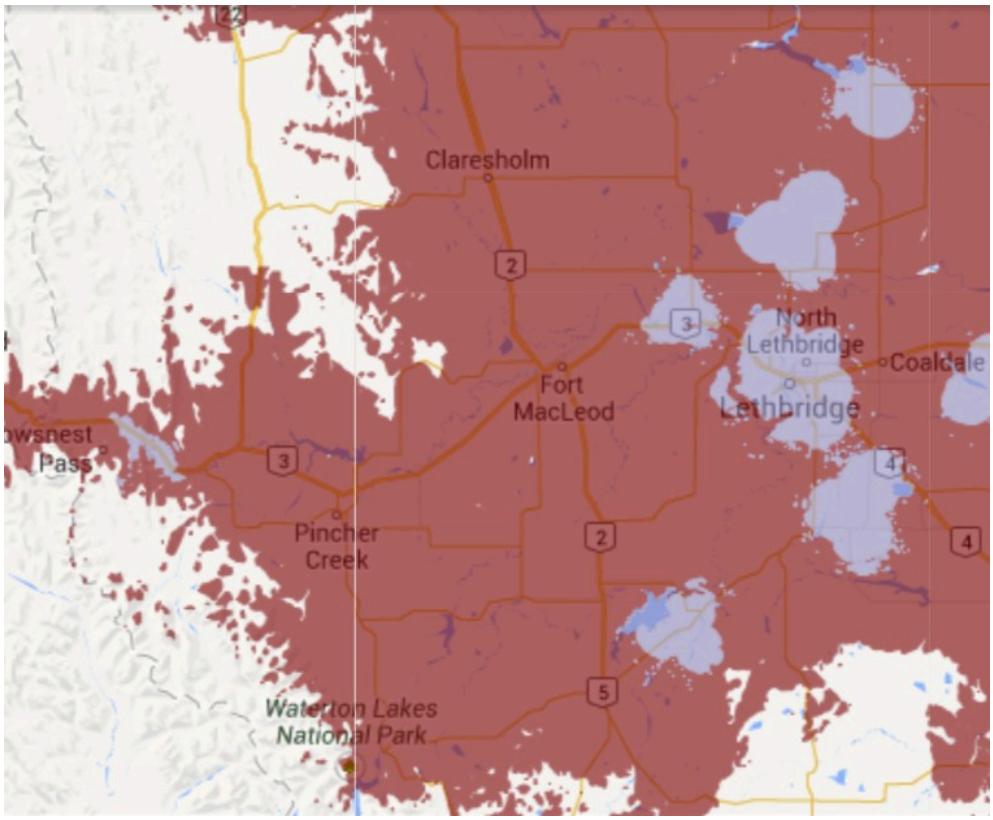


TELUS Legend	Bell Legend
4G HSPA+ HSPA+ Future 21 Mbps (manufacturer's rated peak download speed), average expected speed 4-6 Mbps DC-HSPA+ 42 Mbps (manufacturer's rated peak download speed), average expected speed 7-14 Mbps 4G LTE LTE Future 75 Mbps (manufacturer's rated peak download speed), average expected speed 12-25 Mbps. Customers may experience differing speeds when ir Saskatchewan: Up to 100 Mbps, average expected speed 10-15 Mbps.	HSPA+ (Max 42 Mbps) HSPA+ (Max 21 Mbps) HSPA (up to 1.5 Mbps) HSPA Extended (EXT)

Bell


Claresholm
North Lethbridge
Coaldale
Fort MacLeod
Lethbridge
Pass
Pincher Creek
Waterton Lakes National Park

Rogers


Claresholm
North Lethbridge
Coaldale
Fort MacLeod
Lethbridge
Pass
Pincher Creek
Waterton Lakes National Park

In this chart, purple indicates LTE 75 Mb/s service while the reddish brown areas indicate HSPA+ coverage.