CONNECTING the DOTS

ALBERTA RURAL BROADBAND COVERAGE STUDY
FINAL PUBLIC REPORT (November 2011)

Partners in Advocacy & Busines

Connecting the Dots: Public Version
Alberta Rural Broadband Coverage Study (2011)

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In partnership with the Alberta Association
of Municipal Districts & Counties
and the Alberta Urban Municipalities Association

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1 EXECUTIVE SUMMARY

Enabling broadband access is a long-term investment in rural Alberta's and its ability to build community capacity and initiate economic development.

Communications and business applications are merging. Vendors such as IBM and Microsoft are now developing software that integrates communications with business applications, with the expectation that the end user has access to reliable broadband coverage.

All levels of the Government of Alberta are beginning to implement these communication integrated applications to support education, health and community-based programs. Delivering these programs to rural communities implies that the community has access to broadband services. Reliable broadband is no longer a nice to have, but a must have for all rural communities.

This broadband coverage study is the first step in solving a complex problem. When there is already a well-established community of Wireless Internet Service Providers (WISPs) that provide broadband services to rural residents and businesses, how can broadband access be built that will be able to support a rural community's coverage and capacity requirements today and in the future?

The objective of this study was to estimate the remaining unserved areas in Alberta. The areas studied included:

- Townships
- Municipal Districts
- Specialized Municipalities
- Special Areas
- Improvement Districts
- Cities
- Towns
- Villages
- Summer Villages
- Hamlets
- First Nations
- Métis Settlements

The study excluded the seven large municipalities of Calgary, Edmonton, Fort McMurray, Grande Prairie, Lethbridge, Medicine Hat and Red Deer as they were deemed to be served by one or more Internet Service Providers (ISPs).

During the study, a broadband coverage analysis was completed for each township, town, village, summer village, hamlet, First Nations and Métis settlements in the province. The primary objective of the analysis was to estimate if an area is either "Served" or "Unserved". Fixed wireless broadband services are available in served areas and not available in unserved areas. In order to reduce the complexity of the study the province was divided into five project districts. The study was completed in four phases for each project district. The phases included:

1. Data Collection
2. Site Verification and Discovery
3. Coverage Maps
4. Coverage Analysis

The outcome of the study was a comprehensive coverage map for each project district. The project district coverage maps may be used as a reference for any future broadband initiatives. The uniqueness of each project district must be considered prior to creating and implementing a solution to provide broadband coverage in the unserved areas. (Appendix A: District 1 Project District Coverage)

In the data collection phase, the WISPs were asked to provide detailed technical data and the GPS coordinates for each of their sites. A site can be a tower, building, or pole and used to connect the residents and businesses in the area to the Internet. A total of 1,848 sites were identified during the study.

The majority of the WISPs consider this technical data confidential and as a result did not provide the data required. To compensate for the lack of technical data, a 2.4 GHz template was created and used to estimate the broadband coverage for each site. This template introduced an estimated 15% error rate in the coverage estimate which will result in areas that are currently served to be classified as unserved.

This broadband coverage study is the first step in solving a complex problem.

2/INTRODUCTION

The results show that coverage in the municipal districts, improvement districts and special areas range from 0% coverage in the Municipal District of Ranchland to greater than 90% coverage in municipal districts such as Grande Prairie and Parkland County. All of 108 towns and 95 villages were classified as served, 7 out of 44 summer villages and 55 hamlets were classified as unserved. Metis and First Nations communicates were also studied during this analysis to determine their level of service.

This study is only the first step to ensuring that all rural residents and businesses have access to reliable broadband services today and in the future. Moving forward, it is important to engage the Municipal Districts, Towns, Villages, Summer Villages, Hamlets, First Nations, Métis Settlements, Wireless Internet Service Providers and rural residents and businesses in any future broadband initiatives. The results of this study are a snap shot of the broadband coverage in Alberta. As time goes by, new initiatives, technologies and towers will make these maps become less accurate with age.

The AAMDC conducted a Rural Broadband Gap Analysis survey in 2009. The results of this survey were used to create rural broadband maps indicating the areas where broadband services are available (served) and where broadband services are not available (unserved). (Appendix B: AAMDC Sample Coverage Map (2009))

Recent federal, provincial, municipal and private sector projects have and will continue to result in, improved broadband access in a number of unserved areas. These programs include:

The Rural Connections: Community Broadband Infrastructure Pilot Program has funded broadband infrastructure, testing, feasibility and outreach and extension programs. The program allocated $10.4 million for 34 projects. A complete list of projects approved for funding is available at: http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/csi12826

The Broadband Canada-Connecting Rural Canadians Program approved funding for projects in Alberta and elsewhere in Canada. Canada's Economic Action Plan provided $225 million for the development and implementation of a strategy to extend broadband coverage. By far the biggest component of this strategy is Broadband Canada: Connecting Rural Canadians, an initiative that targets Canadians living in unserved and underserved areas. Additional information is available at: http://www.ic.gc.ca/eic/site/719.nsf/eng/00050.html (Appendix C: Broadband Canada Fund Projects – Proposed Coverage Footprint)

In August 2010 the Canadian Radio-Television Commission (CRTC) directed telecom firms to use a portion of deferral account funds to improve broadband infrastructure in rural communities in Alberta and elsewhere. TELUS had $163 million in its deferral account. TELUS initially proposed spending the fund on the delivery of broadband to 334 rural communities in BC, Alberta and Quebec. Additional information is available at http://www.crtc.gc.ca/eng/archive/2008/dt2008-1.htm (Appendix D: Alberta Deferral Communities)

While these and other funding initiatives will help to close the rural broadband gap, areas remain in Alberta where broadband services continue to be unavailable.

3/ DEFINITIONS

1/ ACCESS POINT (AP)

Access Points are installed on towers, buildings and poles. An AP is used to establish a fixed wireless network to a rural subscriber's residence or business. An access point connects wirelessly with a subscriber module to provide a broadband service.

2/ AGGREGATION RATIO

Wireless Internet Service Providers (WISPs) purchase backhaul bandwidth to the Public Internet from wholesale providers such as TELUS, Bell, Shaw and Axia. The purchased bandwidth is backhauled to the geographical area where the WISP wishes to provide broadband services. The subscribers that connect to the WISP's network share the backhaul bandwidth. Prior to providing any broadband services the WISP will decide how many subscribers will share the bandwidth. This is called the aggregation ratio. The ratio is dependent upon the WISP's management practices and can vary from 5 to 1 (five subscribers share the bandwidth) to as high as 100 to 1. Generally, as the aggregation ratio increases, subscriber bandwidth decreases and connection speeds are slower.

3/ BACKHAUL NETWORK

A broadband network is comprised of three components: (1) Access network to the rural subscriber's residence or business, (2) Backhaul network from the access network to the closest SuperNet Point-of-Presence (PoP), (3) Backbone network from the Point-of-Presence (PoP) to the Public Internet.

4/ BROADBAND

Today the term broadband refers to the amount of bandwidth available to a subscriber. At one time broadband referred to bandwidth speeds of greater than 1.5 Mbps and narrowband referred to speeds of less than 1.5 Mbps.

Example: A subscriber has broadband speeds of 5 Mbps download and 1 Mbps upload. Broadband speeds are measured by the number of bits of data that are transferred over a network over a period of time (for example, one second). A bit is a "binary digit" and is basic unit of information in a computer or telecommunications system. Bits per second (bps) is normally measured in multiples of a thousand bits per second (kbps), million bits per second (Mbps), or billion (Gbps).

5/ dBm

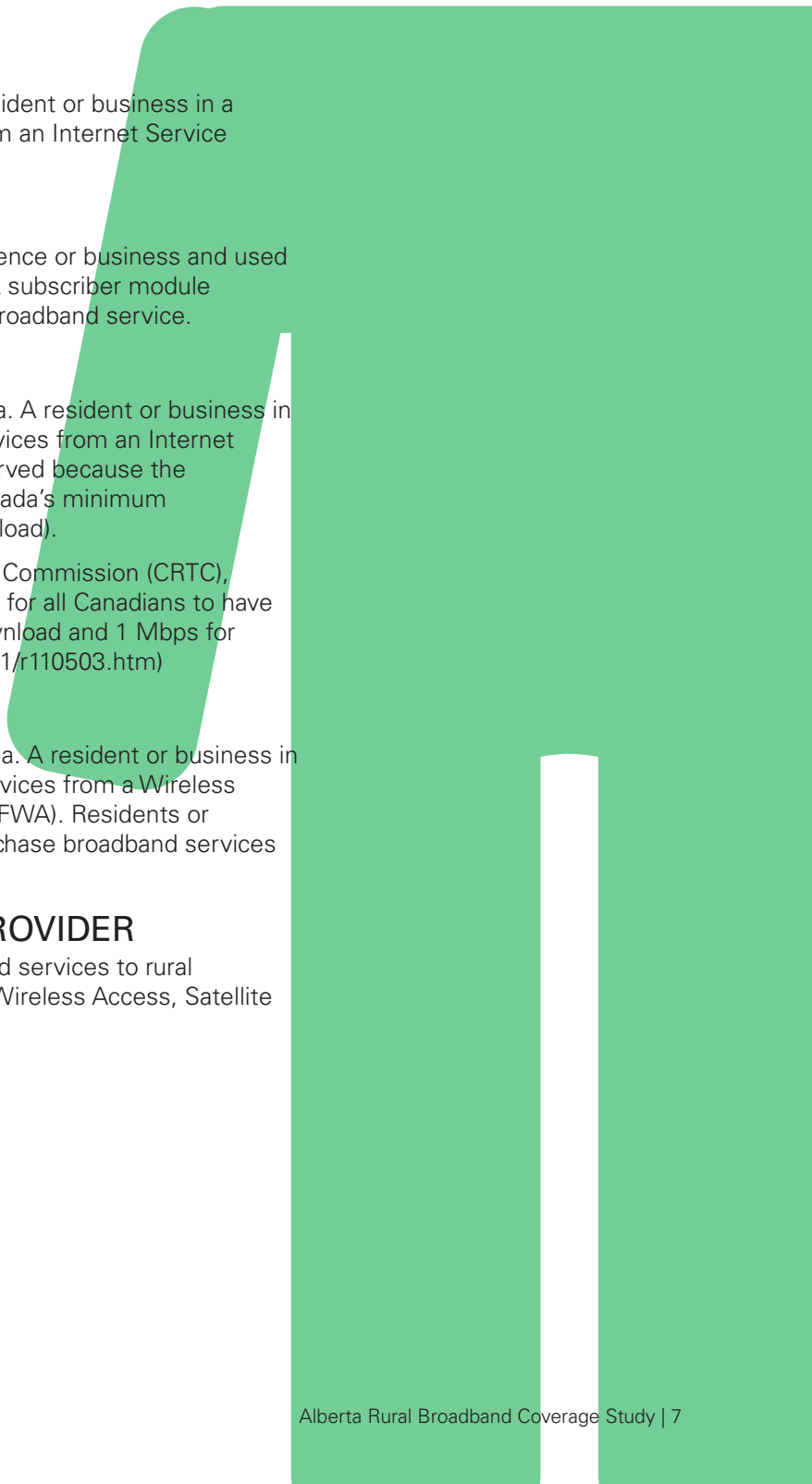
dBm is an abbreviation for the power ratio in decibels (dB) of the measured power between an access point and a subscriber module. The lower the value, the lower the power between the access point and subscriber module. The typical maximum received signal power of a fixed wireless network is between -60 dBm and -90 dBm.

6/ DIGITAL SUBSCRIBERS LINE (DSL)

DSL refers to a family of technologies that is used to provide broadband services over the twisted copper wire that connects a residence or business to the service provider's network. TELUS owns and operates the copper access network in Alberta. Third-Party Internet Service Providers are allowed to lease the copper wire from TELUS to provide broadband services to subscribers. This is called Dry DSL or Unbundled DSL.

7/ FIXED WIRELESS ACCESS (FWA)

There are three types of wireless technologies that can be used to provide broadband services to a rural area: (1) Fixed Wireless Access, (2) Satellite Access, (3) Mobility Access. Fixed Wireless Access networks are comprised of fixed access points and subscriber modules.



8/ SERVED AREA

Broadband services are available in a served area. A resident or business in a served area is able to purchase broadband services from an Internet Service Provider.

9/ SUBSCRIBER MODULE (SM)

A subscriber module is installed on a subscriber's residence or business and used to establish a wireless connection to an access point. A subscriber module connects wirelessly with an access point to provide a broadband service.

10/ UNDERSERVED AREA

Broadband services are available in an underserved area. A resident or business in an underserved area is able to purchase broadband services from an Internet Service Provider, but the area is deemed to be underserved because the download and upload speeds do not meet Industry Canada's minimum requirements of 1.5 Mbps (download) and 384 kbps (upload).

The Canadian Radio-television and Telecommunications Commission (CRTC), Canada's telecommunications regulator, has set targets for all Canadians to have access to broadband speeds of at least 5 Mbps for download and 1 Mbps for upload by 2015. (http://www.crtc.gc.ca/eng/com100/2011/r110503.htm)

11/ UNSERVED AREA

Broadband services are not available in an unserved area. A resident or business in an unserved area is not able to purchase broadband services from a Wireless Internet Service Provider using Fixed Wireless Access (FWA). Residents or businesses in an unserved area may still be able to purchase broadband services from a satellite provider.

12/ WIRELESS INTERNET SERVICE PROVIDER

A Wireless Internet Service Provider provides broadband services to rural subscribers using wireless technologies such as Fixed Wireless Access, Satellite and Mobility.

4/WIRELESS SERVICES

There are three types of wireless services that can be used to provide broadband coverage to rural areas:

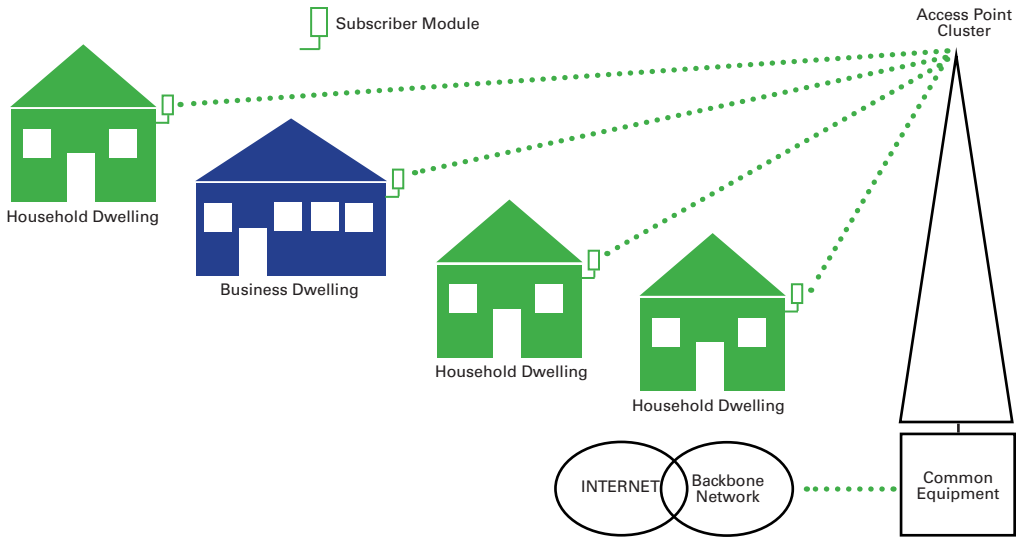
1. Fixed Wireless
2. Mobility
3. Satellite

4.1/ FIXED WIRELESS

Fixed wireless services are provided by Wireless Internet Service Providers (WISPs). The WISPs deploy different fixed wireless technologies such as Wi-FI and WI-Max to provide broadband services to rural areas. The WISPs install access points on sites that are typically placed on a high point of ground near the geographical area they wish to serve. Sites can be built on towers, buildings, or poles. There can be one or more access points installed at each site. There were a total of 1848 sites identified in the study.

Subscriber Modules are installed at the subscriber's premises. The WISP then implements a radio frequency between access point and the subscriber module creating a wireless connection.

Figure 1: Fixed Wireless Services



Industry Canada governs the use of radio frequencies and carves frequencies into bands and specifies how the bands can be used. These bands can be 'Licensed', 'Unlicensed', or 'Lightly Licensed'.

UNLICENSED Anyone is allowed to operate equipment in the unlicensed frequency bands as long as that equipment meets Industry Canada's power and antenna specifications for the band. Systems in the unlicensed bands are quick to deploy and generally cost less. The primary disadvantage to using unlicensed frequencies is interference between the WISPs. The following is a list of the unlicensed frequencies deployed by WISPs in Alberta: 902 – 928 MHz, 2.4 – 2.483.5 GHz and 5.15 – 5.825 GHz.

LICENSED With licensed frequency bands, a WISP pays an annual fee to Industry Canada in exchange for an exclusive right to use a frequency in a specified area. Licensed radio systems are more expensive, but have higher throughput rates and are easier to guarantee reliability. The primary benefit to using licensed frequencies is no interference between service providers. Licensed frequencies held by WISPs in Alberta are 512 – 698 MHz, 2.3 GHz, 2.5 GHz and 3.5 GHz.

LIGHTLY LICENSED Lightly licensed frequency bands are a hybrid of the other two types. A WISP must register with Industry Canada and pay a nominal fee before using any equipment operating in the band. Although registration is required, this does not grant an exclusive right to use that frequency in any particular location. WISPs must still work with each other to mitigate any potential interference issues. Industry Canada is currently issuing lightly licensed spectrum in the 3650 — 3700 MHz bands

An Industry Canada search was completed to estimate the WISPs that have implemented either licensed, unlicensed, or lightly licensed frequencies.

The web site is available at: http://sd.ic.gc.ca/pls/engdoc_anon/web_search.licensee_name_input

Table 1: WISP Frequencies

	Licensed	Unlicensed	Lightly Licensed
WISPs	8	43	2

4.2/ MOBILITY

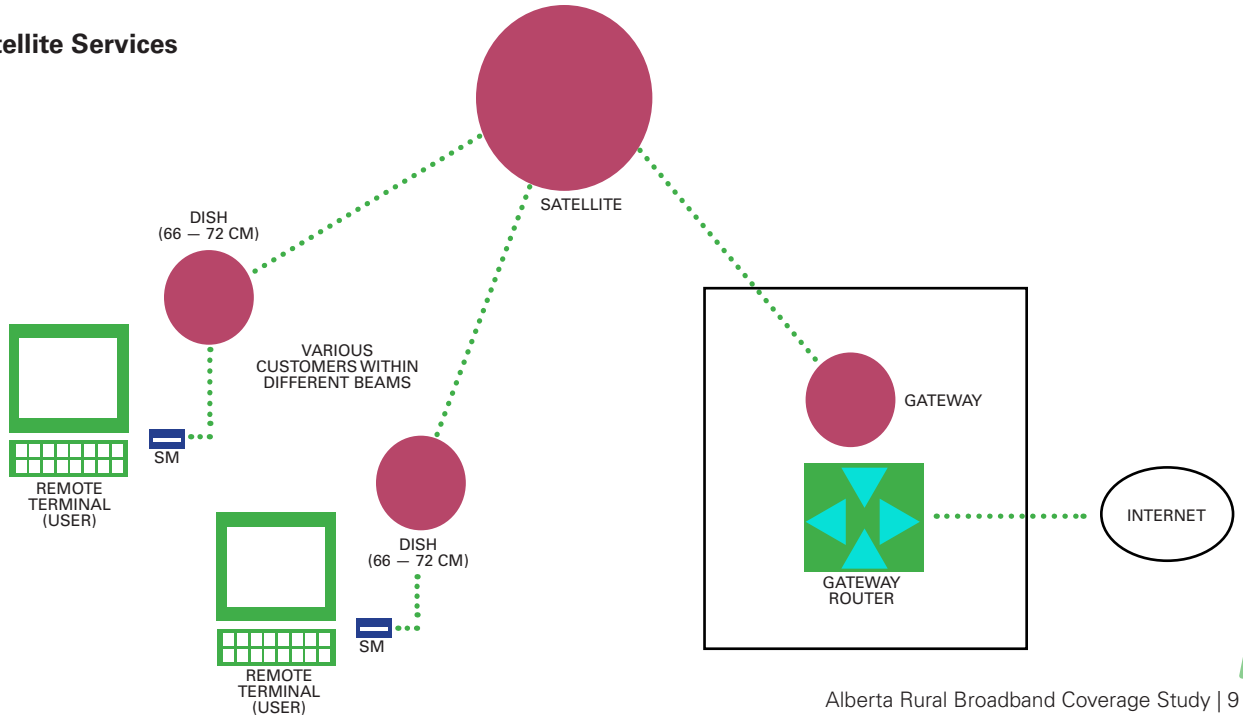
Mobile networks are designed to provide both voice and data services to mobile subscribers. Examples of mobile providers are Bell, TELUS and Rogers. These providers are currently upgrading their current networks to Long Term Evolution (LTE). The LTE standard supports theoretical rates up to 56 Mbps on the downlink and 22 Mbps on the uplink. The actual bandwidth provided to the mobile subscriber will depend on the distance from the subscriber to the tower, tower height and terrain type. All mobile service providers have been actively improving their coverage in rural areas for the past three years.

All mobile service providers have been actively improving their coverage in rural areas for the past three years.

4.3/ SATELLITE

Satellite services are provided between a geostationary satellite and a subscriber's premises. The bandwidth per subscriber is dependent on the total number of subscribers accessing the network at one time, terrain type and weather conditions. The primary providers of satellite services in Alberta are XplorNet and Galaxy Broadband. **Figure 2: Satellite Services** provides an illustration of a typical satellite network.

Figure 2: Satellite Services



The primary providers of satellite services in Alberta are XplorNet and Galaxy Broadband.

Satellite technologies are continually being improved and fourth generation satellite services promise to deliver bandwidths near or better than fixed wireless services in the future.

Table 2: Satellite Service Generations

	First & Second Generation	Third Generation	Fourth Generation
Capability	**Unidirectional**	**Bidirectional (Two Way)**	**Bidirectional (Two Way)**
System Capacity	<1 — 2 Gbps	3 — 10 Gbps	70 — 130 Gbps
Typical Bandwidth/Subscriber	56 — 256 kbps	128 — 500 kbps	5 — 10 Mbps

Third and fourth generation satellite services use regional spot beam technologies to provide coverage in the province. Satellite coverage is dependent upon the selected geographic location of the spot beams.

Satellite coverage is dependent upon the selected geographic location of the spot beams.

5/ OUT-OF-SCOPE

The study excluded the seven large municipalities of Calgary, Edmonton, Fort McMurray, Grande Prairie, Lethbridge, Medicine Hat and Red Deer as they were deemed to be served by one or more Internet Service Providers (ISPs). Due to limited time and available budget the following were also classified as out-of-scope:

- Mobility Coverage
- Satellite Coverage
- Underserved Areas
- Quality of the User Experience

5.1/ MOBILITY COVERAGE

There are three primary mobility providers in the province including TELUS, Bell and Rogers. Each of the providers has constructed an unknown number of tower sites in the province. The following site provides a listing of all the mobility towers in Canada: http://www.ertyu.org/steven_nikkel/cancellsites.html

In order to complete a mobility coverage analysis the following would have to be provided by each of the mobility providers:

- Tower Coordinates and Height
- Radio Equipment Specifications

The above information is considered confidential by the mobility providers and not available.

5.2/ SATELLITE COVERAGE

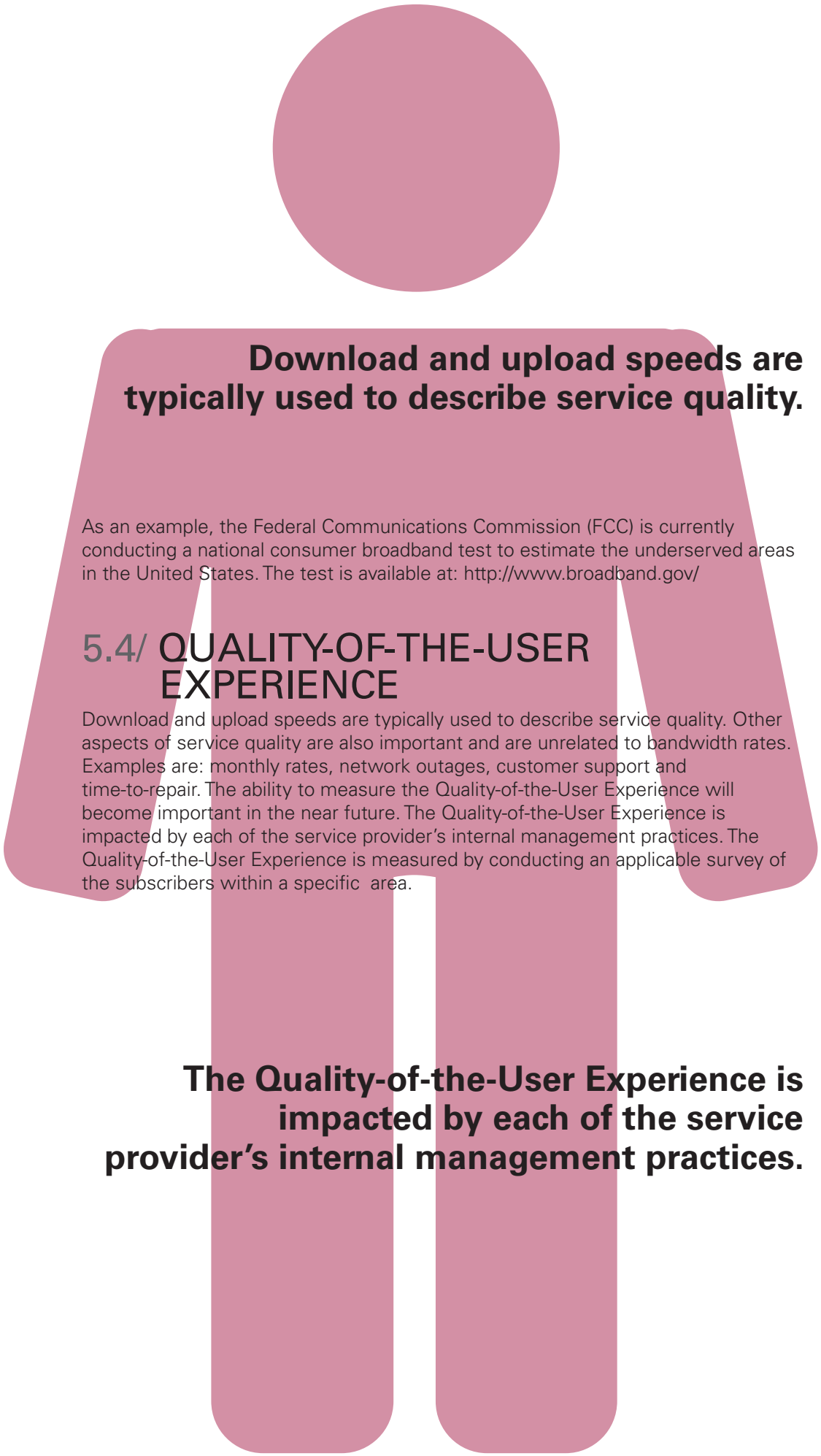
Satellite services and coverage in Alberta is provided by XplorNet and Galaxy Broadband. Both providers currently use a number of satellite companies including Wildblue, Telesat and Spaceway. In the near future they will be providing fourth generation services using KA-SAT, ViaSat-1 and Jupiter satellite companies. The actual coverage footprint that each of these satellite providers has implemented in Alberta is considered to be confidential and not available.

5.3/ UNDERSERVED AREAS

Identifying underserved areas that have less than minimum bandwidth speeds is difficult to estimate because many factors can impact the download and upload speeds. These include:

- Wireless Technology
- Wireless Frequency
- Access Point Height
- Total Number of Subscribers
- Available Backhaul Bandwidth
- Aggregation Ratios
- Service Packages
- Fair Access Policies
- Time-of-Day

Underserved areas are typically identified by having the subscribers within an area conduct a series of broadband speed tests over a predefined period of time. The average of the speed tests could be used to estimate if the area is underserved.



Download and upload speeds are typically used to describe service quality.

As an example, the Federal Communications Commission (FCC) is currently conducting a national consumer broadband test to estimate the underserved areas in the United States. The test is available at: http://www.broadband.gov/

5.4/ QUALITY-OF-THE-USER EXPERIENCE

Download and upload speeds are typically used to describe service quality. Other aspects of service quality are also important and are unrelated to bandwidth rates. Examples are: monthly rates, network outages, customer support and time-to-repair. The ability to measure the Quality-of-the-User Experience will become important in the near future. The Quality-of-the-User Experience is impacted by each of the service provider's internal management practices. The Quality-of-the-User Experience is measured by conducting an applicable survey of the subscribers within a specific area.

The Quality-of-the-User Experience is impacted by each of the service provider's internal management practices.

6/ PROJECT PHASES

There are four project phases:

1. Data Collection
2. Site Verification and Discovery
3. Coverage Maps
4. Coverage Analysis

The province was divided into five geographical project districts based on the AAMDC District Map. Each district is comprised of multiple municipal districts and rural municipalities. (**Appendix H: Project Districts**)

6.1/ PHASE I: DATA COLLECTION

During this phase both Wireless Internet Service Providers and Wired Service Providers were contacted and asked to provide current and future network data for each of the districts.

6.1.1 WIRELESS INTERNET SERVICE PROVIDERS (WISP)

Fifty-three (53) Wireless Internet Service Providers were contacted and asked to provide detailed data about their network including site coordinates and access point/subscriber module information. Most WISPs consider this information to be proprietary, however agreed to provide this information under a Non-Disclosure Agreement (NDA) between the participating WISP and the project contractor, ViTel Consulting.

The data collected was separated into four categories:

1. Data – Provided
   Data was provided by the WISP.
2. Data – Web Site
   Data was not provided by the WISP, but obtained from the WISP's web site.
3. Data – Industry Canada
   Data not provided by the WISP, but obtained from the Industry Canada web site.
4. Data – Not Available
   Data not provided by the WISP and not available from either at the WISP's web site or Industry Canada.

6.1.2 WIRED SERVICE PROVIDERS

Wired Service Providers were contacted and asked to identify the municipalities where they provide wired broadband coverage. The following wired providers were contacted:

- TELUS Communications
- Shaw Communications
- Unbundled DSL Providers (E.g. Internet Centre)
- East Link
- Milk River Cable
- Rainbow Lake Cable

All of the wired service providers responded to the study except: Milk River Cable, Rainbow Lake Cable and TELUS Communications.

6.2/ PHASE II: SITE VERIFICATION & DISCOVERY

This phase included the verification of the network data obtained in Phase I. Westcan Wireless was contracted to discover and verify the sites in Districts 1, 2 and 5. ViTel Consulting completed the discovery and verification in Districts 3 and 4.

6.2.1 SITE VERIFICATION

The accuracy of the coverage study is dependent upon the accuracy of the network data provided by the WISPs. For that reason, it was imperative that the network data be verified. Using the "Data-Provided" data set, the following was verified at each site:

- Site GPS coordinates
- Height
- Total Number of Access Points
- Access Point Models

53 WISPs were contacted and asked to provide detailed data about their network

6.2.2 SITE DISCOVERY

Using the "Data – Web Site" and the "Data – Not Available" data sets Westcan Wireless and ViTel Consulting were contracted to discover and verify the sites. Of the total number of sites categorized as either Data – Web Site and Data – Not Available, approximately 50% of the sites were discovered. The remaining sites that were not discovered had little or no impact on the study as all the areas were already included in the "Data – Provided" data set.

6.3/ PHASE III: COVERAGE MAPS

TaylorWarwick Consulting was contracted to create coverage maps based on the network data collected. Sophisticated propagation software was used to measure the maximum signal strength that can be expected at any geographical location. The propagation software required the manual entry of all sites within and near each area. The result was a best signal coverage map for each municipal district. Additional detail of the process and an example of a coverage map is available in **Section 7: Methodology.**

6.4/ PHASE IV: COVERAGE ANALYSIS

The best signal coverage maps produced in Phase III were used to estimate if a township or municipality is either served or unserved. Additional detail and an example of the coverage analysis is available in **Section 8: Methodology.**

7/ METHODOLOGY

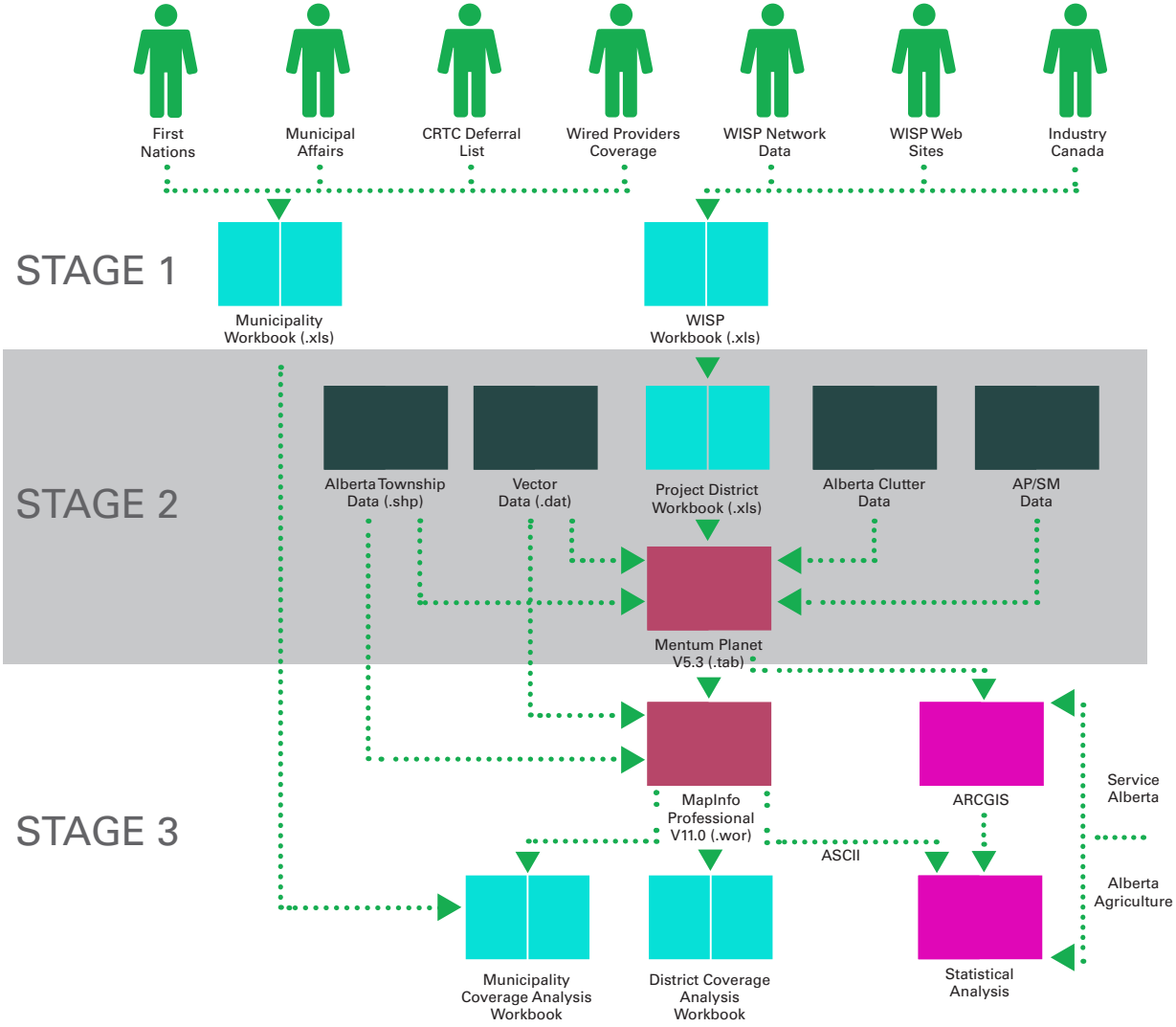
A three-stage methodology was developed and completed in different phases of the study. (See Table 3: Stages and Phases)

Table 3: Stages and Phases

Stage	Description	Phases
Stage 1	Data Collection	1 & 2
Stage 2	Coverage Maps	3
Stage 3	Coverage Analysis	4

7.1/ WORKFLOW DIAGRAM

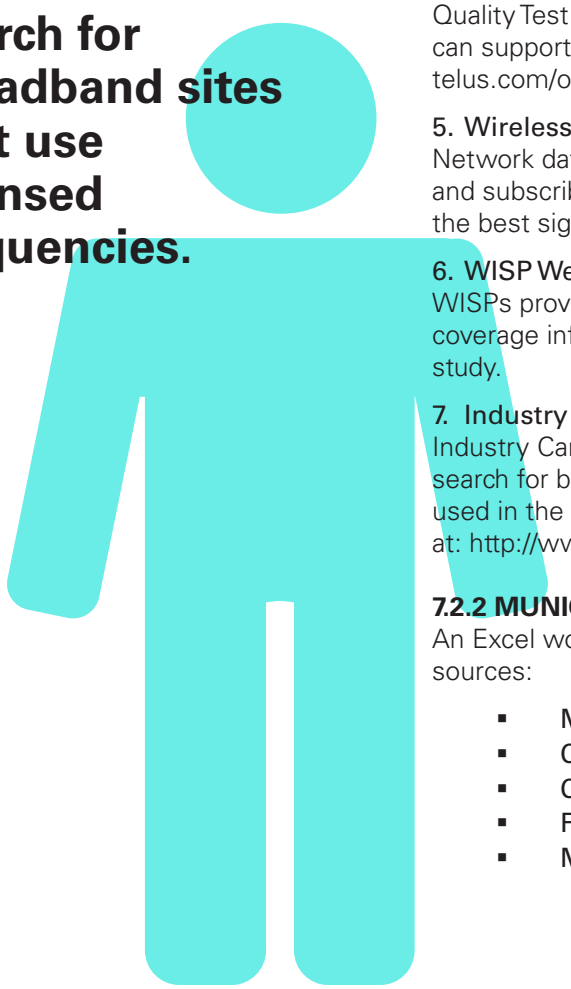
Figure 3: WorkFlow diagram provides an illustration of the three stages.



7.2/ STAGE 1: DATA COLLECTION

The study data was collected from multiple sources including: Municipal Affairs, CRTC Deferral List, Wired Providers Coverage Data, WISP Network Data, WISP Web Sites and Industry Canada. Details are as follows:

Industry Canada provides access to an on-line database that allows users to search for broadband sites that use licensed frequencies.



7.2.1 DATA SOURCES

1. First Nations

Three web sites were used to collect location and coverage information for the Alberta First Nations:

http://www.aboriginal.alberta.ca/documents/2011_MetisSettlementProfile.pdf
http://www.aboriginal.alberta.ca/818.cfm
http://www.ainc-inac.gc.ca/ai/scr/ab/index-eng.asp

2. Alberta Municipal Affairs

The Government of Alberta Municipal Affairs web site was used to identify the location and contact information for all the municipal districts, cities, towns, villages, summer villages. Hamlet information is not available on the Municipal Affairs site. Hamlets are included as part of a municipal district.

www.municipalaffairs.gov.ab.ca/mc_municipal_profiles.cfm

3. CRTC Deferral List

List of municipalities that are on the CRTC deferral list.

Appendix D: Alberta Deferral Communities

4. WIRED Providers

Shaw Communications Inc. and TELUS Communications Inc. were contacted and asked to provide a list of the areas they serve.

Shaw responded and provided a list of their service areas.

TELUS Communications Inc. did not respond to the study. In order to determine which municipalities had DSL services, a Loop Quality Test was conducted for one or more addresses in each city and town. A Loop Quality Test is used to determine if the local loop to a subscriber's premises can support DSL services. The Loop Quality Test is available at: https://www.telus.com/order/loopqual/

5. Wireless Internet Service Providers

Network data provided by WISPs included GPS coordinates, access points and subscriber module information. The WISP network data is used to create the best signal maps in Stage 2.

6. WISP Web Sites

WISPs provide network coverage information on their web sites. This coverage information was used in the verification and discovery phase of the study.

7. Industry Canada

Industry Canada provides access to an on-line database that allows users to search for broadband sites that use licensed frequencies. This information was used in the verification and discovery phase of the study. This data is available at: http://www.ic.gc.ca/eic/site/sd-sd.nsf/eng/Home

7.2.2 MUNICIPALITY WORKBOOK

An Excel workbook was used as a data container for the following data sources:

- Municipal Districts (Including Hamlets)
- Cities, Towns, Villages, Summer Villages
- CRTC Deferral List
- First Nations
- Métis Settlements

7.2.3 WISP WORKBOOK

An Excel workbook was used as a data container for the following data sources:

- WISP Contacts
- WISP Network Data
- WISP Service Packages

7.3/ STAGE 2: BEST SIGNAL STRENGTH MAPS

The data collected in Stage 1 and additional datasets were inputted into a software program, Mentum Planet v5.3. Mentum Planet was used to create the best signal coverage maps for the project districts, municipal districts, municipalities, First Nations and Métis settlements.

7.3.1 PROJECT DISTRICT WORKBOOK

The WISP network data collected in Stage 1 was for the entire province. This data was recompiled into a project district workbook. The WISP network sites were sorted first by project district and then municipal district. The WISP sites for each municipal district were inputted into the Mentum Planet software program.

7.3.2 ALBERTA TOWNSHIP DATA

Dataset (Shapefile) provided by Alberta Agriculture and Rural Development. There are a total of 7165 townships in the province. Appendix J: Alberta Township System (ATS)

7.3.3 VECTOR DATA

Vector data for cities, towns, villages, summer villages, hamlets, highways and water purchased from DMTI Spatial Inc. Vector data is used create a map of a geographical area such as a municipal district.

7.3.4 CLUTTER DATA

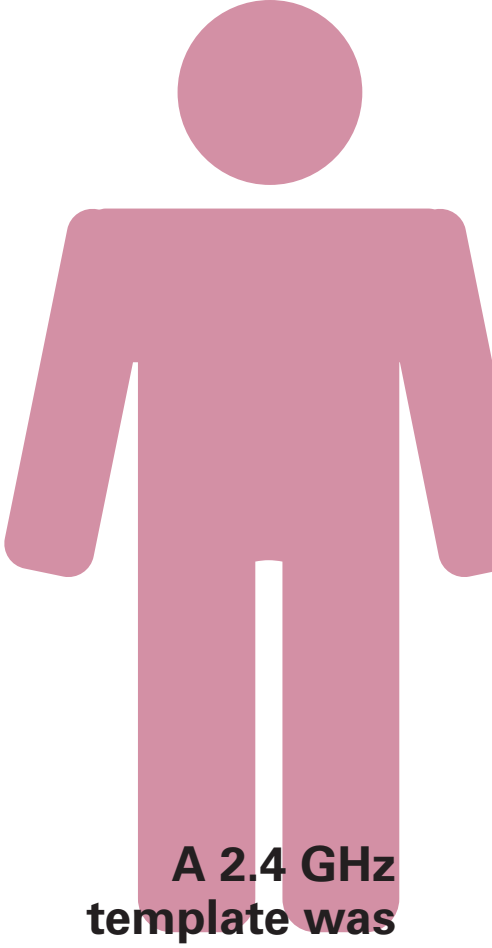
Clutter Data provides a digital representation of the land cover. The type of land cover within an area will impact the overall broadband coverage for that area. Clutter data would include: water, rural/open land, forest, residential, urban and open urban. Clutter data at a 90 meter resolution was purchased from DMTI Spatial Inc.

The clutter data was not available for the whole of District 4, as it was for the other districts. Only three towers were situated within the areas where clutter data was unavailable – and of them, two were just off the boundary. This did not impact the estimated broadband coverage of the three towers. (Appendix K : Alberta Clutter Data)

7.3.5 ACCESS POINT/SUBSCRIBER MODULE DATA

WISPs were asked to provide the technical specifications for their access points and subscriber modules installed on their networks. The Mentum Planet v5.3 software uses this information to estimate the broadband coverage provided by a site. As an example, a 900 MHz access point will provide more broadband coverage than a 5.5 GHz access point.

The majority of the WISPs consider this information to be confidential and refused to provide this data, as a result a 2.4 GHz template was selected and used as a common basis for estimating coverage throughout the province. The 2.4 GHz template was based on Motorola Canopy equipment transmitting in the 2.4 GHz band from a six-sector 8 dBi access point mounted 30 m up the tower. Rx sensitivity was assumed to be -87 dBm.



A 2.4 GHz template was used as a common basis for estimating coverage throughout the province.

Mentum Planet is a wireless network planning and optimization software that offers the ability to design better networks through quality engineering solutions.

In as much as a 2.4 GHz plot understates coverage relative to equipment operating in the UHF and 900 MHz bands and overstates coverage relative to the 3.5 GHz and 5.5 GHz bands, it was thought to provide a consistent and representative view on which provincial coverage could be estimated.

Due to the requirement of the 2.4 GHz template there will be an error rate of approximately 15% in the coverage analysis. Most of the WISPs use 900 MHz to broadband services to rural areas. A 900 MHz access point will provide approximately 15% more coverage than a 2.4 GHz access point. As a result 15% of the townships that are categorized as unserved may be served.

7.3.6 MENTUM PLANET V5.3

Mentum Planet is a wireless network planning and optimization software that offers the ability to design better networks through quality engineering solutions. Mentum Planet is a simulation-based planning tool with the ability to emulate real-world conditions. The default output for best signal strength maps is a .tab Mapinfo file format. It also supports an ASCII Grid format which can be exported into the ARCGIS platform.

Propagation analyses were completed for 1,848 sites using the TDMA/FDMA Predict 4.0 model in Mentum Planet. Once the propagation charts for all towers in a municipal district, including those with 5 km of its perimeter, were complete, a composite signal strength chart for the municipal district was created. The analysis provides the maximum received signal strength that can be expected at any point in the municipal district considering all of the sites in the area.

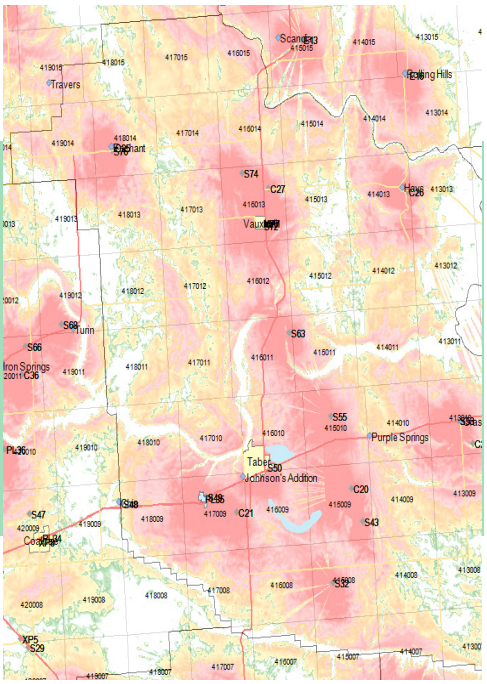
7.3.7 BEST SIGNAL STRENGTH MAPS

The Mentum Planet propagation software measures the potential signal strength of all the sites in and within 5Km of a municipal district. Each level of signal strength, based on dBm value, is identified as a different colour on the map and if the area is either served or unserved:

▪ Red	Strongest Signal	Served Area
▪ Yellow	Medium Signal	Served or Unserved Area
▪ Green	Weak Signal	Unserved Area
▪ White	No Signal	Unserved Area

Figure 4: Best Signal Strength Map – Municipal District of Taber

Level (-dBm)	Colour
-60.1925	Red
-75.0000	Pink
-75.0100	Orange
-85.0000	Yellow
-85.0100	Green
-87.0000	Blue
-87.0100	White



The best signal strength maps were imported into MapInfo and used to classify a township, municipal district, municipality, First Nations and Métis settlements as either served or unserved.

7.4/ STAGE 3: COVERAGE ANALYSIS

7.4.1 COVERAGE ANALYSIS PROCEDURE

The best signal strength maps created in Mentum Planet were imported in MapInfo Professional. The MapInfo Professional platform provides built-in support to access and view a variety of data formats directly such as .tab, .dat and .shp files. This feature allowed the different data sets to be combined into a single MapInfo workspace (.wor) for each municipal district. The best signal strength maps were imported into MapInfo and used to classify a township, municipal district, municipality, First Nations and Métis settlements as either served or unserved. The following criteria was used to classify each of the townships as either served or unserved:

1. Estimate signal strength colour for each township.
    - 100% red the township is classified as served
    - 50% red and 50% yellow the township is classified as served
    - >50% yellow the township is classified as served
    - <50% yellow the township is classified as unserved
    - Green, blue, or white the township is classified as unserved

2. Estimate the proximity of any WISP sites to the township
If a WISP site is within an estimated distance of 4Km of a township it is classified as served. This may override the signal strength colour analysis.

3. Towns, villages, summer villages, hamlets, First Nations and Métis settlements within a township inherited its classification.

7.4.2 PROJECT DISTRICT COVERAGE ANALYSIS

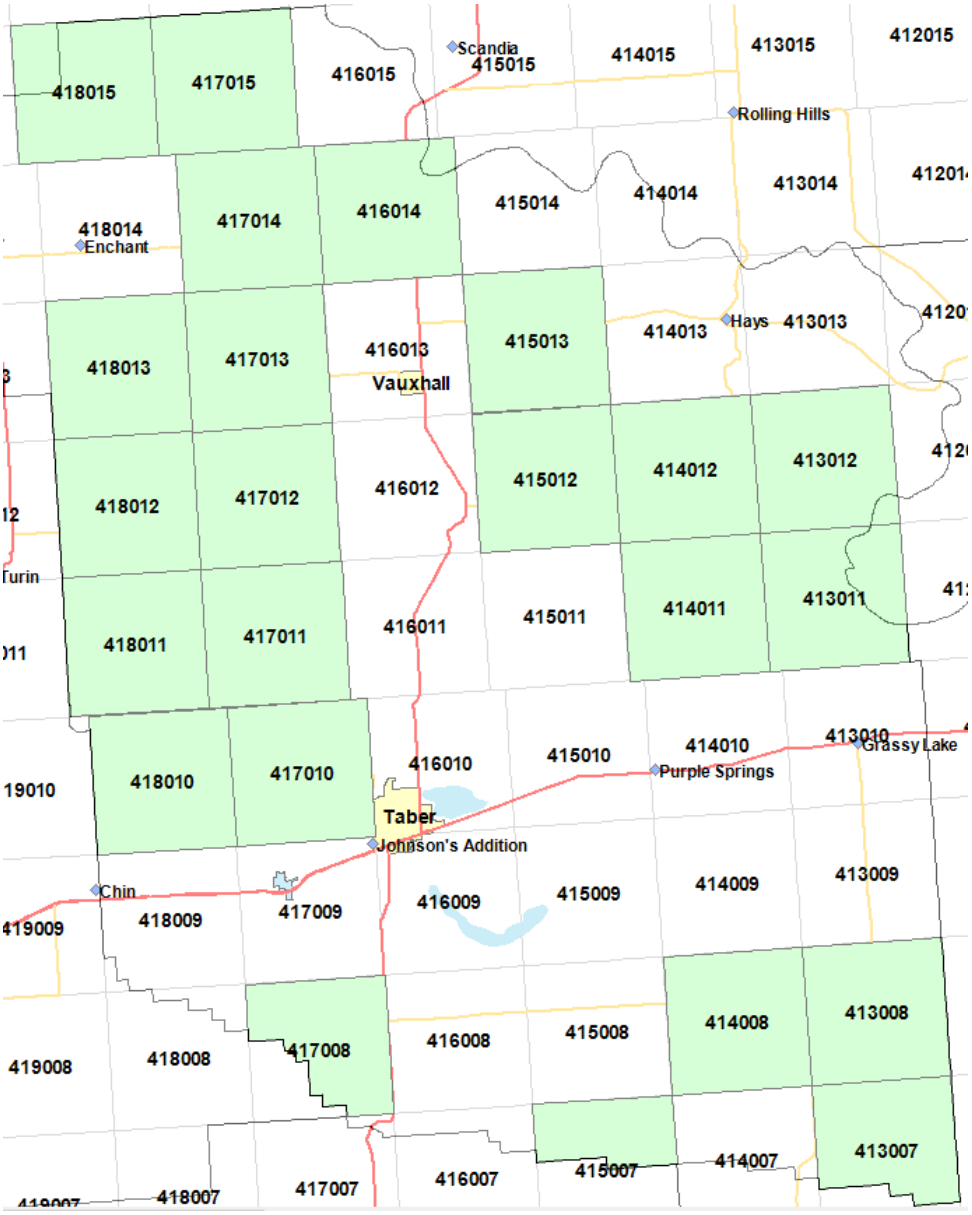
An Excel district coverage analysis workbook was created for each of the project districts. The workbook contains a coverage analysis for each municipal district.

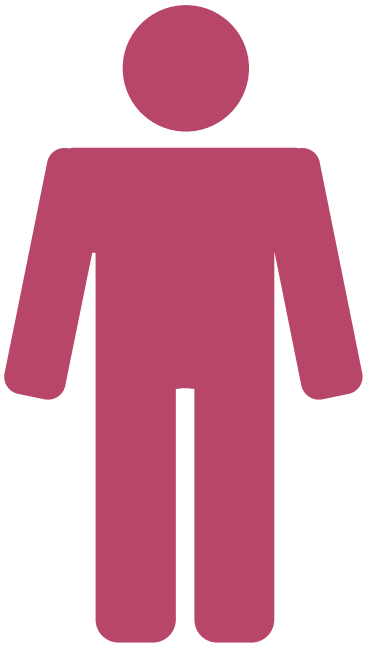
The Municipal District of Taber has 47 townships. Twenty-Four (24) townships are served by one or more Wireless Internet Service Providers. Twenty-Three (23) townships are classified as unserved.

7.4.3 MUNICIPAL COVERAGE ANALYSIS

An Excel municipality coverage analysis workbook was created for all the municipalities except the seven major cities. The municipality analysis was completed in two steps:

Figure 5: Municipal District of Taber Coverage Map





A coverage analysis was completed for all the cities, towns, villages and summer villages.

1. Determine if the municipality is served by a Wireless Internet Service Provider
2. Determine if the municipality is served by a Wired Provider or listed on the CRTC Deferral list. Municipalities on the deferral list were classified as served.

A coverage analysis was completed for all the cities, towns, villages and summer villages.

7.4.4 FIRST NATIONS COVERAGE ANALYSIS

There are currently 45 First Nations Communities and a combined 140 reserves spread over 821,771 hectares of land. According to how data is compiled, there may be some variation in the number of First Nations communities, reserves and land area. For the purpose of this study, coverage data was collected on 44 First Nations as listed on **Table 13: First Nations Coverage**. (http://www.ainc-inac.gc.ca/ai/scr/ab/fn/index-eng.asp)

Each First Nations reserve was classified as either served or unserved.

7.4.5 ARCGIS

The best signal strength maps were exported as ASCII Grid files and provided to the project steering committee.

There are currently 45 First Nations Communities and a combined 140 reserves spread over 821,771 hectares of land.

8.1/ MUNICIPAL DISTRICT COVERAGE

The results of this study are a snap shot of the broadband coverage in Alberta. As time goes by, new initiatives, technologies and towers will make these maps become less accurate with age.

Alberta has 73 municipal districts, improvement districts and special areas with a cumulative population of 447,474. A summary of broadband coverage for each of the project districts is provided in Tables 7 to 11.

Table 7: Project District 1 Coverage

	Municipal District	Population (2010)	Townships	Served	%	Unserved	%	Hamlets	Served	%	Unserved	%
1	Cardston	4,266	55	31	56.36%	24	43.64%	11	10	90.91%	1	10.00%
2	Cypress	6,729	148	45	30.41%	103	69.59%	10	10	100.00%	0	0.00%
3	Foothills	19,736	48	34	70.83%	14	29.17%	8	8	100.00%	0	0.00%
4	Forty Mile	3,414	80	54	67.50%	26	32.50%	5	5	100.00%	0	0.00%
5	Lethbridge	10,302	34	26	76.47%	8	23.53%	7	7	100.00%	0	0.00%
6	Newell	6,862	66	47	71.21%	19	28.79%	6	6	100.00%	0	0.00%
7	Pincher Creek	3,309	47	30	63.83%	17	36.17%	6	5	83.33%	1	20.00%
8	Ranchland	86	33	0	0.00%	33	100.00%	0	0	0.00%	0	0.00%
9	Taber	6,280	47	24	51.06%	23	48.94%	5	5	100.00%	0	0.00%
10	Vulcan	3,718	60	42	70.00%	18	30.00%	6	4	66.67%	2	50.00%
11	Warner	3,776	51	36	70.59%	15	29.41%	2	2	100.00%	0	0.00%
12	Willowcreek	5,337	57	41	71.93%	16	28.07%	4	4	100.00%	0	0.00%
13	Crowsnest	5749	5	4	80.00%	1	20.00%	5	5	100.00%	0	0.00%
14	Waterton	160	7	4	57.14%	3	42.86%	1	1	100.00%	0	0.00%
	Total:	**79724**	**738**	**418**		**320**		**76**	**72**		**4**	
	Percentage:			56.64%		43.36%			94.74%		5.26%	

The two municipal districts that have the least amount of broadband coverage in District 1 are the MD of Ranchland (100%) and Cypress county (69.59%).

Four hamlets out of 76 are classified as unserved in District 1.

Table 8: Project District 2 Coverage

	Municipal Districts	Population (2010)	Townships	Served	%	Unserved	%	Hamlets	Served	%	Unserved	%
1	Acadia	545	12	5	41.67%	7	58.33%	1	1	100.00%	0	0.00%
2	Bighorn	1454	40	6	15.00%	34	85.00%	5	4	80.00%	1	20.00%
3	Clearwater	11,826	200	45	22.50%	155	77.50%	5	5	100.00%	0	0.00%
4	Kneehill	5,218	38	20	52.63%	18	47.37%	7	3	42.86%	4	57.14%
5	Lacombe	10,507	34	30	88.24%	4	11.76%	5	3	60.00%	2	40.00%
6	Mountain View	12,570	57	40	70.18%	17	29.82%	0	0	0.00%	0	0.00%
7	Paintearth	2,126	40	18	45.00%	22	55.00%	2	2	100.00%	0	0.00%
8	Ponoka	8,640	35	26	74.29%	9	25.71%	3	2	66.67%	1	33.33%
9	Red Deer	19,108	50	30	60.00%	20	40.00%	8	6	75.00%	2	25.00%
10	Rocky View	34,597	48	36	75.00%	12	25.00%	14	14	100.00%	0	0.00%
11	Special Areas	4,729	230	79	34.35%	151	65.65%	18	7	38.89%	11	61.11%
12	Starland	2,371	31	15	48.39%	16	51.61%	4	3	75.00%	1	25.00%
13	Stettler	5,216	49	28	57.14%	21	42.86%	5	4	80.00%	1	20.00%
14	Wheatland	8,164	60	40	66.67%	20	33.33%	9	8	88.89%	1	11.11%
15	Banff	938	83	5	6.02%	78	93.98%	1	1	100.00%	0	0.00%
16	Kananaskis	429	50	5	10.00%	44	88.00%	1	1	100.00%	0	0.00%
	Total:	**128438**	**1057**	**428**		**628**		**88**	**64**		**24**	
	Percentage:			40.49%		59.41%			72.73%		27.27%	

The two municipal districts that have the least amount of broadband coverage in District 2 are the Banff National Park (93.98%) and the Improvement District of Kananaskis (88.00%).

Twenty-Four hamlets of 88 are classified as unserved in District 2.

Table 9: Project District 3 Coverage

	Municipal District	Population (2010)	Townships	Served	%	Unserved	%	Hamlets	Served	%	Unserved	%
1	Athabasca	7,592	69	45	65.22%	24	34.78%	12	12	100.00%	0	0.00%
2	Barrhead	5,845	28	19	67.86%	9	32.14%	4	4	100.00%	0	0.00%
3	Brazeau	7,040	36	18	50.00%	18	50.00%	7	6	85.71%	1	14.29%
4	Leduc	13,260	36	31	86.11%	5	13.89%	8	8	100.00%	0	0.00%
5	Slave River	2,442	119	19	15.97%	100	84.03%	7	5	71.43%	2	28.57%
6	Thorhild	3,547	21	15	71.43%	6	28.57%	7	7	100.00%	0	0.00%
7	Lac Ste. Anne	10,220	34	16	47.06%	18	52.94%	8	5	62.50%	3	37.50%
8	Parkland	30,089	37	37	100.00%	0	0.00%	7	6	85.71%	1	14.29%
9	Sturgeon	19,165	29	23	79.31%	6	20.69%	11	10	90.91%	1	9.09%
10	Westlock	6,910	40	25	62.50%	15	37.50%	9	8	88.89%	1	11.11%
11	Wetaskiwin	10,535	44	17	38.64%	27	61.36%	8	6	75.00%	2	25.00%
12	Woodlands	4,158	84	8	9.52%	76	90.48%	3	2	66.67%	1	33.33%
13	Yellowhead	10,045	247	37	14.98%	210	85.02%	10	6	60.00%	4	40.00%
14	Jasper	24	125	9	7.20%	116	92.80%	1	1	100.00%	0	0.00%
	Total:	**130872**	**949**	**319**		**630**		**102**	**86**		**16**	
	Percentage:			33.61%		66.39%			84.31%		15.69%	

The two municipal districts that have the least amount of broadband coverage in District 3 are Woodlands County (90.48%) and Yellowhead County (85.02%).

Sixteen hamlets out of 86 are classified as unserved in District 3.

Table 10: Project District 4 Coverage

	Municipal District	Population (2010)	Townships	Served	%	Unserved	%	Hamlets	Served	%	Unserved	%
1	Big Lakes	4,030	161	44	27.33%	116	72.05%	5	4	80.00%	1	20.00%
2	Birch Hills	1,610	33	15	45.45%	18	54.55%	5	4	80.00%	1	20.00%
3	Clear Hills	3,293	166	18	10.84%	148	89.16%	3	2	66.67%	1	33.33%
4	Fairview	1,856	17	7	41.18%	10	58.82%	2	2	100.00%	0	0.00%
5	Grande Prairie	17,989	77	63	81.82%	14	18.18%	11	11	100.00%	0	0.00%
6	Greenview	5,464	376	53	14.10%	323	85.90%	5	4	80.00%	1	20.00%
7	Mackenzie	10,002	887	31	3.49%	856	96.51%	3	3	100.00%	0	0.00%
8	Northern Lights	3,556	243	21	8.64%	222	91.36%	5	4	80.00%	1	20.00%
9	Northern Sunrise	2,880	232	23	9.91%	209	90.09%	5	4	80.00%	1	20.00%
10	Opportunity	3,259	332	15	4.52%	317	95.48%	5	3	60.00%	2	40.00%
11	Peace	1,487	13	9	69.23%	4	30.77%	1	1	100.00%	0	0.00%
12	Saddle Hills	2,478	72	25	34.72%	47	65.28%	1	1	100.00%	0	0.00%
13	Smoky River	2,442	32	21	65.63%	11	34.38%	3	2	66.67%	1	33.33%
14	Spirit River	662	8	5	62.50%	3	37.50%	0	0	0.00%	0	0.00%
15	Wood Buffalo	91,612	1122	20	1.78%	1102	98.22%	8	7	87.50%	1	12.50%
	Total:	**152620**	**3771**	**370**		**3400**		**62**	**52**		**10**	
	Percentage:			9.81%		90.16%			83.87%		16.13%	

The two municipal districts that have the least amount of broadband coverage in District 4 are Mackenzie County (96.51%) and the MD of Opportunity (95.48%).

Ten hamlets out of 62 are classified as unserved in District 4.

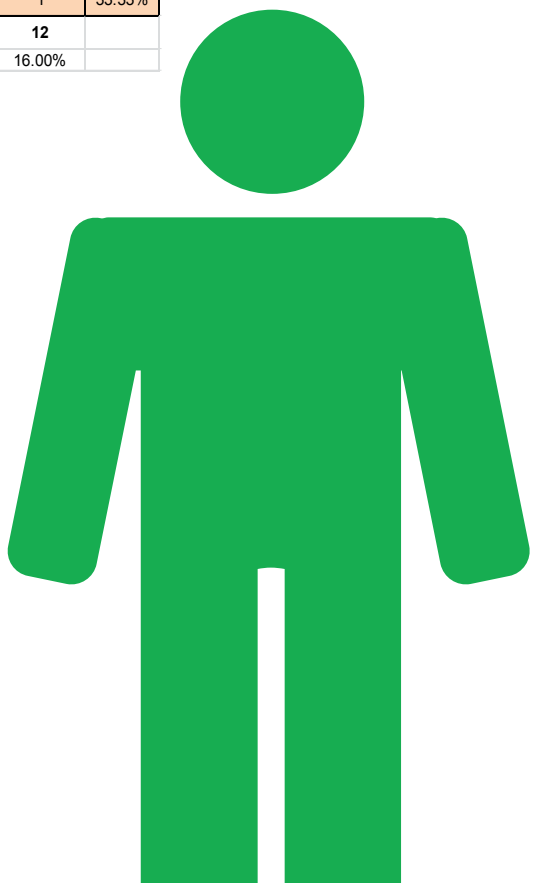
Alberta has 73 municipal districts, improvement districts and special areas with a cumulative population of 447,474.

Table 11: Project District 5 Coverage

	Municipal District	Population (2010)	Townships	Served	%	Unserved	%	Hamlets	Served	%	Unserved	%
1	Beaver	5,676	41	32	78.05%	9	21.95%	2	2	100.00%	0	0.00%
2	Camrose	7,577	38	27	71.05%	11	28.95%	9	7	77.78%	2	22.22%
3	Bonnyville	9,047	79	47	59.49%	32	40.51%	7	6	85.71%	1	14.29%
4	Flagstaff	3,506	44	23	52.27%	21	47.73%	0	0	0.00%	0	0.00%
5	Lac La Biche	9,123	191	31	16.23%	161	84.29%	6	6	100.00%	0	0.00%
6	Lamont	3,925	28	24	85.71%	4	14.29%	5	4	80.00%	1	20.00%
7	Minburn	3,319	32	18	56.25%	14	43.75%	2	2	100.00%	0	0.00%
8	Smoky Lake	2,716	41	29	70.73%	12	29.27%	4	3	75.00%	1	25.00%
9	St Paul	5,925	46	31	67.39%	15	32.61%	10	10	100.00%	0	0.00%
10	Provost	2,547	43	15	34.88%	28	65.12%	4	2	50.00%	2	50.00%
11	Strathcona	87,998	17	15	88.24%	2	11.76%	9	9	100.00%	0	0.00%
12	Two Hills	2,926	33	21	63.64%	12	36.36%	7	5	71.43%	2	28.57%
13	Vermilion River	7,900	63	40	63.49%	23	36.51%	7	5	71.43%	2	28.57%
14	Wainwright	4,113	52	22	42.31%	30	57.69%	3	2	66.67%	1	33.33%
	Total:	**156298**	**748**	**375**		**374**		**75**	**63**		**12**	
	Percentage:			50.13%		50.00%			84.00%		16.00%	

The two municipal districts that have the least amount of broadband coverage in district #5 are Lac La Biche County (84.29%) and the MD of Provost (66.12%).

Twelve hamlets out of 75 are classified as unserved in District 5.



8.2/ HAMLET COVERAGE

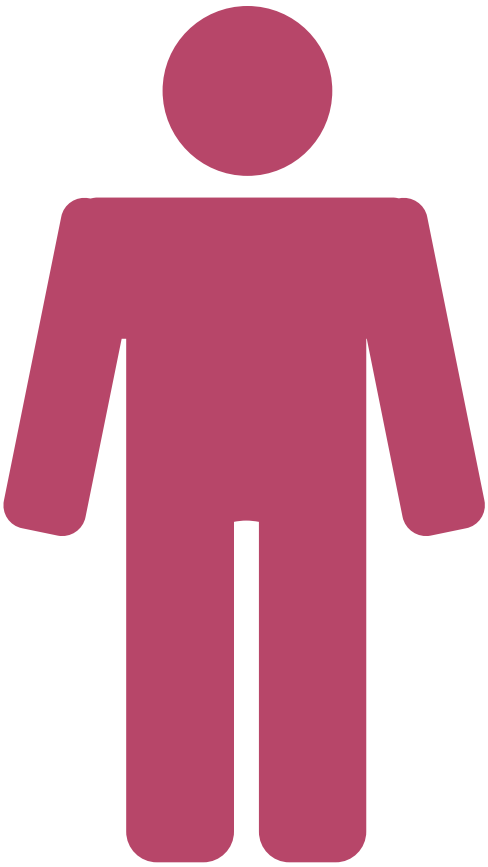
Hamlets are unincorporated communities administered by and within the boundaries of, municipal districts, specialized municipalities, improvement districts or special areas. Fifty-Five Hamlets were classified as "Unserved".

Table 12: Hamlets Coverage

Hamlet	District 1	District 2	District 3	District 4	District 5
Del Bonita					
Brocket					
Shouldice					
Travers					
Benchlands	4				
Hesketh					
Huxley					
Swalwell					
Wimborne					
Haynes					
Joffre					
Leedale					
Ardley					
Lousana					
Craigmyle					
Red Willow					
Chancellor					
Lodgepole		13			
Chisholm					
Marten Beach					
Darwell					
Cherhill					
Green Court					
Carvel					
Pine Sands					
Newstow					
Alder Flats					
Buck Lake					
Blue Ridge					
Cadomin					
MacKay					
Robb					
Wildwood					
Enlida			16		
Peoria					
Bear Canyon					
Little Smoky					
North Star					
Reno					
Sandy Lake					
Peerless Lake					
Guy					
Fort MacKay					
Kelsey				10	
Armena					
Beaverdam					
Wostok					
Edwand					
Bodo					
Metiskow					
Beauvallon					
Morecambe					
Rivercourse					
Streamstown					
Ribstone					12

All 108 towns have broadband access.

8.3/ OTHER MUNICIPAL COVERAGE



8.3.1 TOWNS

A town is a municipality with a population of at least 1,000 people. Alberta has 108 towns with a cumulative population of 441,647.

All of the 108 towns have broadband access. Town residents and businesses will typically have a choice between different providers including: TELUS, Shaw, Unbundled DSL Providers, East Link and WISPs.

8.3.2 VILLAGES

A village is a municipality with a population of at least 300 people. Alberta has 95 villages with a cumulative population of 39,956.

All of the 95 villages have broadband access. The majority of villages will typically have a choice between multiple WISPs. In addition, TELUS, Shaw and East Link provide wired broadband services to some villages.

8.3.3 SUMMER VILLAGES

Summer villages are incorporated communities that have permanent populations, as well as seasonal (non-permanent) residents. Alberta has a total of 51 summer villages with a cumulative population of 6,154. Forty-four of the summer villages have a choice between multiple Wireless Internet Service Providers (WISPs).

The following summer villages were classified as "unserved":

- Birch Cove
- Burnstick Lake
- Castle Island
- Silver Sands
- South View
- Waipaousand West Cove

All 95 villages have broadband access

8.4/ FIRST NATIONS COVERAGE

First Nations /Metis Settlements (as appropriate) come in a variety of sizes from a few townships to large tracts of land. The areas marked by an asterisk are composed of multiple townships where some, but not all, are designated as served.

Alberta has 44 First Nation bands. There are eleven bands that were classified as "unserved".

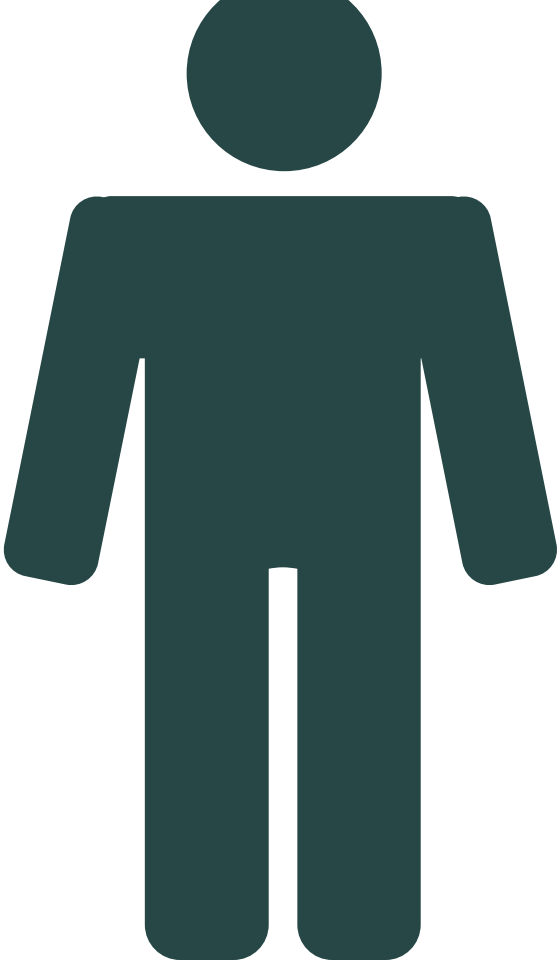
The First Nations bands are generally provided broadband services by WISPs that provide broadband services to the reserve and the surrounding area.

The First Nations bands are generally provided broadband services by WISPs that provide broadband services to the reserve and the surrounding area.

Table 13: First Nations Coverage

First Nation	Served	Unserved
Alexander First Nation*	✓	
Alexis Nakota Sioux Nation	✓	
Athabasca Chipewyan First Nation	✓	
Beaver First Nation		✓
Beaver Lake Cree Nation	✓	
Bigstone Cree Nation	✓	
Blood Tribe*	✓	
Chipewyan Prairie First Nation		✓
Cold Lake First Nations	✓	
Dene Tha' First Nation*	✓	
Driftpile First Nation		✓
Duncan's First Nation	✓	
Enoch Cree Nation #440	✓	
Ermineskin Tribe*	✓	
Fort Mckay First Nation		✓
Fort McMurray #468 First Nation	✓	
Frog Lake First Nation	✓	
Heart Lake First Nation	✓	
Horse Lake First Nation	✓	
Kapawe'no First Nation		✓
Kehewin Cree Nation	✓	
Little Red River Cree Nation	✓	
Loon River First Nation	✓	
Louis Bull Tribe*	✓	
Lubicon Lake Band	✓	
Mikisew Cree First Nation	✓	
Montana First Nation*	✓	
O'Chiese First Nation		✓
Paul First Nation	✓	
Piikani Nation	✓	
Saddle Lake First Nation (Note 1)	✓	
Samson Cree Nation	✓	
Sawridge Band	✓	
Siksika Nation		✓
Smith's Landing First Nation		✓
Stoney Nakoda Nation (Note 2)		✓
Sturgeon Lake Cree Nation	✓	
Sucker Creek First Nation	✓	
Sunchild First Nation	✓	
Swan River First Nation		✓
Tallcree First Nation		✓
Tsuu T'ina Nation	✓	11
Whitefish Lake First Nation*	✓	
Woodland Cree First Nation	✓	
	33	

* – Part Unserved (According to Vitel Served/Unserved Township Reports)



8.5/ MÉTIS SETTLEMENT COVERAGE

First Nations /Metis Settlements (as appropriate) come in a variety of sizes from a few townships to large tracts of land. The areas marked by an asterisk are composed of multiple townships where some, but not all, are designated as served.

Alberta has 8 Métis Settlements. All 8 settlements are classified as "served".

The Métis Settlements are provided broadband services by Wireless Internet Service Providers that provide broadband services to the settlement and surrounding area.

Table 14: Métis Settlements Coverage

Metis Settlement	Served	Unserved
Buffalo Lake*		
East Prairie*		
Elizabeth*		
Fishing Lake		
Gift Lake*		
Kikino*		
Paddle Prairie*		
Peavine*		

* – Part Unserved (According to Vitel Served/Unserved Township Reports)

9/ DISCUSSION

9.1/ ECONOMIC IMPACT OF TERRAIN & POPULATION DENSITIES

An area's terrain type and population density can significantly impact the capital cost to build and operate a fixed wireless network. The capital and operating costs to build and operate a fixed wireless network in an area with a high tree density, hilly topography and low population will be considerably higher than in a township that has a low tree density, flat terrain and high population. Areas can be classified as different terrain and economic types.

9.1.1 TERRAIN TYPES

An area can be classified as one of three terrain types:

Type A: **Hilly and moderate-to-heavy tree density. Most difficult to provide wireless broadband services**

Type B: **Neither Type A nor Type C. Medium difficulty to provide wire less broadband services**

Type C: **Flat and light tree density. Least difficult to provide wireless broadband services**

As the terrain variable significantly influences the effective range of wireless signal transmission, it directly impacts the coverage area. Wireless networks are easier to design and deploy in Type C areas as fewer towers are required and obstructions/shadow areas are minimal. Covering Type A and B areas is more difficult and costly as it typically requires a combination of more and possibly higher towers as well as strategically placed reflectors.

9.1.2 ECONOMIC TYPE

Areas can be classified as an economic type. The economic type is based on the area's ability to generate a positive cash flow based on subscriptions. The three types of economic areas are:

Type 1: Areas that can be, or are, served by market forces.

Type 1 areas will be cash flow positive over a period of time.

Capital Costs + Operating Costs ≤ Total Revenues

Type 2: Areas that will need assistance with initial funding to become self-sustaining.

Type 2 areas require funding to cover the initially negative cash flow resulting from high capital expenditures due to network deployment.

Capital Costs + Operating Costs ≤ Total Revenues + Initial Funding

Type 3: Areas that cannot become self-sustaining and will require initial and ongoing funding. Type 3 areas will remain cash flow negative unless subsidized by either alternative revenues or government funding on an ongoing basis.

Capital Costs + Operating Costs ≤ Total Revenues + Ongoing/ Initial funding

9.2/ WISP TYPES

Throughout the study there were opportunities to meet and discuss rural broadband business and issues with most of the fifty-three (53) Wireless Internet Service Providers in the province. Each WISP has different views on technologies, business models, and the future role of the different levels of government including rural municipalities, Government of Alberta (GOA) and the Federal Government. There are four different types of WISPs:

9.2.1 LOCAL WISP

A local WISP is an individual(s) that live and work in a single area. They recognized the need for broadband services in their area and decided to take on the risk of providing broadband services. The subscriber base will be less than 500 subscribers. A local WISP is willing to lose capital and operating funds to provide broadband services to their community, but recognize that in order to remain in business they must subsidize the costs of the network. Local WISPs tend to provide broadband services to terrain type C and economic type 3 areas. Twenty-two (22) out of the fifty-three (53) WISPs can be categorized as local WISPs.

9.2.2 REGIONAL WISP

A regional WISP builds a network to provide broadband services to multiple communities. The subscriber base can be anywhere between 500 to 10,000 subscribers. A regional WISP is willing to lose capital and operating funds on a per site basis, but with an understanding that profitable sites will subsidize non profitable sites. A site located near a town is more likely to make a profit than a site that provides broadband services to four remote homes. Twenty-four (24) of the fifty-three (53) WISPs can be categorized as regional WISPs. Regional WISPs will provide broadband services to all three terrain and economic types.

9.2.3 PROVINCIAL WISP

A provincial WISP builds a network to provide broadband services to multiple districts in the province. Provincial WISPs are most likely to be publicly traded companies. Their network is generally located in A and B terrain areas, and type 1 and 2 economic areas. Six (6) of the fifty-three (53) WISPs can be categorized as provincial WISPs.

9.2.4 NATIONAL WISP

A national WISP builds a network to provide broadband services to multiple provinces in the country. National WISPs are most likely to be publicly traded companies. Their network is generally located in A and B terrain areas, and type 1 and 2 economic areas. One (1) of the fifty-three (53) WISPs can be categorized as a national WISP.

Each of these WISPs has a different business model. All four business models will be required to fulfill the objective of providing broadband services to 98% of the population.

Each WISP has different views on technologies, business models and the future role of the different levels of government including rural municipalities, Government of Alberta and the Federal Government.

9.3/ WISP SERVICE PACKAGES

An analysis was completed of each of the fifty-three (53) WISP's service packages using information provided on their WISP web sites.

Nineteen (19) out of fifty-three (53) WISPs do not provide their services packages on their web sites.

The remaining thirty-four (34) WISPs provide either complete or partial information on their service packages.

Most WISP provide up to three or more service packages. For the purposes of the study we classified these as Packages A, B and C. Table 15 provides a summary of the WISP service packages.

Table 15: WISP Service Packages

	Package A	Package B	Package C
Cost	**$27.95 — $65.00**	**$30.00 — $149.00**	**$45 — $349**
Installation		**◀ $50.00 — $499.95 ▶**	
Download	**750 kbps — 5.0 Mbps**	**1.0 Mbps — 6.0 Mbps**	**1.5 Mbps — 8.0 Mbps**
Upload	**250 kbps — 1.5 Mbps**	**1512 kbps — 3.0 Mbps**	**512 bps — 5.0 Mbps**
Usage / Month	**10 — 110 GB**	**10 GB — Unlimited**	**25GB — Unlimited**
Usage / GB		**◀ $2.00 — $10.00 ▶**	

Service Alberta's Final Mile Broadband Initiative (FMBI) requires that providers offer, at a minimum, the following service packages for those Alberta homes/businesses that currently do not have access to high-speed Internet service:

1. 1.5 Mbps download, 384 kbps upload
2. 3.0 Mbps download, 768 kbps upload
3. 5.0 Mbps download, 1.0 Mbps upload

The ability to provide download and upload rates to a specific area is based on a number of factors including: Wireless Technology, Access Point Height, Distance between the Subscriber and Access Point, Terrain, Total Number of Subscribers, Available Backhaul Bandwidth and WISP Aggregation Rations.

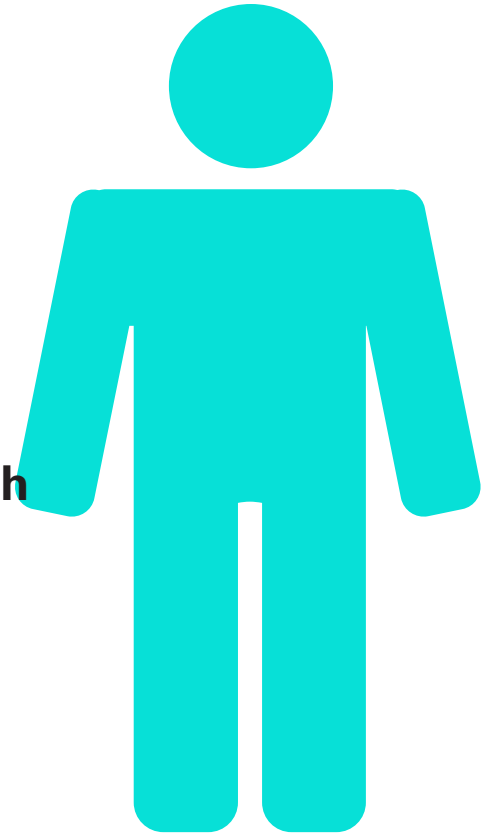
The download/upload rates provided by the WISP's in their service packages should be considered as minimum or average rates.

Many consider the 700 MHz band to be invaluable for providing wireless coverage in rural areas.

9.4/ 700 MHz SPECTRUM

The 700 MHz spectrum was previously used to transmit over-the-air analog television channels. Many consider the 700 MHz band to be invaluable for providing wireless coverage in rural areas.

The conversion from analog to digital broadband casting will make this spectrum available for Internet service. In June 2006, Industry Canada established a policy for the use of 700 MHz systems for Public Safety and subscriber based broadband applications. The purposes of the policy was designate spectrum in the bands of 764 — 770 MHz and 794 — 800 MHz (Formally TV channels 63 and 68) for public safety applications and refined the criteria for channels 2 to 59.



By the spring of 2011, Industry Canada had issued a total of 555 licences in Canada with 450 of the licenses being issued in Alberta

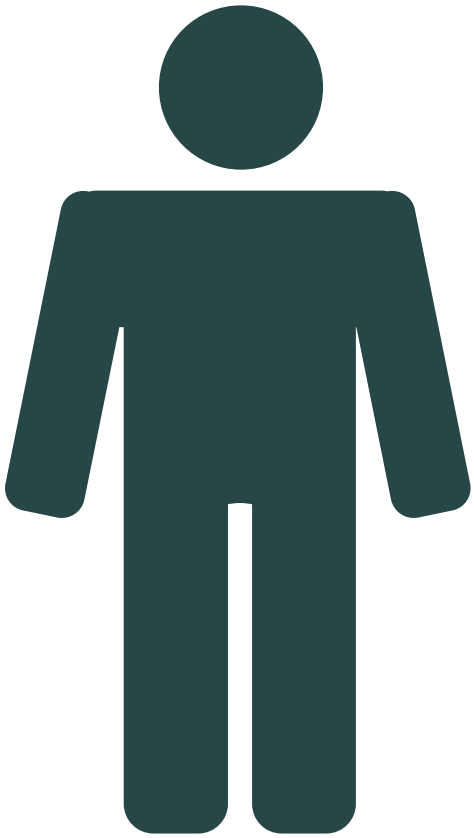
Timeline:

- August 2011 is scheduled to mark the transition from analog television to digital, freeing up spectrum for potential use
- November 2010 – Industry Canada (IC) Minister announces Spectrum Auction for late 2012
- Many private and public agencies are vying for the additional spectrum
- Industry Canada opened consultations on the 700 MHz broad band allocations on November 30th, 2010
- Industry Canada consultations closed on February 28th, 2011

Industry Canada is allowing the use of the RRBS bands (512 — 698 MHz) in remote rural communities. By the spring of 2011, Industry Canada had issued a total of 555 licences in Canada with 450 of the licenses being issued in Alberta. The following Wireless Internet Service Providers have deployed or going to deploy RRBS based systems in Alberta:

- Advanced Interactive
- CCI Wireless
- XplorNet
- XpanServe
- Hakai Networks
- MachLink

The allocation of the 700 MHz spectrum will significant impact both the wireless coverage and capacity in rural areas.



10/ LESSONS LEARNED

The uniqueness of each project district must be considered prior to creating a solution to provide broadband coverage in a district.

10.1/ PROJECT DISTRICTS UNIQUE

To make the project more manageable and reduce the complexity, the province was divided into five project districts. Each of these project districts is unique in terms of:

- Wireless Internet Service Providers (WISP)
- Economic Base
- Population Densities
- Topography

The uniqueness of each project district must be considered prior to creating a solution to provide broadband coverage in a district.

10.2/ RADIO FREQUENCY (RF) EXPERIENCE

The majority of the Wireless Internet Service Providers did not have any radio frequency experience prior to starting their business. Because of the lack of RF experience, WISPs have had to spend hundreds of hours experimenting with different technologies and vendor's equipment. The result is that there are many different philosophies as to what will or will not work and an ad-hoc approach to network design and implementation.

10.3/ SITE DATA NOT AVAILABLE

During the data collection phase of the study it became apparent that most of the Wireless Internet Service Providers do not maintain a site database containing information such as GPS coordinates, site height and access point model numbers. As a result the only site data that was available were the site's GPS coordinates.

10.4/ LOCAL WISPS SUBSIDIZE BROADBAND COVERAGE

Some local WISPs will provide broadband coverage to low populated areas and subsidize the capital and operating costs with revenue generated from higher density areas or another line of business. Their primary objective is to provide adequate broadband coverage to their community and they understand that there is no economic reason to build and operate a broadband network in low populated areas.

10.5/ 900 MHz SIGNAL

Unofficial feedback from several WISPs indicates that the error rate may be higher in a Type C terrain area and lower in a Type A terrain area. This is due in part because most WISPs use 900 MHz access points to provide broadband coverage in both areas. A 900 MHz signal will propagate further in a Type C area increasing the possible error rate.

10.6/ SUBSCRIBER TOWERS

Wireless technologies such as Wi-Fi and Wi-Max cannot provide adequate broadband coverage to Type A terrain areas which are hilly and have a moderate-to-heavy tree density. To resolve this issue Grande Prairie County provides capital funding for subscriber towers to rural residents located in Type A areas. A subscriber tower can be as high as 50' and be positioned to provide a direct line-of-sight to the nearest tower.

10.7/ 700 MHz BAND

700 MHz band may be a viable technical and economic solution for providing broadband coverage in low density Type A areas. A Red Deer based company called Technalogix LTD is the only Industry Canada certified provider of RRBS radio equipment in Canada (http://www.technalogix.ca/)

10.8/ PROJECT OUT-OF-SCOPE

Section 5.0 Project Out-of-Scope provided a list of items that were identified as out-of-scope of this study. The following should be included in any future broadband coverage initiatives:

10.8.1 UNDERSERVED AREAS

A township is deemed to be underserved because the download and upload speeds do not meet Industry Canada's minimum requirements of 1.5 Mbps (download) and 384 kbps (upload). The CRTC has set a target for all Canadians to have access to broadband speeds of at least 5 Mbps for download and 1 Mbps for upload by 2015. Subscriber's bandwidth requirements are increasing at a rate of 40% to 50% year. This will have a significant impact on all wireless networks included fixed, mobility and satellite.

Underserved areas are typically identified by having the subscribers within an area conduct a series of broadband speed tests over a predefined period of time. The average of the speed tests could be used to estimate if the area is underserved.

10.8.2 QUALITY OF THE USER'S EXPERIENCE

The download and upload speeds are typically used to describe service quality. Other aspects of service quality are also important and are unrelated to bandwidth rates. Examples are: monthly rates, network outages, customer support and time-to-repair.

The ability to measure the Quality-of-the-User Experience will become important in the near future. The Quality-of-the-User Experience is impacted by each of the service provider's internal management practices.

Other aspects of service quality are also important and are unrelated to bandwidth rates. Examples are: monthly rates, network outages, customer support and time-to-repair.

11/SUMMARY

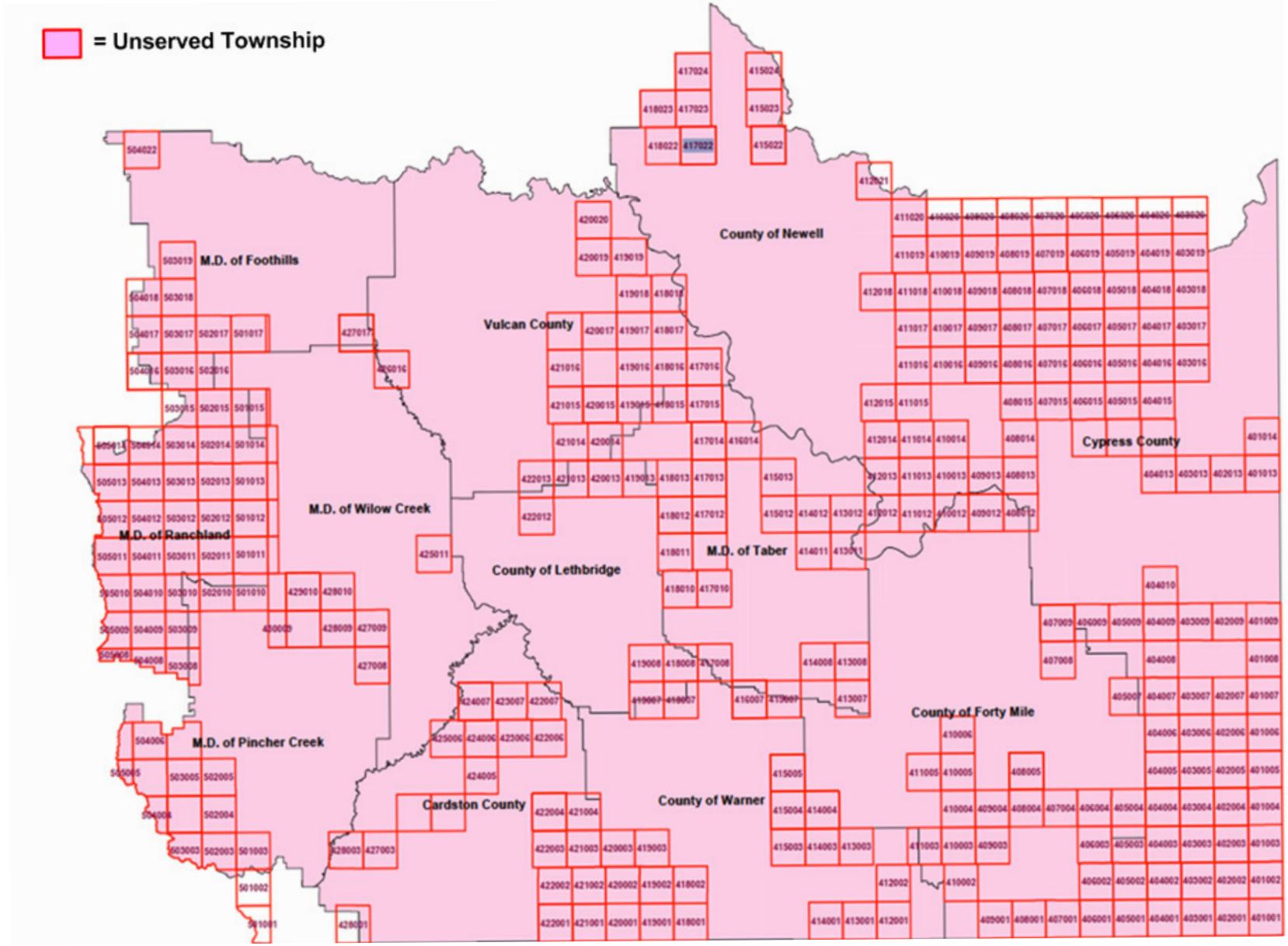
This study is a 'snap shot' and provides an estimate of the current broadband coverage in the province.

Every attempt was made in the development of the study methodology to ensure that the coverage estimate was as accurate as possible. However, having to use the 2.4 GHz template to create the best signal strength maps, it is estimated that there is approximately a 15% error rate. Maps that cover the entirety of the province have been developed, identifying all areas as served or unserved and a greater understanding of broadband coverage in the province was achieved.

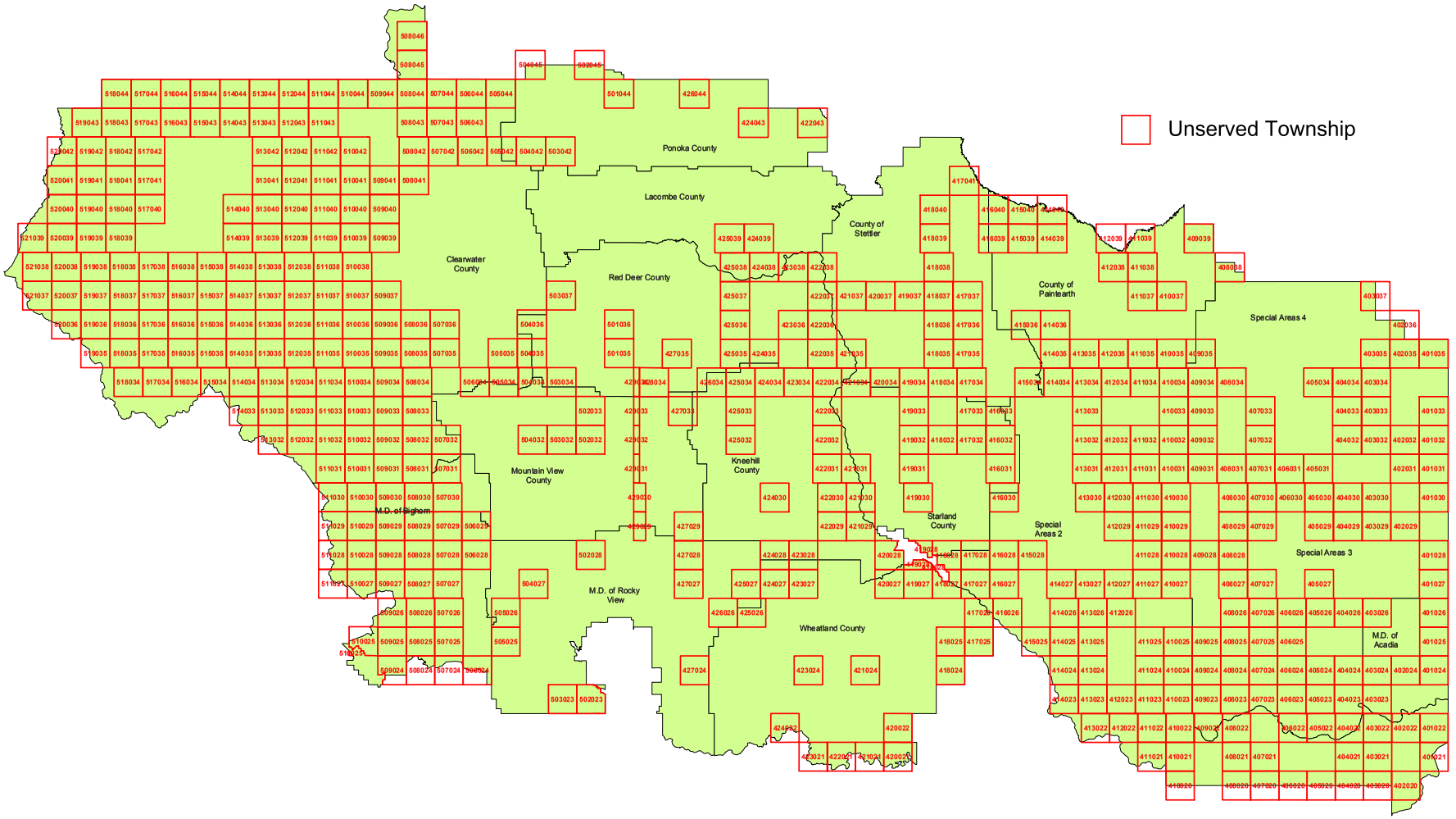
The data and maps are intended to be a starting point. From this data, it is possible for any stakeholder to put forward potential solutions to serve Albertans, whether that be across a region or for a single township. As stakeholders interpret the data, population distribution will be an important aspect to take into consideration. This study did not begin the process to define what remaining unserved areas have residents and businesses that require service. However, as outlined in section 9.0, population plays greatly into determining a successful business case.

The AAMDC encourages the Government of Canada, the Province of Alberta, municipalities, ISPs and individual stakeholders to develop further solutions to complete the final mile. Working together to find cooperative solutions that address local and provincial Internet needs will be an important piece of the puzzle to enable thriving and sustainable rural communities in Alberta.

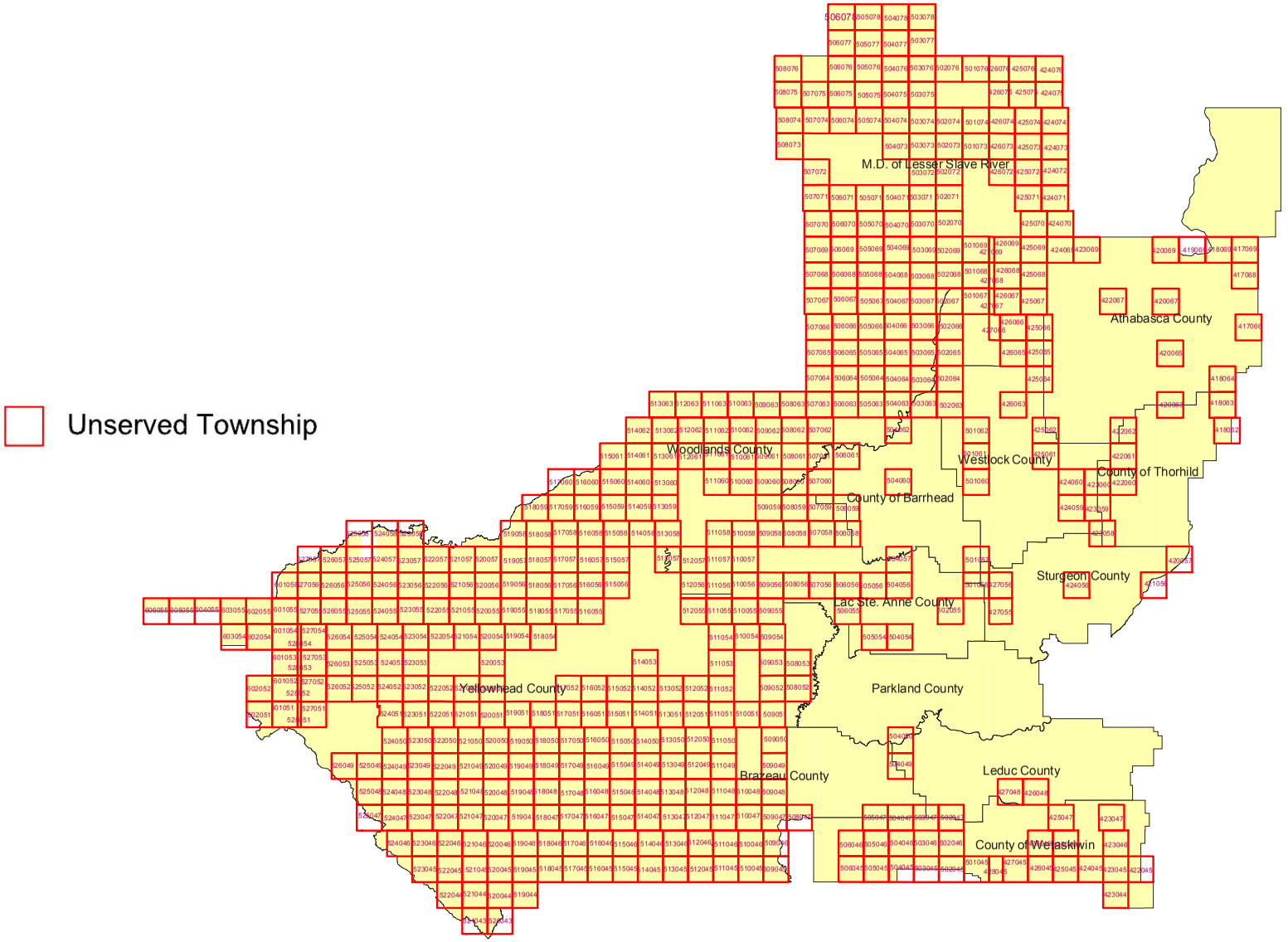
APPENDIX A
DISTRICT 1 COVERAGE



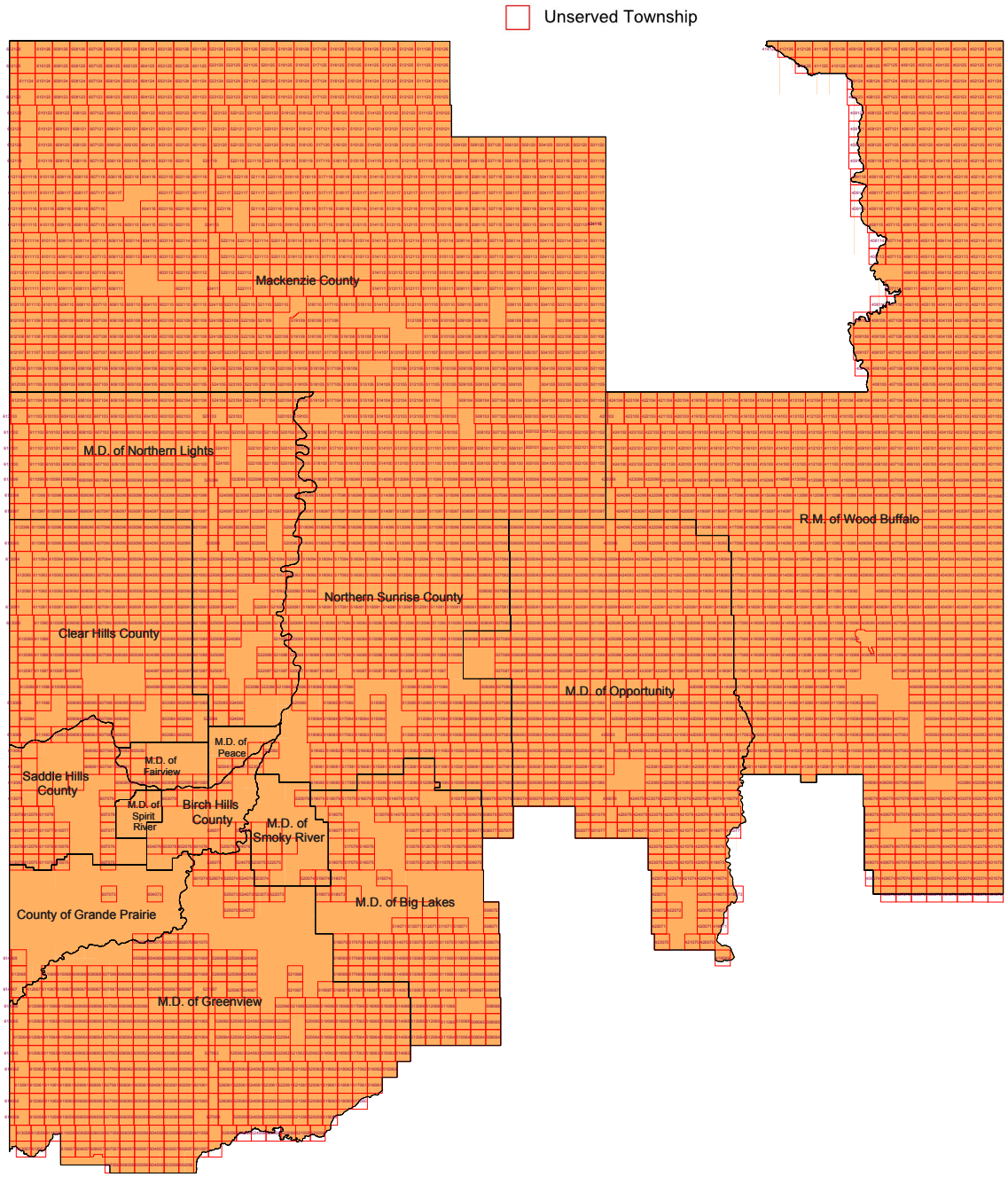
DISTRICT 2 COVERAGE



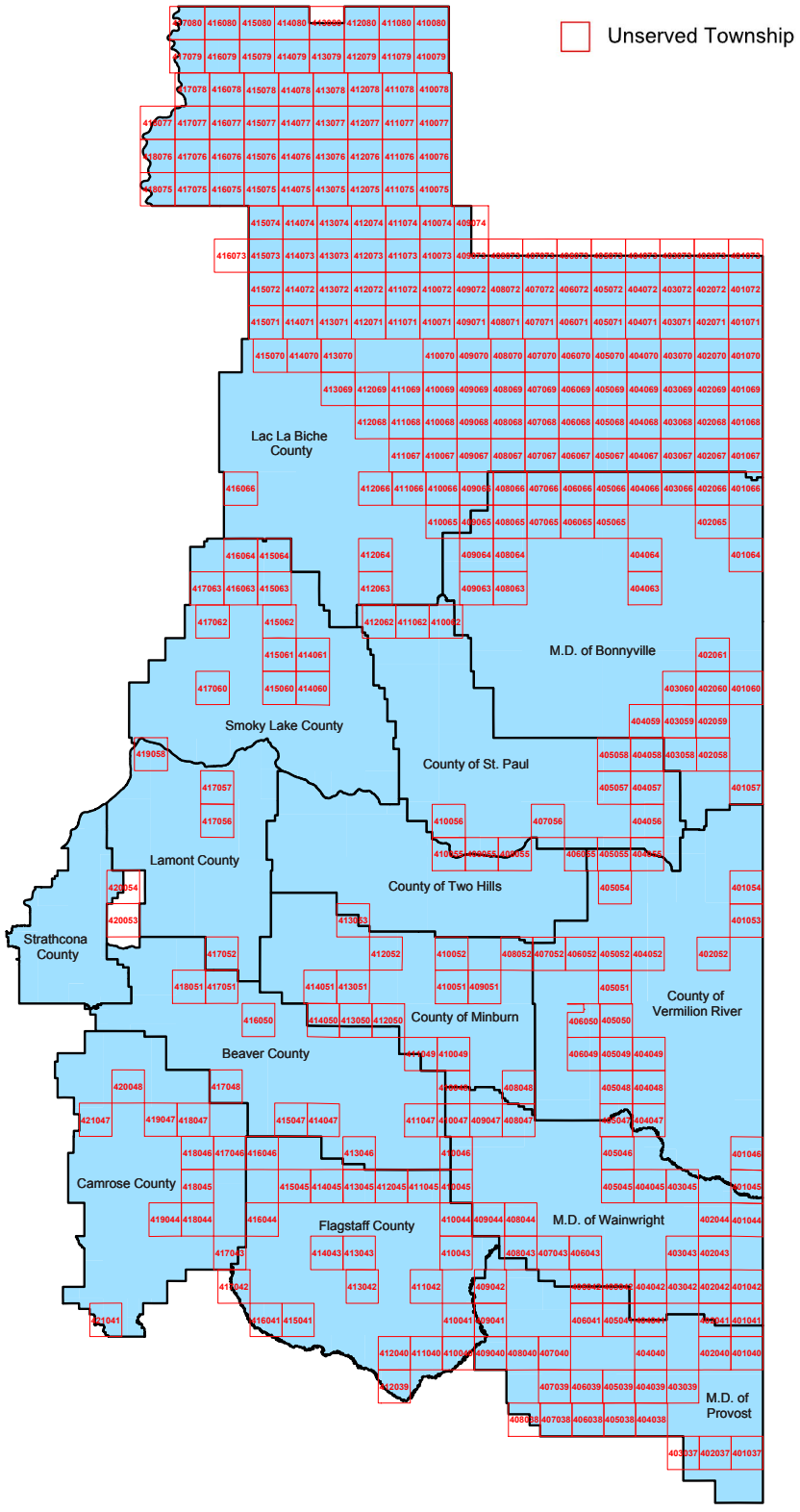
DISTRICT 3 COVERAGE



DISTRICT 4 COVERAGE

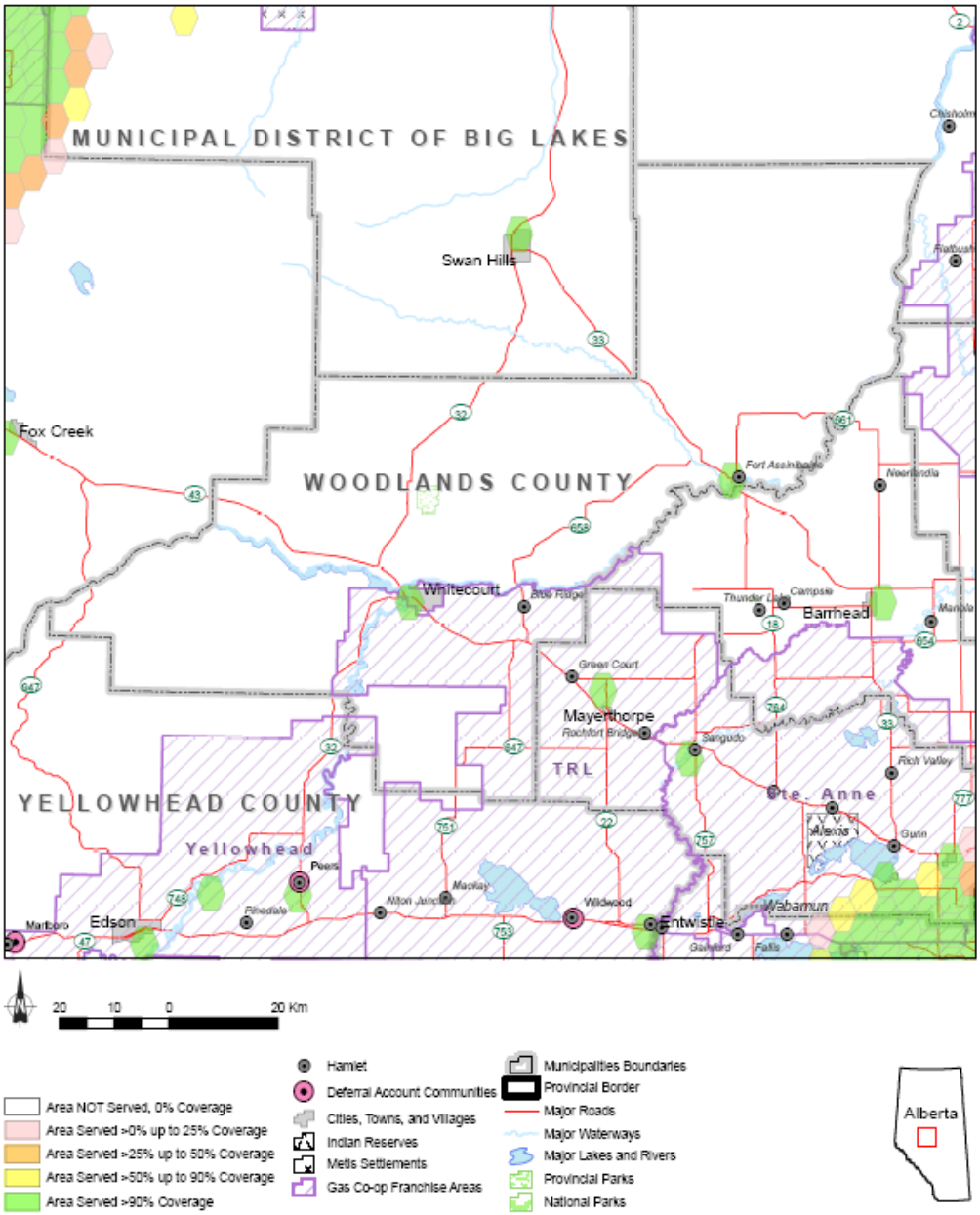


DISTRICT 5 COVERAGE



APPENDIX B

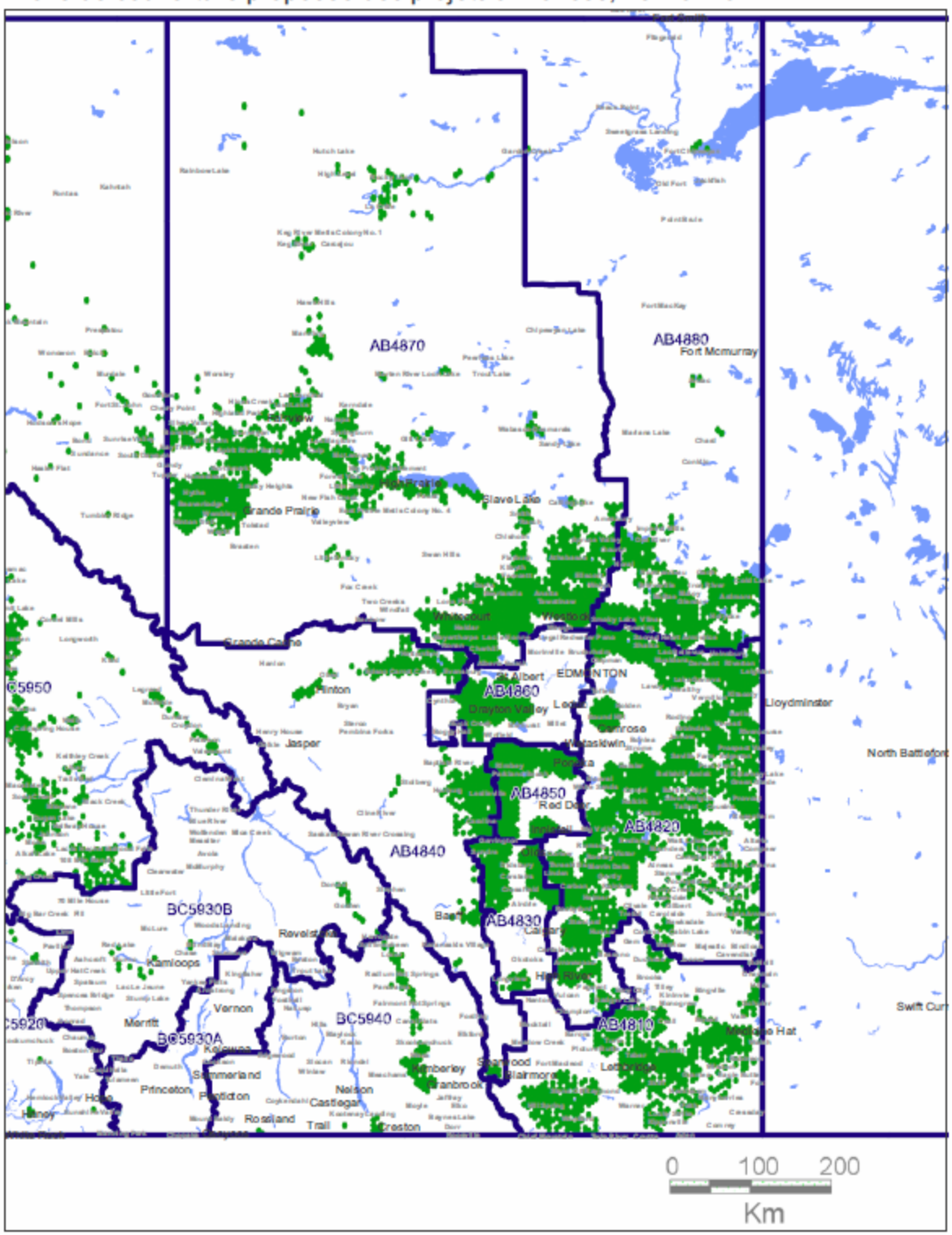
AAMDC SAMPLE COVERAGE MAP (2009)



Source: http://aamdc.com/docman/doc_download/546-woodlands-county

APPENDIX C
BROADBAND CANADA FUND PROJECTS

May 25, 2011 Proposed Coverage Footprint of Announced Projects
Zone de couverture proposée des projets annoncés, 25 mai 2011



Source: http://www.ic.gc.ca/eic/site/720.nsf/eng/h_50010.html

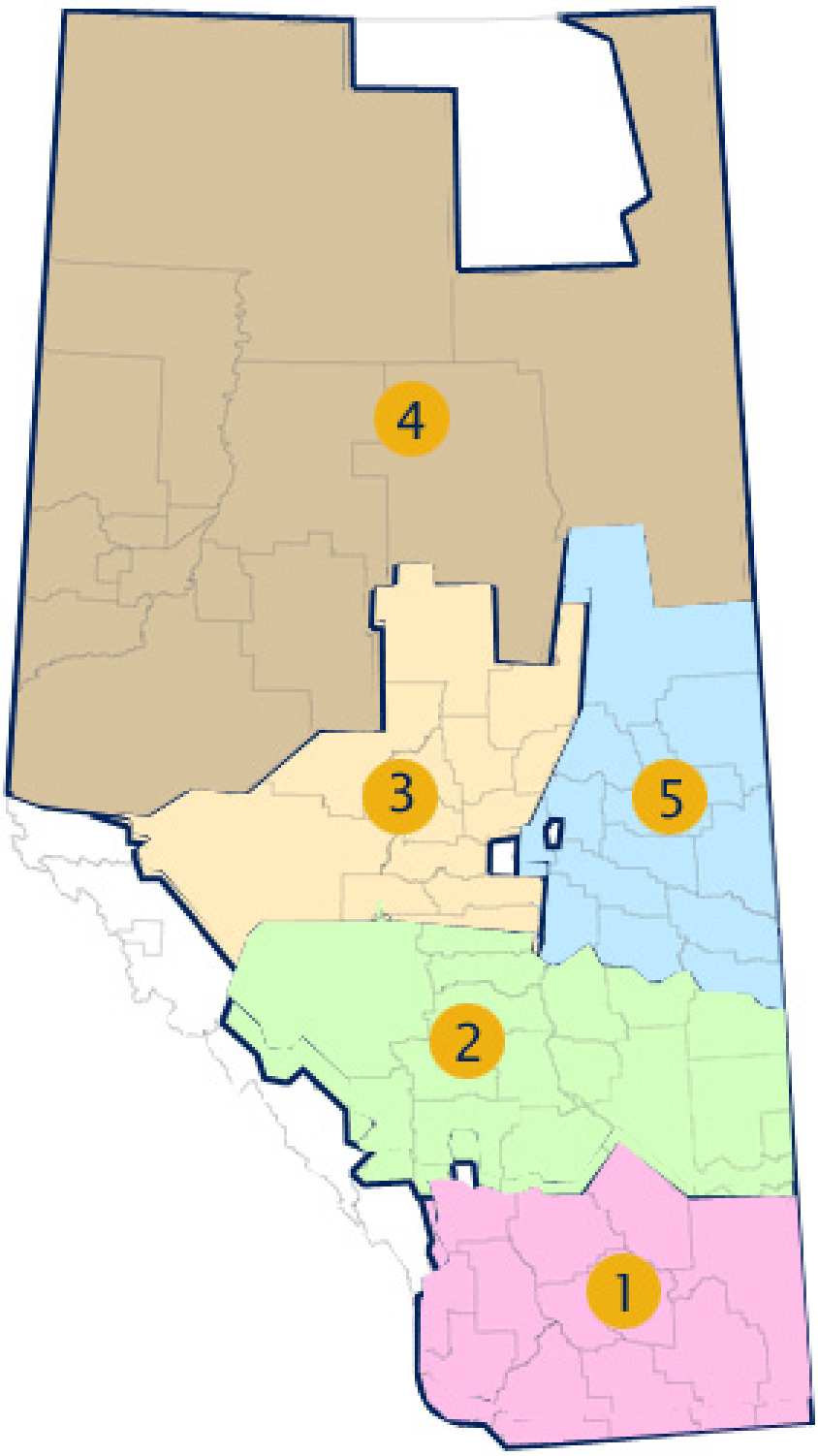
APPENDIX D
ALBERTA DEFERRAL COMMUNITIES

Main Communities (40)	SuperNet Community	ISP Serving Community
Alder Flats	Yes	1
Bear Canyon	Yes	No
Blue Ridge	Yes	No
Brocket	Yes	No
Buck Lake	Yes	No
Donalda	Yes	No
Donnelly	Yes	No
East Coulee	No	No
Etzikom	No	No
Faust	Yes	1
Ferintosh	No	No
Foremost	Yes	No
Girouxville	No	No
Grassy Lake	Yes	3
Hilda	No	No
Holden	Yes	No
Hussar	Yes	No
Irma	Yes	1
Keephills	Yes	No
Keg River	Yes	No
Manyberries	Yes	No
Marlboro	No	No
Mulhurst	No	No
New Dayton	No	No
Nordegg	Yes	3
Peerless Lake	Yes	No
Peers	Yes	2
Robb	No	No
Rolling Hills	Yes	No
Rosalind	Yes	1
Rosebud	No	No
Schuler	Yes	No
Smith	Yes	No
Walsh	Yes	No
Warner	Yes	No
Waterton Park	No	No
Wide Water	No	No
Wildwood	Yes	No
Worsley	Yes	2
Wrentham	Yes	No
Supplemental Communities (8)		
Bruce	Yes	No
Calling Lake	Yes	1
Chipewyan Lake	Yes	Yes
Enchant	Yes	1
Hays	Yes	1
Heinsburg	Yes	1
Heisler	Yes	1
Iron Springs	Yes	1

Approved as of September 2009.

Source: http://www.crtc.gc.ca/eng/archive/2010/2010-639.htm

APPENDIX H
PROJECT DISTRICTS

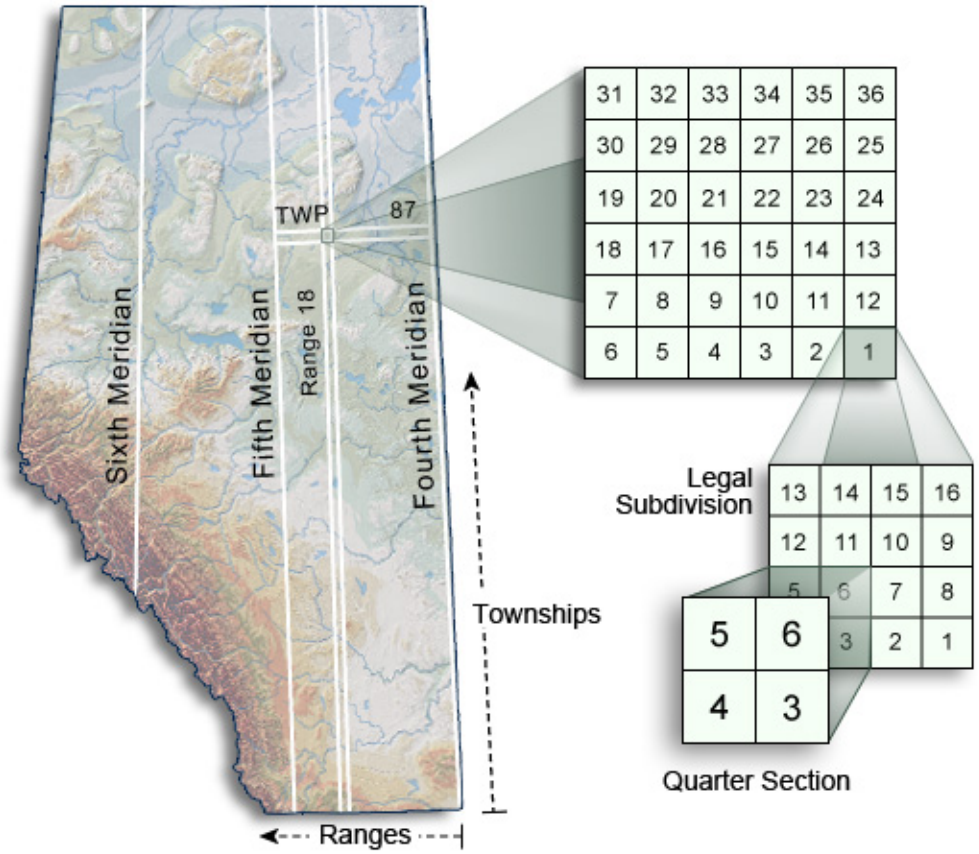


Each district is comprised of multiple municipalities.

APPENDIX J
ALBERTA TOWNSHIP SYSTEM (ATS)

Sections, quarters and legal subdivisions

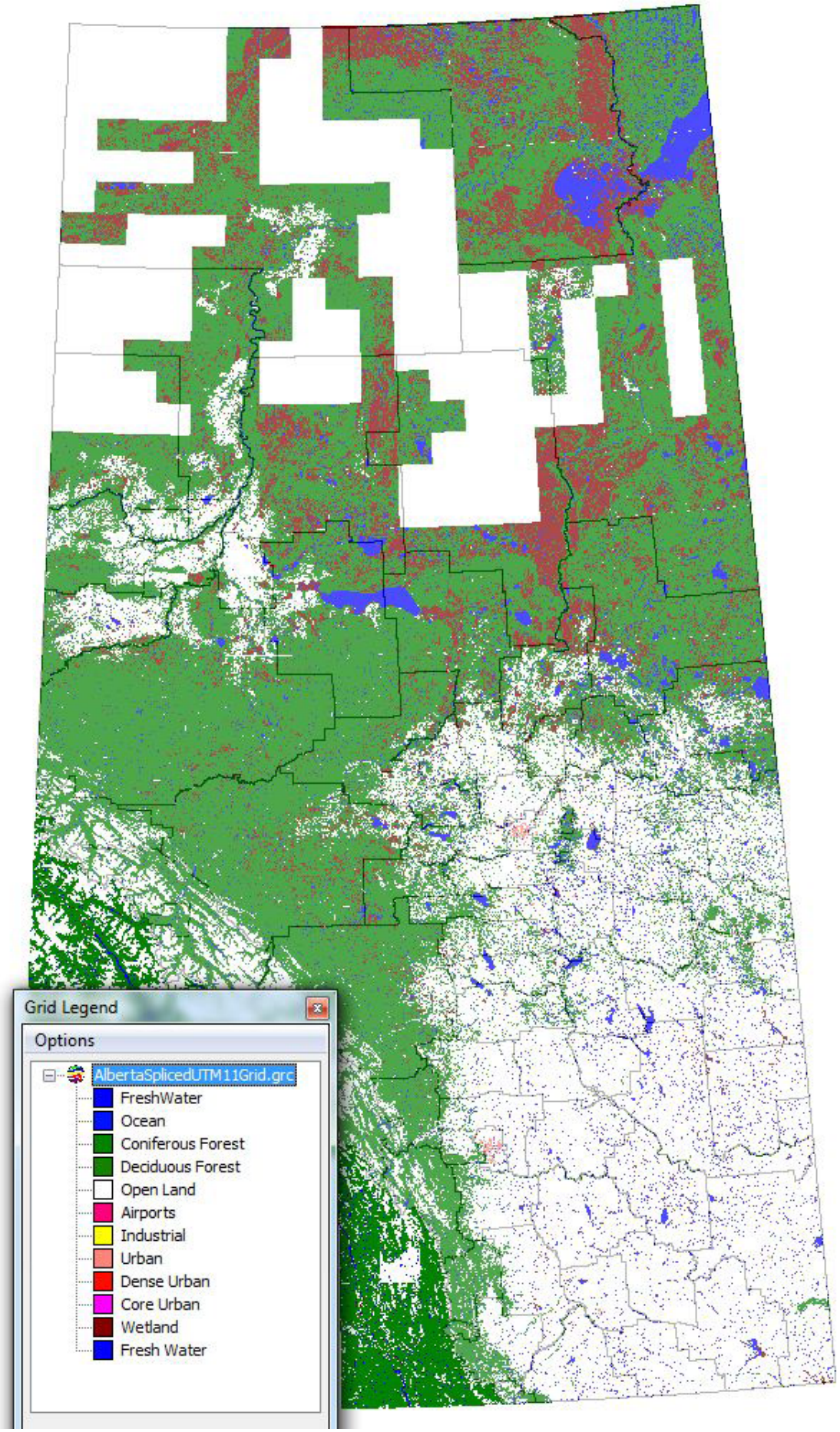
Townships are divided into 36 sections, each section measuring one-by-one mile. Sections can the divided into quarters (NE, NW, SE, SW), or into 16 legal subdivisions (LSD), as indicated.



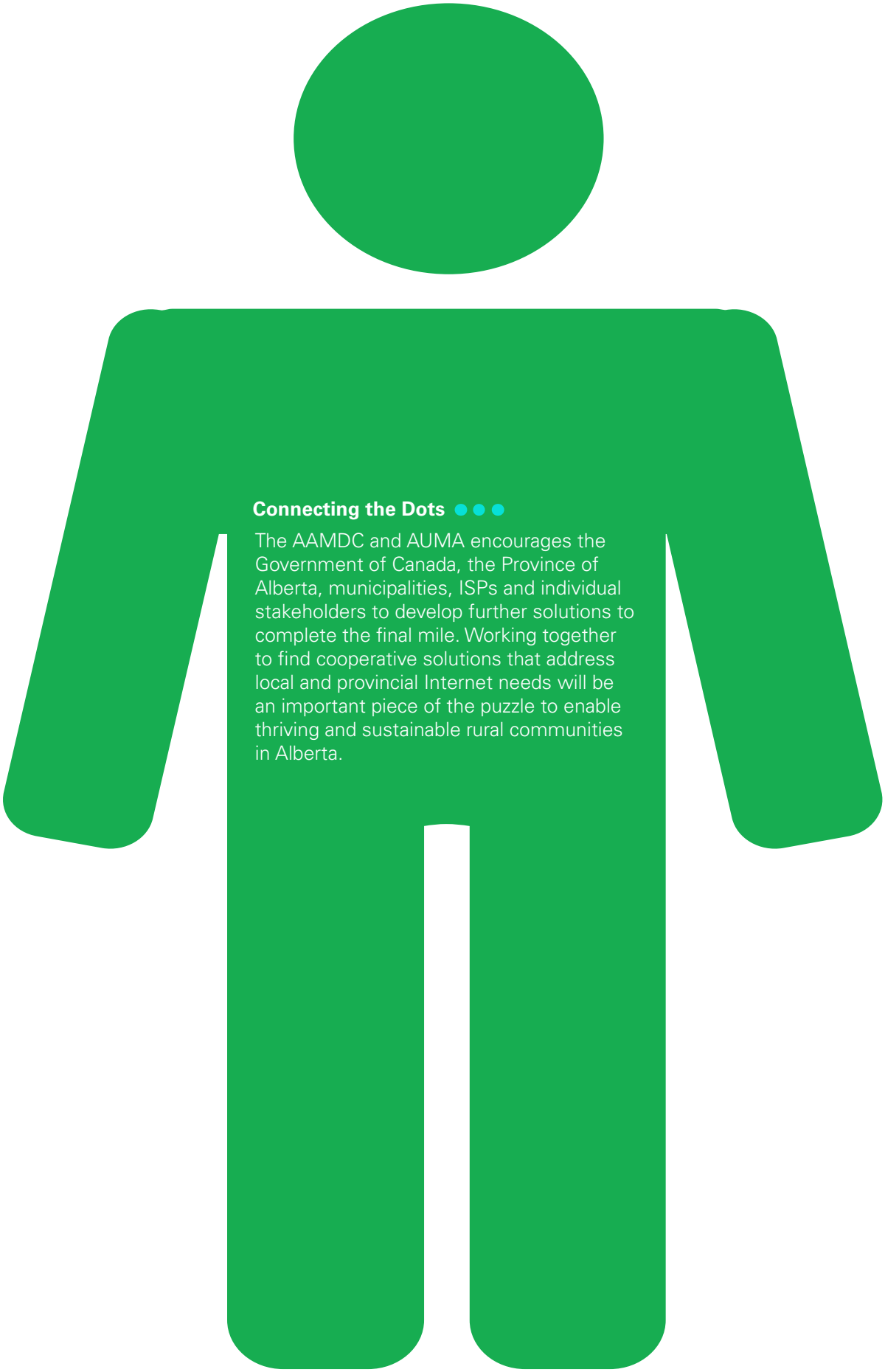
The legal description of the section highlighted in the diagram above would be written as:

1 - 87 - 18 - W4
Sec. Twp. Rge. Meridian

APPENDIX K
ALBERTA CLUTTER DATA



Map provided by DMTI Spatial Inc.



Connecting the Dots

The AAMDC and AUMA encourages the Government of Canada, the Province of Alberta, municipalities, ISPs and individual stakeholders to develop further solutions to complete the final mile. Working together to find cooperative solutions that address local and provincial Internet needs will be an important piece of the puzzle to enable thriving and sustainable rural communities in Alberta.