Town of Stony Plain

Broadband Strategy

Final Report | February 2023

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TOWN OF STONY PLAIN

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RSM

Table of Contents

Executive Summary

Background

Stony Plain recognizes that high speed, high quality and reliable broadband connectivity is imperative for communities to be a competitive and desirable place to do business, live and visit. With Stony Plain's proximity to Edmonton and the rapidly diversifying economy of the Edmonton Metropolitan Region, highspeed connectivity is essential to link Stony Plain many businesses and facilities together, providing new and existing businesses and residents access to global opportunities.

Recognizing how fundamentally important connectivity is to the economic growth and prosperity of the Region, Stony Plain has identified developing a Broadband Strategy as a key action item to address broadband infrastructure gaps for businesses and residents as an economic opportunity to '*Strengthening our vibrant business community*'.

Stony Plain is undertaking this Broadband Strategy development in two phases, with phase 1 (this report) aimed at analyzing Stony Plain's current state of connectivity to produce several possible broadband development options. This report informs the basis and need for phase 2, which entails the development of a Business Plan.

This report is broken down into five overarching sections, which are summarized in this section.

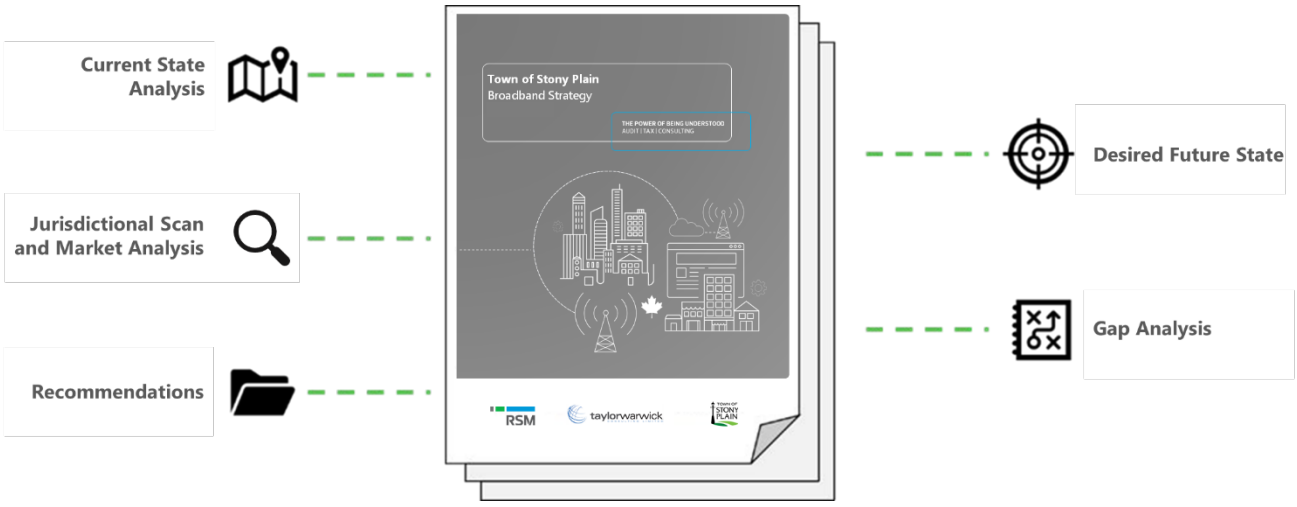


Figure 1: Stony Plain's Broadband Strategy

Current State Analysis

The Current State Analysis of Stony Plain's broadband ecosystem provides an overview of reasonable standards and future expectations for the variety of residential and non-residential applications. As such, the analysis reviews current state broadband infrastructure assets, service levels and providers, as well as residential and business sentiment.

Infrastructure

The infrastructure review analyzed several broadband infrastructure assets, including the municipal fibre network owned by Stony Plain, hybrid-fibre coaxial (HFC) infrastructure owned by Shaw, copper and fibre-based assets owned by TELUS, towers utilized by wireless providers, towers utilized by mobile providers, and satellite infrastructure availability in Stony Plain. When reviewing the coverage that these assets provide, it was found that 90% of subdivisions have access to infrastructure that provides high-speed broadband services, and the 10% of subdivisions that do not, include Rosenthal Estates and the northern business parks. When considering the future growth of Stony Plain, these gaps need to be filled while also ensuring Stony Plain is positioned for the increasing demands of the future. As such, it is important to consider the future of incumbent service levels.

First, it is important to note that Shaw is providing up to 1000 Mb/s speeds in the downstream direction to the customer and 100 Mb/s speeds upstream from the customer to the network (i.e., 1000/100 Mb/s) speeds to the majority of Stony Plain through its HFC infrastructure. Due to recent network technology innovations, Shaw's infrastructure could theoretically support 2.5 Gbps symmetrical speeds.

Secondly, TELUS is in the midst of deploying a fibre network throughout Stony Plain that will be able to provide symmetrical 1 Gbps speeds and up. This network upgrade was first announced in July of 2021, when TELUS announced $43M would be spent deploying a fibre network that would reach every residential and business premises. The initial deployment planned to cover approximately 2,459 premises or 31% of the residential premises within Stony Plain and was set to complete in early 2023.

TELUS' overall plan is to provide PureFibre services to all addressed premises within their planned footprint (it is estimated that some 8 rural commercial and 26 rural premises will not be covered under the current plan). However, due to priorities, budgetary issues, and supply chain disruptions, deployment to other planned areas of Stony Plain will be delayed until at least 2024.

This asset information was then further analyzed against service levels to understand and confirm the speeds residents and businesses were actually experiencing versus what speeds were being marketed to them.

Service Levels

The analysis of service levels resulted in the following table, which provides a summary of the speeds seen in each subdivision in Stony Plain.

Table 1. Advertised vs. actual Internet speeds for Shaw and TELUS

#	Area	Shaw – Advertised		Shaw – Tested		TELUS – Advertised		TELUS – Tested	
		Download	Upload	Download	Upload	Download	Upload	Download	Upload
1	Meridian Meadows**	N.S.	N.S.	No Tests	No Tests	N.S.	N.S.	17 Mbps	2 Mbps
2	Legends Trail	1.5 Gbps	100 Mbps	No Tests	No Tests	15 Mbps	1 Mbps	6 Mbps	1 Mbps
3	Umbach Business Park	N.S.	N.S	No Tests	No Tests	15 Mbps	1 Mbps	14 Mbps	1 Mbps
4	North Business Park**	N.S.	N.S	No Tests	No Tests	75 Mbps	15 Mbps	22 Mbps	6 Mbps
5	Old Town North	1 Gbps	100 Mbps	65 Mbps	68 Mbps	15 Mbps	1 Mbps	14 Mbps	1 Mbps
6	Meridian Cove	1 Gbps	100 Mbps	377 Mbps	24 Mbps	50 Mbps	10 Mbps	No Tests	No Tests
7	St. Andrews	1.5 Gbps	100 Mbps	341 Mbps	109 Mbps	150 Mbps	30 Mbps	55 Mbps	8 Mbps
8	Brookview/Homesteads	1.5 Gbps	100 Mbps	No Tests	No Tests	50 Mbps	10 Mbps	35 Mbps	14 Mbps
9	South Business Park	1.5 Gbps	100 Mbps	294 Mbps	51 Mbps	150 Mbps	30 Mbps	No Tests	No Tests
10	Sandstone/Silverstone	1.5 Gbps	100 Mbps	No Tests	No Tests	150 Mbps	30 Mbps	No Tests	No Tests
11	Jutland Ridge/Sun Meadows	1.5 Gbps	100 Mbps	No Tests	No Tests	75 Mbps	15 Mbps	No Tests	No Tests
12	Brickyard	1.5 Gbps	100 Mbps	301 Mbps	98 Mbps	1.5 Gbps	940 Mbps	No Tests	No Tests

13	Tiffany	1 Gbps	100 Mbps	No Tests	No Tests	50 Mbps	10 Mbps	No Tests	No Tests
14	Heritage Estates	1 Gbps	100 Mbps	No Tests	No Tests	15 Mbps	1 Mbps	No Tests	No Tests
15	Old Town South	1 Gbps	100 Mbps	390 Mbps	59 Mbps	150 Mbps	30 Mbps	45 Mbps	7 Mbps
16	The Glens	1 Gbps	100 Mbps	201 Mbps	87 Mbps	75 Mbps	15 Mbps	7 Mbps	3 Mbps
17	Folkstone	1.5 Gbps	100 Mbps	No Tests	No Tests	25 Mbps	5 Mbps	No Tests	No Tests
18	Downtown	1 Gbps	100 Mbps	34 Mbps	30 Mbps	75 Mbps	15 Mbps	12 Mbps	4 Mbps
19	49th Ave Commercial Corridor	1.5 Gbps	100 Mbps	260 Mbps	41 Mbps	50 Mbps	10 Mbps	22 Mbps	9 Mbps
20	Egerland Place/Heritage Court	1.5 Gbps	100 Mbps	44 Mbps	16 Mbps	50 Mbps	10 Mbps	15 Mbps	3 Mbps
21	Forest Green	1 Gbps	100 Mbps	350 Mbps	18 Mbps	2.5 Gbps	2.5 Gbps	27 Mbps	5 Mbps
22	Fairways	1 Gbps	100 Mbps	284 Mbps	83 Mbps	150 Mbps	30 Mbps	65 Mbps	2 Mbps
23	Graybriar	1 Gbps	100 Mbps	261 Mbps	12 Mbps	1.5 Gbps	940 Mbps	63 Mbps	11 Mbps
24	Whispering Cove/Woodlands	1.5 Gbps	100 Mbps	377 Mbps	24 Mbps	50 Mbps	10 Mbps	49 Mbps	7 Mbps
25	Southridge	1.5 Gbps	100 Mbps	398 Mbps	17 Mbps	2.5 Gbps	2.5 Gbps	49 Mbps	16 Mbps
26	Creekside/Stony Creek	1 Gbps	100 Mbps	No Tests	No Tests	2.5 Gbps	2.5 Gbps	No Tests	No Tests
27	Sommerville	1.5 Gbps	100 Mbps	No Tests	No Tests	1.5 Gbps	940 Mbps	No Tests	No Tests
28	South Creek	1 Gbps	100 Mbps	No Tests	No Tests	1.5 Gbps	940 Mbps	270 Mbps	23 Mbps
29	Rosenthal Estates	N.S.	N.S.	No Tests	No Tests	N.S.	N.S.	No Tests	No Tests
30	Willow Park	1 Gbps	100 Mbps	210 Mbps	28 Mbps	150 Mbps	30 Mbps	47 Mbps	8 Mbps
31	High Park	1.5 Gbps	100 Mbps	112 Mbps	61 Mbps	75 Mbps	15 Mbps	17 Mbps	5 Mbps
32	Cedar Brae	1.5 Gbps	100 Mbps	No Tests	No Tests	50 Mbps	10 Mbps	No Tests	No Tests
33	Genesis on the Lake	1 Gbps	100 Mbps	305 Mbps	28 Mbps	1.5 Gbps	940 Mbps	No Tests	No Tests
34	Westerra (West)	1 Gbps	100 Mbps	187 Mbps	12 Mbps	1.5 Gbps	940 Mbps	233 Mbps	41 Mbps
35	Westerra (East)	1 Gbps	100 Mbps	190 Mbps	43 Mbps	150 Mbps	30 Mbps	141 Mbps	58 Mbps
36	Country Plain Estates	1.5 Gbps	100 Mbps	No Tests	No Tests	150 Mbps	30 Mbps	62 Mbps	8 Mbps

LEGEND

	Coax and copper-based services
	TELUS PureFibre to be completed
	Unserved/underserved area

*N.S.: No Service.

**Although some premises have access to 1000/100 Mbps speeds from Shaw, not all premises are covered, and deployment appears sporadic.

Data used for TELUS and Shaw tested speeds was based on CIRA results from August 2022 – January 2023.

In analyzing the data, the following observations are important to note:

- Comparison between the advertised and observed median Internet speeds shows that, on average, both download and upload speeds are 300-400% lower for both Shaw and TELUS. However, note that the advertised speeds are the maximum offered and that the tested speeds will be impacted by the service tier the customers have subscribed to. As such, it is likely that many residents and businesses across Stony Plain are not subscribed to the highest level of service that they have access to.
- As observed when reviewing infrastructure gaps and confirmed when reviewing service levels, only four areas within Stony Plain are not served or underserved, which includes areas north of Highway 16A (Meridian Meadows, Umbach Business Park, and the North Business Park) and rural areas such as Rosenthal Estates.
- All other subdivisions have access to speeds greater than 1 Gbps / 100 Mbps through Shaw, with eleven subdivisions that have access (or will have access in the future) to TELUS Purefibre, with symmetrical 1 Gbps speeds or greater.

Based on the infrastructure and service levels data, the majority of the Town is currently well serviced.

The data from this service level analysis was further reviewed against results received from residential and business surveys that were distributed within Stony Plain.

Residential and Business Survey Results

Although many questions were asked within the survey, a key finding was that the majority of respondents likely do not subscribe to the highest Internet speeds available to them. All of the business respondents selected that they either subscribe to service levels 'Up to 50 Mbps' or '50 to 250 Mbps' upload and

download speeds suggesting that none of them were paying for fibre Internet. 70-80% of residential respondents were paying for the same two categories of speeds.

These results were also plotted for the two most subscribed to ISPs – TELUS and Shaw.

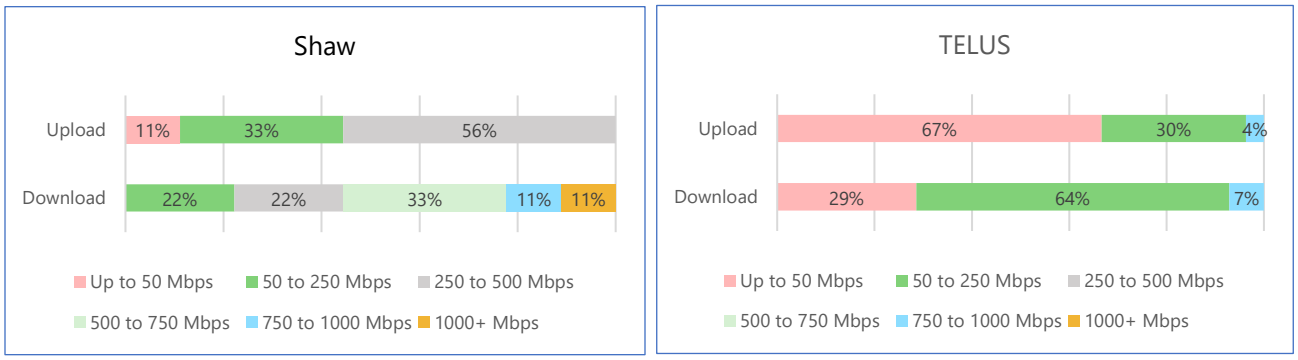


Figure 2: Internet speed plans being utilized per ISP

Interestingly, although residents are not subscribing the fastest speeds available to them, 64% of resident respondents rated that they were Neutral or Satisfied with Internet speeds, while only 30% of business respondents were Neutral or Satisfied. This may once again point to the key gaps that were seen in the northern business parks.

Market Analysis

As the Current State Analysis revealed, although the majority of the Town is well serviced, there are key gaps in broadband coverage that need to be further analyzed and understood. In doing so, it is important to understand trends, strategy, and funding available in the market that could be of use to Stony Plain.

When reviewing funds made available through the Federal government, Industry, Science and Economic Development's (ISED) Universal Broadband Fund (UBF) is of interest. In conjunction with the Canadian Radio-television and Telecommunications Commission (CRTC), ISED produced a National Broadband Internet Service Availability Map in 2019 (most recently updated on November 8th, 2022) indicating their view of Internet services availability across Canada. To qualify for and access funding, the proposed coverage area must be shown on the map to have service levels below 50/10 Mbps, which is the minimum service objective for Canada set by the CRTC in the *Telecom Regulatory Policy CRTC 2016-496*. The services to Stony Plain appear in the maps below.

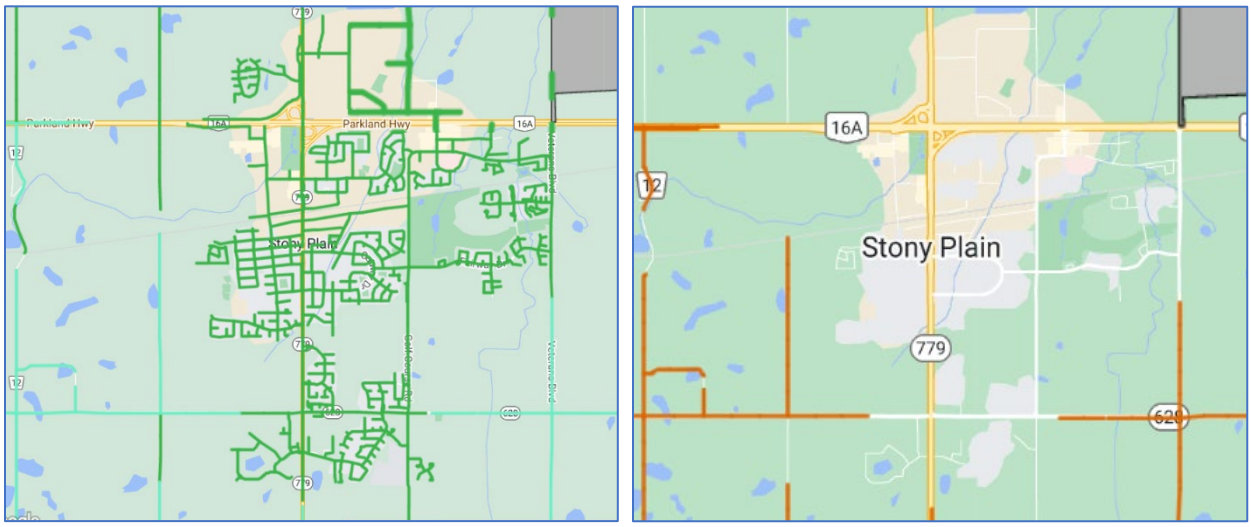


Figure 3: ISED broadband map showing Internet service levels in Stony Plain

The map on the left was produced using the National Broadband Internet Service Availability Map, which shows that a minimum of 50/10 Mbps speeds are available along the green roadways, while 25/5 Mbps speeds are shown in teal. Furthermore, when utilizing the Eligibility Mapping Tool, an alternate view seen on the right can be produced. Road segments, which are highlighted in orange, indicate areas where funding can be accessed. Interestingly, this showcases eligibility for Rosenthal Estates and other rural areas within Stony Plain's boundaries, despite these areas being covered by satellite providers such as Starlink.

When looking at funding available through the Provincial government, the Alberta Broadband Fund (ABF) set up by Government of Alberta is aimed at identifying the unique opportunities and challenges of improving access to broadband connectivity and setting a clear path to eliminate the digital divide as quickly as possible. The Government has allocated $36M to the ABF with applications from communities and service providers likely to open in the first half of 2023. As eligibility criteria for ABF applications are expected to remain aligned with ISED's UBF guidelines, only applications focused on improving rural connectivity in Stony Plain are likely to qualify.

In addition to the funds and grant specifically focused on broadband initiatives, municipalities can access loans from the Government of Alberta under its *Grants and Funding for Municipalities* program. Alternatively, private equity financing has become available for municipalities, as broadband infrastructure is increasingly seen as a long-term stable asset class, and private capital to fund the required infrastructure is becoming increasingly available.

When further analyzing what has been done in the Edmonton Region by neighboring and local municipalities, it can be seen that a number of these options have been considered and employed to invest in broadband development projects. The graphic below provides a brief summary of what has been seen in the Region.

Edmonton Region Jurisdictional Scan		
Unique Deployments	Parkland County	• RFP is in the final stages of negotiation for a FTTH deployment to 3000-6000 dwellings (phase 1 of 5) • $8M in County funding was put forth, largely funded by the sale of wireless towers • Contract provisions to start with one provider but open the network after 5 years and the County has "some" dark fibre access
	Sturgeon County	• Canadian Fibre Optics Corporation (CFOC) won an RFP in 2021 to connect 1800 premises with an open access network • CFOC is to provide the optoelectronics while Sturgeon owns the fibre • $7.55M of funding was put forth by Sturgeon County (debenture financing)
	Beaumont	• Fully funded deployment by the Digital Infrastructure Group • Open-access model, with Primus being the initial service provider • Considers smart city and open Wi-Fi needs
Incumbent Investments	Spruce Grove	• $4.25M of funding provided to TELUS to complete a $50M deployment to every municipal address by the end of 2022
	Edmonton	• TELUS made a $1B fibre investment in the City with no municipal investment
	City of Leduc	• TELUS completed a $45M fibre deployment in October of 2022
	St. Albert	• TELUS announced a $10M investment to enhance fibre infrastructure in 2022
Status Quo	Strathcona County	• The municipality is not actively working with any service providers or partners to enhance internet speeds, although a deal was near completion in 2022 to enhance rural connectivity. Funds were reallocated to the construction of a field house and an agricultural centre.
	Fort Saskatchewan	• The municipality is not actively working with any service providers or partners to enhance internet speeds, although it is completing a municipal fibre loop to ensure redundancy of its municipal network and enable smart city technology
	Leduc County	• The municipality is not actively working with any service providers or partners to enhance internet speeds, although it is paying close attention to deployments in neighboring municipalities
	Devon	• The municipality is not actively working with any service providers or partners to enhance internet speeds
	Morinville	• The municipality is not actively working with any service providers or partners to enhance internet speeds

Figure 4: Summary of Edmonton Region Jurisdictional Scan

Projects that are particularly notable for Stony Plain are those in Spruce Grove and Parkland County, as these Tri-municipal Region municipalities have successfully attracted investment, albeit in two very separate ways.

As Stony Plain moves forward and considers the actions it needs to take to spur broadband infrastructure development and increase service levels, lessons can be taken from the Region to understand the options that it has. In addition, Stony Plain also needs to consider what the appropriate service levels are which are needed as technology advances. Both of these items are explored further within the next section.

Desired Future State

According to a study done by the Fiber Broadband Association's (FBA's) Technology Committee, current and projected bandwidth requirements significantly exceed the CRTC target of 50/10 Mbps Internet speeds, and moving forward, simply maintaining the status quo will not be sufficient if Stony Plain aims to attract and retain residents and businesses. The figure below graphically displays projected service levels needed

in this decade, and it can be seen that symmetrical 2 Gbps speeds will be needed by 2030 for the average household of four.

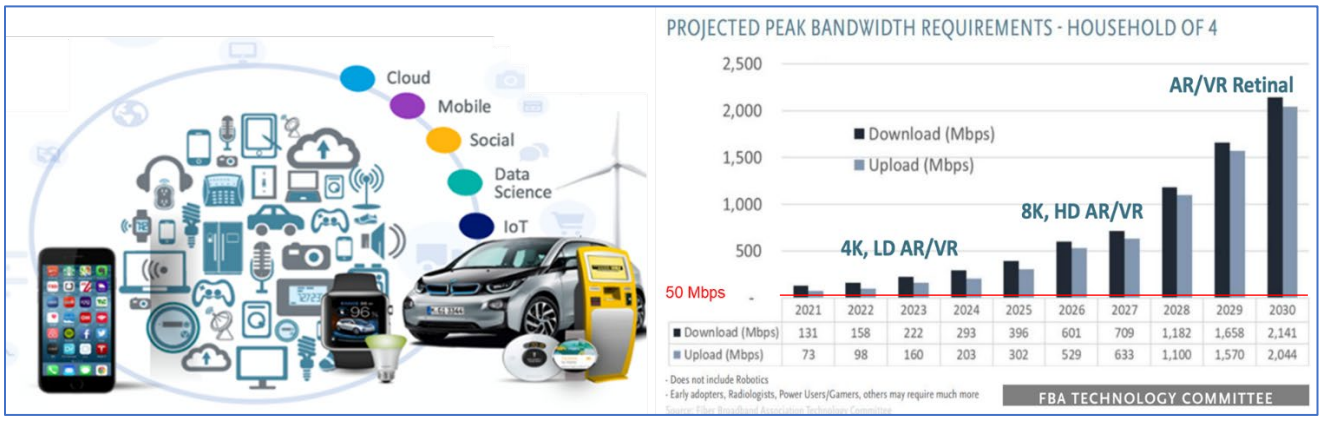


Figure 5: Need for increased bandwidth

Moreover, broadband networks rank among the most important infrastructure assets of our time — for purposes of economic development and competitiveness, innovation, workforce preparedness, healthcare, education, democratic discourse, and environmental sustainability. Numerous studies have been conducted to quantify what the socio-economic impacts can be, and a summary of estimates for Stony Plain is provided below for consideration:

Consumer Benefits:

- According to the 2019 (US) Cartesian study, symmetrical gigabit Internet availability provides an average benefit of CAD$220 per household over that provided by cable-based services. Hence, if 75% of Town households had access to fibre-based broadband connectivity, it would accrue consumer benefits of $1.23M annually.

Property Values:

- RVA estimates that a residential fibre connection will increase the real estate value of the properties by about 3.6%. With a 75% uptake, this would increase aggregate property values by $69.9M (assuming an average property value of $363k).
- At a mill rate of 7.8, with 7,134 residential properties, this would equate to increased property tax revenues of $177,000 per annum

GDP Growth:

- Assuming the 2021 per capita Alberta GDP of $71,030 to be representative of that in Stony Plain and that the availability of symmetrical gigabit Internet services results in an 0.19% mid-range lift, Stony Plain would see an increased GDP of $2.45M.
- At a provincial and federal tax to GDP ratio of 33%, improved Internet services deployment would thus increase federal and provincial tax revenues by $0.810M/year or $16.2M over 20 years.

Other Socio-economic Return on Investment (SROI) Benefits:

- The SROI in the Edmonton Metropolitan Region's study found the lift to be 0.68% (~$1 billion per year)
- A University of Lethbridge study found the ROI associated with a fibre-to-the-farm (FTTF) initiative may be as high as ~317%.

From a socio-economic perspective, the availability of Shaw's 1000 by 100 Mbps services throughout the commercial and residential areas of Stony Plain will have significantly enhanced Stony Plain's quality of life and tax base. Deployment of fibre-to-the-premise (FTTP) infrastructure, either via the proposed TELUS deployment or a municipally led version, will enhance these benefits even more – and particularly so in the underserved business parks north of Highway 16A.

While the currently planned TELUS fibre deployment in Stony Plain may enable much of the socio-economic benefits, their deployment will not be ubiquitous and, as a private enterprise, their longer-term business objectives for the network may not fully align with Stony Plain's future state objectives for economic development, security, social inclusion, smart city enablers, etc. As such, Stony Plain must weigh its deployment options to ensure an informed decision is made on the path ahead. The general options that Stony Plain has are summarized in the figure below.

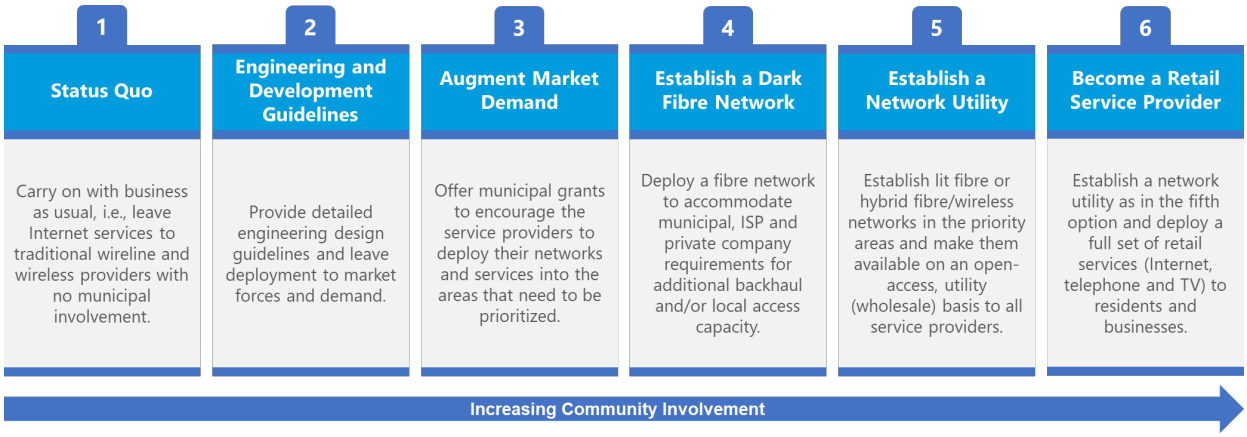


Figure 6: Broadband deployment options

These options are further discussed in the next section, with further consideration of the broadband asset and service level gaps that were seen within Stony Plain.

Gap Analysis

The following are the key gaps that were identified through analyses:

- TELUS' median Internet service levels in Stony Plain are 45 Mbps down by 7 Mbps up, just below the minimal CRTC service objectives. In early 2023, symmetric 1 Gbps fibre-based services will become available to 31% of the premises. TELUS' plans to expand fibre-services throughout the urban area of Stony Plan are on-hold through to at least 2024. In addition, though Shaw services of 1 Gbps down by 100 Mbps up are advertised, current median measured service levels in Stony Plain came in at 298 Mbps down by 31 Mbps up. This may be indicative of residents and business of Stony Plain not subscribing to the highest service levels available to them.

- Service levels in both the North and Umbach Business Parks are inadequate.
- Service levels for rural businesses and residents, including those in Rosenthal Estates, are inadequate.

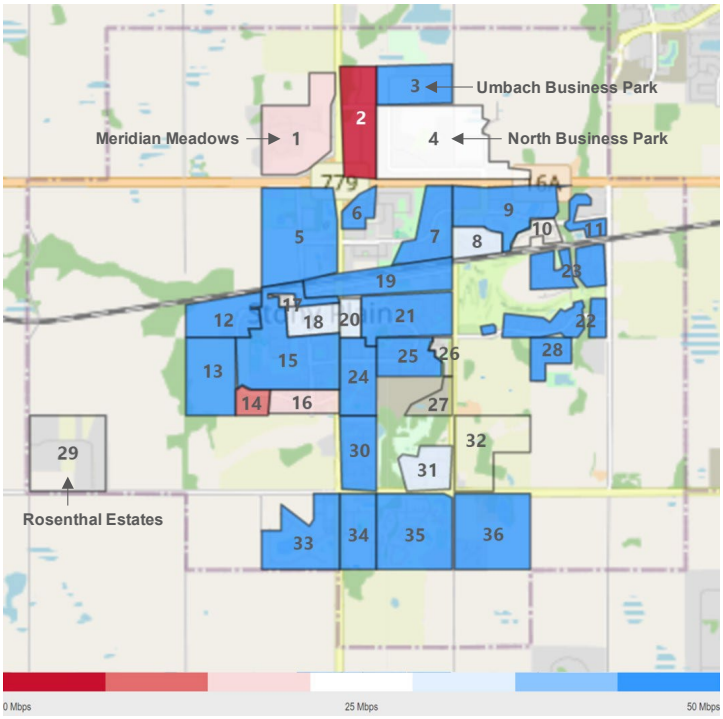


Figure 7: Unserved and underserved areas in Stony Plain

Options

To close the current gaps in terms of coverage and service levels, Stony Plain could utilize a number of strategic and tactical options, which are provided in this section.

Strategic

The table below summarizes a list of strategic options for Stony Plain to bridge its current gaps.

Table 2: Strategic broadband deployment options for Stony Plain

Strategic Option	Description
1. Status Quo: Leave the issue to private industry	• TELUS is pre-positioned to complete an FTTP deployment that will support symmetric Gbps services to 98% of the urban premises within the next few years. • Through upgrades, Shaw's network electronics can support symmetric 2.5 Gbps services. ○ Should the Roger's acquisition go through, services to the rural premises may be improved via 5G deployments.

		• While the simplest and least expensive option, some of the benefits (e.g., increased competition, smart city support) that would accrue to a municipally controlled open network will not be realized.
2.	Adopt fibre-friendly policies and engineering guidelines	• Not likely to impact deployment but would future-proof new developments and save trenching costs where providers are overbuilding.
3.	Augment market demand	• Negotiate with incumbents or new partners to improve services within Stony Plain, with focus on key gaps in the northern business parks and rural areas.
4.	Establish a dark or lit network utility	• Stony Plain could establish its own dark or lit network utility and make it available to all ISPs interested in providing their service sets within Stony Plain. This could be achieved by: • Initiating talks with funding, procurement, and operational partners such as the Digital Infrastructure Group, Canadian Fibre Optics, and Equs Connect to establish a municipal network. • Releasing an RFP asking for partnership proposals to do the same. • If Stony Plain were to require that fibre-conduit (under Options 2) be placed within the shallow utility trenches in all new developments, 75% of the deployment costs in these areas would be saved should the Town opt to establish a network utility down the road.
5.	Become a retail provider	• Going into retail competition with private competitors is not recommended.

Tactical

When considering the immediate needs and gaps of Stony Plain, two items are of note:

- Services in the North and Umbach Business parks are not adequate, with both limited download and upload speeds, which can impact the functionality of many collaborative and cloud-based applications.
- While test results in rural areas were limited, it is likely that most do not receive services that meet the CRTC minimum service objective. This is especially true for Rosenthal Estates which does not receive wireline services from incumbents.

To fil these gaps, Stony Plain could:

- Work with incumbents or new partners to deploy and prioritize fibre services in the unserved/underserved areas.
- Alternatively, Stony Plain could invest in mm-Wave Fixed Wireless Access (FWA) equipment to provide fibre equivalent (~1 Gbps) speeds to these areas on an interim basis..

Partnerships

In general, partnerships could enable Stony Plain to leverage and balance its funding strength with the operational and, perhaps, deployment expertise of private enterprise. Partnerships range from simple contractual outsourcing arrangements to highly structured public-private-partnerships and the special purpose vehicles required to accommodate significant financial arrangements. Depending on the direction Stony Plain selects, one or more partnerships may be required.

The following table summarizes potential partnership options available for Stony Plain. Note this is not an exhaustive list and is for consideration only.

Table 3: Partnership options for Stony Plain

Partnership Option	Description
Connect Mobility and MCSnet	Negotiate to deploy mm-Wave equipment in the business parks to provide symmetric 1 Gb/s services.
Shaw	Negotiate to include business parks in their upgrade plans in 2023.
TELUS	Negotiate to complete fibre deployment to at least the business parks in 2023.
Parkland County	Parkland County is currently closing an RFP to select a partner to deploy a fibre network in their rural areas. Once selected, Stony Plain could see if their partner would also be interested in deployment fibre within Stony Plain.
Crown Capital	Crown Capital is currently providing investment capital for fibre deployment in Brooks. Stony Plain could see if they would also be interested in investing in a fibre deployment within Stony Plain.
Digital Infrastructure Group (DIG)	DIG is currently backing open access fibre deployments in Beaumont and Vermilion with investment capital, deployment, and operational expertise. Stony Plain could pursue a similar partnership to deploy fibre within Stony Plain.
Equs/Valo	The co-op model used to support deployment in Red Deer County could be pursued by Stony Plain to deploy fibre within Stony Plain.
Canadian Fibre Optics (CFO)	CFO is currently deploying an open access fibre network in Sturgeon County. Stony Plain could pursue a partnership with them to deploy fibre within Stony Plain.
Rock Networks	Rock Network is currently working with Yellowhead County on broadband deployments. Stony Plain could pursue a partnership with them to deploy fibre within Stony Plain.

Next Steps

The options provided for consideration in the previous section need to be considered as a whole, and a strategic plan of action needs to be taken to ensure Stony Plain is able to capitalize on the value that ubiquitous high-speed broadband connectivity can bring. Specifically, to ensure that Stony Plain is future-proofed to 2030, it needs to have infrastructure capable of providing symmetrical speeds of 2 Gbps. As indicated within this study, the Edmonton Region is largely connected or being connected through fibre

deployments that offer speeds of a minimum of 1 Gbps symmetrical. Furthermore, when we look to the future, symmetrical 2 Gbps speeds are quickly becoming required to access and gain the benefits of new and emerging technology. As such, as Stony Plain grows strategically, it is imperative that Stony Plain seeks and fosters the right partnerships to realize the economic opportunity that the highest speed broadband connectivity and infrastructure can bring. This will help ensure that as the community grows from 18,000 residents today to 30,000 residents over the next decade, it has access to the highest levels of broadband services and benefit from the significant quality of life and economic opportunity that this brings.

Introduction

Project Background

Stony Plain recognizes that high speed, high quality and reliable broadband connectivity is imperative for communities to be a competitive and desirable place to do business, live and visit. With Stony Plain's proximity to Edmonton and the rapidly diversifying economy of the Edmonton Metropolitan Region, highspeed connectivity is essential to link Stony Plain's many businesses and facilities together, providing new and existing businesses and residents access to global opportunities.

Recognizing how fundamentally important connectivity is to the economic growth and prosperity of the Region, Stony Plain has identified a Broadband Strategy as a key action addressing broadband infrastructure gaps for businesses and residents as an economic opportunity to '*Strengthening our vibrant business community*'.

Stony Plain is undertaking this Broadband Strategy development in two phases, with phase 1 (this report) aimed at analyzing Stony Plain's current state of connectivity to produce several possible broadband development options. This report informs the basis and need for phase 2, which entails the development of a Business Plan.

This report is broken down into five overarching sections:

The report begins with a **Current State Analysis** of Stony Plain's broadband ecosystem to provide an overview of reasonable standards and future expectations for the variety of residential and non-residential requirements and applications in Stony Plain. In addition, this section provides an overview of historic data, current state service levels and assets, residential and business sentiment analysis, and an overview of service providers including their capacity and future availability.

The next section comprises of the **Market Analysis** which provides the current state of initiatives within local and regional jurisdictions (including the Tri-Municipal and Edmonton Metropolitan Region) to understand trends, opportunities and challenges that may inform strategies to enhance future broadband services. It also includes an overview of the current National and Provincial strategies and funds.

To move forward from the current state and establish **the Desired Future State**, an overview of technological growth and connectivity needs are discussed, alongside the economic opportunity that this brings. This section establishes what the future looks like and provides key insights and best practices to inform Stony Plain of the options it has to realize broadband benefits.

In completing each of the above sections, key gaps are identified and summarized in the **Gap Analysis** section of the report. These identified and consolidated gaps provide direction for the recommendations of the report.

The Broadband Strategy report concludes with a set of key **Next Steps** for Stony Plain to consider in enhancing broadband connectivity. These next steps have been developed in response to the identified gaps and provide an actionable path forward for enabling regional collaboration.

Figure 8: Stony Plain's Broadband Strategy

Project Approach

The project followed a three-phased approach which is outlined below.

Phase I – Mobilize

In the mobilization phase, RSM and TW worked with Stony Plain to set foundations for the project. This included confirming project scope and the deliverables to be produced, setting expectations around project communication, and planning stakeholder engagement activities.

At the completion of the first phase of the project, a Project Charter and Stakeholder Engagement Plan, and drafted internet surveys for businesses and residents were produced.

Phase II – Review and Analysis

After confirming strategic objectives with Stony Plain, RSM and TW reviewed existing documentation and information on current broadband infrastructure and service agreements to understand Stony Plain's current capacity and the adequacy of broadband services that are delivered to citizens and businesses. In addition, the analysis included:

- Analysis of current service levels and assets that can support Stony Plain's broadband network;
- An analysis of the ecosystem of current service providers, including their infrastructure, services, capacity and future plans;
- An evaluation of the assets which Stony Plain may leverage to facilitate further improvements to broadband service levels available throughout Stony Plain; and
- Analysis of initiatives within local and regional jurisdictions (including the Tri-Municipal and Edmonton Metropolitan Region) to understand trends, opportunities and challenges that may inform strategies to enhance future broadband services.
- This information was gathered from internal and external stakeholder discussions through a review of existing documentation and a detailed review of Stony Plain's technical infrastructure.

The team engaged with internal Town stakeholders identified during the first phase of the project to understand each stakeholder's perspective on Stony Plain's capacity to deliver broadband services to citizens and businesses. This included a review of Stony Plain's strategic goals and objectives through Current State and Future State Workshops to understand how the Broadband Strategy may further enable businesses and residents to strengthen the community they call home.

RSM and TW also engaged external stakeholders to understand how the current broadband network can meet the needs of citizens and businesses now and into the future. With support from Stony Plain, the following engagement activities were completed :

- Two surveys were released, one focused on citizens and the other on businesses, to understand their expectations of broadband services now and into the future;
- Third-party service providers were engaged in discussions to understand their plans within Stony Plain;
- Regional partners and neighboring municipalities were engaged to understand their goals, objectives, and investment plans for broadband infrastructure in the short, medium, and long-term planning horizon; and
- Municipalities across the Edmonton Region were engaged to understand trends and identify strategic opportunities.

Phase III – Recommendations and Report

The final phase of the project included combining the results from review and analysis with best-practice knowledge and experience to assemble this comprehensive report for Stony Plain to consider strategic recommendations for the enhancement of Stony Plain's broadband infrastructure.

Current State Analysis

This section provides an overview of the current state broadband infrastructure, internet service levels and results from surveys sent to residents and businesses in Stony Plain.

Infrastructure

Stony Plain

Stony Plain has deployed 12 to 24-strand fibre optic cables in conduit to connect four municipal buildings.

The infrastructure is owned and managed by Stony Plain with help from outside contractors for deployment and maintenance support. The current network is not used to its full capacity and there are ongoing conversations about ways to utilize the unused bandwidth and to expand the current network to connect additional municipal buildings. In the future, there is potential to utilize the fibre to connect non-government premises, which is explored in the Gap Analysis section of the report.

Wireline-based Internet

The wireline-based Internet network includes underground infrastructure consisting of copper and coaxial cables and fibre that carry Internet services to households and businesses. TELUS and Shaw are the primary wireline-based Internet service providers in Stony Plain.

TELUS

The TELUS network in Stony Plain includes underground infrastructure consisting of copper and fibre cables to connect households and businesses to provide Internet, telephone, and television services.

In July 2021, TELUS announced an investment of $43M to upgrade current infrastructure in Stony Plain to PureFibre. Under their PureFibre plan, symmetric Internet services of up to 940 Mbps would become available. This deployment build is to complete in early 2023 and will cover approximately 2,459 premises or 31% of the residential premises within Stony Plain.

TELUS' overall plan is to provide PureFibre services to all addressed premises within their footprint It is estimated that some 8 rural commercial and 26 premises will not be covered under the current plan. However, due to priorities, budgetary issues, and supply chain disruptions, deployment to other planned areas of Stony Plain will be delayed until at least 2024.

TELUS Internet services to the remainder of Stony Plain are copper-based and have measured median rates of 50 Mbps down by 7 Mbps up. Details of TELUS' current service offerings can be found in Appendix D.

Shaw

The wireline-based Shaw network is based on an underground HFC infrastructure consisting of fibre to the neighborhood distribution nodes and coaxial cabling to households and businesses.

Though Shaw plans appear to cover majority of the neighborhoods in Stony Plain, some noteworthy areas not covered by the current infrastructure include parts of the North Business Park and Umbach Business Park – especially premises along the Range Road 280 along with approximately 20 rural commercial properties.

Even though Shaw appears to provide services to Meridian Meadows, connectivity to premises within that region is sporadic. In addition, it also does not appear to cover Rosenthal Estates and around 27 rural premises in the region.

While coaxial cable infrastructure is intrinsically capable of supporting multi-gigabit per second services, the traditional electronics deployed are optimized to support television services and are therefore limited in the bandwidths available to support Internet. Based on its buried fibre to the neighbourhood and coax to the home infrastructure, Shaw is able to provide 1000 by 100 Mb/s services throughout most of the urban area of Stony Plain. Remaining service gaps include the two business parks and the Town's rural areas.

In addition, on March 15, 2021, Shaw and Rogers announced an agreement for Rogers to acquire Shaw in a $26B transaction to create new jobs and investment in Western Canada and accelerate Canada's 5G rollout. Should Rogers be allowed to acquire Shaw, services available to rural residents will likely be improved by leveraging Rogers 5G mobility spectrum and towers. Additional details on the merger can be found in the *Market Analysis* section of the report, under the *Competition Bureau and the Roger/Shaw Merger* subsection.

Details of Shaw's current service offerings can be found in Appendix D.

Bell Canada

As a base-network community from SuperNet, Bell Canada has fibre infrastructure within Stony Plain to support services to public facilities such as government offices, clinics, hospitals, libraries, and schools. When Bell Canada acquired Axia's assets, it sold Axia's fibre access plant to TELUS. Hence, it is unlikely that Bell Canada would be looking to expand its network footprint in Town any time soon.

Fixed Wireless Internet

Unlike copper, coaxial cable, and fibre-based wireline connectivity, fixed wireless services connect fixed locations – such as homes and businesses – through a combination of towers and antenna infrastructure. Though Fixed Wireless Access (FWA)-based Internet services are available throughout Stony Plain from at least five providers, due to slower speeds, they largely serve the rural areas around the urban centre.

A map of existing FWA towers in the Stony Plain region is provided in the figure below.

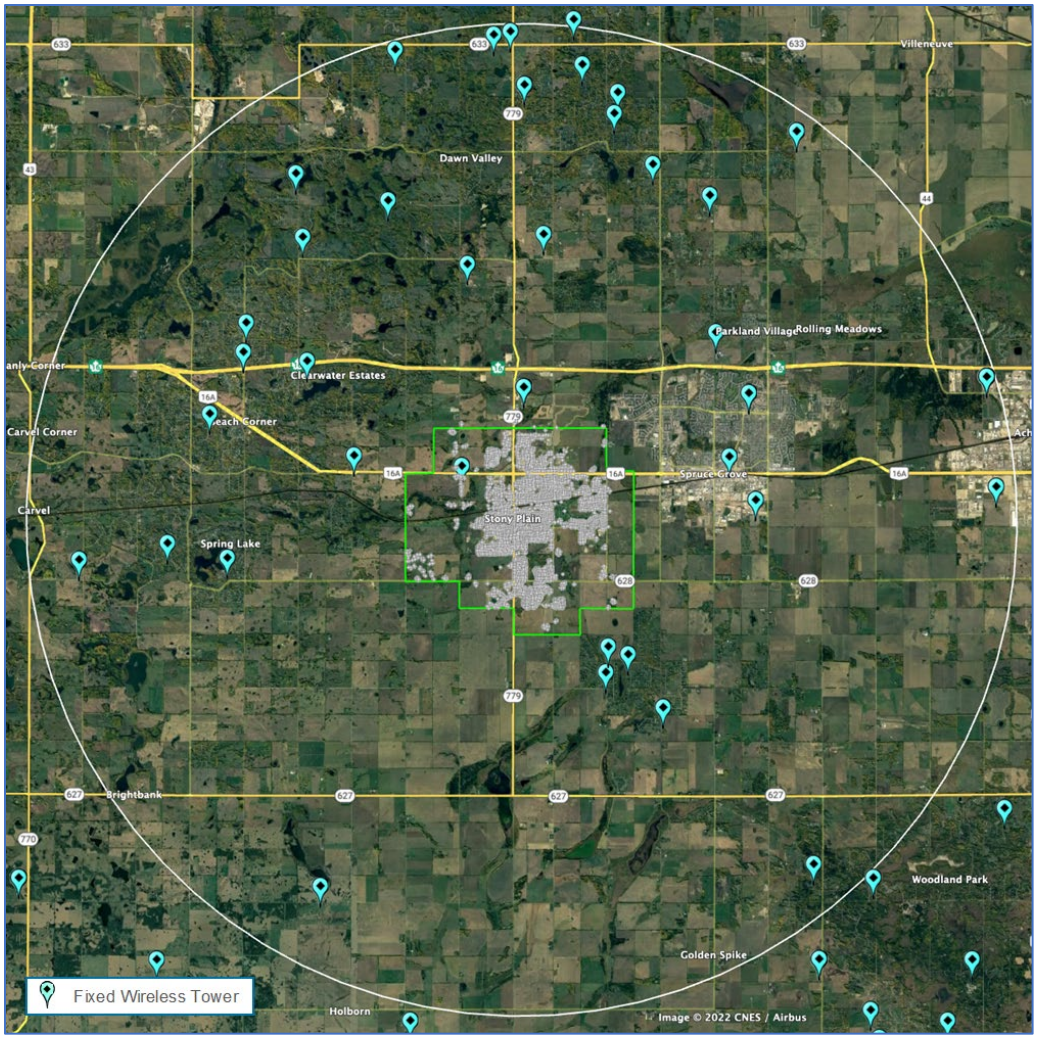


Figure 9: Fixed Wireless Access (FWA) towers in the Stony Plain region

Though there is only one FWA tower within the borders of Stony Plain, as a FWA tower can typically provide services to premises up to 15 km from a tower, services to the urban residents could be provided off any of the towers falling with the 15 km radius shown by the white circle.

Wireless service providers with coverage that includes Stony Plain include Broadband Surfer, Clearwave, TekSavvy, TeraGo, and Xplore. Details of their service plans appear in Appendix D.

Cellular Internet Providers

Though generally expensive, Internet services are available via LTE, 4G and 5G cellular networks. The figure below, shows cellular towers falling within 15 km of Stony Plain centre. Though Bell towers are scarce, Bell services are often provided off TELUS towers, and vice-versa.

There has only been one cellular-based Internet speed test run so far which was through Rogers' network. The test showed speeds of up to 16 Mbps download and 2 Mbps upload.

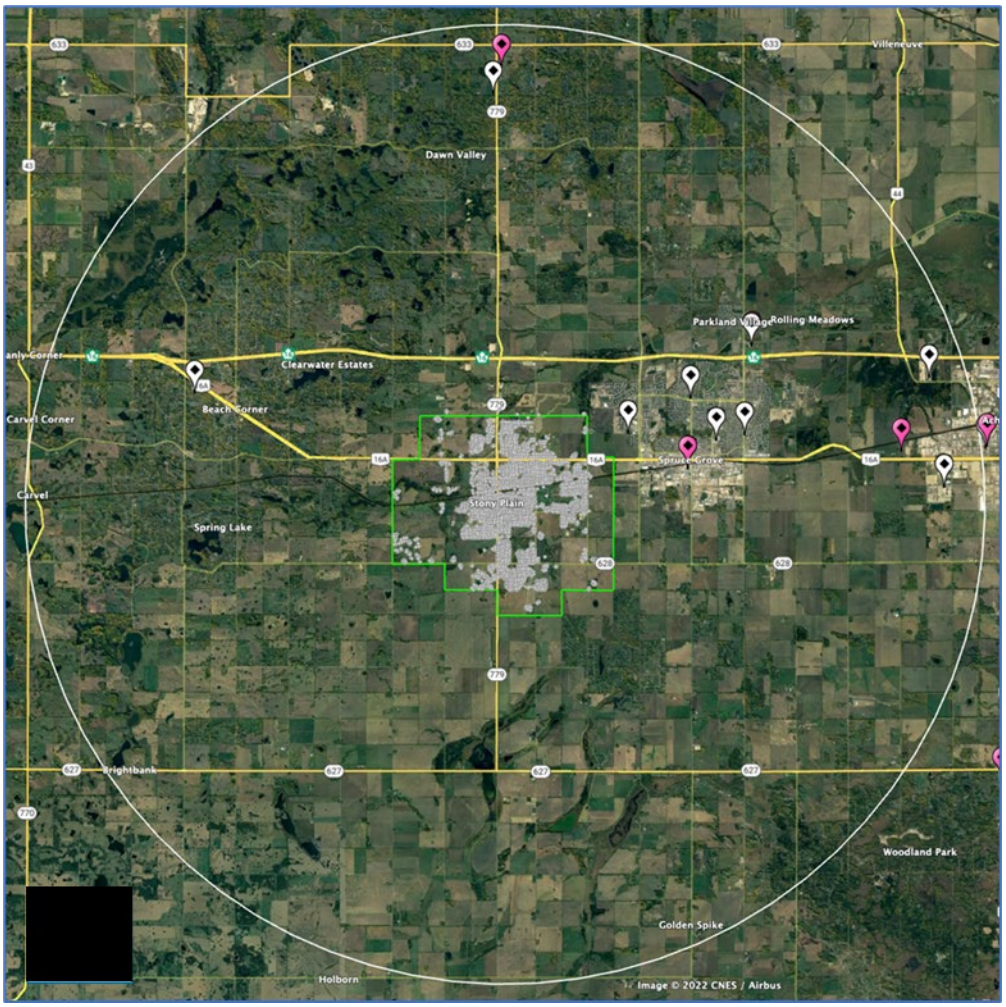


Figure 2: Cellular towers in the Stony Plain region

Wireless Hotspots

A wireless hotspot is a physical location where devices wirelessly connect to Internet via a local router installed and operated by ISPs and business owners. Hotspots deployed within indoor environments typically do not serve much beyond a building's perimeter.

The TELUS Wi-Fi and Shaw Go Wi-Fi hotspot service locations available within Stony Plain are shown by the purple and blue circles in the maps below.

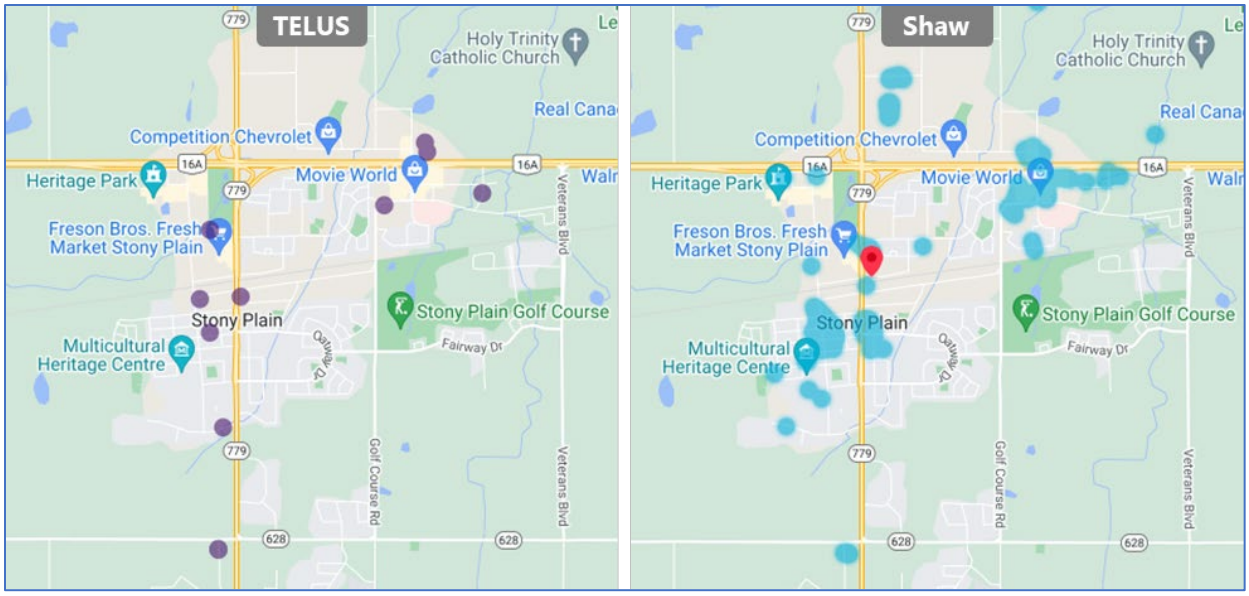


Figure 3: TELUS and Shaw Wi-Fi hotspots in Stony Plain

Shaw appears to have more hotspots than TELUS. Most hotspots are located in the Downtown and South Business Park areas.

Satellite Networks

Starlink

Starlink plans to disrupt global broadband services via a constellation of 42,000 low Earth orbit satellites (LEOS) of which 12,000 are approved, paperwork for 30,000 more has been filed, and, to date, 2,793 are operational.

Though LEOS-based services such as those from Starlink, will not be competitive services in urban areas, they will provide an option for rural premises with advertised speeds of 75 Mbps down by 15 Mbps up. However, should customer demand grow faster than capacity can be expanded via satellite launches (as expected), Starlink will not be able to keep up with customer demand, and delivered rates will decline.

This can be analyzed via a simple calculation. As of August 2022, Starlink had 2,793 satellites in operation. Each satellite covers ~300,000 sq. km and has a capacity of ~20 Gbps. Hence, at any one time, each location on the planet is in view of 1.64 satellites (considering that the Earth's surface is 510M sq. km). Together, the currently deployed constellation makes 1.64 x 20 Gbps = 32.8 Gbps available to each 300,000 sq. km area on the planet. Without oversubscription, with this capacity, Starlink is only able to provide 75 Mbps down by 15 Mbps up (90 Mbps of bandwidth in total), to 364 customers (32,800 Mbps / 90 Mbps) in each 300,000 sq. km area – an area that's just under half the size of Alberta. However, it is likely that the service is already oversubscribed as speeds are falling below what is advertised, as indicated by Ookla, an internet speed test provider who has been tracking actual Starlink speeds across the globe.[1]

[1] Starlink Slowed in Q2, Competitors Mounting Challenges

This capacity issue is also why Starlink lost US$900M in US federal funding in August 2022. The FCC concluded that the Starlink "application failed to demonstrate that the provider could deliver the promised services."[2]

Figure 4: Starlink satellite Internet coverage in Stony Plain

As illustrated in the map, Starlink service is available in most neighborhoods of Stony Plain with the exception of some parts of Meridian Meadows. To date, no Starlink speed tests have been run in Stony Plain.

Xplore

The acquisition of Xplornet by Stonepeak Partners in early 2020 provided the organization with the capital required to expand its services footprint significantly, both through acquisitions and infrastructure deployment. In Alberta, they acquired CCI Wireless in late 2020 and put together grant applications to both the UBF and the CRTC's Broadband fund for a number of large regional infrastructure plays that include Canadian Infrastructure Bank (CIB) funding. Xplore's multi-tiered approach to services in rural areas includes geo-synchronous satellite services for the most remote households. This is in addition to services they provide via large-cell FWA technology for the low-density areas (the predominant approach within the Stony Plain area) and small-cell FWA technology or FTTP to fill in pockets of density within large-cell areas such as hamlets or rural subdivisions.

[2] FCC Rejects LTD Broadband, Starlink Bids for Broadband Subsidies

Internet Service Levels

Often times, residents and businesses find that the advertised 'up to' speeds they are paying for are not always what they experience. In order to gain an understanding of the actual service levels provided by the ISPs in Stony Plain, an Internet Performance Test tool developed by Canadian Internet Registration Authority (CIRA) was made available to residents and businesses in Stony Plain, alongside residential and business surveys. They were available on Stony Plain's website and were promoted through all social media platforms, the Economic Development Newsletter, and mentioned on 88.1 The One radio multiple times to encourage residents to run the speed tests on their devices at various times of the day and on various days of the week. As CIRA tests are conducted using test nodes located at Internet exchange points, rather than at nodes favoring an ISP's network, the results are more reflective of the actual speeds experienced under real network conditions.

Based on CIRA test results from the past few years, Stony Plain ranked 18th for median download speeds at approximately 34 Mbps on a list of over 200 cities and towns across Canada.

There were just over 600 CIRA test results collected in Stony Plain from May 25, 2015, to January 4, 2023, and the median Internet speeds in each subdivision are shown in the table below. The subdivision map can be found in the figure below. Unfortunately, there were insufficient results to adequately document speeds in all subdivisions.

Table 4: Median download and upload speeds in Stony Plain subdivisions

#	Subdivision	Median Download Speed	Median Upload Speed
1	Meridian Meadows	17 Mbps	8 Mbps
2	Legends Trail	6 Mbps	1 Mbps
3	Umbach Business Park	27 Mbps	4 Mbps
4	North Business Park	22 Mbps	6 Mbps
5	Old Town North	8 Mbps	2 Mbps
6	Meridian Cove	172 Mbps	8 Mbps
7	St. Andrews	62 Mbps	12 Mbps
8	Brookview/ Homesteads	35 Mbps	14 Mbps
9	South Business Park	284 Mbps	36 Mbps
10	Sandstone/ Silverstone	No Tests	No Tests
11	Jutland Ridge/Sun Meadows	7 Mbps	11 Mbps
12	Brickyard	189 Mbps	54 Mbps
13	Tiffany	131 Mbps	29 Mbps
14	Heritage Estates	13 Mbps	2 Mbps
15	Old Town South	52 Mbps	11 Mbps
16	The Glens	7 Mbps	3 Mbps
17	Folkstone	No Tests	No Tests
18	Downtown	20 Mbps	11 Mbps
19	49th Ave Commercial Corridor	29 Mbps	9 Mbps
20	Egerland Place/Heritage Court	29 Mbps	9 Mbps
21	Forest Green	144 Mbps	11 Mbps
22	Fairways	271 Mbps	41 Mbps
23	Graybriar	63 Mbps	14 Mbps
24	Whispering Cove/Woodlands	49 Mbps	11 Mbps
25	Southridge	50 Mbps	17 Mbps
26	Creekside/Stony Creek	No Tests	No Tests
27	Sommerville	No Tests	No Tests
28	South Creek	270 Mbps	23 Mbps
29	Rosenthal Estates	No Tests	No Tests
30	Willow Park	63 Mbps	8 Mbps
31	High Park	26 Mbps	9 Mbps
32	Cedar Brae	No Tests	No Tests
33	Genesis on the Lake	275 Mbps	23 Mbps
34	Westerra (West)	68 Mbps	27 Mbps
35	Westerra (East)	138 Mbps	15 Mbps
36	Country Plain Estates	29 Mbps	8 Mbps

LEGEND
50/10 Mbps or greater
Less than 50/10 Mbps
No data available

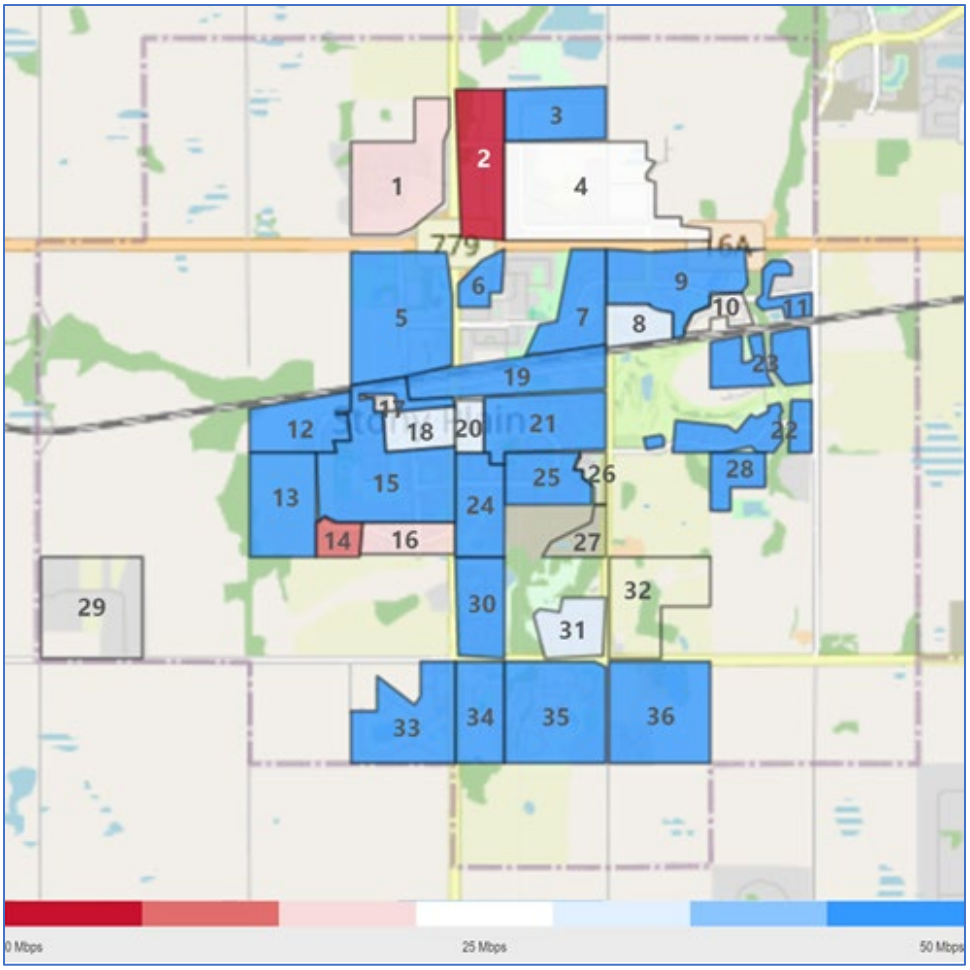


Figure 13: CIRA speed test results in Stony Plain as of January 4, 2023

As illustrated in the table, there were 6 subdivisions in which no tests were run, 15 subdivisions with median speeds under the 50/10 Mbps CRTC target[3], and 15 subdivisions with median speeds above 50/10 Mbps.

The majority of the subdivisions located near the center of Town, in the north-east part south of Highway 16A, and on the southside of Town had median download speeds above 100 Mbps. Interestingly, Downtown – even though surrounded by high-speed neighborhoods – showed only about 20 Mbps. The areas of Heritage Estates and The Glens both had very low median speeds of only 13 Mbps and 8 Mbps despite being covered under both Shaw's HFC and TELUS' fibre infrastructures. This could be due residents not being aware of Shaw services, to TELUS' fibre services not made available yet, and/or residents not having chosen fibre Internet plans. The areas north of Highway 16A, which includes Meridian Meadows and the northern business parks, showed lower speeds of around 17 Mbps. Old Town North only had 8 Mbps speeds despite being next to Old Town South which showed 52 Mbps.

[3] The 50/10 Mbps target is the minimum service objective for Canada set by the CRTC in the *Telecom Regulatory Policy CRTC 2016-496*. The Government of Canada uses this speed threshold to determine if an area qualifies for federal broadband funding.

Considering the recent infrastructure upgrades by TELUS and Shaw, more recent CIRA tests from August 29, 2022 – January 4, 2023, were analyzed to gauge the impact of the upgrades on Internet speeds. These aggregated CIRA results are plotted on a histogram below. In the plot, the upstream and downstream results are sorted and plotted separately. This means that, for example, test 186 does not represent upstream and downstream results for a single test, but rather the 186th result from the sorted upstream values and the 186th result from the sorted downstream values.

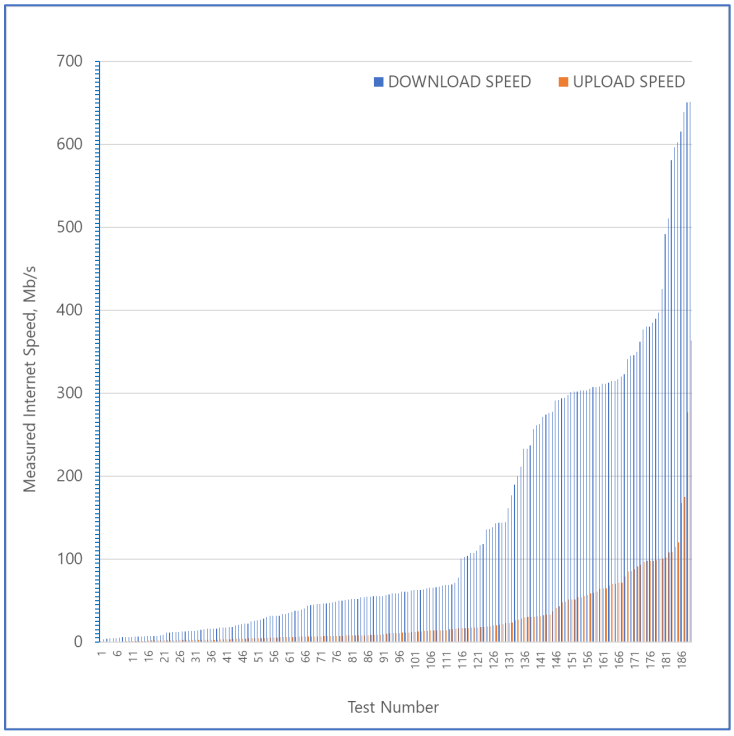


Figure 14: CIRA speed test results in Stony Plain

Even though the overall differences between the upstream and downstream values are visually apparent from the above diagram, a more quantitative view is provided by the so-called box and whisker plot. As shown in the figure below, box plots divide the results into four quartiles, wherein each quartile represents 25% of the results. The box represents results falling within the 2nd and 3rd quartiles, or those results representing the middle 50% of the results collected – also referred to as the interquartile range. The median result marks the mid-point of the data – so 50% of the speeds collected fall below the median, while the remaining 50% lie above.

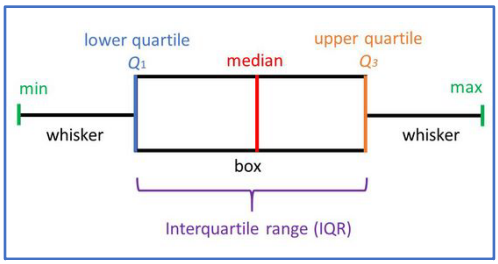


Figure 15: Box plot representations

Calculation of box plots also includes removal of 'outliers' which are those values that lie beyond 1.5 times the interquartile range. A box plot with the overall results for TELUS and Shaw services, together with a table summarizing the results appear below. Though the outlier results extend to around 650 Mbps, the vertical scale has been limited to 600 Mbps to showcase the interquartile range in greater detail.

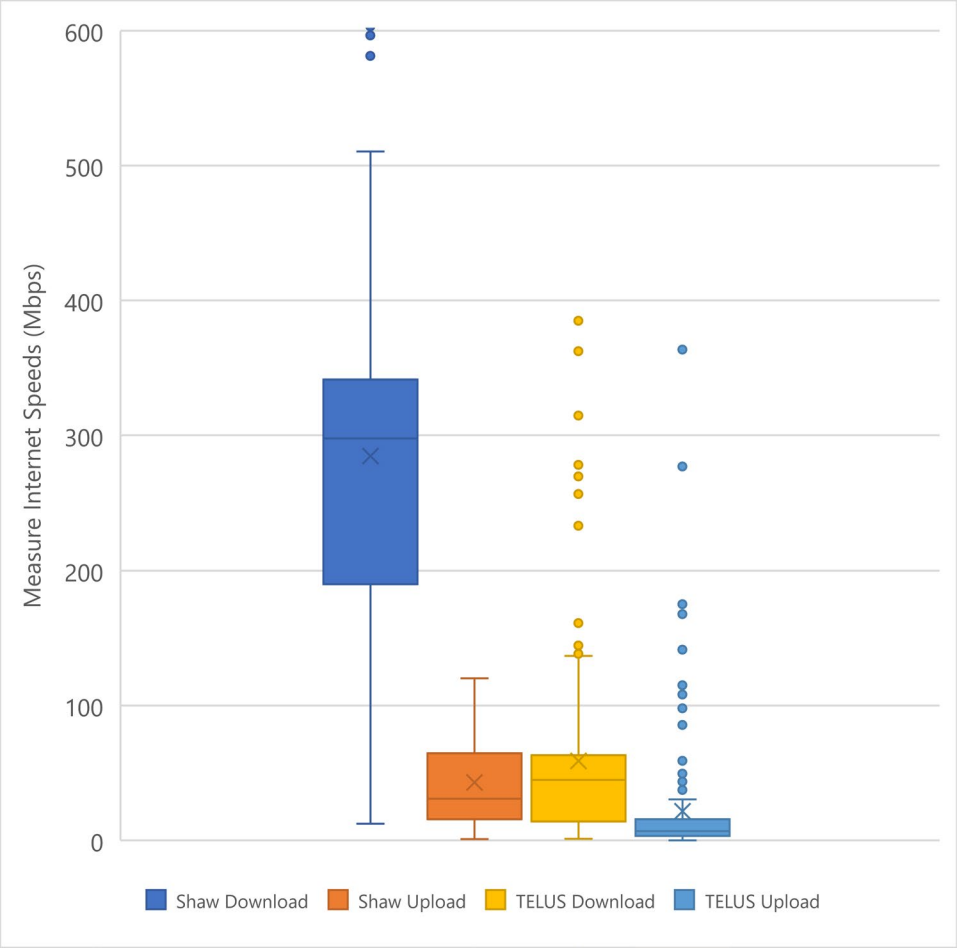


Figure 16: Box plot results for Shaw and TELUS Internet speeds

Table 5: CIRA test results for Shaw and TELUS Internet speeds

	Download		Upload	
	Shaw	**TELUS**	**Shaw**	**TELUS**
Maximum	651.6	385.0	120.2	363.6
Q3	341.5	63.1	64.1	14.8
Average (x)	284.8	58.8	43.0	21.2
Median	297.8	45.0	31.0	7.0
Q2	194.8	14.1	16.2	3.2
Minimum	12.4	1.2	1.1	0.1

On average, current service levels offered by Shaw and TELUS exceed the CRTC objectives of minimum 50 Mbps download and 10 Mbps upload speeds. However, Shaw's median download and upload speeds are 6-times and 4-times those experienced by TELUS customers.

As mentioned previously, often times customers do not experience the advertised "up to" speeds that they pay for. To gain an understanding of the difference between the service levels for popular ISPs, an analysis was conducted looking at the advertised maximum Internet speeds by Shaw and TELUS in each of the neighborhoods of Stony Plain. The results of this survey were then compared to actual service levels as measured in CIRA tests. The results of this survey are given in the table below.

Table 6: Advertised vs. actual Internet speeds for Shaw and TELUS

#	Area	Shaw – Advertised		Shaw – Tested		TELUS – Advertised		TELUS – Tested	
		Download	**Upload**	**Download**	**Upload**	**Download**	**Upload**	**Download**	**Upload**
1	Meridian Meadows**	N.S.	N.S.	No Tests	No Tests	N.S.	N.S.	17 Mbps	2 Mbps
2	Legends Trail	1.5 Gbps	100 Mbps	No Tests	No Tests	15 Mbps	1 Mbps	6 Mbps	1 Mbps
3	Umbach Business Park	N.S.	N.S	No Tests	No Tests	15 Mbps	1 Mbps	14 Mbps	1 Mbps
4	North Business Park**	N.S.	N.S	No Tests	No Tests	75 Mbps	15 Mbps	22 Mbps	6 Mbps
5	Old Town North	1 Gbps	100 Mbps	65 Mbps	68 Mbps	15 Mbps	1 Mbps	14 Mbps	1 Mbps
6	Meridian Cove	1 Gbps	100 Mbps	377 Mbps	24 Mbps	50 Mbps	10 Mbps	No Tests	No Tests
7	St. Andrews	1.5 Gbps	100 Mbps	341 Mbps	109 Mbps	150 Mbps	30 Mbps	55 Mbps	8 Mbps
8	Brookview/Homesteads	1.5 Gbps	100 Mbps	No Tests	No Tests	50 Mbps	10 Mbps	35 Mbps	14 Mbps
9	South Business Park	1.5 Gbps	100 Mbps	294 Mbps	51 Mbps	150 Mbps	30 Mbps	No Tests	No Tests
10	Sandstone/Silverstone	1.5 Gbps	100 Mbps	No Tests	No Tests	150 Mbps	30 Mbps	No Tests	No Tests
11	Jutland Ridge/Sun Meadows	1.5 Gbps	100 Mbps	No Tests	No Tests	75 Mbps	15 Mbps	No Tests	No Tests
12	Brickyard	1.5 Gbps	100 Mbps	301 Mbps	98 Mbps	1.5 Gbps	940 Mbps	No Tests	No Tests
13	Tiffany	1 Gbps	100 Mbps	No Tests	No Tests	50 Mbps	10 Mbps	No Tests	No Tests
14	Heritage Estates	1 Gbps	100 Mbps	No Tests	No Tests	15 Mbps	1 Mbps	No Tests	No Tests
15	Old Town South	1 Gbps	100 Mbps	390 Mbps	59 Mbps	150 Mbps	30 Mbps	45 Mbps	7 Mbps
16	The Glens	1 Gbps	100 Mbps	201 Mbps	87 Mbps	75 Mbps	15 Mbps	7 Mbps	3 Mbps
17	Folkstone	1.5 Gbps	100 Mbps	No Tests	No Tests	25 Mbps	5 Mbps	No Tests	No Tests
18	Downtown	1 Gbps	100 Mbps	34 Mbps	30 Mbps	75 Mbps	15 Mbps	12 Mbps	4 Mbps
19	49th Ave Commercial Corridor	1.5 Gbps	100 Mbps	260 Mbps	41 Mbps	50 Mbps	10 Mbps	22 Mbps	9 Mbps
20	Egerland Place/Heritage Court	1.5 Gbps	100 Mbps	44 Mbps	16 Mbps	50 Mbps	10 Mbps	15 Mbps	3 Mbps
21	Forest Green	1 Gbps	100 Mbps	350 Mbps	18 Mbps	2.5 Gbps	2.5 Gbps	27 Mbps	5 Mbps
22	Fairways	1 Gbps	100 Mbps	284 Mbps	83 Mbps	150 Mbps	30 Mbps	65 Mbps	2 Mbps
23	Graybriar	1 Gbps	100 Mbps	261 Mbps	12 Mbps	1.5 Gbps	940 Mbps	63 Mbps	11 Mbps
24	Whispering Cove/Woodlands	1.5 Gbps	100 Mbps	377 Mbps	24 Mbps	50 Mbps	10 Mbps	49 Mbps	7 Mbps
25	Southridge	1.5 Gbps	100 Mbps	398 Mbps	17 Mbps	2.5 Gbps	2.5 Gbps	49 Mbps	16 Mbps

26	Creekside/Stony Creek	1 Gbps	100 Mbps	No Tests	No Tests	2.5 Gbps	2.5 Gbps	No Tests	No Tests
27	Sommerville	1.5 Gbps	100 Mbps	No Tests	No Tests	1.5 Gbps	940 Mbps	No Tests	No Tests
28	South Creek	1 Gbps	100 Mbps	No Tests	No Tests	1.5 Gbps	940 Mbps	270 Mbps	23 Mbps
29	Rosenthal Estates	N.S.	N.S.	No Tests	No Tests	N.S.	N.S.	No Tests	No Tests
30	Willow Park	1 Gbps	100 Mbps	210 Mbps	28 Mbps	150 Mbps	30 Mbps	47 Mbps	8 Mbps
31	High Park	1.5 Gbps	100 Mbps	112 Mbps	61 Mbps	75 Mbps	15 Mbps	17 Mbps	5 Mbps
32	Cedar Brae	1.5 Gbps	100 Mbps	No Tests	No Tests	50 Mbps	10 Mbps	No Tests	No Tests
33	Genesis on the Lake	1 Gbps	100 Mbps	305 Mbps	28 Mbps	1.5 Gbps	940 Mbps	No Tests	No Tests
34	Westerra (West)	1 Gbps	100 Mbps	187 Mbps	12 Mbps	1.5 Gbps	940 Mbps	233 Mbps	41 Mbps
35	Westerra (East)	1 Gbps	100 Mbps	190 Mbps	43 Mbps	150 Mbps	30 Mbps	141 Mbps	58 Mbps
36	Country Plain Estates	1.5 Gbps	100 Mbps	No Tests	No Tests	150 Mbps	30 Mbps	62 Mbps	8 Mbps

LEGEND

	Coax and copper-based services
	TELUS PureFibre to be completed
	Unserved/underserved area

*N.S.: No Service.

**Although some premises have access to 1000/100 Mbps speeds from Shaw, not all premises are covered, and deployment appears sporadic.

Data used for TELUS and Shaw tested speeds was based on CIRA results from August 2022 – January 2023.

In analyzing the data, the following observations are important to note:

- Comparison between the advertised and observed median Internet speeds shows that, on average, both download and upload speeds are 300 - 400% lower for both Shaw and TELUS. However, note that the advertised speeds are the maximum offered and that the tested speeds will be impacted by the service tier the customers have subscribed to. As such, it is likely that many residents and businesses across Stony Plain are not subscribed to the highest level of service that they have access to.
- As observed when reviewing infrastructure gaps and confirmed when reviewing service levels, only four areas within Stony Plain are not served or underserved, which includes areas north of Highway 16A (Meridian Meadows, Umbach Business Park, and the North Business Park) and rural areas such as Rosenthal Estates.
- All other subdivisions have access to speeds greater than 1 Gbps / 100 Mbps through Shaw, with eleven subdivisions that have access (or will have access in the future) to TELUS Purefibre, with symmetrical 1 Gbps speeds or greater.

Based on the infrastructure and service levels data, the majority of the Town is currently well serviced.

Residential and Business Survey Results

Stony Plain ran both a residential and business survey pertaining to Internet usage and experience. Specifically, the objectives of these survey were to:

- Understand where priority areas for broadband infrastructure development are;
- Gather anecdotal evidence on current state pain points; and
- Understand how businesses and home lives are transforming, and how much bandwidth this requires.

The surveys ran from October 11 to November 16, 2022, and surveys were made available via Stony Plain's website, promoted on social media, 88.1 The One radio news and in the Economic Development Newsletter. In total, 39 residents and 10 representatives from businesses took part. Considering the population of Stony Plain (~18,000) and the total number of businesses (~600), the sample size of responses has a margin of error of +/- 15% and +/- 30% respectively at a 95% confidence level. In other words, results can provide a general sense of sentiment but need to be understood in conjunction with additional data, such as infrastructure and service level information.

The respondents were first asked to provide information about their current Internet service provider (ISP), the results of which are given in figure below.

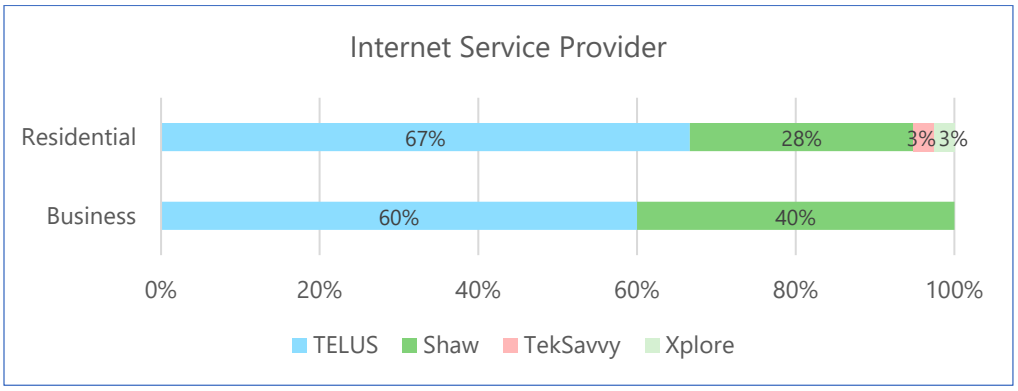


Figure 17: Internet service provider by premise type

TELUS is the most popular ISP with over two-thirds respondents citing them as their provider. Shaw is the second most popular ISP with Xplore and TekSavvy accounting for a small percentage. This provides further evidence that many of Stony Plain's businesses and residents are not subscribing to the highest tiers of service available, which is currently provided by Shaw in most areas of Stony Plain.

With more and more people working or studying from home after the COVID pandemic, and with the increasing need for reliable Internet service, respondents were asked about the importance of Internet access at home. As illustrated in the figure below, almost 70% of the residential respondents said that they either worked or studied from home, and the majority of the respondents rated home Internet access being *Extremely Important* to them. At the same time, half of the business respondents said that they were a home-based business who utilized their Internet for personal use as well.

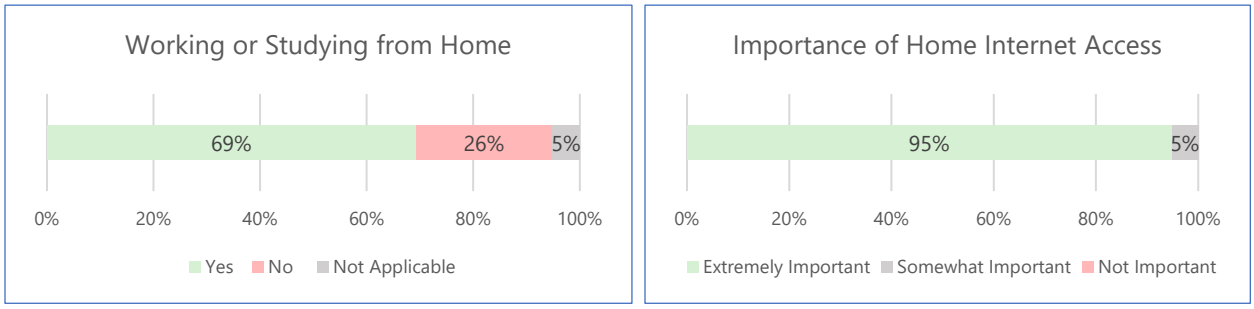


Figure 18: Importance of Internet access for working or studying from home

Respondents were also asked to rate their satisfaction with the speed, reliability, value, and customer service of current Internet service providers. The given choices included 'Perfect', 'Excellent', 'Good', 'Alright', 'Terrible' and 'Worst of the worst'. In the results showcased in the figures below, *Satisfied* includes the first three choices, *Neutral* includes those who responded 'Alright', and *Not Satisfied* includes the last two choices.

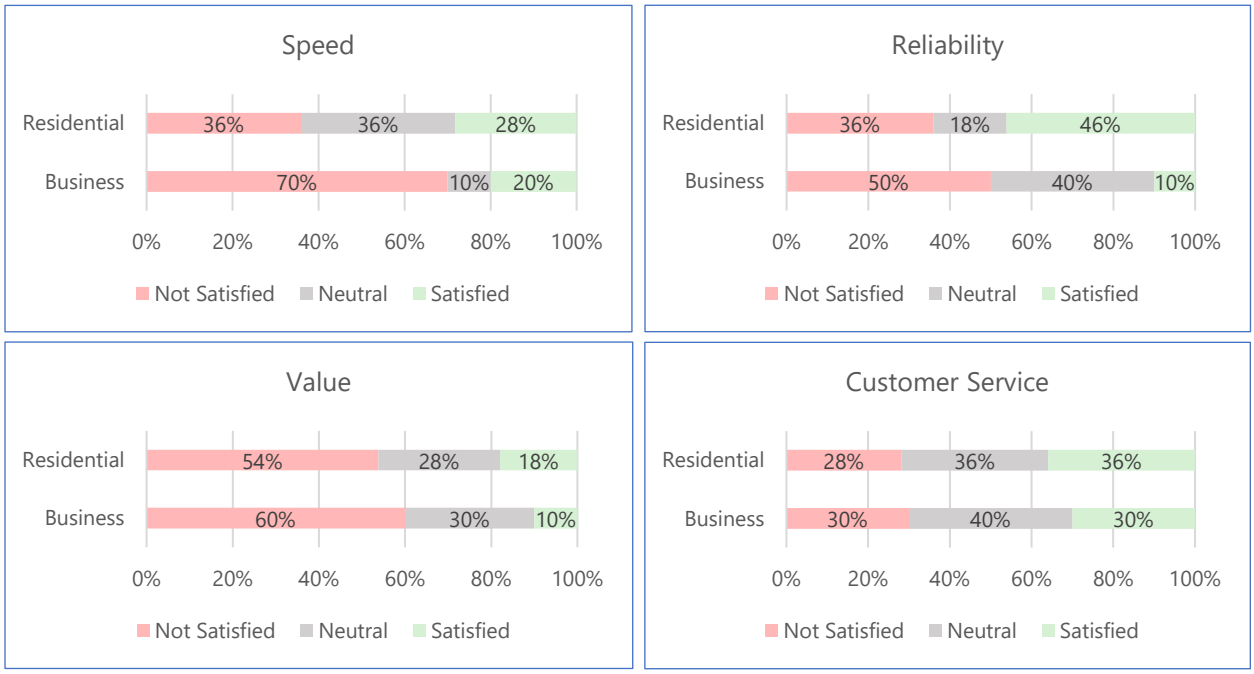
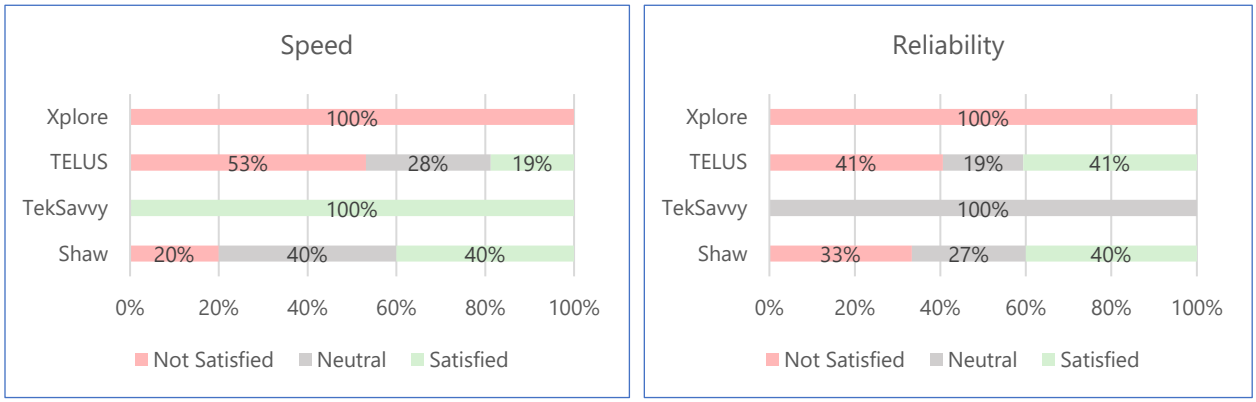


Figure 19: Internet speed, reliability, value and customer service per premise type

64% of resident respondents rated that they were *Neutral* or *Satisfied* with Internet speeds, while only 30% of business respondents were *Neutral* or *Satisfied*. Satisfaction with reliability largely matched satisfaction with speed for residents, while there was a slightly more positive sentiment for businesses in terms of reliability. Value of the service had the largest degree of negative sentiment across the board with only 18% and 10% satisfaction from residents and businesses respectively. Lastly, sentiment around customer service was mostly spread evenly across the three satisfaction levels for both groups.

The same satisfaction categories were also plotted against service providers to understand sentiment for each ISP. The results of this analysis are given in the figure below.



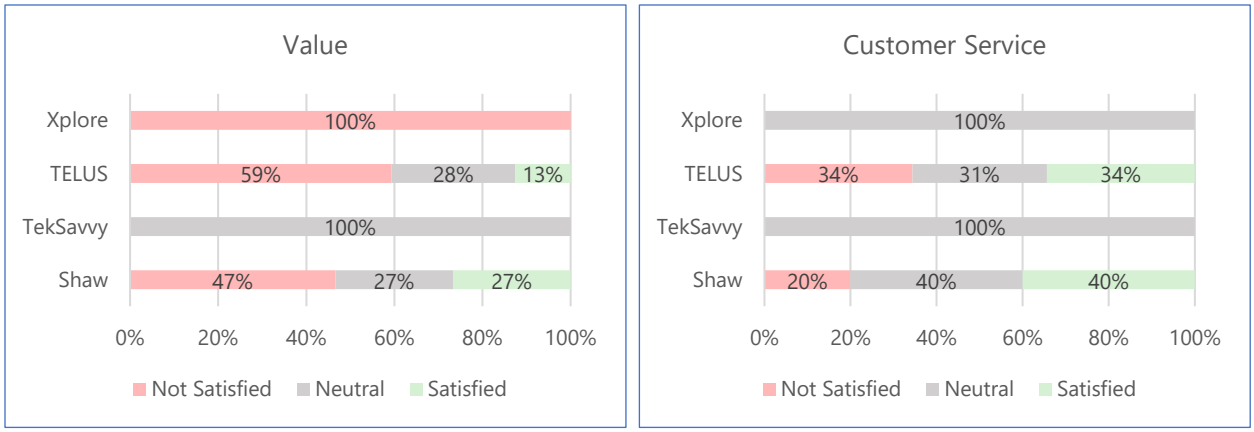


Figure 20: Internet service speed, reliability, value and customer service per ISP

As there was only one response each for Xplore and TekSavvy, their results were swayed across the categories and hence, they might not be representative of the overall sentiment for these ISPs.

When it came to Internet speeds, 80% of Shaw subscribers were *Neutral* or *Satisfied* as opposed to only 47% for TELUS. Reliability had the largest positive sentiment with 40% satisfaction for both ISPs. On the contrary, value received the highest negative sentiment with 59% TELUS and 47% Shaw subscribers rated as *Not Satisfied*. Customer service was spread almost evenly across the three choice types for TELUS, while Shaw had slightly more positive sentiment with 80% subscribers rated as *Neutral* or *Satisfied*.

With the CRTC objectives focused on minimal service levels of 50 Mbps download and 10 Mbps upload in mind, respondents were asked what Internet speeds they were currently paying for.

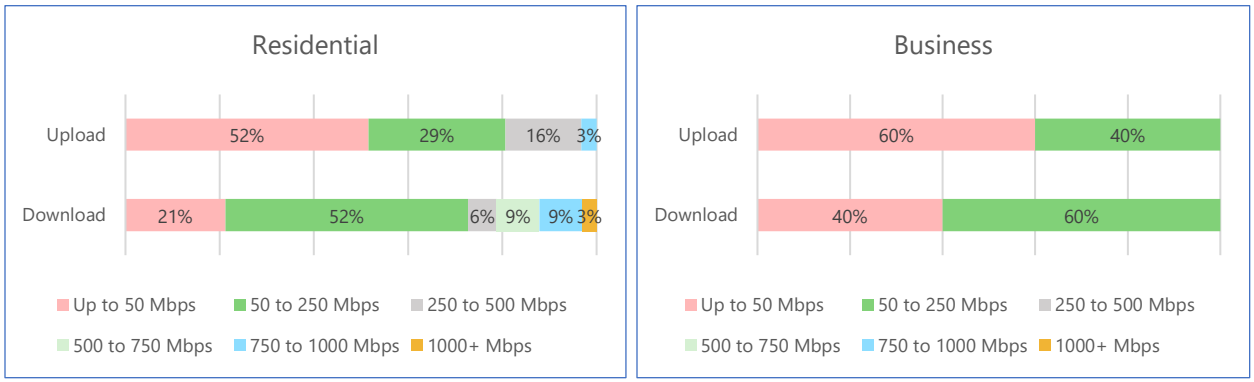


Figure 21: Internet speed plans being utilized by premise type

In general, and once again, it can be observed that the majority of respondents likely do not subscribe to the highest Internet speeds available to them. All of the business respondents selected either 'Up to 50 Mbps' or '50 to 250 Mbps' upload and download speeds suggesting that none of them were paying for fibre Internet. 70-80% of residential respondents were paying for the same two categories of speeds.

These results were also plotted for the two most popular ISPs – TELUS and Shaw.

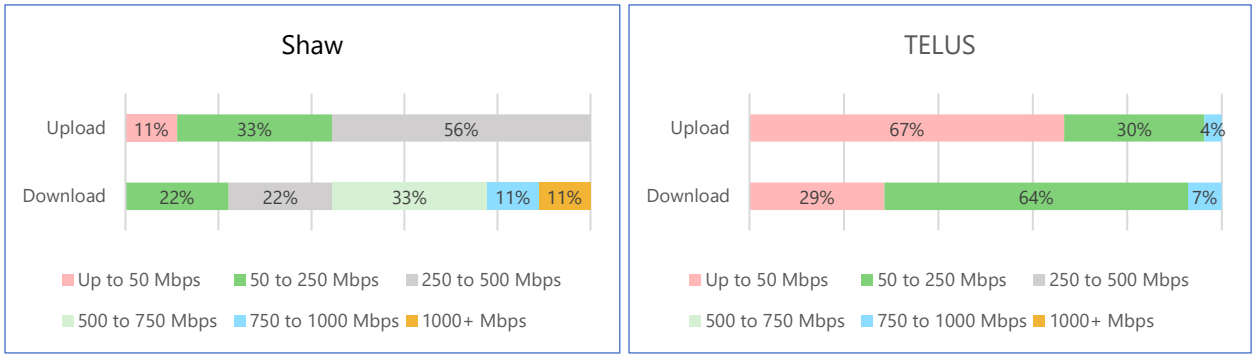


Figure 22: Internet speed plans being utilized per ISP

In general, more respondents were paying for higher Internet speeds from Shaw compared to TELUS. Download speeds were relatively spread evenly across the categories for Shaw, while majority of the download speeds fell under '50 to 250 Mbps' category for TELUS.

As the need for higher bandwidth increases with the advancements in technology, more devices getting connected and more residents working or studying from home, it is safe to assume that people will likely pay for higher service levels in order to get their desired Internet speeds. Indeed, when asked if they expected their use of Internet to increase in the next 3, 5 or 10-year time frames, majority of the respondents answered *Yes* as shown in the figure below.

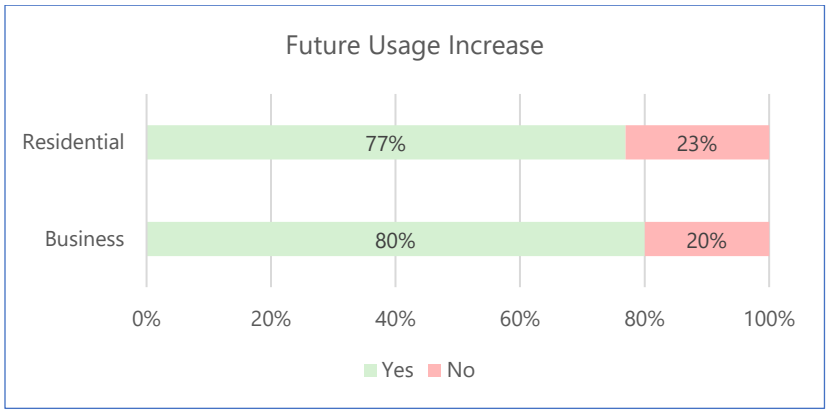


Figure 23: Expected future increase in the use of Internet

Finally, when asked about what level of involvement Stony Plain should have in ensuring that the community's future needs can be met, majority of the business respondents felt that it should be *Medium-High*, while most the residential respondents were split almost evenly between *Low*, *Medium* and *High* with some even saying *None*. In general, this indicates that residents and businesses would support Stony Plain taking action on ensuring that the highest speeds are available and subscribed to.

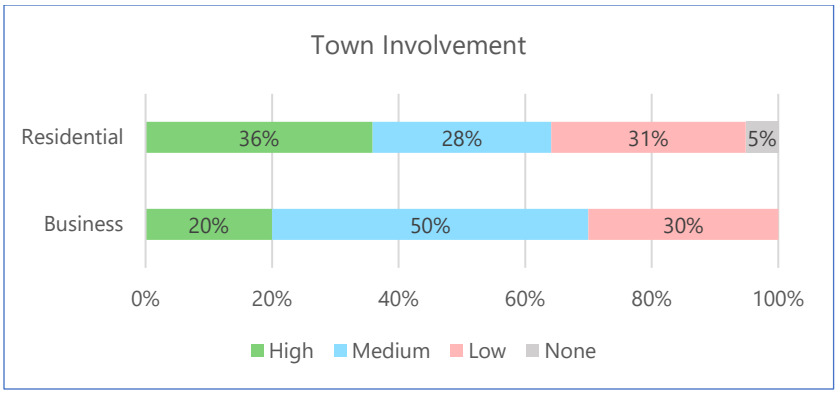


Figure 24: Expected involvement from Stony Plain in Internet development

Market Analysis

Broadband Landscape

Canada's CRTC policy objective of 50 Mbps downstream and 10 Mbps upstream is 'middle of the road' from a global perspective, as can be seen in the figure below. This objective of 50/10 Mbps partly reflects the policy's age (which was written in 2016) and, arguably, a desire to ensure the suitability of fixed wireless access technologies in rural areas[4].

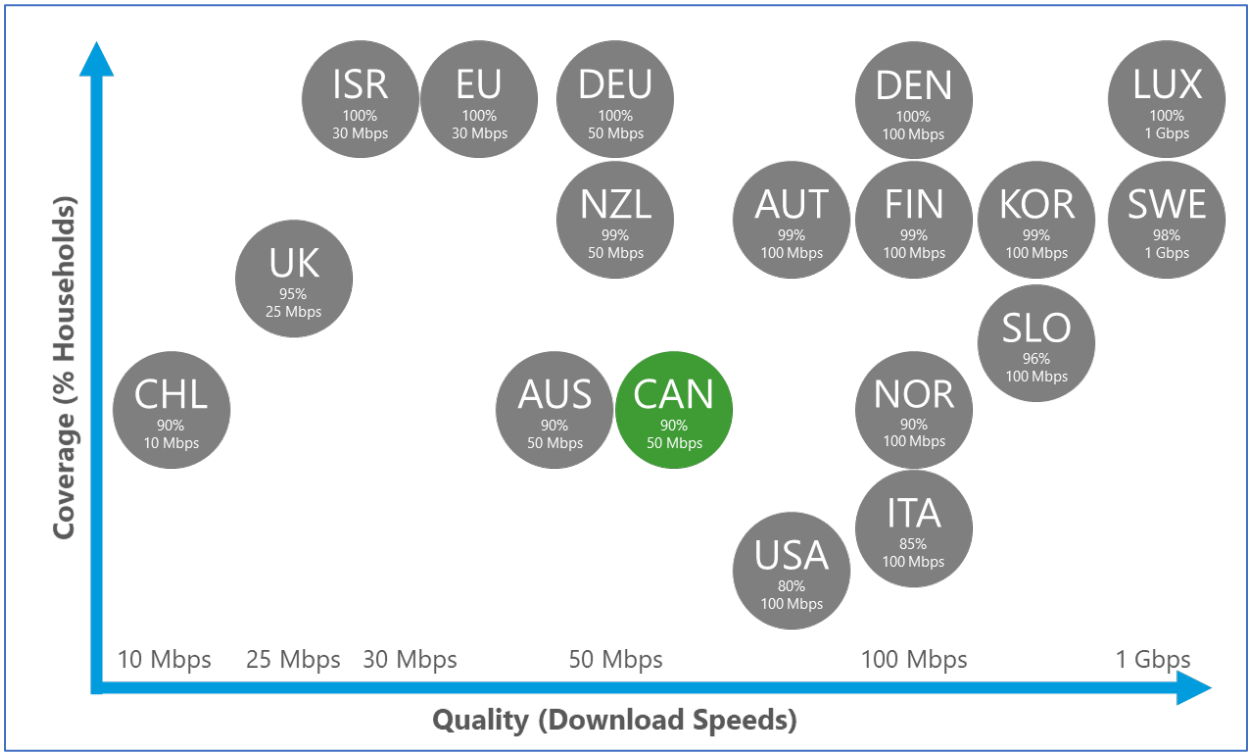


Figure 25: Global Internet speeds and household coverage objectives

Globally, these aspirational goals and the recognition of broadband as critical infrastructure have led to an unprecedented level of government funding. For example, based on estimates from the *Fiber Broadband Association,* the *Federal Communications Commission,* and *Independence Research* analysis, in the US, this cumulative funding is in the ballpark of US$70-80 Billion, and it is expected to bring fiber-based availability to over 95% of U.S. homes and businesses.

In Canada, the levels of committed public funding have increased significantly in recent years. According to a market analysis study conducted by *Digital Ubiquity Capital*, public funding commitments from the

[4] Telecom Regulatory Policy CRTC 2016-496

Federal, Provincial, and Territorial governments have increased 2.7 times from $5.2B in 2019 to $14.1B in 2022.

These broadband improvement projects, supported by public funding, have made substantial progress towards achieving Canada's overall objective of 50/10 Mbps speeds in at least 90% of Canadian households in 2021, 95% in 2026 and 100% by 2030. Progress as of August 2022 is illustrated in the figure below.

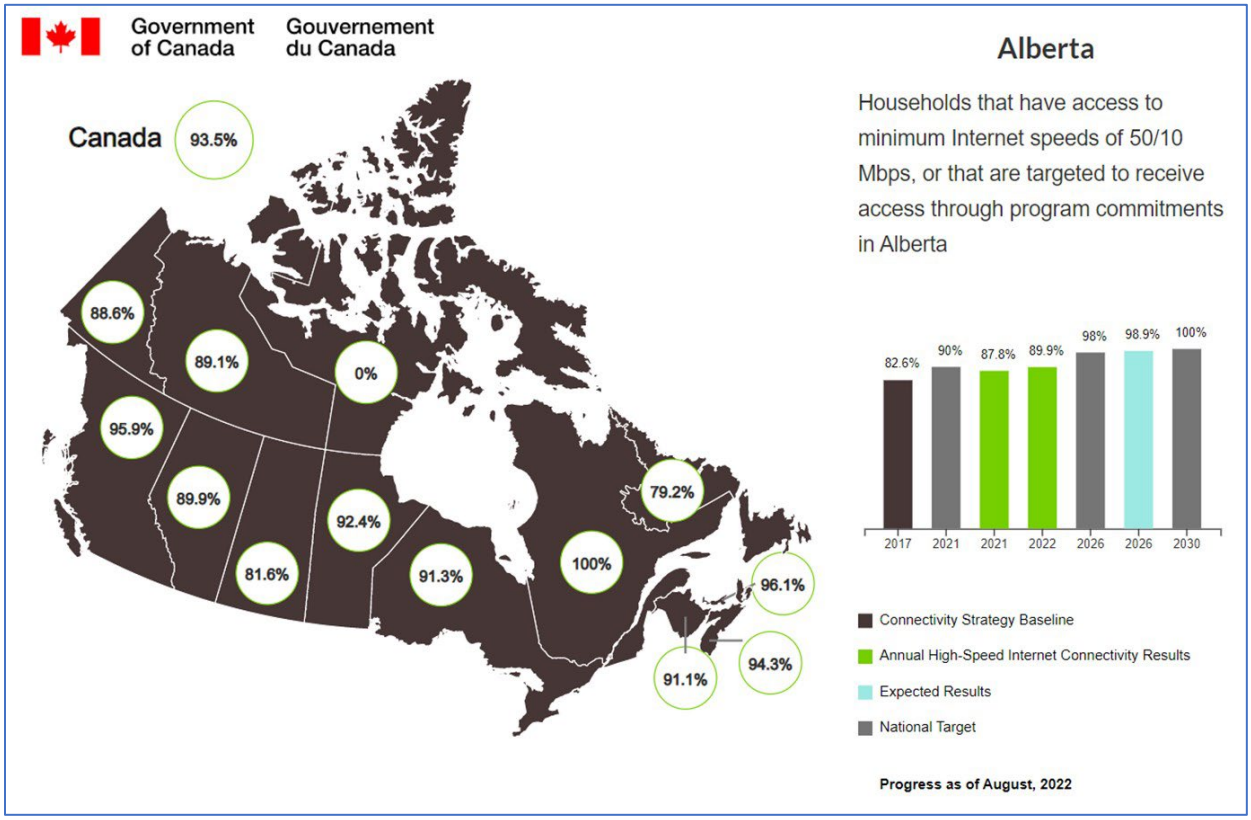


Figure 26: Progress towards achieving 50/10 Mbps target by province

Government of Canada

Industry, Science and Economic Development

ISED is a department of the Federal Government of Canada that works "to improve conditions for investment, enhance Canada's innovation performance, increase Canada's share of global trade and build a fair, efficient and competitive marketplace."[5] Given this broad mandate, ISED falls under four ministers:

- Minister of Innovation, Science and Industry
- Minister of International Trade, Export Promotion, Small Business and Economic Development
- Minister of Tourism and Associate Minister of Finance

[5] Government of Canada Website - ISED Homepage

- Minister of Rural Economic Development

Both Innovation, Science and Industry, and Rural Economic Development have an interest and play a role in enhancing broadband services in Canada. Given the proposed Shaw/Roger's merger (discussed further in this section), the Competition Bureau is also involved.

In recognition that broadband connectivity plays a vital role in achieving their goals, ISED developed the strategy document *High-Speed Access for All: Canada's Connectivity Strategy* in 2019. The strategy has an outlook to 2030 and has three overarching pillars, which are summarized below:

1. **High-Speed Access for All** – Further refines targets of 50 Mbps download / 10 Mbps upload and expanded mobile wireless; to reach 90% of all households by 2021, 98% by 2026, and 100% by 2030. Other important considerations include affordability, reliability, and scalability (ability to upgrade for faster speeds).
2. **Investing for Impact** – Specifies funds that are targeted where the private sector is not investing and that need to leverage other tools such as access to spectrum and existing infrastructure.
3. **Partnering for Progress** – Ensures that new funding will be rolled out in coordination with existing programs, will consider the needs of all stakeholders, and that tools are made available that simplifies application development (such as enhanced data sets that can be used for planning and a new online portal (canada.ca/get-connected)).

High-Speed Access for All sets out clear goals as defined above, while **Investing for Impact** outlines the funds that will be made available and **Partnering for Progress** ensures that the voice of stakeholders is heard when developing criteria for application eligibility.

To spur investments in broadband infrastructure across Canada, ISED set up a $3.225B Universal Broadband Fund in 2019 with the aim of connecting 98% Canadians to reliable high-speed Internet by 2026 and 100% of Canadians by 2030. UBF received almost 1,900 applications from all over Canada before it was closed on March 15, 2021. It is unclear at this point if there will be any funding left over after all of the current applications have been processed. However, Prime Minister, Justin Trudeau, announced on November 8, 2022, a $475M top-up to the UBF to further help rural areas across Canada achieve high-speed Internet. Also, it is important to note that the Government of Alberta has promised to provide $390M in matching funds to UBF projects awarded to Alberta communities.

To avoid duplicated applications, ISED stated that application requirements for both the UBF and the CRTC's complementary $750M Broadband Fund (also launched in 2019) would remain largely the same, and applicants would be eligible for funding from both. In addition to coordinating efforts between the UBF and CRTC's Broadband Fund, ISED has been working with Infrastructure Canada (INFC)'s $2 billion Rural & Northern Communities Infrastructure Stream and Canada Infrastructure Bank (CIB), which is seeking to invest $1 billion over the next 10 years in infrastructure projects, including broadband infrastructure.

In conjunction with the UBF and CRTC, ISED produced a National Broadband Internet Service Availability Map in 2019 (most recently updated on November 8th, 2022) indicating their view of Internet services availability across Canada. To qualify for access funding, the proposed coverage area must be shown on the map to have service levels below the 50/10 Mbps target. The services to Stony Plain appear in the maps below.

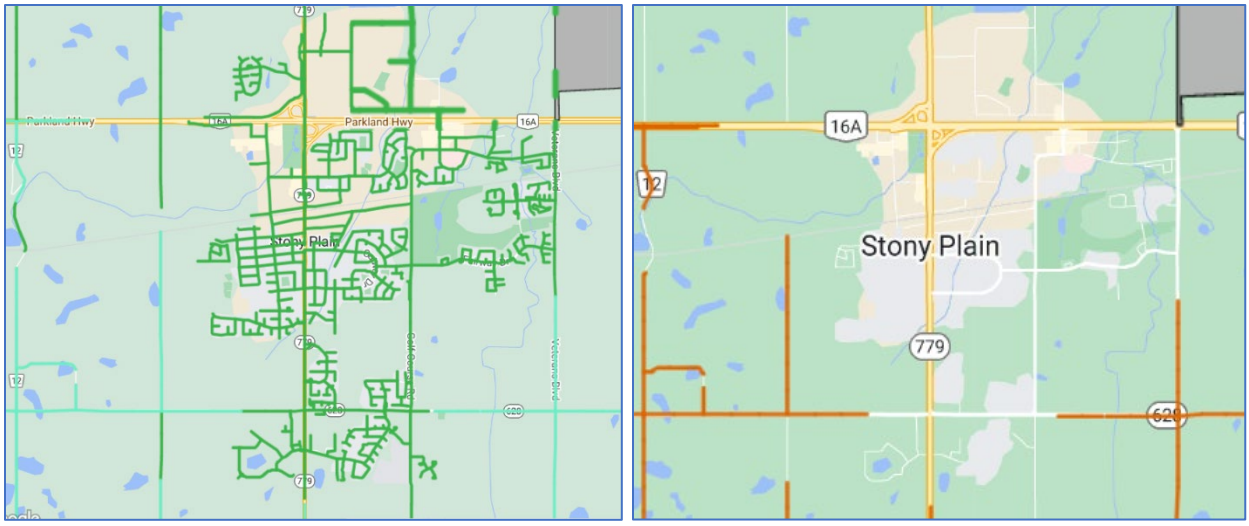


Figure 27: ISED report on Stony Plain Internet service levels

The map on the left was produced using the National Broadband Internet Service Availability Map, which shows that a minimum of 50/10 Mbps speeds are available along the green roadways, while 25/5 Mbps speeds are shown in teal. Furthermore, when utilizing the Eligibility Mapping Tool, an alternate view seen on the right can be produced. Road segments, which are highlighted in orange, indicate areas where funding can be accessed. This showcases eligibility for Rosenthal Estates and other rural areas within Stony Plain's boundaries.

Canada Infrastructure Bank (CIB)

The CIB provides loans and equity for large-scale high-speed Internet projects in unserved and underserved communities. In line with its objectives of investing in the next generation of infrastructure to drive sustainable economic growth, connected communities and climate change action, CIB is investing $3B to provide low-cost, flexible financing to broadband projects to connect many premises that would otherwise not be commercially viable. The financing requires a private partner to assume risk and deal sizes requiring at least $20M in financing. CIB is collaborating with ISED to encourage, jointly assess and enable these types of broadband projects. Investments from CIB will be made alongside contributions from ISED, private capital from ISPs and private investors to connect Canadians.

To qualify for CIB support, Stony Plain would need to partner with surrounding municipalities to aggregate a proposal requiring capital well in excess of $20M.

Connect to Innovate

Connect to Innovate funds projects that bring improved Internet speeds to rural and remote communities in Canada. The program has committed $585M to improve connectivity in over 975 rural and remote communities, including 190 Indigenous communities, by 2023. Even though the program is currently not accepting any new applications, there is a possibility of additional funding in the future.

Canadian Radio-television and Telecommunications Commission

Though the structurally separated utility model is key to many successful deployments globally, the 'facilities-based' competition policy in Canada– which means each telecommunications company needs to deploy its own network to provide retail telecom services – has inhibited its adoption in Canada. As a result, competition in Canada is limited to those companies with the capital required to deploy a network, rural

deployments remain limited, and, in smaller urban centres where only one network can be justified, the first in with fibre enjoys a long-term de facto monopoly even though there are some CRTC rules for sharing.

Hence, ISPs are rushing to deploy fibre in smaller communities where the financials work and in which they can be first-in. Since the EMRB Broadband Situation Analysis was completed in 2020, this 'land-grab' has become particularly evident in the Edmonton Metropolitan area. TELUS has been deploying fibre within Edmonton for several years now and has since announced and has been building in the City of Leduc, Spruce Grove, St. Albert, and Stony Plain. Shaw is focusing on facility deployments and upgrades in the western portion of the region and Alberta Networks is deploying fibre in Beaumont. Canadian Fibre Optics has the contract for Sturgeon County and there has been wide-ranging interest in the recent broadband deployment and operations RFP issued by Parkland County.

The CRTC 5-year $750M Broadband Fund is to support projects that provide Internet and mobile wireless services in eligible underserved areas of Canada. This funding does not come from tax revenues, but rather from contributions made by large Canadian telecommunications service providers whose annual Canadian revenues amount to at least $10M. There is a set budget available during each of the five years, and the application process involves calls for applications, eligibility, assessment and selection, and announcement of approved projects.

The third call for applications is now open and is focused on transport projects, mobile wireless projects along major transportation roads, and projects requiring operational funding to increase satellite transport capacity. Stony Plain is unlikely to benefit from this round as the focus areas do not cover the types of Internet connectivity required within Stony Plain's boundaries.

Competition Bureau and the Roger/Shaw Merger

On March 15, 2021, Shaw and Rogers announced an agreement for Rogers to acquire Shaw in a $26B transaction creating new jobs and investment in Western Canada and accelerating Canada's 5G rollout. As part of the deal, Rogers promised an investment of $6.5B to build critically needed 5G networks, connect underserved rural and indigenous communities, and bring added choice to residents and businesses in Alberta, British Columbia, Manitoba and Saskatchewan.

The merger is required to go through a multi-layer complex review process that includes multiple regulatory authorities such as the CRTC and House of Commons both of which have completed their review process. A separate review by ISED is still pending, while the Competition Bureau recently raised concerns over the merger with Competition Tribunal, which adjudicates on matters of civil competition and is expected to hold a hearing to decide whether the merger will go ahead. The result of this hearing is still pending.

If the merger were to complete and if Rogers follows through with their promise to invest in 5G network infrastructure connecting rural areas, Stony Plain could benefit from these activities.

Province of Alberta

Alberta Broadband Strategy

Alberta's government has been actively working with municipalities, Indigenous communities and the telecommunications industry to understand the magnitude of Alberta's connectivity problem, and what is required to fix it. Although Edmonton and Calgary have some of the fastest Internet connectivity in Canada, only 33% of rural and 20% of Indigenous communities have services meeting the 50/10 Mbps CRTC targets. As such, the Government of Alberta has committed to achieving 100% connectivity by the end of fiscal year

2026/27 under the *Alberta Broadband Strategy* and as a part of its *Recovery Plan* to build, diversify and create good jobs for Albertans across the province.

In an effort to close the digital divide, the Government of Alberta has secured a matching agreement with the Government of Canada for a total of $780M in funding, with $390M committed by each. This funding, which is a part of the Government of Canada's UBF, will unlock a significant amount of private sector investment, and will be available to support Alberta-based broadband projects including fibre-to-the-home, fixed wireless access, and low earth orbit satellites.

Alberta Broadband Fund

The ABF set up by Government of Alberta is a part of the Alberta Broadband Strategy that is aimed at identifying the unique opportunities and challenges of improving access to broadband connectivity and setting a clear path to eliminate the digital divide as quickly as possible. The Government has allocated $36M to the ABF with applications from communities and service providers now open from December 20, 2022 through March 20, 2023. As eligibility criteria for ABF applications are expected to remain aligned with ISED's UBF guidelines, only applications focused on improving rural connectivity in Stony Plain are likely to qualify.

Loans to Local Authorities

Under its *Grants and Funding for Municipalities* program, The Government of Alberta offers loans to eligible local authorities for projects that require capital financing. The loans are issued every quarter, and a separate application is needed for each capital project along with assurance of security. The loans are structured at fixed rates with blended amortization over 3-40 years and semi-annual payments. The debt limit for most municipalities is calculated based on 1.5 times the revenue.

Private Equity

Partly as a result of COVID, broadband infrastructure is now being seen as a long-term stable asset class, and private capital to fund the required infrastructure is becoming increasingly available.

Private equity was behind two recent acquisitions:

- The acquisition of Xplore by Stonepeak Partners. With the infusion of capital, Xplore acquired WISPs such as CCI Wireless and put together grant applications for a number of large regional infrastructure plays that included CIB funding. In Alberta they were developing applications for southern, central, and northern regions.
- The acquisition of the Zayo Group by affiliates of Digital Colony Partners and the EQT Infrastructure IV fund

Other examples include:

- Agentis is backing significant deployments in southern Manitoba
- US-based Smart City Capital has partnered with several Canadian ISPs –at least one in Alberta and one in Ontario
- Backed by a European fund, the Digital Infrastructure Group (DIG) recently won projects in Vermilion and Beaumont
- Valo, which won the County of Red Deer project is backed by a real estate group.
- Crown Capital out of Toronto is backing the Brooks project.
- Equs, an Alberta electrical co-op, is now working with Valo Networks to leverage its capital pool to enhance broadband services throughout rural areas of the province.

While the investment models vary, most have minimum deal sizes (larger than what's required to improve services in Stony Plain), prefer fibre, and require significant investor control.

Partly in response, TELUS has accelerated its PureFibre deployment plans.

Edmonton Metropolitan Region

Beaumont

The City has currently undertaken a high-speed Internet project called The Beaumont Broadband Network which will connect residents and businesses throughout the entire city to a fibre optic internet network designed to support internet speeds of up to 10 Gpbs. Following a competitive Request for Proposal process in 2021, the City selected Alberta Broadband Networks (A-NET) – a consortium led by Meridiam and the Digital Infrastructure Group – as the preferred proponent to design, finance, construct, own, operate, and maintain the fibre network. The service model will include open access with Primus (Distributel which is being acquired by Bell) as the lead ISP. Construction has begun on the west side of Beaumont and will continue into the next construction season. Completion of the entire network will depend on supply chains and weather conditions but is expected at the end of 2023.

The City is also concurrently planning for Wi-Fi and Smart City applications.

Edmonton

The City of Edmonton is the most well-connected municipality in the Edmonton Region and was one of the first municipalities that TELUS began to target for PureFibre upgrades in 2015 after a commitment of $1B in infrastructure investments in the City. In 2022 alone, $220M was spent to continue enhancement of the network, further deploying 5G technology and increasing fibre speeds to some areas to 2.5 Gbps symmetrical. In addition, residents are able to access the Internet through several service providers, including Shaw which offers 1.5 Gbps/100 Mbps speeds over its HFC network.

Fort Saskatchewan

The City is focused on expanding its municipal fibre network. All municipal facilities are currently connected with the City's private fibre network and there are plans to extend this connectivity to RCMP, DOW Centennial Center and all the way down to West River's Edge, which would create a redundant fibre ring. The progress has slowed down due to budgetary constraints.

TELUS is continuing to upgrade some areas of the City – especially some old neighborhoods. The rural areas, on the other hand, do not seem to have good service, and the City has not taken any initiatives to move out further than City limits as of now.

Leduc

In October 2022, TELUS completed a $45M PureFibre build within the City. One of the biggest drivers for this deal was achieving connectivity to the industrial area east of highway 2 and north of Telford Lake – which is their oldest industrial area. Now complete, the build connects more than 13,000 homes and 2,000 businesses in Leduc, the only 100% fibre-to-the-home network in Western Canada. In partnership with the City of Leduc, TELUS also connected 17 municipal sites, including RCMP station and the local fire halls, dramatically enhancing the speed and reliability of the network for emergency responders in the City. 5G small equipment was also deployed on municipal buildings to assist TELUS in the development of its 5G network. The entire project was designed and built in just 20 months, making it one of TELUS' fastest builds to date.

Spruce Grove

Spruce Grove is collaborating with TELUS to install PureFibre throughout industrial areas of the City and 90% of homes and business within city boundaries. The City held discussions with multiple ISPs before an agreement with TELUS was made. As a part of the agreement, Spruce Grove is investing $4.25M (to connect the industrial parks) with TELUS contributing another $50M. The aim is to complete the build and have high-speed Internet services turned on for all residents and business by the end of 2023 and beginning with the industrial areas. The timely completion of this project may be partly due to City officials providing a direct line for escalations and holding status meetings with TELUS every two weeks to track progress.

Apart from TELUS fibre infrastructure, the City also has its own fibre connecting some municipal buildings. The original plan for the City was to build its own fibre ring connecting all municipal buildings, but now they are also leveraging TELUS network as part of a hybrid model approach.

Spruce Grove plans to become a Smart City, and as part of that, TELUS has provided connectivity to light poles, bus stops, etc., while traffic light operations have been outsourced. The City considers having modern infrastructure a critical component of its Smart City vision.

St. Albert

TELUS has agreed to invest $10M to enhance its fibre infrastructure in 2022, but recent conversations revealed that there have been capital constraints for these projects, and the City is doing its best to keep it moving forward. The TELUS fibre build in the City has not been completed yet, and the City is currently waiting on TELUS to identify and schedule the neighborhoods for the 2023 construction season.

St. Albert also has its own fibre infrastructure for municipal purposes, and wherever possible, the City has leveraged TELUS conduits. The City also operates its fibre network to ensure physical, cyber and economic security. There are plans to grow this network with projects to be funded in 2023 and 2024, however, they are not finalized yet.

Devon

Although Devon does not have a broadband strategy, there is recognition from Devon's Council that broadband is important, but a lack of budget for core infrastructure development has hindered any immediate deployment. Shaw has indicated plans to invest in the installation of FibrePlus to connect buildings within Devon and increase their speeds up to 1 Gbps, but there is no indication that these plans have been followed through. In addition, Devon has indicated that all municipal buildings will be connected via Shaw's network, using the TELUS network as a fall back. Despite the network that both Shaw and TELUS have built, service is not ubiquitous, with reported speeds of 50/20 Mbps existing throughout Devon.

Morinville

Morinville is not actively working with any service providers or partners to enhance Internet speeds at this time.

Leduc County

In Leduc County, Shaw, TELUS, and Bell all provide services; however, speeds only reach the 50 Mbps CRTC standard around the County's larger population centres, according to ISED's National Broadband Internet Service Availability Map. Overall, there is still a large need for better connectivity, speed, as well as fibre redundancy for the limited fibre that they have in their County Centre and firehall.

Though the County is not actively working with any service providers or partners to enhance Internet speeds, it is paying close attention to deployments in neighboring municipalities.

Parkland County

Parkland County has mainly relied on wireless towers to provide broadband connectivity in the region. It owned and operated 20 such towers and encouraged WISPs such as Xplor and cellular providers such as TELUS and Rogers to co-locate their equipment on them. However, after a recent Feasibility Study, it was determined this was not a part of their core business and hence, the County sold its towers to SBA.

Parkland County has now switched its attention to fibre connectivity with a pilot project in the Hamlet of Entwistle which has been quite successful in the past year. Moreover, using the proceeds from the sale of their wireless towers, the County has decided to invest $8M for fibre-to-the-home (FTTH) projects with an RFP being closed by the end of 2022. The first phase of the plan is to connect 3,000 – 6,000 dwellings by September 30, 2023, with four more phases planned afterwards. The County intends to choose one partner initially and provide an option to open the network to others after 5 years. The County plans to set aside dark fibre as a backup option for municipal use as well.

The County has about 35,000 residents and 15,000 dwellings, and it is aiming to cover these areas with a combination of fibre, FWA and satellite Internet connectivity. There have been trials for satellite Internet with Starlink in five different remote sites in the County which have shown promising results.

Recent conversations with Parkland County have revealed that they are open to discussions with other counties and municipalities regarding joint projects to enhance broadband connectivity in the region. They are already working with Sturgeon County.

Strathcona County

Strathcona County is not actively working with any service providers or partners to enhance internet speeds, although a deal was near completion in 2022 to enhance connectivity in the West Industrial Commercial neighborhood as well as rural areas. Funds were reallocated to other municipal construction and improvement projects.

Sturgeon County

Sturgeon County has invested $7.55M in its own fibre network through debenture financing. The County plans to own its fibre infrastructure and partner with a service provider who can provide optoelectronics needed as part of Internet service operations. The County put out an RFP in 2021 which was won by Canadian Fibre Optics Corporation (CFOC). The first phase of this deal is expected to connect up to 1,800 residential and business premises in the southwest corner of the County which will cover around 55% of that area. This connectivity will be provided in the form of open access network and so far, six ISPs have expressed interest in using the network including existing ISPs that currently serve the area with wireless Internet. Progress on the current build has been disrupted by supply chain issues.

The County estimates that it will need $30M investment in total to complete the fibre build in the rest of the areas and is looking at CIB funding as well as further financing as potential options.

Desired Future State

As discussed, the current state of deployment within Stony Plain presents opportunities for improvement – especially in northern business parks and rural areas. As such, it is imperative to understand and explore what the path forward entails and to set a goal for Stony Plain to achieve its desired future state.

In exploring the path forward, this section first provides a brief overview of the considerations that need to be given to the technological advancements and the importance of broadband infrastructure in meeting the higher level requirements created by those advancements.

Secondly, it provides an overview of the options that municipalities can generally pursue in order to enhance broadband services in the area. These options include guidance on broadband deployment as well as partnerships with operators, ISPs, municipalities and other governmental entities.

Considerations

This is About More than Internet

The world is witnessing an economic revolution as the value of physical assets are being far exceeded by the value of knowledge and data. Access to information and communications technology (ICT) has become critical to sustainable global economic competitiveness and increased quality of life in virtually every society on the planet. Moving forward, the requirement for connected infrastructure is no longer about simply moving data around, it is essential to enabling the fundamental societal transformation that impacts all aspects of daily life.

As we move towards societal transformation, our reliance on technology has shifted the focus from improving the 'quality of service' to improving the 'quality of life' for us.

Figure 28: Need for connected infrastructure is ever-increasing

Unlocking the full potential of technology requires robust broadband infrastructure to facilitate collaboration, innovation, integrated supply chains, business process optimization, access to global markets, and so on. Broadband networks rank among the most important infrastructure assets of our time – for purposes of economic development and competitiveness, innovation, workforce preparedness, healthcare, education, democratic discourse, and environmental sustainability.

Availability of robust infrastructure along with access to advanced technology allows creation of 'Internet of Things' (IoT) which merges physical and digital worlds and enables digital initiatives that transform how

we live and work. At its core, IoT refers to the connection of sensors via a network that collect data from which decisions can be made either by humans or through AI and machine learning algorithms. For example, in the municipal context, sensors on traffic lights (connected via a broadband network) can be used to monitor traffic conditions across the municipality, and the information gained from across the network can be utilized to have traffic lights work optimally in a synchronized manner that reduces congestion and makes roadways safer. According to McKinsey, the potential economic value that the IoT could unlock is large and growing. By 2030, it is estimated that it could enable $5.5 to $12.6 trillion in value globally, including the value captured by consumers and customers of IoT products and services.

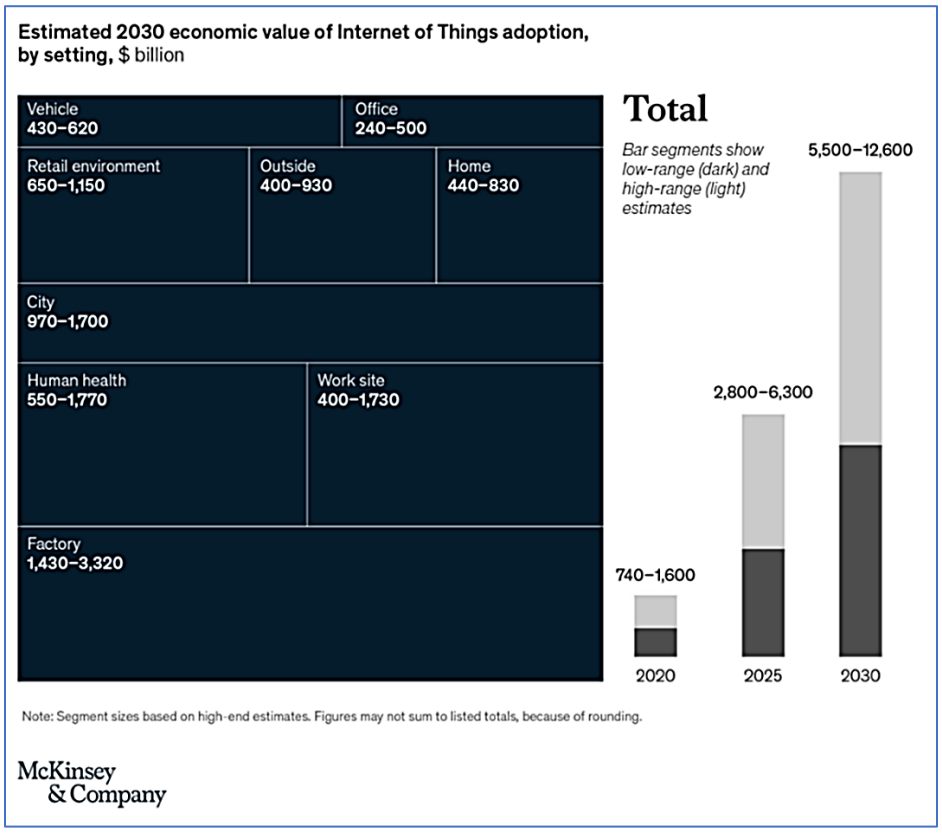


Figure 29: Economic value of IoT adoption

As illustrated in the figure above, there are considerable economic benefits to be had from investing in broadband infrastructure today. This includes benefits not just for Stony Plain itself, but also other segments that make up our society.

Explosive Growth in Requirements

According to the law of accelerating returns, humankind can expect to see twenty-thousand years of progress over the next century. In essence, technology is building on itself, and progress is exponential. As can be seen in the figure below, digital technologies and fast, symmetric, bi-directional network capabilities will enable much of it.

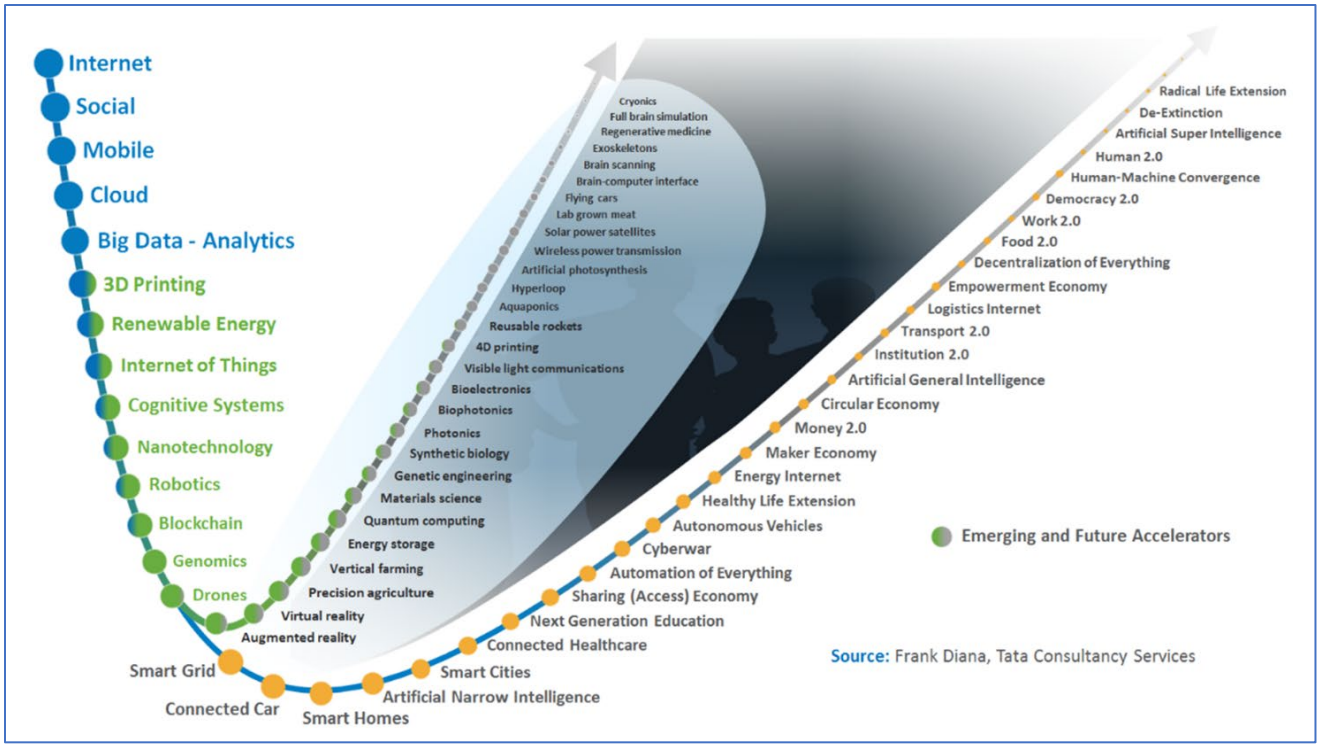


Figure 30: Future of technology

The demands on and use cases for broadband infrastructure and applications are increasing geometrically. Whereas private providers focus on retail return on investment, Stony Plain could focus on the social and operational benefits to be had from developing smart-city technologies.

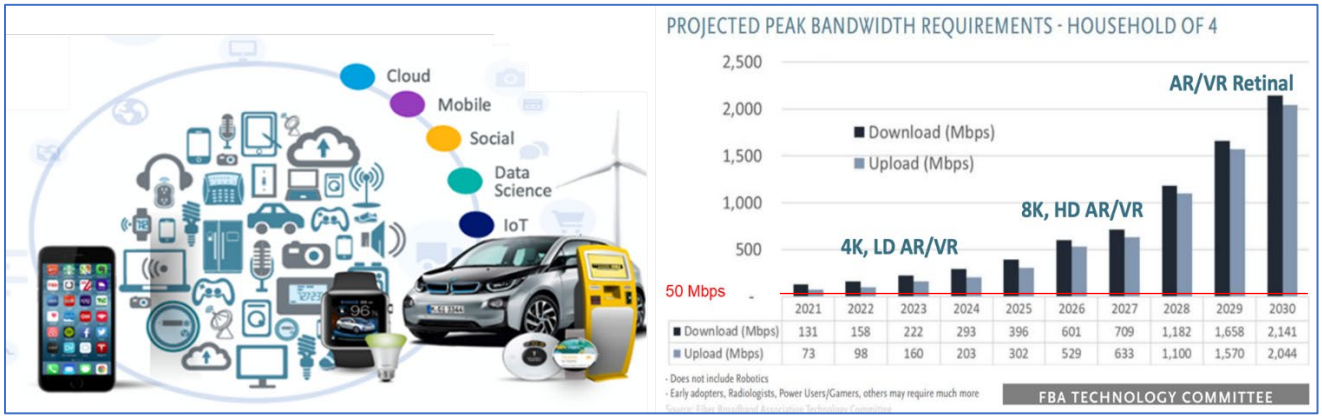


Figure 31: Need for increased bandwidth

According to a study done by FBA's Technology Committee, current and projected bandwidth requirements are significantly more than the CRTC target of 50/10 Mbps Internet speeds, and moving forward, simply maintaining the status quo will not be sufficient if Stony Plain aims to adopt IoT and develop smart-city technologies.

Access Technology

A visual comparison amongst the traditional capabilities of the four major transmission technologies – wireless (tan), copper (tan), coaxial cable (yellow), and fibre (red) appears in the figure below. In the figure, unless otherwise specified, the numbers shown are in Mbps.

As shown by the tan circles, the Internet capabilities of fixed point-to-multipoint wireless technology are similar to those of copper, but at distances up to ~30km, some 30-times that of copper. On FWA networks, however, speeds, are shared between all those serviced off the same antenna – so if 10 clients share a 100/10 Mbps signal, they might only see 10/1 Mbps each. FWA and copper are also similar in that both can support faster speeds over short distances. Copper, for instance, is used for 1 Gbps computer connections within small offices and the new mm-wave FWA systems support 1/1 Gbps services to homes at distances less than ~300m.

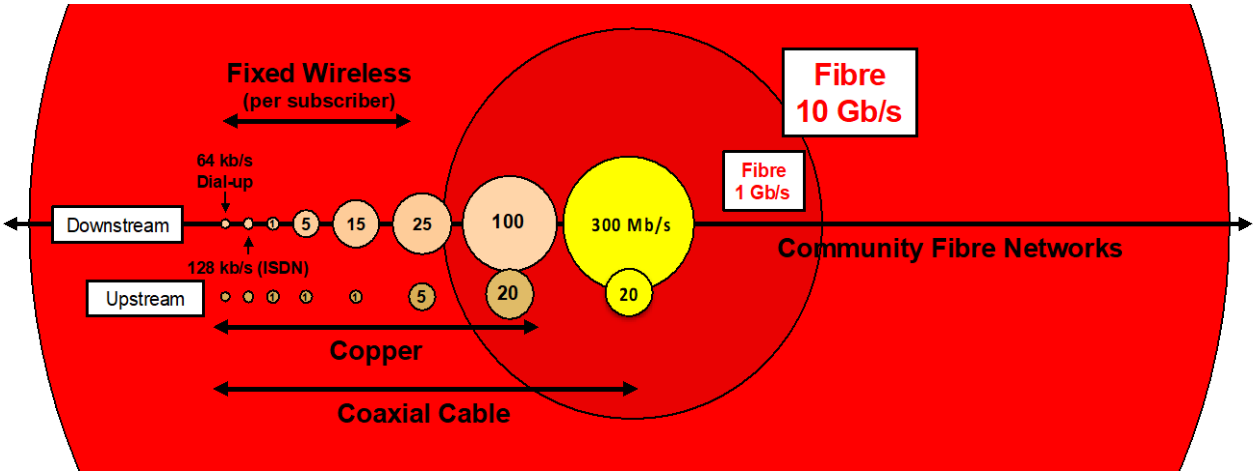


Figure 32: Types of Internet transmission technologies and associated speeds

Traditional coaxial cabling used by the cable television companies, support speeds of up to 300 Mbps down by 20 Mbps up within neighborhoods and current access fibre systems support symmetric 1 and 10 Gbps services up to distances of 35 and 18 km, respectively. As both coaxial cable and fibre strands intrinsically support much greater bandwidths, these speed limitations relate to the electronics deployed. With upgraded electronics, coaxial cable systems can support symmetric services up to 10 Gbps within neighborhoods whereas fibre systems can theoretically support symmetric rates up to 35,000 Gbps over hundreds of kilometers.

To increase Internet services beyond 100 by 20 Mbps telecom providers must replace their copper plant whereas cable companies can largely make do by running fibre to a neighborhood distribution point and upgrading the electronics on their coaxial cable plant running from there to each premise. Interestingly, this is the same strategy used by telecom companies over the past 30-years to increase speeds on their copper plant using digital subscriber line (DSL) technology; i.e., they shorten the copper distance to the home by deploying fibre to neighborhood distribution points and then going copper from there.

Since ~80% of wireline deployment costs are associated with the civil works on deployment, given fibre's low cost and capability, going forward, deploying either copper or coaxial cable no longer makes any sense. As well, given fibres made of glass, fibre will last at least 40-years and require much less maintenance.

Whereas the capital costs to deploy fibre far exceed that for FWA systems, as shown below, on a total cost-of-ownership basis over a ten-year period, fibre networks come in a under half that of FWA due to increased scalability and reduced operational costs.

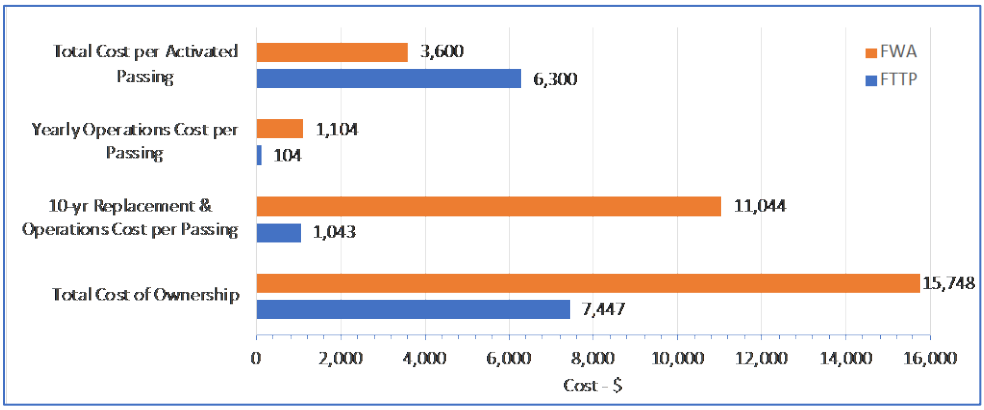


Figure 33: Total cost of ownership comparison for fibre vs. wireless technologies

The dynamics of the above are currently playing out in Stony Plain. TELUS is deploying fibre and abandoning their copper plant whereas Shaw is upgrading their electronics to support symmetric Gbps services. Due to the expense of fibre deployment, and perhaps due to other priorities and competitive pressure of the higher speed services available from Shaw, TELUS is delaying their fibre upgrades. Should Stony Plain wish to fill in the services gap in their business parks, they could look at the new mm-wave technology.

Though traditional geo-synchronous satellite-based services such as those from Xplore offer speeds similar to fixed wireless, capacity is limited, and services are not suitable for collaborative applications due the time-delay (latency) resulting from signal transmission to and from a satellite ~35,800 km away. Low-earth-orbit satellite networks being deployed by upstarts like Starlink obviate both the capacity and latency issues by orbiting the satellites some 35,400 km closer to the earth and launching them by the thousands.

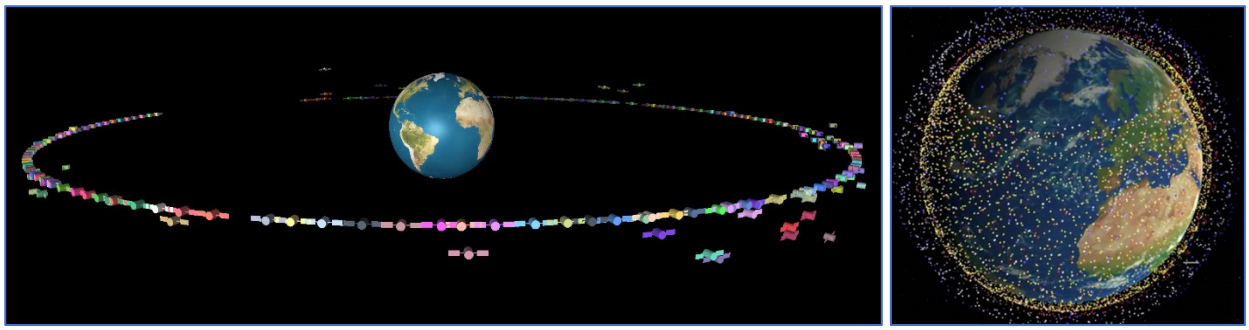


Figure 34: Illustration of Low Earth Orbit (LEO) satellite technology

An overall comparison amongst three wireless and one wired service offering appears below.

Table 7: Internet service level comparison for various technologies

	Starlink Internet	Traditional Satellite	Cellular LTE	Telco DSL
Avg. Actual Speed	75 / 15 Mbps	5 / 1 Mbps	50 / 3 Mbps	6 / 1 Mbps
Ave. Latency	40 – 100 ms	600 ms	80 – 200 ms	50 – 100 ms
Uptime	Okay – Good	Poor – Average	Good – Great	Great – Excellent
Data Cap	Unlimited	100 GB	350 GB + $4/GB or throttled	Unlimited
Price / Month	$129	$100 - $200	$100 - $150	$80 - $100

Importance of Infrastructure Investment

Even though the future benefits of investing in broadband infrastructure now are enormous, it should not be considered only from that perspective. There are also short-term implications for not having sufficient connectivity and service levels for local businesses and residents as revealed from our discussions with other municipalities and several market studies. Some highlights from two of these studies are given below.

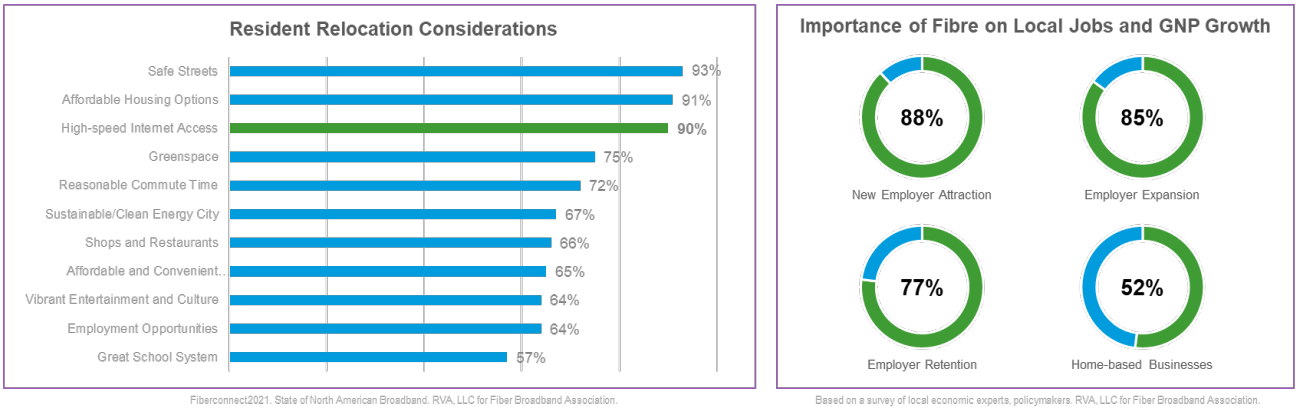


Figure 35: Importance of access to high-speed Internet for residents and businesses

According to surveys conducted for Fiber Broadband Association, 'High-speed Internet Access' is among the top 3 factors that residents consider when relocating to a new area or a city. At the same time, availability of high-speed Internet has a large impact on local jobs, businesses and GDP growth. One such survey of economic experts and policy makers showed that 88% respondents considered availability of fibre Internet as an important factor for new business attraction.

Additionally, a separate study conducted in the U.S. showed that 70% of senior officials in state and local governments believe that fibre networks should be considered a public good that government regulates and sometimes runs – similar to water, sewer and other utility services.

By investing in broadband infrastructure in new developments and business areas such as Meridian Meadows and northern business parks, Stony Plain could provide an incentive for new residents and businesses and ensure existing ones do not relocate due to low quality of broadband services.

Moreover, from a socio-economic perspective, there a number of benefits, which include:

Consumer Benefits:

- According to the 2019 (US) Cartesian study, symmetrical gigabit Internet availability provides an average benefit of CAD$220 per household over that provided by cable-based services. Hence, if 75% of Town households had access to fibre-based broadband connectivity, it would accrue consumer benefits of $1.23M annually.

Property Values:

- RVA estimates that a residential fibre connection will increase the real estate value of the properties by about 3.6%. With a 75% uptake, this would increase aggregate property values by $69.9M (assuming an average property value of $363k).
- At a mill rate of 7.8, with 7,134 residential properties, this would equate to increased property tax revenues of $177,000 per annum

GDP Growth:

- Assuming the 2021 per capita Alberta GDP of $71,030 to be representative of that in Stony Plain and that the availability of symmetrical gigabit Internet services results in an 0.19% mid-range lift, Stony Plain would see an increased GDP of $2.45M.
- At a provincial and federal tax to GDP ratio of 33%, improved Internet services deployment would thus increase federal and provincial tax revenues by 0.810M/year or $16.2M over 20 years.

Other Socio-economic Return on Investment (SROI) Benefits:

- The SROI in the Edmonton Metropolitan Region's study found the lift to be 0.68% (~$1 billion per year)
- A University of Lethbridge study found the ROI associated with a fibre-to-the-farm (FTTF) initiative may be as high as ~317%.

Broadband Deployment Opportunities

When considering broadband investment opportunities, it is important to first understand the service provision model of broadband services.

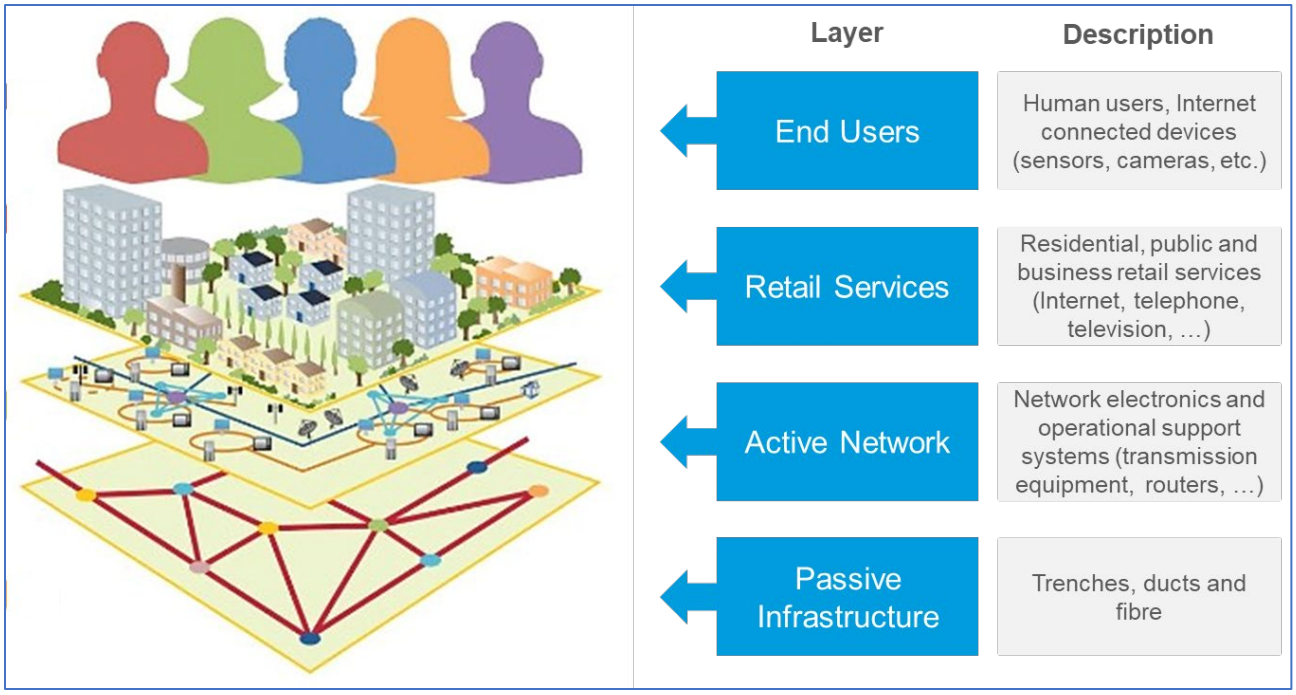


Figure 36: Various layers of broadband infrastructure

As illustrated in the figure above, there are four layers to a broadband network and service provision model. Passive Infrastructure – which includes trenches, ducts, cables and fibre – forms the foundation of the network that connects physical and digital worlds. The next layer is called Active Network which consists of electronics and other hardware that enables use of technology. Retail Services are the actual broadband services such as Internet, telephone, television, etc. that are delivered to consumers over the network. The final layer consists of End Users such as residents and businesses which consume broadband services.

Various business models exist for how each layer or a combination of layers is owned and operated in order to deliver broadband services to end users. The nature of ownership and operational activities as well as comparison of community benefits, investment requirements, risks and returns for each business model are given below.

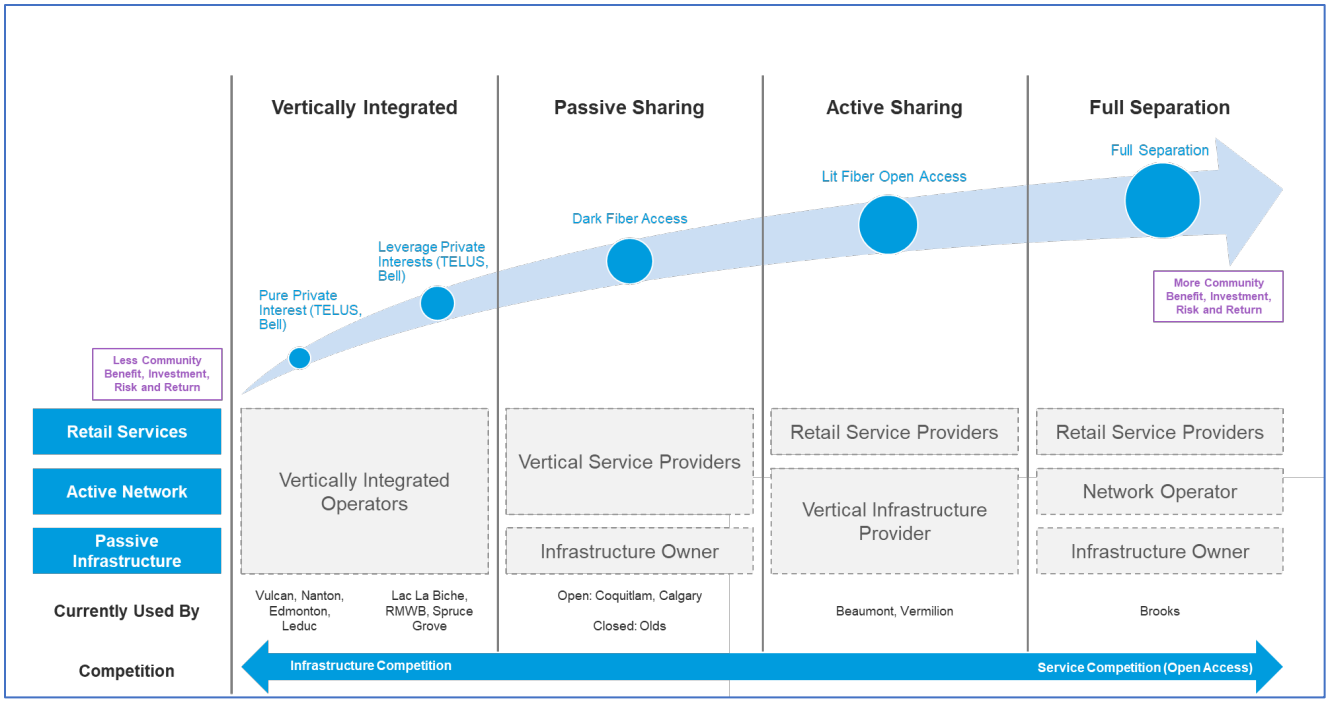


Figure 37: Business models associated with ownership and service of broadband

There are essentially four models that Stony Plain could choose from when considering its broadband deployment options.

The first is the Vertically Integrated model wherein one entity – such as an ISP – owns and operates all layers of the broadband network. As a result of the facilities-based competition policy set by the federal government and under which the CRTC regulates telecom, this is the dominant model in Canada. Under this model, each incumbent EPCs both the passive and active components of their network, operates and maintains their network, and sells their retail services sets over it. Integrated network/service providers deploy their networks in areas where it makes financial sense for them and, in this process, communities have little say and assume none of the risks.

The Passive Sharing option is one in which a municipality such as Campbell River, New Westminster, Calgary, and Olds deploy and own the passive network infrastructure and allow ISPs to lease access to it – generally on a conduit or fibre-strand basis. The ISPs then light, operate, and maintain the leased facilities and use it to deliver their retail service sets to clients. As most of the capital deployment costs associated with wired networks relate to the passive network components and the civil works required to deploy them, this takes a significant cost off the table and helps encourage competition amongst the ISPs operating in the area.

The Active Sharing and Full Separation models enable the open access utility networks common in Europe and which are partly responsible for significantly higher levels of fibre penetration in those countries. With active sharing, a municipality or network provider deploys both the passive and active network components and then operates and manages a fully functional broadband network. The operator then makes the network available on a wholesale basis to any and all service providers interested in delivering their service sets over it. Examples include the DIG/Alberta Network deployments in Beaumont and Vermilion. With full separation, a passive infrastructure owner contracts a network operator to light, operate, and maintain the network and make it available on a wholesale basis to retail service providers. A partial example of this is the approach taken by the City of Brooks. In their case both the City and the Network Operator own portions

of the passive network infrastructure. The Network Operator (Community Network Partners Inc.) lights, operates, and maintains the network. Retail service providers such as O-Net then provide retail services to the City's residents and businesses.

Options to Enhance Broadband Services

Based on broadband deployment business models given in the preceding section, there are a total of six strategic options that municipalities can utilize to enhance broadband services.

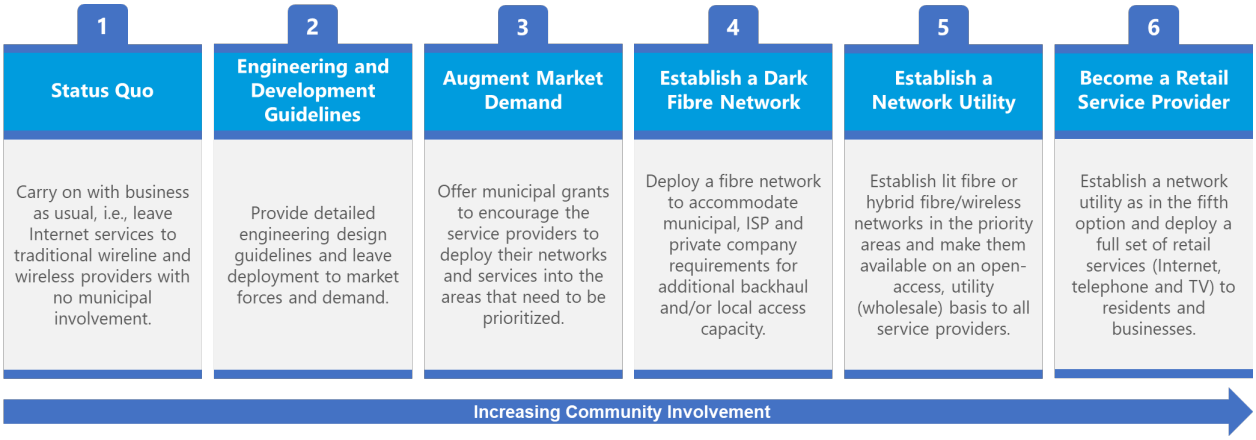


Figure 38: Broadband deployment options

Each option contains a varying degree of municipal and community involvement with respect to deployment of broadband network and operation of services along with various levels of investment, risks and returns, and community benefits. Partnership options are available to assist communities with options 4, 5, and 6.

For comparative purposes, the following icons have been used to characterize each option at a high level.

📄: Planning, Policy | 📐: Engineering | 🛠: Deployment | $–$$$$$: Cost | 💎–💎💎💎💎💎: Benefit

Option 1 – Status Quo

The first option is to carry on with business as usual, i.e., to leave Internet services for residents and businesses to traditional incumbent wireline and wireless providers with no municipal involvement. Arguments for and against this approach are summarized in the table below. Note that in the status quo option, Stony Plain may wish to continue the development of its internal municipal network for municipal uses as it can increase security, capacity, and reduced operational costs.

Table 8: Broadband deployment option 1: Status quo

Status Quo	
Examples	• All communities which have decided to leave broadband issues in the hands of the private sector.

Pros	• No municipal money used and no project execution or operational risk. • No perception of government competing in private industry.
Cons	• Incumbent services focus on areas which make business sense. • Service pricing depends on what can be competitively monetized versus enabling cost-based services that emphasize inclusion, affordability, and economic development. • Little to no control over the infrastructure or service levels, either to meet municipal requirements or those of residents and businesses. • Internet speeds and reliability are business as usual.
Risks	• Internet service levels may lag residential and business requirements, potentially leading to declines in population, business activity, and municipal revenue. • Given the pace of advancing technology, the projected impact of digital technologies on quality of life, entrepreneurship, and business growth, any mismatch between residential and commercial requirements and the availability of Internet services throughout Stony Plain may negatively impact economic development. • If service availability is not uniform, some areas may end up on the wrong side of the digital divide.
Risk Management	• Turn municipal direction to other economic development initiatives.

Option 2 –Engineering and Development Guidelines

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With a modest level of effort, a municipality could augment its policy and engineering standards to promote the development of enhanced broadband network capabilities in new developments or greenfield situations and to leverage any planned linear infrastructure deployments or refurbishment programs. Requirements on municipal access agreements and permitting might also be updated and increased to ensure all telecommunication infrastructure adheres to consistent engineering design guidelines. These would be in place to protect against interim builds that do not meet the requirements and prevent situations where the municipality may need to address issues or account for lower quality infrastructure. These guidelines should be structured to support municipality participation in any of the options to follow. Arguments for and against this approach are summarized in the table below.

Table 9: Broadband deployment option 2: Provide engineering and development guidelines

Engineering and Development Guidelines	
Examples	• City of Calgary • Town of Olds
Pros	• No municipal money used for infrastructure build. • No perception of government competing in private industry.

	• Protects long-term municipal interest in developing reliable Internet infrastructure by protecting right-of-way access from lower quality telecommunication builds. If at a future date, the municipality decides to build and/or operate a community broadband network, this would enable augmenting existing infrastructure with future infrastructure builds.
Cons	• As this only impacts new infrastructure, if growth is slow or negative, the impact will be minimal. • This approach does not address the current issues with inadequate Internet infrastructure or support. • Internet speeds and reliability are business as usual. • Little to no control over the infrastructure or service levels, either to meet municipal requirements or those of residents and businesses.
Risks	• Internet service levels may lag residential and business requirements, potentially leading to declines in population, business activity, and municipal revenue. • Given the pace of advancing technology, the projected impact of digital technologies on quality of life, entrepreneurship, and business growth, any mismatch between residential and commercial requirements and the availability of Internet services throughout the municipality may negatively impact economic development. • If service availability is not uniform, some areas may end up on the wrong side of the digital divide.
Risk Management	• Turn municipal direction to other economic development initiatives.

Option 3 – Augment Market Demand

Provide Incentives to ISPs

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Leverage the municipality's telecom, cable and Internet service providers to support their own builds in compliance with the engineering and development guidelines. Offer municipal 'grants' to encourage them to deploy their networks and services into areas the municipality prioritizes. Arguments for and against this approach are summarized in the table below.

Table 10: Broadband deployment option 3: Provide incentives to ISPs

Incentives to ISPs	
Examples	• A popular approach. Notably, this approach was taken by Spruce Grove to gain TELUS' commitment to complete their fibre build. • In the past, this was the model upon which Wildrose operated and deployed towers in a number of counties. • In the Regional Municipality of Wood Buffalo area, this approach was used to improve services in the Gregoire Lake Estates area.

	• More recently, negotiations with private suppliers to improve services in select areas often result in a request for a cash infusion to make the providers' effort in particular areas worth their while. Surprisingly, in return for the funding, some providers are reluctant to provide strong commitments.
Pros	• No perception of government competing in private industry. • Protects long-term municipal interest in developing reliable Internet infrastructure by protecting right-of-way access from lower quality telecom infrastructure builds. If at a future date the municipality decides to build and/or operate a community broadband system this would enable augmenting existing infrastructure with future infrastructure builds. • Provides incentive to ISPs to build more infrastructure in priority areas.

Cons	• Perception that the municipality is either picking a winner or subsidizing a local favorite.
	• Given the high capital costs associated with infrastructure deployment, the cash infusions/grants/ subsidies may be significant. In spite of this:
	  ○ All ownership and infrastructure control vests with the private providers.
	  ○ No municipal access or flexibility to meet larger connectivity requirements.
	  ○ No direct return on the municipal investment.
	• Little to no control over the infrastructure or service levels, either to meet municipal requirements or those of residents and businesses.

Risks	• While the one-time infusion may help put assets in place, area revenues may be insufficient to cover on-going operational and upgrade costs in some districts – as was the case with the Wildrose subsidies years ago. Over time, quality-of-service declines, and additional subsidies may be required.
Risk Management	• Due diligence on the selected companies and their operations. • Careful evaluation of the network's scalability requirements and operational costs. • Stony Plain may be able to access grant funding from the Alberta Broadband Fund and the Universal Broadband Fund, as discussed in the *Market Analysis* section of this report. Further conversation with ISPs, the Government of Alberta, and Government of Canada are needed to determine eligibility. • Longer term agreement with coverage, deployment timeframes, scalability requirements, service levels, and built-in operational requirements.

Option 4 – Establish a Dark Fibre Network

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This option involves deploying a fibre network to accommodate municipal, ISP and private company requirements for additional backhaul and/or local access capacity which could include:

- Establishing points-of-presence (POPs) in rural subdivisions and thereby enabling fibre to be further deployed into any areas requiring it.

- Providing connections to ISP fixed wireless access (FWA) towers that need additional backhaul capacity and thereby enabling improved services provided off the tower.
- Providing connections to larger rural commercial and industrial facilities.
- Providing connection to rural municipal facilities – from community halls, fire stations, and other facilities

Summary arguments for this approach is given in the table below.

Table 11: Broadband deployment option 4: Establish a dark fibre network

Dark Fibre Network	
Examples	• This approach has been evaluated in detail for the City of Calgary, the Counties of Clearwater, Cypress, Forty-mile, Newell, Red Deer, Strathcona, the County of Acadia, and Special Areas 2, 3, and 4, among others. • Red Deer County recently awarded an RFP to deploy a backhaul network.
Pros	• Enables support for smart city infrastructure and services as well as improved wireless and Internet speeds in the targeted areas. • In lieu of a direct subsidy, this may help to promote competition amongst ISPs. • No perception of government competing in private industry.
Cons	• While an enabler that private enterprise can use to improve Internet service levels, they may not do so. • As backhaul infrastructure will not initially run everywhere, there may be the perception that the municipality is favoring some ISPs, commercial complexes, and communities over others. • As an infrastructure play, such deployments can be expensive with little in the way of a business case.
Risks	• Internet service levels may lag residential and business requirements, potentially leading to declines in population, business activity, and municipal revenue. • Given the pace of advancing technology, the projected impact of digital technologies on quality of life, entrepreneurship, and business growth, any mismatch between residential and commercial requirements and the availability of Internet services throughout the municipality may negatively impact economic development. • If service availability is not uniform, some areas may end up on the wrong side of the digital divide.
Risk Management	• Turn municipality direction to other economic development initiatives. • Public campaign to present the decision to delay spending municipal dollars on a major infrastructure build in favor of support to smaller backhaul projects that will spur on local economic development within the Internet services market.

Option 5 – Establish a Network Utility

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Though an end-to-end buried fibre network is the gold standard in terms of long-term scalability, it is initially expensive to deploy and does not address the growing need for high data-rate, untethered communication. To address both issues, in smaller communities and more urban settings, a municipality could consider a converged network strategy in which the initial fibre deployment is limited to supporting wireless access connections and connections to larger business and enterprise clients that require it. Wireless options, whether provided by third-party ISPs or as part of the municipality build, offer a way to improve services more quickly and with significantly reduced upfront capital. With proper design, the option to then move to a fibre-to-the-premise (FTTP) solution, either where needed or on a staged basis, as capital becomes available, does not need to be compromised.

Arguments for and against this approach are summarized in the table below.

Table 12: Broadband deployment option 5: Establish a network utility (connectivity infrastructure)

Connectivity Infrastructure	
Examples	• This approach is currently being deployed by the City of Beaumont and the Town of Vermilion
Pros	• Enables support for smart community infrastructure and services as well as improved wireless and Internet speeds within each community. • Provides support for a variety of wireless access options – FWA, wi-fi, 5G, small-cell – and operational models (e.g., the Connect Mobility IAAS option, for instance). • Provides for both mobility and fixed services and provides support to 5G providers and IoT devices • Reduces both the deployment time and the upfront capital required to deploy the network. • In lieu of a direct subsidy, this may help to promote competition amongst ISPs. • No perception of government competing in private industry.
Cons	• While an enabler that private enterprise can use to improve Internet service levels, they may not do so. • With fewer end clients, pay-back periods may be lengthy.
Risks	• Unless the community takes on the access piece as well, Internet service levels may lag residential and business requirements, potentially leading to declines in population, business activity, and municipal revenue. • Given the pace of advancing technology, the projected impact of digital technologies on quality of life, entrepreneurship, and business growth, any mismatch between residential and commercial requirements and the availability of Internet services throughout the municipality may negatively impact economic development.

	• If service availability is not uniform, some areas may end up on the wrong side of the digital divide.
Risk Management	• Arrange for a wireless access provider or look at taking on the access piece as well. • Public campaign to present the decision to delay spending municipal dollars on a major infrastructure build in favor of support to smaller connectivity projects that will spur local economic development within the Internet services market.

Option 6 – Become a Retail Services Provider

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The last option involves establishing a network utility as in the fifth option, and then deploying a full set of municipality-supported retail services (Internet, telephone, and television) to residents and businesses. All network operations and retail services operations could be outsourced. Summary arguments for this approach are given in the table below.

Table 13: Broadband deployment option 6: Become a retail services provider

Retail Services Provider	
Examples	• When the OICRD was unable to attract retail providers to supply services over its dark-fibre network, it established O-Net to both light and provide services over its network. • An integrated fibre network and services solution was developed for Valleyview – but unfortunately interest waned once their CAO moved on. • The Incumbents and wireless ISPs.
Pros	• Full control over all aspects of network and service operations, including coverage, pricing, and quality. • Reduces operational complexity associated with multiple providers using one network and improves operational efficiency. • Increased overall profitability and margins. • All proceeds from the operation would accrue to the municipality. • Obviates the risk of not being able to attract a service provider.
Cons	• Large capital cost and increased operational complexity. • The perception that the municipality is entering a private industry marketplace and directly competing in both the network and services space. • All technical, deployment, market, and operational risk resides with the municipality.
Risks	• Poor execution could lead to cost over-runs and an operational model which is not sustainable.

Risk Management	• Management and operational complexity can be minimized by outsourcing network and service operations to an experienced provider.

Gap Analysis

Gaps have been brought to light through comparing the Desired Future State to the findings of both the Current State Analysis and the Market Analysis. These are discussed in-length within each of the respective sections and are summarized here as they inform key recommendations.

Key Gaps Identified

The following are the key gaps that were identified through analyses:

- TELUS' median Internet service levels in Stony Plain are 45 Mbps down by 7 Mbps up, just below the minimal CRTC service objectives. In early 2023, symmetric 1 Gbps fibre-based services will become available to 31% of the premises. TELUS' plans to expand fibre-services throughout the urban area of Stony Plan are on-hold through to at least 2024. In addition, though Shaw services of 1 Gbps down by 100 Mbps up are advertised, current median measured service levels in Stony Plain came in at 298 Mbps down by 31 Mbps up. This may be indicative of residents and business of Stony Plain not subscribing to the highest service levels available to them.
- Service levels in both the North and Umbach Business Parks are inadequate.
- Service levels for rural businesses and residents, including those in Rosenthal Estates, are inadequate.

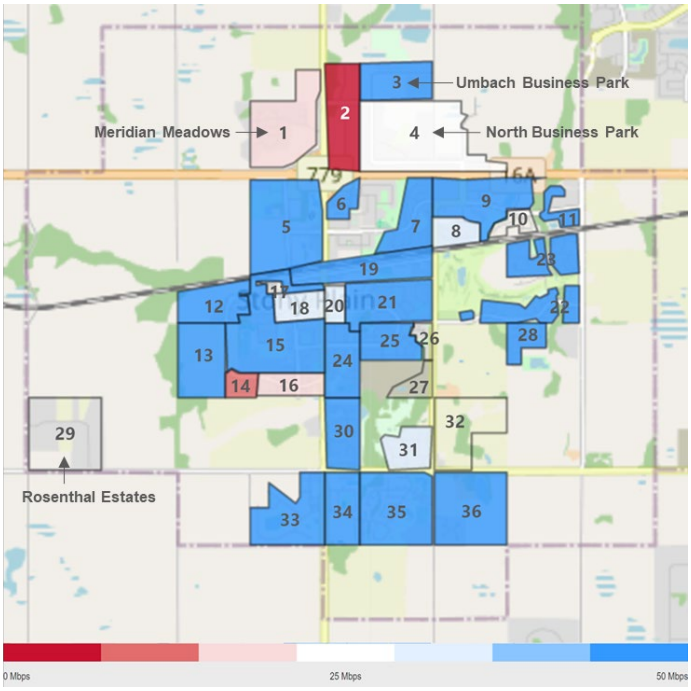

Figure 39: Unserved and underserved areas in Stony Plain

Options

To close the current gaps in terms of coverage and service levels, Stony Plain could utilize a number of strategic options discussed in the Desired Future State section as well as some tactical options provided in this section.

Strategic

The table below summarizes a list of strategic options for Stony Plain to bridge its current gap.

Table 14: Strategic broadband deployment options for Stony Plain

Strategic Option	Description
1. Status Quo: Leave the issue to private industry	• TELUS is pre-positioned to complete an FTTP deployment that will support symmetric Gbps services to 98% of the urban premises within the next few years. • Through upgrades, Shaw's network electronics can support symmetric 2.5 Gbps services. ○ Should the Roger's acquisition go through, services to the rural premises may be improved via 5G deployments. • While the simplest and least expensive option, some of the benefits (e.g., increased competition, smart city support) that would accrue to a municipally controlled open network will not be realized.
2. Adopt fibre-friendly policies and engineering guidelines	• Not likely to impact deployment but would future-proof new developments and save trenching costs where providers are overbuilding.
3. Augment market demand	• Negotiate with incumbents or new partners to improve services within Stony Plain, with focus on key gaps in the northern business parks and rural areas.
4. Establish a dark or lit network utility	• Stony Plain could establish its own dark or lit network utility and make it available to all ISPs interested in providing their service sets within Stony Plain. This could be achieved by: • Initiating talks with funding, procurement, and operational partners such as the Digital Infrastructure Group, Canadian Fibre Optics, and Equs Connect to establish a municipal network. • Releasing an RFP asking for partnership proposals to do the same. • If Stony Plain were to require that fibre-conduit (under Options 2) be placed within the shallow utility trenches in all new developments, 75% of the deployment costs in these areas would be saved should the Town opt to establish a network utility down the road.
5. Become a retail provider	• Going into retail competition with private competitors is not recommended.

Tactical

Stony Plain could work with incumbents or new partners to deploy and prioritize fibre services in the unserved/underserved areas.

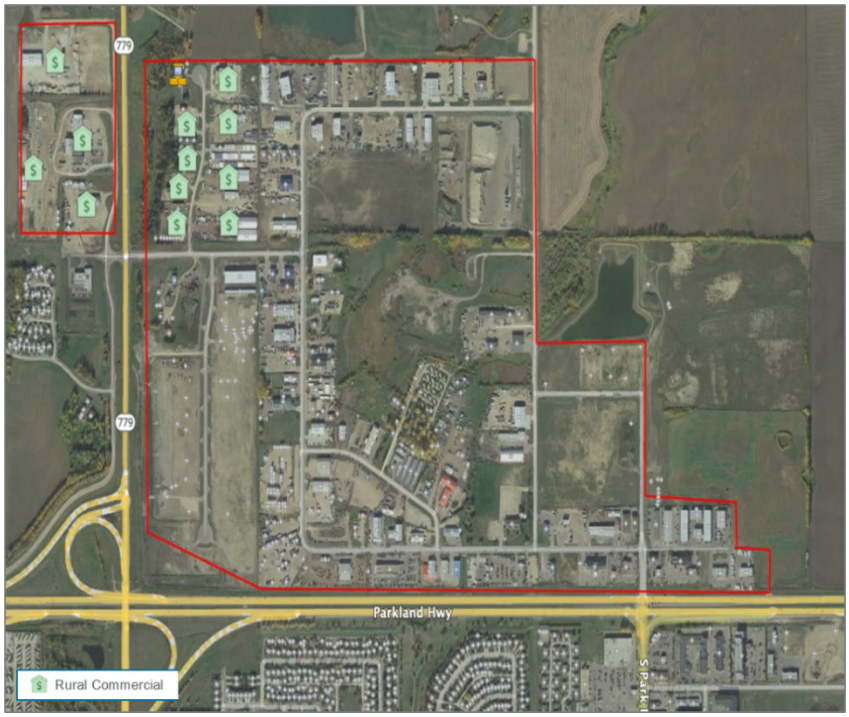

Figure 40: Unserved/underserved areas north of Parkland Highway

Alternatively, Stony Plain could approach Connect Mobility and MCSnet regarding a potential deployment in the northern business parks. Stony Plain could also directly invest in 60 GHz mm-Wave FWA equipment to provide fibre equivalent (~1 Gbps) speeds to the business parks on an interim basis. Based on initial estimates, capital costs for Cambrium cnWave equipment would be $75,000, and with engineering and installation, the total costs would be less than $250,000.

Partnerships

In general, partnerships could enable Stony Plain to leverage and balance its funding strength with the operational and, perhaps, deployment expertise of private enterprise. Partnerships range from simple contractual outsourcing arrangements to highly structured public-private-partnerships and the special purpose vehicles required to accommodate significant financial arrangements. Depending on the direction Stony Plain selects, one or more partnerships may be required.

The following table summarizes potential partnership options available for Stony Plain. Note this is not an exhaustive list and is for consideration only.

Table 15: Partnership options for Stony Plain

Partnership Option	Description
Connect Mobility and MCSnet	Negotiate to deploy mm-Wave equipment in the business parks to provide symmetric 1 Gb/s services.
Shaw	Negotiate to include business parks in their upgrade plans in 2023.
TELUS	Negotiate to complete fibre deployment to at least the business parks in 2023.
Parkland County	Parkland County is currently closing an RFP to select a partner to deploy a fibre network in their rural areas. Once selected, Stony Plain could see if their partner would also be interested in deployment fibre within Stony Plain.
Crown Capital	Crown Capital is currently providing investment capital for fibre deployment in Brooks. Stony Plain could see if they would also be interested in investing in a fibre deployment within Stony Plain.
Digital Infrastructure Group (DIG)	DIG is currently backing open access fibre deployments in Beaumont and Vermilion with investment capital, deployment, and operational expertise. Stony Plain could pursue a similar partnership to deploy fibre within Stony Plain.
Equs/Valo	The co-op model used to support deployment in Red Deer County could be pursued by Stony Plain to deploy fibre within Stony Plain.
Canadian Fibre Optics (CFO)	CFO is currently deploying an open access fibre network in Sturgeon County. Stony Plain could pursue a partnership with them to deploy fibre within Stony Plain.
Rock Networks	Rock Network is currently working with Yellowhead County on broadband deployments. Stony Plain could pursue a partnership with them to deploy fibre within Stony Plain.

Next Steps

The options provided for consideration in the previous section need to be considered as a whole, and a strategic plan of action needs to be taken to ensure Stony Plain is able to capitalize on the value that ubiquitous high-speed broadband connectivity can bring. Specifically, to ensure that Stony Plain is future-proofed to 2030, it needs to have infrastructure capable of providing symmetrical speeds of 2 Gbps. On a positive note, Stony Plain does not fall on the wrong side of the digital divide as 50/10 Mbps speeds are available throughout Stony Plain. However, as indicated within this study, the Edmonton Region is largely connected or being connected through fibre deployments that offer speeds of a minimum of 1 Gbps symmetrical. Furthermore, when we look to the future, symmetrical 2 Gbps speeds are quickly becoming required to access and gain the benefits of new and emerging technology. As such, as Stony Plain grows strategically, it is imperative that Stony Plain seeks and fosters the right partnerships to realize the economic opportunity that the highest speed broadband connectivity and infrastructure can bring. This will help ensure that as the community grows from 18,000 residents today to 30,000 residents over the next decade, it has access to the highest levels of broadband services and benefit from the significant quality of life and economic opportunity that this brings.

Appendices

Appendix A: Telecommunications Technology

An Access Technology Comparison

A visual comparison amongst the capabilities of the four major transmission technologies – wireless (tan), copper (tan), coaxial cable (yellow), and fibre (red) appears in the figure below. In the figure, unless otherwise specified, the numbers shown are in Mbps.

As shown by the tan circles, the Internet capabilities of fixed point-to-multipoint wireless technology are similar to those of copper, but at distances up to ~30km, some 30-times that of copper. Newer FWA systems will do up to 100 Mbps per antenna. This bandwidth is split amongst downstream (from the network to the client, like a Netflix stream) and upstream (from the client to the network, say for uploading photos or backing up data to the cloud) link requirements as needed and would typically be split into something like 75 Mbps down and 25 Mbps up. As the available bandwidth is then shared amongst all the homes taking service within the coverage area, if 50 homes took service and happened to be streaming media content concurrently, the maximum available to each would be 1.5 Mbps down by 0.5 Mbps up

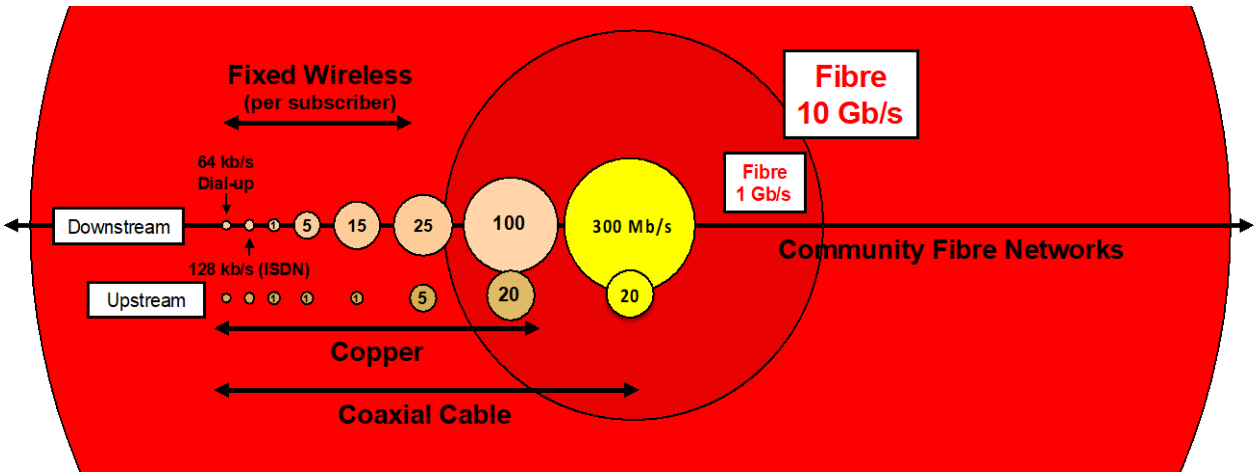

Figure 41: Connectivity speed by technology

Internet data services over the copper plant deployed by the telecommunication incumbents were provided via an evolving family of digital subscriber line (DSL) technologies. Due to the attenuation of higher frequencies required to support broader bandwidth signals, the higher the supported bit rates, the shorter the possible serving distance between the incumbent equipment and the client's home or office. Whereas initial asymmetric DSL equipment supported 6 to 8 Mbps down and 0.512 Mbps up from central offices within 4 km of the client, with fibre to every block, current equipment can provide services up to 100 by 20 Mbps. To increase Internet services beyond 100 by 20 Mbps telecom providers must replace their copper plant whereas cable companies can largely make do by running fibre to a neighbourhood distribution point and upgrading the electronics on their coaxial cable plant running from there to each premise.

FWA and copper are also similar in that both can support faster speeds over short distances. Copper, for instance, is used for 1 Gbps computer connections within small offices and the new mm-wave FWA systems support 1x1 Gbps services to homes at distances less than ~300m.

Traditional coaxial cabling used by the cable television companies, support speeds of up to 300 Mbps down by 20 Mbps up within neighbourhoods. Current access fibre systems support symmetric 1 and 10 Gbps services up to distances of 35 and 18 km, respectively. As both coaxial cable and fibre strands intrinsically support much greater bandwidths, these speed limitations relate to the electronics deployed. With upgraded electronics, coaxial cable systems can support symmetric services up to 10 Gbps within neighbourhoods whereas fibre systems can theoretically support symmetric rates up to 35,000 Gbps over hundreds of kilometers.

Since ~80% of wireline deployment costs are associated with the civil works on deployment, given fibre's low cost and capability, going forward, deploying either copper or coaxial cable no longer makes any sense. As well, given fibre's made of glass, fibre it will last least 40-years and require much less maintenance.

Whereas the capital costs to deploy fibre far exceed that for FWA systems, as shown below, on a total cost-of-ownership basis over a ten-year period, fibre networks come in a under half that of FWA due to increased scalability and reduced operational costs.

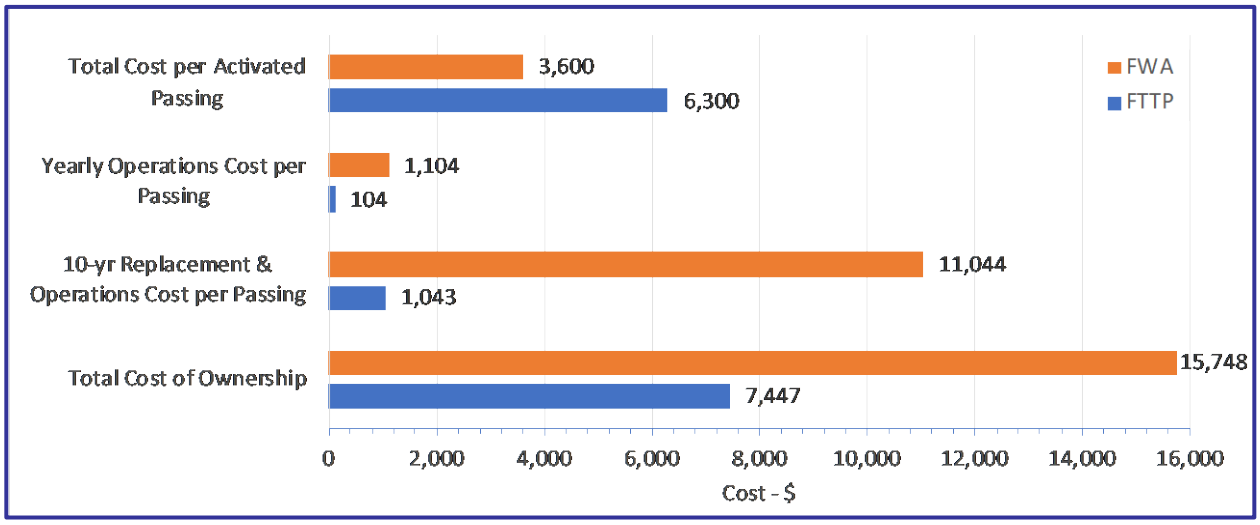

Figure 42: Fibre and FWA Total Cost of Ownership

The dynamics of the above are currently playing out in Stony Plain. TELUS is deploying fibre and abandoning their copper plant whereas Shaw is upgrading their electronics to support symmetric Gbps services. Due to the expense of fibre deployment, and perhaps due to other priorities and competitive pressure of the higher speed services available from Shaw, TELUS is delaying their fibre upgrades. Should Stony Plain wish to fill in the services gap in their business parks, they could look at the new mm-wave technology.

Backhaul Fibre Considerations

Opto-electronics used in long distance backhaul networks currently support 160 concurrent data streams at up to 100 Gbps each in one direction over single span distances in excess of 100 km. For bi-directional systems, two fibres are required.

Fibre Network Considerations

Optical Fibre

Fibre cables are comprised of many individual fibre strands. Cable sizes vary, but a single cable may contain hundreds of fibre strands, as displayed in next figure. As fibre strands are glass, the signals are transmitted by pulses of light. As different colours of light can be used on any fibre strand, a single fibre can support the concurrent transmission of multiple data streams.

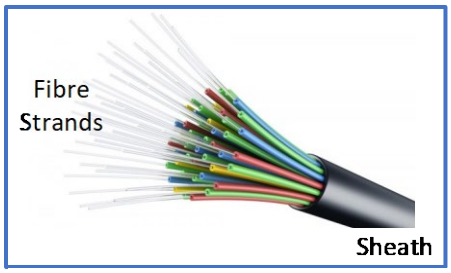

Figure 43: Fibre cable

Fibre's advantages over copper and coaxial cable lines result from the physics of transmitting information using photons of light instead of electrons of electricity. In glass, optical attenuation is much less than the attenuation of electrical signals in copper or coaxial cable and much less dependent on signal frequency/wavelength. In terms of distance and bandwidth, fibre's capabilities are unparalleled. As fibre can theoretically support connection speeds up to 2,800 Gbps at 1.55 microns (µm) [6] and current access systems operate at only 80 Gbps, deployed fibre capacity can be increased by 35-fold before its limits are reached. Though it is expensive to deploy due to the civil works involved, with essentially unlimited capacity, it can be considered to be a 40-year asset. To increase capacity, a community only needs to upgrade the opto-electronics at each end of the fibre.

Unlike copper wires that radiate signals capable of interfering with other electronic equipment (i.e. radio frequency interference or RFI), fibre is benign and neither radiates RFI nor is susceptible to it, making it immune to lightning strikes, safe when sharing a trench with gas-lines, and an excellent choice for secure communications (it cannot be tapped).

Deployment

Figure 44: Flavours of fibre conduit

Fibre infrastructure can be deployed either aerially, via the use of messenger cables in the communications space on power poles, or by burying conduit through which fibre cables can then be blown or pulled. Though aerial deployments are less expensive than buried ones, they are marginally less robust. Aerial deployments reduce deployment expenses by some 30% relative to the buried equivalent. Those estimates, though, assume that the power poles in those areas can be used to deploy fibre. Prior to proceeding with an aerial deployment, the poles will need to be evaluated. If many poles have to be replaced, then a fully buried deployment may be the least expensive option.

In buried deployments, costs vary with ground conditions – soft is better than hard or rock and gravel roads and alleys are less expensive than paved ones. Though fibre cable can be direct buried, for both flexibility and ease of maintenance, it is often placed in conduit. Whereas fibre cable has traditionally been *'pulled'* into conduit, newer methods use compressed air. The latter, referred to as air-blown fibre, enables smaller conduit sizes (which saves cost) as well as significantly greater deployment distances. With air-blown fibre,

[6] Bandwidth estimate assumes 256 QAM at **λ** =1.55 µm

the conduit can be deployed first and then the fibre only blown in when needed. Samples of air-blown fibre conduit appear in the figure above.

Architecture

Two options for fibre deployment architecture are illustrated in the figure below. In point-to-point (PTP) or home-run configurations, separate fibre strands are run from a central office (CO) to every premise to be served. This offers the maximum flexibility to the network operator and enables the greatest bandwidths to be delivered to each premise. Active-ethernet (A-E) services over homerun fibre can be used to deliver symmetric, dedicated, 1 and 10 Gbps services.

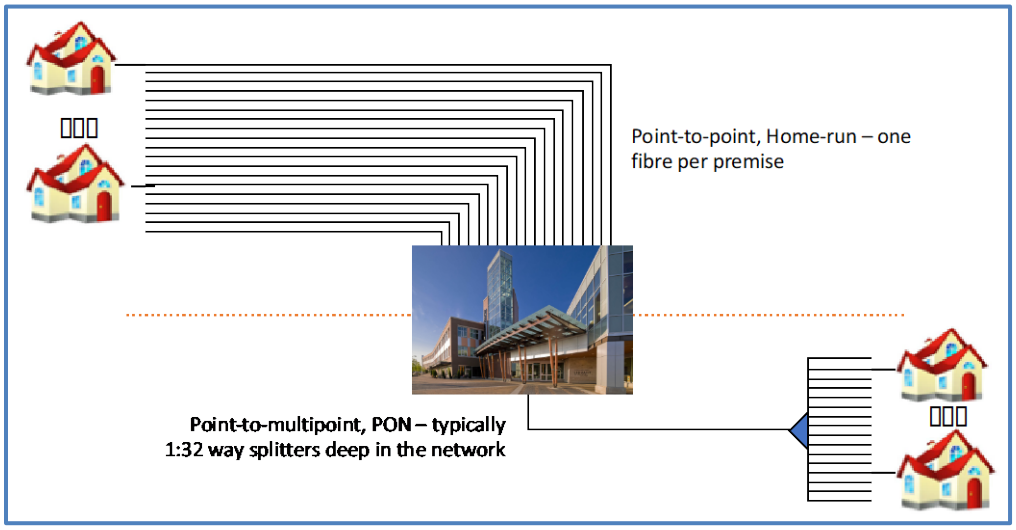

Figure 45: Point-to-point versus point-to-multipoint fibre architectures

In the gigabit passive optical network (G-PON) architecture, the transmit and receive data-streams on each fibre strand leaving the CO are eventually split and are used to service 2, 4, 8, 16, 32, or 64-fibre strands that then continue to subscriber premises. In this way, one strand at the CO can be used to serve up to 64 premises. While offering some regulatory protection to the incumbents, G-PON configurations both increase the complexity of the required opto-electronics and reduce the concurrent bandwidths that can be delivered to each premise by an amount equal to the split ratio.

As traditional G-PON electronics use a pair of optical wavelengths – one to transmit a downstream bit-stream at 2.488 Gbps and receive an upstream bit-stream of 1.244 Gbps, a 1:64 split-ratio reduces this to 38.875 Mbps by 19.44 Mbps to each premise, should all 64-premises be using the network concurrently. In Olds, the split-ratio is limited to 1:16, thus ensuring minimum premise bandwidths of 155 by 78 Mbps. Interestingly, if only one of the sixteen premises happen to be using their connection at a particular time, that premise would experience the whole 2.488 by 1.244 Gbps service. Current opto-electronics support up to 8-wavelength pairs (colours) in which each transmit and receive pair supports symmetric 10 by 10 Gbps service. At 10 by 10 Gbps, a 1:64 split ensures a minimum per home bit rate of 156.25 by 156.25 Mbps.

Serving Area

In laying out the opto-electronics to support a county-wide deployment, two distance constraints must be considered:

1. the backhaul distance between the opto-electronic units (optical line terminals or OLTs) in each CO and a transit or gateway point and
2. the access distance between the OLT and the premise opto-electronics (optical network units or ONUs) it serves.

Both are fibre quality and distance dependent but (2) also depends on the split ratio and the maximum distance separation between the closest and furthest ONUs from the OLT. Typically, the maximum distance for (1) is ~80 km at 10 Gbps and 40 km at 40 to 100 Gbps. On the access side, (2), with a maximum split ratio of 1:16 and long-range optics, these units can serve up to 40 km for connections up to 1 Gbps and 20 km for connections up to 80 Gbps. This means that as long as units are not placed more than 80 km apart, the access opto-electronics can serve all premises in-between at rates up to 1 Gbps.

Wireless Network Considerations

General Considerations

While progress in digital technologies is exponential and both wireless and wireline technologies are progressing rapidly, wireline technologies are currently 100-times more capable than wireless technologies and this lead is unlikely to diminish. Mobile, and especially 5G, technologies get more press, however, and with these rapid advances in, and hype around, wireless technologies, questions around whether wireless could make for a less expensive replacement to fibre often arise. The general answer is no, and reasons include:

- Wireless is typically an access technology only and fibre is generally required to connect wireless access nodes and establish a network. The capacity and quality of the wireless access system therefore depends on the quality of the network connections underlying it.
- Wireless and wireline technologies are complementary – wireless will never have the capacity of wireline for backhaul and wireline technology will never be mobile. Indeed, the '*ideal*' future-proof network will likely be one with a core fibre network connected to either 5G or Wi-Fi-6[7] at the edge. While fibre is, in essence, a medium independent of capacity (effectively unlimited), overtime, the capacity of the 5G and Wi-Fi 6 networks will need to be upgraded as demands increase.

Figure 46: A complementary technology set

- As a replacement for wireline technology, mobile wireless is less capital intensive, but operationally more expensive and less capable. There are, however, FWA versions of the mobile (cellular) technologies becoming available that provide a good compromise in some access applications.

As access capacity in a wireless system is shared amongst all concurrent users of the system, the Internet speed or bit-rate available to a user is inversely proportional to the number of users – the more users, the slower the available bit-rate. In a fibre access system, beyond the split ratio mentioned earlier, no such sharing takes place. If a premise has a 1 Gbps access line, they should see a 1 Gbps service.

[7] Wi-Fi 6 is the rebranded IEEE 802.11ax standard and is the most recent standard governing wi-fi networks typically deployed in homes and businesses.

Lastly, unlike wireline systems, wireless performance is affected by weather, terrain, vegetation, and buildings along the line-of-sight between the user and the access point (AP) as well as by the distance between them. Wireline systems are essentially immune to these effects.

Scalability

A key difference between wireless and fibre-based access networks is scalability, where scalability refers to the ease and expense related to upgrading system capacity to enable higher bit rate services to end users. As end-user bit rate requirements increase annually, unless the system can be scaled, the provider will eventually run out of capacity. Similar issues arise when the provider's client-base and number of connected devices increases.

When wireless and wireline options are compared, the total costs with scaling, should be considered. Whereas fibre systems are initially more expensive, on a scaled basis, they may not be.

As fibre capacity with a home-run architecture is effectively unlimited, scaling fibre systems is accomplished by upgrading the opto-electronics (typically ~10% of the overall deployment cost). Upgrading wireless access systems is typically more expensive and limited. Options to scale wireless systems involve sectorizing the antennas, adding APs that operate at different frequencies or in a different band, and increasing the number of towers (densification). Furthermore, to enable 5G electronics, the radio equipment at every cell site – of which there will be many – will need to be upgraded.[8]

5G

Though 5G wireless technologies will be a significant complement to fibre access networks, they are not a replacement. While the technology is not yet mature, current hype indicates aggregate (shared) data speeds of up to 10 Gbps. These speeds, though, can only be realized under ideal conditions and for devices located near the radio AP. Including overhead, practical usable bit rates are typically only about 20% of the peak – or 2 Gbps per AP or cell site in this case. To achieve these rates, higher frequencies (up to ~60 GHz) are used and cell sites must be very small and this evolution to ever smaller cell sites is illustrated in the figure above. Moving from 3G to 5G requires 400-times more cell sites and thus, 400-times the amount of fibre as these bandwidths can only be supported if the APs are fibre-connected. As each site will also need power and all will need to be replaced to upgrade the system, the capital considerations are significant.

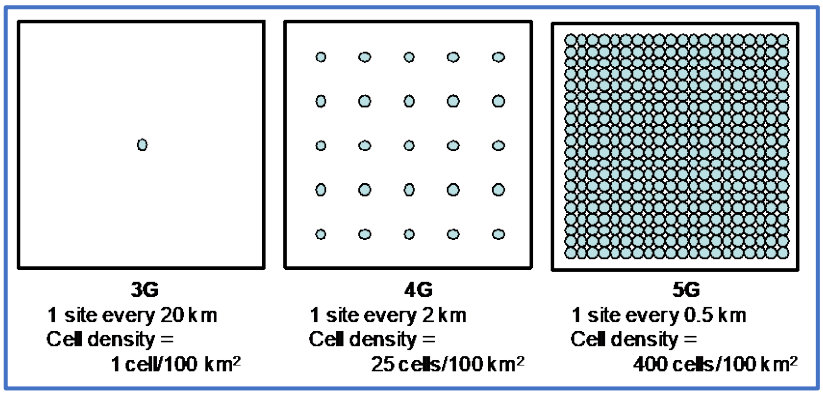

Figure 47: Increased cell tower densities will be needed to meet increased 5G capacity requirements

For example, in urban areas with premise densities of, 500 premises/km^2, at a 0.5 km spacing, each square-kilometer would be home to 4 APs. With each AP supporting 125 homes, if 40% or 50 homes were sharing the 2 Gbps capacity of the AP at any time, each premise would only see 40 Mbps. Increasing this requires even smaller cell sites and a commensurate increase in the number of APs. With fibre, 10 Gbps services are

[8] The Cloud Radio Access Network (C-RAN) concept proposes to address this issue by centralizing the radios and only distributing the antennas.

available. As well, the premises equipment typically proposed for utility networks supports the new Wi-Fi-6 standard, thus enabling in-premise wireless connectivity speeds up to 6 Gbps, with no sharing.

Fixed Wireless Access

As illustrated in figure below, fixed wireless or wireless point-to-multipoint (PMP) access networks use a central access point (AP) to provide services to premises in the area surrounding the AP. Coverage areas depend on the height of the AP, local terrain, and foliage. With a 100m tower and near line-of-sight (LOS), signals in the 2 and 3.5 GHz bands can provide services up to 25-30 km away. If the AP has a backhaul link capacity of 100 Mbps, this is typically split to say 75 Mbps for downstream and 25 Mbps for upstream services. These speeds are then shared amongst however many subscribers are concurrently online and utilizing the system. If 100 premises are so doing, then each would see services of only 750 x 25 kb/s. In FWA networks, each premise requires a subscriber antenna to receive signals from the AP and transmit their data back.

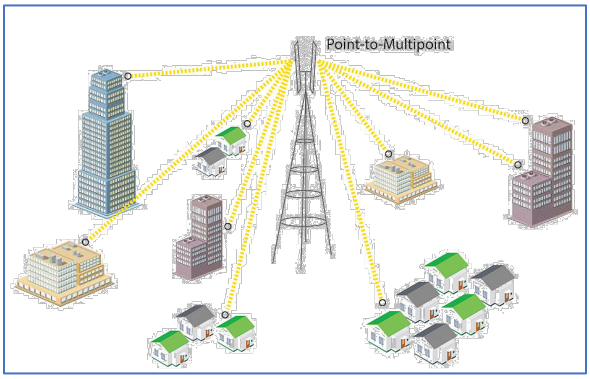

Figure 48: Point-to-multipoint FWA

As advances in 5G will benefit the fixed-wireless and satellite markets and vice-versa, the capability-to-cost ratio with wireless equipment is improving rapidly. FWA versions of 5G cellular systems are becoming available and some, such as that being developed by Cambrium, Silku, and Starry, are being targeted as a replacement to last-mile fibre connections.

To achieve the aggressive capability targets set for 5G systems, all aspects of the radio technology are being exploited, from software-defined radio technology to more complex modulation, signal processing, and antenna (beam-forming) technologies, among others. Of these, beam-forming is especially key, as much for its capabilities as its price-tag. Beam-forming refers to the ability of an antenna to generate multiple '*spot*' beams within its coverage area and coordinate the frequency re-use much more efficiently than that possible with fixed coverage antennas – together this increases the effective capacity of the system significantly. In effect, they create many mini-cells within the macro-cell associated with the fixed antenna equivalent – simultaneously increasing both signal strength and bandwidth.

Urban mm-Wave Technology

With the introduction of 5G-based mm-Wave FWA equipment operating in the 60 GHz band, urban communities have the option to provide a wireless access network capable of providing fibre-like (~1 Gb/s) speeds at a much lower cost than traditional FTTP solutions. An example of how this technology works is provided in the figure below.

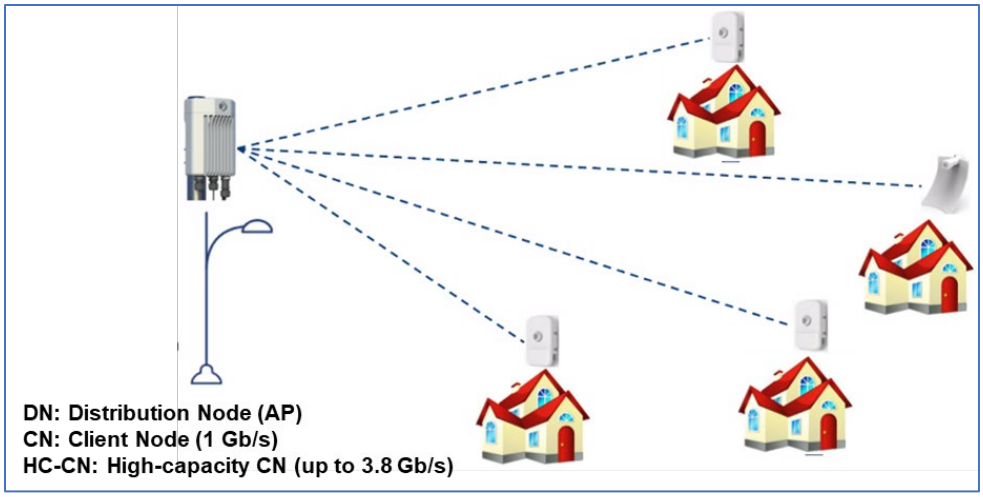

Figure 49: mm-Wave wireless access network example

The mm-Wave wireless access network works by creating a mesh of devices that transmit and receive information. The transmission devices are called Distribution Nodes (DNs) and they form the wireless mesh with main access connected to the Internet via a wireless tower or fibre. As the DN equipment is small, it is typically deployed on lampposts and/or power poles. The DNs are then connected to Client Nodes (CNs) which are installed on customer's homes that receive Internet services. As access links between DNs and CNs must be short (~ 250m), and line-of-site is essential for the mesh network to work reliably.

This type of solution is typically deployed to cover rural areas and parts of urban areas which do not have direct access to fibre or a fixed wireless tower.

Satellite Networks

For decades, satellites in geo-synchronous orbit have provided world-wide television converge, and more recently, Internet access to remote areas.

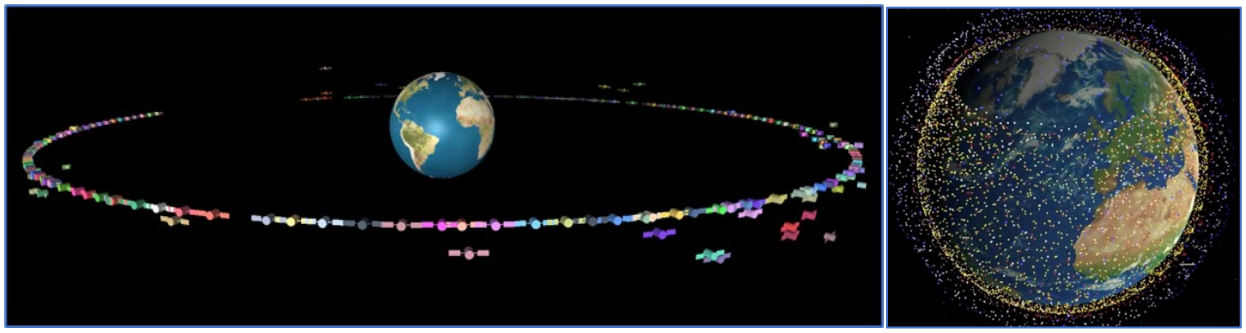

Figure 50: Illustration of satellite technology

As the geo-synchronous orbit is situated at 22,300 miles or 36,000 kilometres above the equator, these multi-hundred million-dollar satellites (one per launch vehicle) have two issues when it comes to providing Internet services:

1. Capacity – Each satellite is within view of millions of premises which share the same network.
2. Latency – Due to the round-trip times to the satellite, the signals are delayed by a minimum of 240 ms.

Low Earth Orbit (LEO) satellites solve both problems by using many small and relatively inexpensive satellites in low earth orbit less than 2,000 km above the surface. There are several organizations that have planned and/or deployed constellations of LEO satellites. A comparison of their deployment plans is given in the table below.

Table 16: LEO satellite Internet service providers

	OneWeb	Starlink	Telesat	Amazon (Kuiper)
Altitude, km	1,200	240 – 1,150	1,000 – 1,240	590 – 630
Constellation Size	720	12,000 by 2026 42,000 planned	298	3,236
# Deployed	74	1,993	1	0
Capacity / Satellite	8.8 Gbps	20.1 Gbps	35.7 Gbps	TBD
Beam Coverage, km^2	75,000	28,000	960 – 250,000	TBD
Service Launch	2021	2020 – US & Canada 2021 - Global	2022	TBD

Appendix B: List of Stakeholders Engaged

Table 1716: List of stakeholders engaged

Name	Organization	Title
Nelson Pacheco	Alberta SuperNet	Operations Manager
Paresh Dhariya	Devon	GM of Planning and Operations
Kent Pudlowski	Leduc County	Director of Strategic Initiatives
Trevor Harder	Fort Saskatchewan	Director of IT
Marc Fiht	Parkland County	Director of Strategic Initiatives
Michelle Levasseur	Stony Plain	Economic Development Officer
Adam Scharmann	Stony Plain	Manager of Technology Services
Brenda Otto	Stony Plain	General Manager, Strategic Services; Acting Manager, Corporate Services
Amanda Alwyn-Smith	Stony Plain	Administrative Assistant II Engineering
Kaleb Brink	Stony Plain	Economic Development Specialist
Aleks Cieply	Stony Plain	Manager of Engineering
Tom Goulden	Stony Plain	Town Manager
Courtney Cathcart	Shaw Communication Inc.	Government Relations, Prairies
Annita Wilton	Shaw Communication Inc.	Director, National Planning Operations
Todd Musat	Shaw Communication Inc.	Director, Critical Infrastructure Services
Brent Ives	Spruce Grove	Director of IT
Joanne Graham	St. Albert, previously Leduc	Sr. Manager of IT
Rob Schneider	Sturgeon County	Manager, Information Services
Tom Hovland	TELUS	Strategy Manager
Matthew Schweighart	TELUS	General Manager, Northern Alberta

Appendix C: Survey and Speed Test Results

Data from the surveys can be found in the following file:

Combined Internet Satisfaction Survey Da

CIRA Speed Test results can be found at this link: CIRA Stony Plain

Alternatively, data can be found in the following file:

CIRA Data Stony Plain 23-01-04.xlsx

Appendix D: Detailed Service Plans

To access the Internet, residents and businesses require a subscription to an Internet service provider (ISP). This section provides a listing of the various ISPs that serve Stony Plain and the region around it, and a synopsis of their offerings.

Broadband Surfer

Broadband Surfer Canada utilizes Cambium wireless technologies to provide Internet services in Alberta. Their current coverage includes Parkland, Lac Ste Anne and Leduc Counties. Information about offered Internet service packages is given below.

Table 18: Broadband Surfer Internet plans

	Basic	Surfer	Premium	Sunset Special
Price	$49.95/month	$59.95/month	$69.95/month	$139.95/month
Download Speed	3 Mbps	6 Mbps	10 Mbps	50 Mbps
Upload Speed	500 Kbps	800 Kbps	1.2 Mbps	10 Mbps
Monthly Data Limit	Unlimited	Unlimited	Unlimited	Unlimited

Clearwave

Clearwave Broadband Networks provides Fixed Wireless Access (FWA) Internet services to rural and urban areas in Alberta. There are different service plans offered for residences and businesses.

Residential Internet

There four different categories of Internet services available for residential premises.

Table 19: Clearwave Rural Wireless Internet plans

Rural Wireless	RSS6.0	RPS15.0	RPS25.0	RPS50.0	RPS50.0UL
Price/month	$69.95	$79.95	$99.95	$129.95	$169.95
Download Speed	6 Mbps	15 Mbps	25 Mbps	50 Mbps	50 Mbps
Monthly Data Limit	200 GB	350 GB	600 GB	1000 GB	Unlimited

Rural Wireless requires $299.95 installation fees with no contract and 60-day money back guarantee.

Table 20: Clearwave Urban Cable Internet plans

Urban Cable	CAB50	CAB150	CAB300	CAB600
Price/month	$49.95	$69.95	$79.95	$89.95
Modem Rental	$15/month	$15/month	$15/month	$20/month
Modem Purchase	$155	$155	$155	$195
Download Speed	50 Mbps	150 Mbps	300 Mbps	600 Mbps
Upload Speed	5 Mbps	15 Mbps	20 Mbps	20 Mbps
Monthly Data Limit	Unlimited	Unlimited	Unlimited	Unlimited

Urban cable requires $149.95 installation fees with no contract and 30-day money back guarantee.

Table 21: Clearwave Urban Wireless Internet plans

Urban Wireless	RPS25.0	RPS50.0	RPS100.0	RPS150.0
Price/month	$64.95	$74.95	$84.95	$104.95
Download Speed	25 Mbps	50 Mbps	100 Mbps	150 Mbps
Upload Speed	12 Mbps	25 Mbps	50 Mbps	100 Mbps
Monthly Data Limit	600 GB	750 GB	1000 GB	1500 GB

Urban wireless requires $149.95 installation fees with no contract and 60-day money back guarantee.

Table 22: Clearwave Cottage Wireless Internet plans

Cottage Wireless	RPS15.0	RPS25.0	RPS50.0
Price/month	$39.95	$49.95	$59.95
Download Speed	15 Mbps	25 Mbps	50 Mbps
Upload Speed	7 Mbps	12 Mbps	12 Mbps
Monthly Data Limit	100 GB	200 GB	400 GB

Cottage wireless requires $199.95 installation fees with no contract and 60-day money back guarantee.

Business Internet – Capital Region

There are four categories of Internet services available for businesses.

Installation fees include $350 for wall-mounted modem, $395 for a tripod and $475 for a non-penetrating roof mount (NPRM).

Table 23: Clearwave Basic Services Business Internet plans

Basic Services	CBS15.0	CBS25.0	CBS50.0	CBS100.0
Price/month	$79.95	$99.95	$119.95	$139.95
Download Speed	15 Mbps	25 Mbps	50 Mbps	100 Mbps
Upload Speed	7 Mbps	12 Mbps	25 Mbps	50 Mbps
Monthly Data Limit	500 GB	1000 GB	1000 GB	1000 GB

Table 24: Clearwave Standard Services Business Internet plans

Standard Services	CSS15/15	CSS25/25	CSS50/50	CSS100/100
Price/month	$99.95	$149.95	$169.95	$229.95
Download Speed	15 Mbps	25 Mbps	50 Mbps	100 Mbps
Upload Speed	15 Mbps	25 Mbps	50 Mbps	100 Mbps
Monthly Data Limit	Unlimited	Unlimited	Unlimited	Unlimited

Table 25: Clearwave Managed Services Business Internet plans

Managed Services	CMS50	CMS100	CMS250
Price/month	$199.95	$399.95	$499.95
Download Speed	50 Mbps	100 Mbps	250 Mbps
Upload Speed	50 Mbps	100 Mbps	250 Mbps
Monthly Data Limit	Unlimited	Unlimited	Unlimited

Table 26: Clearwave Backup Internet Services Business Internet plans

Backup Internet Services	BIS25	BIS50	BIS100	BIS200
Price/month	$24.95	$39.95	$49.95	$79.95
Download Speed	25 Mbps	50 Mbps	100 Mbps	200 Mbps
Upload Speed	15 Mbps	25 Mbps	50 Mbps	100 Mbps
Monthly Data Limit	25 GB	50 GB	100 GB	150 GB

Shaw

Shaw offers Fibre Internet service in the Stony Plain area. There are two types of home Internet services offered depending upon the consumption needs of the customer – Fibre+ Essentials and Fibre+ Max – with each one containing multiple plans.

Table 27: Shaw Fibre+ Essentials Home Internet plans

Fibre+ Essentials	Fibre+ 10	Fibre+ 75
Contract Term	2-year	2-year
Price	$50/month	$79/month
Download Speed	Up to 10 Mbps	Up to 75 Mbps
Upload Speed	Up to 1 Mbps	Up to 7.5 Mbps
Monthly Data Limit	150 GB	500 GB
Supported Devices	1	1-3

Table 28: Shaw Fibre+ Max Home Internet plans

Fibre+ Max	Fibre+ 250	Fibre+ 500	Fibre+ Gig	Fibre+ Gig 1.5
Contract Term	2-year	2-year	2-year	2-year
Price	$79/month	$89/month	$99/month	$129/month
Download Speed	Up to 250 Mbps	Up to 500 Mbps	Up to 1 Gbps	Up to 1.5 Gbps

Upload Speed	Up to 25 Mbps	Up to 100 Mbps	Up to 100 Mbps	Up to 100 Mbps
Monthly Data Limit	Unlimited	Unlimited	Unlimited	Unlimited
Supported Devices	8+	14+	20+	30+

The Fibre+ Max Internet comes with the next generation of Wi-Fi network protocol - i.e., Wi-Fi 6 – which brings faster Internet speeds, better battery life and less bandwidth congestion compared to the previous iterations.

In addition to home Internet, Shaw also offers Fibre Internet for businesses.

Table 29: Shaw Business Internet plans

Shaw Business	**Business Internet 750**	**Business Internet Gig**	**Business Internet Gig 2.0**
Contract Term	2-year	2-year	2-year
Price	$89/month	$99/month	$129/month
Download Speed	Up to 500 Mbps	Up to 1 Gbps	Up to 1.5 Gbps
Upload Speed	Up to 100 Mbps	Up to 100 Mbps	Up to 100 Mbps
Monthly Data Limit	Unlimited	Unlimited	Unlimited
Supported Devices	14+	20+	30+

Note that the business Internet plans provided above are advertised standard plans which are typically designed for small-medium businesses with limited capacity. Their enterprise solutions, which are designed for bigger entities such as a municipality, are much more complex as they include Service Level Agreements (SLAs) and are usually priced much higher. Since the prices for enterprise solutions are dependent on unique needs of each organization, they have been excluded from this section.

Starlink

Starlink offers satellite Internet service for residential and business areas or remote RV or mobile users as long as they have clear access directly to the Starlink satellite network.

There is singular Internet plan or service options for residential, businesses and RV/Mobile available for areas within Stony Plain that contain a monthly service fee and various priority access and Internet speed options as given below.

Table 30: Starlink Internet plans

Satellite	Residential	Business	RV/Mobile
Price	$140/month	$635/month	$170/month
Download Speed	20-100 Mbps	40-220 Mbps	5-50 Mbps
Upload Speed	5-15 Mbps	8-25 Mbps	2-10 Mbps
Monthly Data Limit	1 TB	3 TB	1 TB
Additional Priority Access	$0.32/GB	$1.28/GB	$2.56/GB

TekSavvy

TekSavvy offers two types of Internet plan options: cable and DSL.

Table 31: TekSavvy Cable Internet plans

Cable	1000 unlimited	500 unlimited	100 unlimited	60 unlimited	30 unlimited
Price	$124.95/month	$114.95/month	$77.95/month	$67.95/month	$57.95/month
Download Speed	Up to 1000 Mbps	Up to 500 Mbps	Up to 100 Mbps	Up to 60 Mbps	Up to 30 Mbps
Upload Speed	Up to 25 Mbps	Up to 100 Mbps	Up to 10 Mbps	Up to 6 Mbps	Up to 5 Mbps
Supported Devices	200+	10+	5-9	5-9	5-9

Table 32: TekSavvy DSL Internet plans

DSL	25 unlimited	15 unlimited	6 unlimited	6 pro
Price	$62.95/month	$49.95/month	$44.95/month	$39.95/month
Download Speed	Up to 25 Mbps	Up to 15 Mbps	Up to 6 Mbps	Up to 6 Mbps
Upload Speed	Up to 5 Mbps	Up to 1 Mbps	Up to 1 Mbps	Up to 1 Mbps
Monthly Data Limit	Unlimited	Unlimited	Unlimited	400 GB
Supported Devices	1-4	1-4	1-4	1-4

TELUS

TELUS offers various Internet plans based on either a fixed term contract or on a month-to-month basis. There are three most popular options for the home Internet based on a 2-year contract term.

Table 33: TELUS Home Internet plans

	Fast Internet 15	Faster Internet 25	Fastest Internet 75
Contract Term	2-year	2-year	2-year
Price	$50/month	$55/month	$60/month
Download Speed	15 Mbps	25 Mbps	75 Mbps
Upload Speed	1 Mbps	5 Mbps	15 Mbps
Supported Devices	1 (streaming/gaming)	1 (streaming/gaming)	1-10 (streaming/gaming)

The same plans are also offered on a month-to-month basis, but users are required to pay a higher price - $80, $85 and $90 respectively – per month.

There are three separate plans offered for business with different contract terms and prices, however, the speeds offered are essentially the same as home plans.

Table 34: TELUS Office Internet plans

	Office Internet 15	Office Internet 25	Office Internet 75
Contract Term	3-year	3-year	3-year
Price	$40/month	$50/month	$70/month
Download Speed	15 Mbps	25 Mbps	75 Mbps
Upload Speed	1 Mbps	5 Mbps	15 Mbps
IP Addresses	2 (Dynamic)	2 (Dynamic)	2 (Dynamic)

Similar to home plans, office plans are also offered on a month-to-month basis at a higher price point - $50, $60 and $80 respectively.

Note that the business Internet plans provided above are advertised standard plans which are typically designed for small-medium businesses with limited capacity. Their enterprise solutions, which are designed

for bigger entities such as a municipality, are much more complex as they include Service Level Agreements (SLAs) and are usually priced much higher. Since the prices for enterprise solutions are dependent on unique needs of each organization, they have been excluded from this section.

In the areas where TELUS has PureFibre infrastructure, it offers some of its fastest Internet plans.

Table 35: TELUS PureFibre Internet plans

PureFibre	Fast	Faster	Fastest
Contract Term	2-year	2-year	2-year
Price	$89/month	$119/month	$175/month
Download Speed	940 Mbps	1.5 Gbps	2.5 Gbps
Upload Speed	940 Mbps	940 Mbps	2.5 Gbps
Supported Devices	20+ (Wi-Fi 6 included)	30+ (Wi-Fi 6 included)	50+ (Wi-Fi 6 included)

In addition, TELUS offers Internet to rural areas (not covered by their ground cables) via their Smart Hubs which are 5G enabled devices that provide access to Internet over TELUS 5G and LTE network. The plans offered vary depending upon location and availability of network towers. In general, there are three options offered for the areas surrounding Stony Plain.

Table 36: TELUS Smart Hub Internet plans

	Smart Hub 25	Smart Hub 50	Smart Hub 100
Contract Term	2-year	2-year	2-year
Price	$70/month	$89/month	$110/month
Download Speed	Up to 25 Mbps	Up to 50 Mbps	Up to 100 Mbps
Monthly Data Limit	500 GB	500 GB	500 GB

It is important to note that the Smart Hub is a fixed connection meaning that the device cannot be moved once installed even though it may seem that the devices could be portable.

TERAGO

TERAGO provides wireless connectivity and private 5G wireless networking services to businesses operating across Canada.

Table 37: TERAGO Internet plans

Business Internet	Internet 100/20	Internet 50/10
Download Speed	100 Mbps	50 Mbps
Upload Speed	20 Mbps	10 Mbps
Monthly Data Limit	Unlimited	Unlimited

Xplore

Xplore offers voice and data communication services through a mixture of fibre, fixed wireless and satellite technologies to extend service across rural Canada. For all neighborhoods within Stony Plain including outside of the core area such as Meridian Meadows, Umbach and North Business Parks, and Rosenthal Real Estates, Xplore offers fixed wireless plans given below.

Table 38: Xplore Fixed Wireless Internet plans

Fixed Wireless	LTE 50 unlimited	LTE 25 unlimited	LTE 25	LTE 10 unlimited
Contract Term	1-year	1-year	1-year	1-year
Price	$99/month	$69/month	$59/month	$59/month
Download Speed	Up to 50 Mbps	Up to 25 Mbps	Up to 25 Mbps	Up to 10 Mbps
Upload Speed	Up to 10 Mbps	Up to 5 Mbps	Up to 5 Mbps	Up to 1 Mbps
Monthly Data Limit	Unlimited	Unlimited	350 GB	Unlimited

In addition to Fixed Wireless plans, Xplore also has a satellite plan option for remote premises not covered by their fixed wireless network.

Table 39: Xplore Satellite Internet plans

Satellite	Sat 10	Sat 25
Contract Term	1-year	1-year
Price	$89.99/month	$119.99/month

Download Speed	Up to 10 Mbps	Up to 25 Mbps
Upload Speed	Up to 1 Mbps	Up to 1 Mbps
Monthly Data Limit	50 GB	200 GB
Speed After Quota	512 Kbps	512 Kbps

Appendix E: Glossary

In accordance with industry standards, the following definitions have been developed by the National Telecommunications and Information Administration.

Numbers

3G: The term for the 3rd generation wireless telecommunications standards usually with network speeds of less than 1 Mbps.

4G: The term for 4th generation wireless telecommunications standards usually with network speeds greater than 1 Mbps.

5G: The term for emerging 5th generation wireless telecommunications standards usually associated with network speeds of up to 1 GBPS or more.

B

Backbone: A major high-speed transmission line that strategically links smaller high-speed Internet networks across the globe.

Backhaul: The portion of a broadband network in which the local access or end-user point is linked to the main Internet network.

Bandwidth: The capability of telecommunications and Internet networks to transmit data and signals.

Broadband: The term broadband commonly refers to high-speed Internet access that is always on and faster than traditional dial-up access. Broadband includes several high-speed transmission technologies, such as fiber, wireless, satellite, digital subscriber line and cable. For the Federal Communications Commission (FCC), broadband capability requires consumers to have access to actual download speeds of at least 25 Mbps and actual upload speeds of at least 3 Mbps.

Broadband Adoption: The use of broadband in places where it is available, measured as the percentage of households that use broadband in such areas. Link to Digital Inclusion definition

D

Dark Fiber: Fiber that is in place but not being used for broadband services. ("non-lit" fiber, also see "Lit Fiber").

Digital Divide: The gap between those of a populace that have access to the Internet and other communications technologies and those that have limited or no access.

Digital Equity: Recognizes that digital access and skills are now required for full participation in many aspects of society and the economy. Digital Equity links Digital Inclusion to social justice and highlights that a lack of access and/or skills can further isolate individuals and communities from a broad range of opportunities.

Digital Inclusion: Implies that individuals and communities have access to robust broadband connections; Internet- enabled devices that meet their needs; and the skills to explore, create and collaborate in the digital world.

Digital Literacy: The ability to leverage current technologies, such as smartphones and laptops, and Internet access to perform research, create content and interact with the world.

Digital Skills: Any skills related to operating digital devices or taking advantage of digital resources.

DOCSIS (Data Over Cable System Interface Specification): The international telecommunications standard for cable signaling data and spectrum sharing.

DSL (Digital Subscriber Line): A form of technology that utilizes a two-wire copper telephone line to allow users to simultaneously connect to and operate the Internet and the telephone network without disrupting either connection.

E

eGovernment Services: The government's use of web-based and information technology resources to connect with citizens and provide online services and resources.

F

Fibre Broadband Association (FBA): A member-led association that collaborates with industry allies to propel fiber deployment forward for a better broadband future.

Fiber (Also referred to as Fiber Strand): A flexible hair-thin glass or plastic strand that is capable of transmitting large amounts of data at high transfer rates as pulses or waves of light.

FTTF (Fiber to the Farm): The delivery and connection of fiber optics directly to a farm

FTTH or FTTP (Fiber to the Home or Fiber to the Premise): The delivery and connection of fiber optics directly to a home or building.

Fixed Wireless Broadband Access: The use of wireless devices/systems in connecting two fixed locations, such as offices or homes. The connections occur through the air, rather than through fiber, resulting in a less expensive alternative to a fiber connection.

G

Grant: A legal instrument reflecting a relationship between a government agency and a recipient. The main purpose of the relationship is to dispense money or resources in order to accomplish a public purpose. No substantial involvement is anticipated by the government agency during the recipient's completion of the activity.

I

Internet Service Provider (ISP): A company that provides users (individuals or businesses) with access (a connection) to the Internet and related services.

Interconnection: The linking of numerous telecommunications networks to exchange user traffic.

L

Last Mile: The technology and process of connecting the end customer's home or business to the local network provider.

Lit Fiber: An active fiber optic cable capable of transmitting data.

Loan: The giving of money or property in exchange for payment of the principal amount plus interest.

Local Area Network (LAN): A group of network devices that are on a high-speed connection and typically within the same building or location. (cite: Indiana University, https://kb.iu.edu/d/agki)

LTE (Long Term Evolution): A 4G wireless broadband technology that provides speeds up to 100 Mbps download and 30 Mbps upload.

M

Middle Mile: The connection between a local network, also called a "last mile" connection, and the backbone Internet network.

N

Network Infrastructure: The hardware and software components of a network that provide network connectivity and allow the network to function.

O

Open Access Network: Networks that offer wholesale access to network infrastructure or services provided on fair and reasonable terms with some degree of transparency and non-discrimination.

P

Point of Presence: The particular place or facility where local Internet service providers connect to other networks. Distance from the Point of Presence can affect service availability and pricing.

R

Rights-of-Way (ROW): ROW are legal rights to pass through property owned by another. ROW are frequently used to secure access to land for digging trenches, deploying fiber, constructing towers and deploying equipment on existing towers and utility poles.

S

Socio-economic return on investment (SROI): Socio-economic return is a method for measuring values that are not traditionally reflected in financial statements, including social, economic, and environmental factors.

Service Area: The entire area within which a service provider either offers or intends to offer broadband service.

SDSL (Symmetrical DSL): A technology that permits the transfer of data over copper telephone lines. The transmission bandwidth for uploads and downloads is equal.

SONET (Synchronous Optical Network): An American National Standards Institute standard for the simultaneous transmission of data over optical fiber.

Spectrum: A conceptual tool used to organize and map the physical phenomena of electromagnetic waves. These waves propagate through space at different radio frequencies, and the set of all possible frequencies is called the electromagnetic spectrum.

W

Wi-Fi (Wireless Fidelity): A technology that uses radio transmissions to enable electronic devices to connect to a wireless local area network (LAN).

WISP: An ISP that provides service through a wireless network.