Grand Forks Broadband Connectivity

Business Development Roadmap

Final Report

Presented to:

The County of Grand Forks

And

The Base Realignment Impact Committee

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Introduction

In March 2007 the County of Grand Forks, through the Base Realignment Impact Committee, retained Access Consulting, P.C. of Missoula, Montana to prepare a Broadband Connectivity Business Development Roadmap. The objectives of the Roadmap were:

1. To assess and describe the current internet/telecommunications landscape in the Grand Forks area (the Region);
2. To identify potential gaps in that landscape by County, City and rural areas;
3. Describe potential future needs of the Region by application and geography;
4. To suggest enhancements for the Region's internet and telecommunications infrastructure to better meet the needs of current and future residents and businesses;
5. To compare potential connectivity systems to include positives and negatives for service capability, technology, costs of installation and area coverage;
6. To develop possible implementation strategies (including enhanced use leasing options);
7. To identify financial resources and additional assistance programs; and
8. To suggest potential employment opportunities that could exploit increased broadband capabilities, should such capabilities be implemented.

This study has been broken down into two phases. Phase One addressed objectives 1 through 3 above and provided the Region's baseline requirements for telecommunications services. Phase Two, summarized by this report, covers the remaining objectives and provides the master plan for future action.

The study methodology began with interviews of key public and private sector stakeholders and community meetings in three of the towns surrounding Grand Forks Air Force Base. The goal of these interviews and meetings was to develop an understanding of the availability and affordability of advanced telecommunications services, primarily broadband internet access, and to identify unmet requirements for services by application and geography. These interviews and meetings were held over a three day period during the last week of April, 2007. One significant outcome of these sessions was that issues of cellular service coverage and public safety radio coverage were of greater concern to outlying town and rural residents than broadband internet service. An Application Analysis was conducted to identify significant tele-communications users and roughly define their usage requirements.

The next step in the methodology was to develop an understanding of what services were available, what technologies were being used, and who the service providers were. This part of the study was conducted through internet research, e-mail inquiries and telephone interviews with service providers. Because the initial interviews and meetings indicated that telecommunications gaps in cellular service and public safety radio coverage were of greater concern than the availability of broadband internet service, this step in the methodology was expanded to included providers of those services as well. A summary assessment of the existing telecommunications infrastructure was completed.

The third step in our methodology was to identify future telecommunications requirements for the users identified in the Community Documentation. Having defined the future uses of the technology, it is possible to project the services required and identify gaps in the existing infrastructure. The gap analysis is included as part of the existing infrastructure assessment.

I. Community Documentation

The purpose of this section is to provide baseline documentation about the communities surrounding Grand Forks Air Force Base (GFAFB) and to identify stakeholders within those communities that require access to broadband or other telecommunications services. A rough order of magnitude estimate of future bandwidth needs will be derived from this demographic data. Where possible, this section will also document how those stakeholders' requirements are currently being met. Typical among the community stakeholders requiring broadband and other advanced telecommunications services are government/public agencies, K-12 and higher education institutions, healthcare, and commercial users. By identifying these entities and their requirements individually and then combining those requirements across disparate categories, the aggregate need for broadband or other communications services can be defined. This aggregate need will form the baseline from which this plan will build. This baseline will also provide a means to assess the existing network capacity and identify any possible shortfall in capacity as usage grows.

The Region

This study focused on five counties surrounding GFAFB, including Grand Forks, Nelson, Traill and Walsh Counties in North Dakota and Polk County, Minnesota. According to the U.S. Census, these counties had a total 2000 population of 122,059 and covered a total of 6,534 square miles. The following table provides the population, population density, number of occupied housing units and number of businesses by County, as derived from 2000 US Census data:

COUNTY	2000 Population	Population Density per Square Mile	Occupied Housing Units	Business Units
Grand Forks, ND	66,109	46	27,373	1,309
Nelson, ND	3,715	3.8	2,014	90
Traill, ND	8,477	10	3,708	190
Walsh, ND	12,389	9.7	5,757	311
Polk, MN	31,369	16	14,008	583
TOTAL	**122,059**	**18.7**	**52,860**	**2483**

By comparing the population densities shown above to nearby urban areas like Minneapolis (7,067 people per square mile) or Winnipeg (3,660 people per square mile), the truly rural nature of the region can be better understood.

Educational Institutions

Educational institutions have long been leaders in the consumption of advanced telecommunications services. These services are recognized as a vital component of the

curriculum at all levels of education. The Federal government recognized this vital role and established the e-rate program to subsidize the connection of public schools to the internet.

The State of North Dakota similarly recognized the need for broadband services in education and government and procured a single broadband network to link all schools, universities and state government offices. This network is called the Dakota Carrier Network (DCN). All state offices and public school districts are required to obtain their broadband service from DCN. The reasoning for this requirement was that mandatory participation would generate the economy of scale required to make the operation of such a network feasible. Dakota Carrier Network, LLC, was created in 1996 by 15 independent rural telecommunications companies representing 85% of all the telephone exchanges in North Dakota and over 90% of the state's total surface area.

Post Secondary:

University of North Dakota: Grand Forks is home to The University of North Dakota. UND enrolls 12,834 students (fall 2006) in 193 fields of study from baccalaureate through doctoral and professional degrees. Fifty-one percent come from North Dakota; the rest represent all other states, seven Canadian provinces, and more than 50 other countries. The University employs about 2,500 people including faculty, administrators, researchers, and support staff. The campus consists of 223 buildings on 549 acres. The University is mandated to use the Dakota Carrier Network for broadband internet access.

University of Minnesota – Crookston: UM Crookston is a four-year university with 1,200 students that awards associate and bachelors degrees in more than 25 fields. The campus is located east of Grand Forks.

K-12:

K-12 schools are typically a significant user of telecommunications services. The Federal Communications Commission's E-rate subsidies have enabled many school systems to receive significant discounts on telecommunications services that supply telephone and broadband internet service. The terms of the E-rate program do not allow these discounted services to be shared with the general public. All public schools in North Dakota are mandated to receive their broadband service from the Dakota Carrier Network, which is also restricted from providing service to the public. It can be argued that these limitations on the use of E-rate or DCN services limit our ability to leverage the investments of the schools to provide broadband service to underserved rural areas. It is important, however, to understand the bandwidth needs of the K-12 schools in order to predict bandwidth demands for the Region in general in the immediate and long term.

There are eleven school districts in the immediate region serving Grand Forks AFB, including:

Emerado District 127: The Emerado School District consists of one elementary school serving 118 students with approximately 20 administrators, teachers and support staff. Emerado is located immediately south of GFAFB.

Grand Forks District 1/Grand Forks AFB District 140: The Grand Forks and Grand Forks Air Force Base School Districts serve the 7,600 students who attend schools in the two

communities. Eleven hundred people are employed including 700 teachers and 400 support and administrative staff. Together the two Districts have two high schools, an alternative high school, four middle schools, twelve elementary schools and one Head Start program. Grand Forks is located approximately 15 miles east of GFAFB.

Hatton District 7: The Hatton District consists of two schools serving approximately 240 students in Grades PK to 12 and has a staff of over 30 administrators, teachers and support staff. This District is considering a consolidation with Northwood District 129 in the Fall of 2008. Hatton is located approximately 22 miles south of GFAFB.

Larimore District 44: This District consists of an elementary (K-6) school with a student population of 237 and a staff of approximately 25 and a high school with a student population of 289 and a staff of approximately 30. Larimore is located approximately 12 miles west of GFAFB.

Northwood District 129: This district consists of a single elementary school with 150 students and a high school with 168 students. The District has a staff of approximately 50. Both schools are located at the same address. This District is considering a consolidation with Hatton District 7 in the Fall of 2008. Northwood is located approximately 17 miles southwest of GFAFB.

There are six other school systems in the Grand Forks region which will also impact broadband capacity, demand and availability, including:

Midway Public Schools (District 128): Located in Inkster, Midway Public Schools consists of one elementary school with 111 students, one middle school with 61 students and one high school with 87 students. Inkster is located approximately 18 miles northwest of GFAFB.

Manvel Schools (District 125): Manvel School is a K-8 school serving 153 students and is located approximately 13 miles northeast of GFAFB.

Thompson Public Schools (District 61): Thompson Public Schools consists of one elementary school and one high school. The elementary school serves 199 students in grades K through 6. The high school serves 234 students in grades 7 through 12. Thompson is located approximately 18 miles southeast of GFAFB.

East Grand Forks Public Schools: East Grand Forks Public Schools is organized into four schools. New Heights School serves 389 students in grades k through 2. South Point School serves 399 students in grades 3 through 5. Central Middle School serves 408 students in grades 6 through 8. EGF Senior High School serves 572 students in grades 9 through 12. East Grand Forks, Minnesota is located approximately 19 miles east of GFAFB.

Sacred Heart Catholic Schools: Located in East Grand Forks, Scared Heart Schools serve children from pre-school through high school.

Riverside Christian School is a non-denominational private school located in East Grand Forks, MN serving students in grades k through 8. The enrollment in 2002-03 was 80 students.

Healthcare

ALTRU Health System provides hospital and health care services to northeastern North Dakota and northwestern Minnesota through 20 locations centered on Grand Forks. It is the Region's largest healthcare provider. Altru employs over 3,000 people and had a 2006 operating revenue of over $348 million. Altru was recognized in 2006 as one of the 100 most wired hospitals in the United States, and as such, is a dominant participant in the Region's telecommunications infrastructure. Altru has facilities in 10 North Dakota counties and five Minnesota counties.

Northwood Deaconess Health Center operates a 12 bed acute care hospital and a 77 bed skilled nursing facility. The Center also provides a full range of laboratory and diagnostic services as well as physical and occupational therapy and ambulance service. The Center employs over 190 people and had a 2004 payroll of $3.7 million. The Center is the Northwood area's largest employer.

Commercial Users

According to 2005 data from the U.S. census, there are over 1,700 employers in Grand Forks County alone. The five largest business segments in the region ranked by total employment are:
1. Government and non-NAICS services,
2. Agriculture, forestry, fishing and hunting,
3. Health and social services,
4. Manufacturing, and
5. Food services.

Attempting to list all of the significant consumers of telecommunications services is beyond the scope of this report. Highlighting a few businesses noted during our initial interviews helps to illustrate the dynamic growth of the Region's economy and the resulting increasing dependence on telecommunications services. Those companies highlighted in our discussions included:

- Meridian Environmental Technology offers a unique range of customer-specific environmental and operational forecasting products and services, based on field-tested, proprietary computer algorithms. Meridian utilizes the advantages of the Internet to deliver customized surface forecasting and tracking reports to customers across the nation. Meridian provides 511 travel weather forecasting services to 10 states. Meridian is headquartered in Grand Forks and operates their main call center in Fargo. Meridian's reliance on advanced telecommunications access can not be overstated. One of the reasons for locating the call center in Fargo was because the Grand Forks region could not provide two independent sources of inbound WATS lines for the 511 service. The call center has 1300 telephone lines and operates on a 24/7/365 basis. Any downtime at the center can jeopardize Meridian's contracts with the States that it serves.
- LM GlasfIber is the world's largest wind turbine blade manufacturer. They opened their only U.S. plant in Grand Forks in 1999. The plant employs over 900 people.

- Cirrus Design Corporation designs, manufactures and markets general aviation composite aircraft. In 1995 the company began a 93,000 square foot expansion of their Grand Forks facility and now employs over 350 people.

II. Future Applications and Bandwidth Demand

The demand for broadband connectivity is a function of both the users' knowledge of broadband applications and their reliance on broadband applications. Without broadband connectivity, users cannot become aware of or dependent on those applications. In many cases, the users have not had sufficient exposure to broadband applications and services to provide an accurate gauge of a community's unmet demand for those services. Therefore, it is important to study existing and emerging applications being used in broadband-enabled communities today and predict when and where those will be deployed in the study communities. Goals for broadband deployment in the study region can be derived from these observations.

The Users' Perspective

As a bare minimum, the study communities should have access to the services that users need today, at prices they can afford, without any concern for reliability or performance. The current user demand can be best summed up in three categories: individual and small business user needs, institutional user needs, and economic development needs.

Individual and small business users require reliable, affordable broadband internet access. This access will be used for the following tasks:
- Selling merchandise or services in a larger marketplace (i.e. E-Bay, etc.)
- Buying goods and services from a larger market
- Tourism promotion, through internet advertising, web sites, etc.
- Electronic data interchange with remote employers or service providers

Institutional users include state and local government, school districts, higher education, and healthcare. These entities require broadband internet access and regional wide area networking capabilities. For example, these services will be used for:
- Linking hospitals and rural clinics and healthcare providers
- Linking schools on a district-wide broadband network
- Providing distance learning services at both the K-12 and higher education level
- Data exchange between state and local government agencies within the study region

Communities and their economic development professionals require the availability of broadband services in order to attract out of area businesses seeking to relocate. Many of these businesses include broadband connectivity in their go/no-go criteria for assessing potential relocation or expansion sites. It is also not uncommon for relocating businesses to require two independent sources of broadband connectivity to improve reliability.

Affordable broadband availability is also required to enable existing local businesses to grow through access to the larger markets made available by the internet. Economic development officials also need access to broadband services to promote their communities through web sites and online advertising.

Emerging Applications

Broadband enabled communities are quickly developing new applications and services. These services may promote those communities, support the residents, agencies, institutions and businesses in those communities, or enable new service delivery. Among the applications being developed are:

- Public safety mobile data: Many broadband enabled communities are developing broadband public safety mobile data applications. Broadband mobile data systems can deliver multi-megabit data rates to police, sheriff, fire and emergency medical responders both while on route and when on the scene. Previous generations of mobile data terminals operated on VHF/UHF radio modems and provided significantly less bandwidth. The difference between these two systems can be visualized as the difference between broadcasting a color picture or video of a suspect versus broadcasting a text-based description of a suspect in the same amount of time.
- Internet telephony: Services like Vonage and Skype allow broadband users to place voice calls around the world for little or no cost. This author used the Skype service to call a daughter living in Beijing, China via DSL service for much of the last two years. The call clarity and connection quality are equal or better than that of our incumbent telephone service provider, and the call is free beyond the monthly DSL charge.
- Internet-based video: Broadband users have had access to streaming video, such as the NBC Nightly News broadcast or sporting events, for several years. The logical direction for this service to grow is the broadcast of complete program content via broadband. In fact, television networks have begun offering internet downloads of their programming in multiple formats. In the future consumers will be able to select from the local cable TV provider or a video over broadband provider, if they live in a broadband-enabled community.
- E-government applications: Government services, including tax filing, building permit applications, meter reading, and many others, are increasingly being ported to the internet. In broadband-enabled communities, property ownership records including digital aerial photos are available online. Geographic information systems enable land use and management information to the general public that was never generally available before the advent of broadband services.

Future Needs

With the above observations as a starting point, the following future telecommunications needs should be used to guide the development of community telecommunications needs of the study communities over the next ten years:

Residential Users: Residential users will move to more real time applications like video on demand, gaming, video distance learning, and internet telephony in the near future. This will demand moderately high bandwidth, on the order of 1.5 to 3 megabits per second per household. In addition, the real time nature of these

applications will demand low network latency. Network latency is the measure of the time it takes a message to travel from the sender to the receiver. Voice applications and live video applications demand very low latency. Network carriers will have to increase backhaul capacity in order to deliver this service quality.

<u>Small to Medium Business Users:</u> Business users will also demand high bandwidth and low latency to support the many of the same real time applications of residential users. Businesses with more than one location are carrying voice and video conference traffic between locations on the internet to avoid toll charges. The internet circuits carrying this traffic require the ability to prioritize latency-sensitive voice traffic over more latency-tolerant traffic such as web browsing or file uploads or downloads. The amount of bandwidth required by a business will vary dramatically as a function of the business size and the business function. A small advertising business producing and distributing TV commercials can require as much bandwidth as a large retail concern. It will not be unusual for information dependent small to medium businesses to require 100 megabit per second connections. In addition to fixed broadband circuits, small to medium businesses will begin to deploy mobile data applications that require broadband voice and data coverage wherever their employees may be working outside their home office.

<u>Large Business and Institutional Users:</u> Large businesses and institutional users (government and education) will grow more reliant on broadband telecommunications as well as secure mobile applications. Healthcare and government applications demand strict security and privacy standards that increase bandwidth demands even further. Tele-medicine networks are becoming increasingly common in rural communities. The networks carrying this service will have very strict reliability requirements and require significant bandwidth to enable the timely transport of very large diagnostic imaging files. Public safety mobile data terminal applications will require secure, broadband network coverage for first responders while on route to and at the scene of an emergency throughout their area of operations.

In summary, the growth in demand for telecommunications services in the region is a question of when, not if. Enabling technologies are available to provide more cost effective solutions to problems like rural broadband delivery, path independent redundant broadband services, or secure mobile networking. The remainder of this report will focus on identifying the existing shortcomings in the regional telecommunications infrastructure and defining actions that can be taken to address those deficiencies.

III. Existing Telecommunications Infrastructure Assessment

Introduction

During the initial interviews and public meetings for this project, it became apparent that the telecommunications needs of the region included other systems beyond broadband internet service. Various users and public agencies raised concerns about cellular coverage, public safety radio coverage, and traditional voice services. The issues raised included questions about availability, affordability, quality of service, reliability and redundancy. In order to develop a comprehensive plan to address all of the telecommunications needs in and around the Base, it is necessary to first document the state of the existing telecommunications infrastructure for all of these services. The following assessment is drawn from input provided by public meeting participants, public agency officials, service provider representatives and through independent research.

Telephone

North Dakota is served by 37 different incumbent local exchange carriers (telephone companies). The Grand Forks region is served by at least three of those companies: MLGC, Qwest, and Polar. In addition, North Dakota law allows for other companies to become "telephone companies" and provide competition to the existing incumbent telephone companies. Both incumbent and competitive telephone companies can apply to the Public Service Commission for designation as "Eligible Carriers". This designation allows these companies to receive federal and state subsidies for providing telephone service in unserved or under served rural areas. Midcontinent provides competitive telephone services in the Grand Forks region and is also eligible for universal service subsidies.

- Polar Communications provides local telephone service in ten North Dakota counties including Grand Forks, Griggs, Nelson, Steele and Traill. Communities in the immediate vicinity of GFAFB that are served include Giby, Inkster and Niagara. Polar also provides broadband service to the GFAFB area. A map of Polar Communications' service area is included in the Appendix.
- Qwest Communications provides telephone service in parts of Grand Forks County and along the I-29 corridor north to Grafton and south to Fargo. Grand Forks, Grand Forks AFB, Emerado, Hatton, Larimore and Northwood are all served by Qwest. Northwood currently has a franchise agreement with Qwest that grants Qwest exclusive use of the utility poles owned by the City's power company.
- MLGC (Moore and Liberty, Griggs County Telephone/Internet Communications), as the name implies, offers voice service in three counties south and west of the GFAFB region. They are included in this listing because they provide cable TV and broadband services in Northwood. It is possible that they could offer competitive voice service in this community.
- Midcontinent Communications offers competitive voice services in Grand Forks, GFAFB, Emerado, Hatton and Thompson.

Cellular

Cellular telephone service has grown from a convenience to a common necessity over the last 10 years. Cellular systems in the United States operate on FCC licensed frequencies granted on a state by state basis. However, cellular carriers are not required to cover the entire area delineated by the license. Rural, lightly populated states such as North Dakota have seen strong growth of cellular service availability in more densely populated areas, but still suffer from spotty coverage in rural areas away from major highways. There are three cellular service providers in the Region: Alltel, Verizon, and Sprint/Nextel.

Cellular service has great economic advantages for providing voice service growth in rural areas, as evidenced by its explosive growth as the only voice service in developing nations. Cellular service has many infrastructure requirements in common with other radio-based services including regularly spaced tower locations with available power. Telecommunications development plans that focus on wireless solutions can focus on this common infrastructure to use limited funding for significant improvements in service.

Alltel acquired the North Dakota assets of Western Wireless (then doing business as Cellular One) in 2005. Their coverage map (see Appendix) indicates the availability of digital voice service over the entire region. Alltell provides broadband data and Blackberry service over a portion of the Region. A search of the Federal Communications Commission (FCC) Universal Licensing System (ULS) shows that Alltel has eleven towers in the Region, including five in Polk County, three in Grand Forks County, and one each in Nelson, Trail and Walsh Counties.

Verizon Wireless covers most of Grand Forks County with digital voice service. Their map shows coverage holes on the western edge of the County. Verizon also offers their National Access mobile data service in all of Grand Forks County except along the western and southwestern edges of the County. National Access provides data connectivity to personal computers and other handheld devices that are equipped with a compatible modem card. This service operates at up to 144Kbps, so it does not meet the FCC definition of broadband. Blackberry devices and service are also available from Verizon. The FCC ULS shows that Verizon has eight towers in the Region, including three in Polk County, two in Walsh County, and one each in Grand Forks, Nelson and Traill Counties (See Figure 1.)

Verizon has recently committed to building a permanent tower in Northwood. This new tower will replace the temporary tower brought in after the August 26, 2007 tornado disrupted telephone service throughout the community. The improved cellular service was so helpful to recovery efforts that local leaders lobbied successfully to have a permanent tower placed in Northwood. At a minimum, this tower will help to fill the coverage gaps reported in the southwestern corner of Grand Forks County. Should Verizon choose to equip this tower with wireless broadband services, it will also address some of the need for affordable broadband services in the rural areas surrounding Northwood.

Sprint/Nextel provides voice service through Sprint's personal communications system (PCS) and Nextel's legacy system as well. Their coverage map indicates the availability of voice and Push-to-Talk (walkie-talkie) service south from Grand Forks along the I-29 corridor to Fargo and west along the U. S. Highway 2 corridor to GFAFB. Sprint/ Nextel also offers broadband mobile data service in the city of Grand Forks.

The coverage maps presented in the Appendix were made available by the providers. Actual coverage, based on comments received during our initial public

meetings and interviews and on personal experience, is somewhat less than advertised. Cellular service is limited in range and requires reasonably clear line of sight between the tower and the user. We received reports of new cellular towers being installed in Hatton and Northwood, but those reports could not be confirmed from the FCC database. The tower locations pulled from that database do corroborate the anecdotal data provided by users that coverage is spotty to non-existent in the western and southwestern portions of the Region. For example, the figure below is a map of the Verizon antenna locations by a database search for the Grand Forks area.
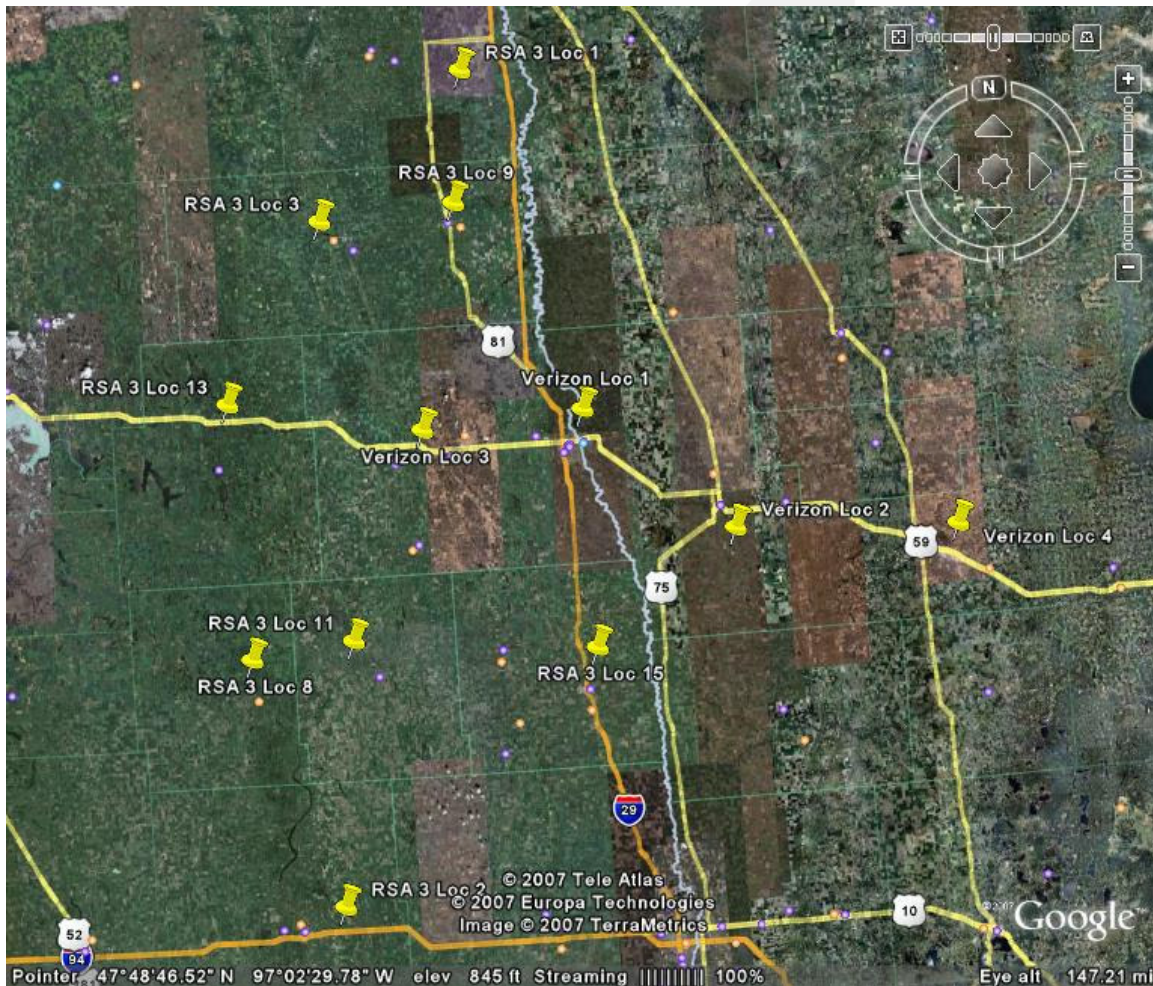
Figure 1. Verizon antenna locations from FCC ULS database.

Cable Television

Cable television networks are the second most common carriers of broadband internet traffic behind digital subscriber lines. The presence of cable TV service in a community is a positive step toward providing broadband service in an unserved community or offering competition in a monopolized community. Two cable TV providers are active in the GFAFB region. Midcontinent Communications offers cable TV service in over 200 locations in North and South Dakota and Minnesota, including select

communities in Grand Forks, Nelson, Polk, Traill and Walsh Counties. MLGC offers cable television service in Northwood.

Broadband

The FCC defines broadband internet service as connections that equal or exceed 250 kilobits per second. Advances in communications technologies and applications have driven demand for bandwidth by users to higher levels in larger markets. However, the FCC definition provides a baseline that is still applicable to rural and otherwise underserved regions for the planning purposes of this study.

To date we have identified six providers who cover some part of the Region. These providers are using traditional telephony methods (typically digital subscriber lines), cable modem services, and wireless services. These providers include:

- **Qwest Communications** provides DSL-based broadband services to Crookston, Grafton, Grand Forks City, Larimore and Thompson residents.
- **Midcontinent Communications** provides cable modem based broadband services to select communities in the five county region. The Broadband Distribution Network map provided by their website (see Appendix) shows service in fifteen communities distributed across the five counties.
- **Polar Communications** provides broadband services to residents and businesses in Grand Forks AFB, Emerado, Hatton, Larimore, Northwood, Thompson, and seven other Grand Forks and Traill County communities.
- **InvisiMax** provides wireless broadband services to the City of Grand Forks, Grand Forks AFB, Emerado, Hatton, Larimore, Northwood, Thompson, and other areas in Grand Forks County. These services are provided through a network of at least twelve transceivers located throughout the County.
- **MLGC** (Moore and Liberty, Griggs County Internet/Telecommunications) provides cable modem based broadband service in Northwood.
- **Sprint** provides mobile broadband services in the City of Grand Forks.

Interviews and community meetings held at the start of the project provided a brighter picture of broadband availability than was initially expected. The Region is served by a substantial number of providers who are using most of the available technologies to serve the Region. Problems with broadband availability were noted, but mostly in areas located well outside the city and towns.

Public Safety Communications

During the summer of 2007, the City of Grand Forks, Grand Forks County and Polk County installed a new VHF digital public safety radio (voice) network. This network will support interoperable radio communications for police, fire, EMS, and other local government agencies. The system is supported by three repeater sites, including one in East Grand Forks, one in Larimore, and one in Grand Forks. The system provides secure, encrypted voice and data communications. According to first responders interviewed for this study, the new radio system has apparently filled known holes in coverage in the western portions of Grand Forks County.

A public safety wireless data network is being installed by the City to provide mobile broadband data coverage for Police patrol vehicles and other City government functions. The bandwidth made available by this system will effectively extend the City

network to the patrol car. Patrol officers will be able to access local, state and federal information resources using this system. The system could be expanded to cover Grand Forks County, and the entire study area, by adding additional towers and repeater locations.

Infrastructure Assessment

Telephone: Traditional telephone service is available in all parts of the region. Telephone service providers do appear to have monopoly status in some of the communities in the region. Other regions we have studied have shown that the presence of competitive voice service carriers encourages the development of advanced services and puts downward pressure on price. The communities in the region that have different companies providing telephone and cable TV service will benefit from the introduction of voice services by the cable provider (and TV services by the voice provider) in at least two ways. The obvious benefit will be the downward pressure on price and the upward pressure on customer service. But a secondary benefit, the development of networks with both provider and path redundancy, will also serve these communities well. Path redundancy is achieved when services are delivered to a community or individual user by means of two physically separate physical pathways. Path redundancy eliminates service outages caused by one failure in one leg of the network. Provider redundancy is defined as the availability of telecommunications services from more than one provider. Provider redundancy prevents service outages in the case of single provider failures. Single provider failures can be caused by network failures, power failures or provider bankruptcy. Communities that can boast two independent providers of advanced telecommunications services will stand a greater chance of attracting and keeping information based businesses. The call center for Meridian Environmental Technology is located in Fargo instead of Grand Forks in part because two network providers with independent network routes were available there.

Cellular: Cellular coverage is lacking in some portions of the Region. Cellular service is becoming mandatory for many businesses and individuals for many different reasons. The lack of coverage in a rural community may be discouraging business relocation or expansion. Cellular service also provides a back up method of emergency communication. Finally, Alltel, Sprint and Verizon are now deploying mobile broadband solutions. This wireless data service operates with the range and reliability of cellular voice service but at a price competitive with satellite and other terrestrial wireless broadband services. Encouraging the further development of cellular service in the rural parts of the Region can have many collateral benefits. These benefits include competitive pressure on telephone service rates, added options for emergency communications as experienced following the Northwood tornado, and wireless broadband service.

Television: While many communities in the study area are served by cable television providers, these systems do not reach all residents. The cost of deploying cable TV service to residents in very low population density areas is simply prohibitive. The common alternative for the near term will be satellite TV service from DirecTV or Dish Network. The recurring costs of satellite TV are similar to those of Cable TV service. Cable TV service does have the added advantage of enabling bundled voice and broadband services. However, from the standpoint of television service alone, satellite TV provides an affordable and available alternative to cable service.

Broadband: Many of the communities studied have at least two providers of broadband internet service. Broadband users within a three mile radius of many cities

and towns should be able to get competitive pricing from these providers. Compared to other rural regions we have studied, this Region is relatively well served with respect to broadband telecommunications. Issues with broadband availability exist, but primarily in the remote, unincorporated areas of the Region. In the near term the most likely solution for remote users is a satellite internet link from Skycasters, WildBlue or HughesNet. It may be possible for land-based wireless (Invisimax and Polar) or cellular mobile data providers (Alltel, Sprint, and Verizon) to enhance their coverage and reach some remote users. They would also provide beneficial competition to established providers.

Public Safety Communications: The recent upgrade of public safety radio service in the Grand Forks and Polk Counties and the installation of the wireless broadband public safety network in Grand Forks City are major improvements to the area infrastructure. The expansion of these services to cover the entire region would also represent significant improvements to the effectiveness of public safety officers and first responders throughout the region.

Systemic Concerns: At least one broadband-dependent business was concerned about the lack of reliability, redundancy and capacity. As businesses and institutions become more reliant on the internet, the reliability of their provider becomes more critical. Data networks have yet to achieve the reliability of telephone networks. It is still not unusual for data networks to demonstrate a few hours of downtime a month. By comparison, voice networks designed to a higher standard that accept less than six minutes of downtime a year. As more traffic moves to internet protocol based data networks, the reliability of those networks will have to be greatly improved.

Network redundancy, the ability of a network to sustain failures and remain in operation, was also a concern for some participants in our interviews. One level of redundancy can be achieved by providing duplicate, parallel network components within the same trench. This level of redundancy is achieved in some of the study region. A higher level of redundancy, path redundancy, is achieved when services are delivered to a community or user by two or more physically separated paths. Greater redundancy is achieved by greater physical separation. Fiber optic rings achieve this greater level of redundancy because one failure in the ring does not interrupt network service. At least one interviewee suggested that further business expansion was being considered outside the Grand Forks region because of a lack of path redundancy in their provider's network. Redundancy can also be improved by the presence of multiple service providers with path independent networks.

Network capacity was a concern for at least one study participant. Data networks, unlike other utilities, do not grow linearly as users are added. While new users do add to the capacity requirements of the network, new applications can have a much more significant and less predictable impact. When a new application is introduced, for example video on demand, bandwidth demand growth will occur across all network users, new and old.

The Dakota Carrier Network may actually be inhibiting the development of competitive service providers in the Region. While DCN provides a valuable service to state and local agencies and public schools, it also removes their purchasing power from the marketplace and reduces the incentive for alternative providers to expand into this region.

Conclusions

Our study has shown that the telecommunications infrastructure in the region surrounding Grand Forks Air Force Base has some significant strengths and some

significant weaknesses. Foremost among the strengths is the presence of multiple broadband internet providers in each of the communities we visited. Another strong positive can be found in the degree to which providers such as Midcontinent, MLGC, and Polar have diversified services to provide alternative sources for voice, TV, or broadband internet.

There are still significant weaknesses that need to be addressed. Foremost among the weaknesses is the spotty cellular telephone coverage in remote parts of the region. Second, recent improvements to public safety telecommunications have been limited in reach by the funding available. And finally, the need for broadband internet service outside the more densely populated cities and towns should be addressed. This last weakness may indeed be the most technologically and economically challenging, but it can be overcome through the innovative use of existing technologies and business models.

IV. Potential Connectivity Solutions

Rural Cellular Coverage

The solution to this issue is simple, but has nonetheless proven difficult to address. The only option for improving cellular coverage in rural areas is to add towers. Cellular providers plan tower locations according to the revenue they can produce. A new cell tower and the equipment it requires can cost up to $1 million.

Rural Broadband Coverage

There are five common technologies used for last mile broadband service delivery: digital subscriber lines (DSL), cable modems, fixed wireless, mobile (cellular) wireless and satellite. DSL and cable modem technology account for almost all of the broadband last mile connections in the United States, while fixed wireless and satellite account for less than ten percent. Mobile wireless data has only come into common use in the last two years when major cellular service providers began deploying broadband services in major markets. The five technologies and their associated advantages and disadvantages are noted below.

DSL service was developed to carry high speed internet traffic over existing telephones lines. DSL uses available bandwidth in existing telephone lines that is not used for carrying traditional voice traffic. Because DSL uses bandwidth not used by voice traffic, the two services can run simultaneously on one telephone line. DSL can provide bandwidths up to 9Mbps at distances up to 18,000 feet. Typical commercial DSL offerings provide up 1.5Mbps within 18,000 feet of the telephone company office.

DSL has several drawbacks that limit its applicability to rural areas. The first limitation is the cost of the central office equipment required to offer DSL service. A device called a DSL Access Multiplexer (DSLAM) must be installed in the telephone company's central office. All DSL circuits originate at the DSLAM and terminate in a DSL modem or router at the customer's office or home. DSLAM's can be very expensive and may not be cost effective in a small community where a majority of the population lives outside the 18,000 foot service radius. DSL service also requires high quality, dedicated (one customer per line) wires between the DSLAM and the customer home or place of business. Many rural community telephone systems have old cabling systems which may be shared among homes or businesses through a technology known as

multiplexing. These lines can not be used for DSL because of the requirement for dedicated wires from the DSL provider to each home or place of business.

Cable modem technology uses available bandwidth on existing cable TV systems to carry broadband internet service. Cable modem systems typically offer up to 3Mbps upload and download speeds. The popularity of cable modem systems has led to many cable providers offering telephone service (using voice over internet protocol technology) along with TV and internet access. Such bundled offerings are introducing new competition to the telephony market in many more densely populated areas.

There are several disadvantages to cable modem technology. Most obviously, a community must have cable TV service first before high-speed data service can be added to it. Most of the study communities do not have cable TV service. Cable modem service also has distance and quality of cable limitations similar to those noted for DSL. Rural communities that may have older cable TV infrastructure most likely do not have the quality of cabling required for broadband data. A third shortcoming to cable modem service is the cost of "central office" equipment required to provide the service. A cable modem termination switch (CMTS) is required at the main office of the cable system to strip the data traffic off of the cable system and link it to a broadband internet source. Most of the study communities' populations are too small and too widely dispersed to make cable modem service a cost-effective broadband solution.

Fixed wireless broadband service, sometimes referred to as Wi-Fi (for wireless fidelity), has been in development for the last seven years. The technology has been developed in parallel with wireless local area networks (WLANs), in some cases even using the same hardware and software. Fixed wireless broadband uses radios to carry service to users. The most popular types of fixed wireless services operate in two unlicensed frequencies, 2.4GHz and 5GHz. These systems typically conform to the IEEE 802.11 standard for wireless networking. Adherence to this standard has allowed for the mass production of equipment by multiple vendors. The competition among these vendors has significantly lowered the cost of the equipment. Standards-based equipment also allows users to use a single device (e.g. a PC or laptop) in multiple locations (home, office, airport or hotel).

Fixed wireless systems can achieve bandwidths of up to 27Mbps (full duplex) without the costly equipment and cabling required by DSL and cable modem systems. The range of a typical fixed wireless system using the 2.4GHz band is about three miles. Commercial, off-the-shelf antennae can be used to extend the range of such systems. End user devices include built-in or external wireless network cards, external wireless modems, and wireless routers. Cost for these devices range from $40 to $400. There are also fixed wireless services that operate in the licensed 700MHz frequency range. Polar Communications is using such a service in Northwood. This technology has the advantage of operating at higher radiated power because it is licensed to a single provider. This higher radiated power, combined with a lower carrier frequency, gives this licensed service greater range and reliability. These advantages may be offset by the cost of equipment and the limited competition enabled by the license.

Fixed wireless systems can have some limitations which must be evaluated when considering their use. First, as noted above, many are based on the use of frequencies that are not licensed by the Federal Communications Commission. Because these frequencies are unlicensed, it is possible that interference may be caused by other applications in the same frequency band. Careful system design, including antenna and channel selection, may be required to build a successful system. The 2.4 and 5GHz systems also require clear line of sight between stations on the network. Careful system design, including the use of active repeaters, is required to overcome line of sight issues.

Cellular service providers began deploying mobile wireless data services over two years ago. The different providers are using different technologies, but all with the same goal in mind. Mobile data systems enable mobile devices (personal computers, laptops, handhelds or personal digital assistants) to receive broadband service using the same infrastructure as the cellular voice network. Connections of up to 2 megabits per second are possible anywhere with in range of a cellular tower equipped with the mobile data equipment. The service plans and equipment are relatively inexpensive with a typical two year contract for unlimited use running $60 per month with no charge for the wireless card. The distinct disadvantage of this technology is that it has not been deployed in most of the study region.

The final option for rural broadband service is satellite internet service. There are three common providers of satellite internet service: HughesNet, Skycasters, and WildBlue. Satellite internet service has the unique advantage of being available anywhere in the study region. Initial equipment costs are relatively high ($200 to $2000) and monthly service charges greatly exceed those of DSL or cable modem service. This technology typically provides faster download than upload speeds, with downloads up to 2 megabits per second and uploads of roughly half the download speed. Satellite internet has high latency because of the time it takes a signal to travel from sender to receiver via the satellite. This latency makes the service unsuitable for real time applications such as voice or two way teleconferencing. One provider stated that satellite internet was acceptable for online gaming as long as the satellite user was willing to always lose!

Region-wide public safety data coverage

Public safety mobile data applications are especially effective in rural law enforcement because they enable a patrolling officer to perform more of their routine job functions from the field. They can also deliver important data, such as pictures, building plans, or hazardous materials data, that can not be quickly communicated by traditional voice services. There are some significant challenges to delivering reliable and secure mobile data on rural communities, primarily the cost of the equipment required to provide the coverage required. There are three common technologies used for mobile data terminals: traditional VHF radio modems, dedicated wireless data, and public cellular data services combined with virtual private network applications. The advantages and disadvantages are as follows:

Radio-based mobile data terminals (MDT) operate on licensed radio frequencies dedicated to public safety agency use. These systems usually require a modem and laptop PC in each mobile unit. Bandwidth is typically limited to less than 192 kilobits per second (not broadband) and the number of simultaneous users is typically very limited. The North Dakota Highway Patrol uses this type of system on the State radio network. The State MDT's can not be used by County and local law enforcement because of the bandwidth limits of the radio network.

Dedicated mobile public safety applications typically operate in the 4.9GHz range reserved by the FCC for public safety use only. The MDS system currently being installed by the City of Grand Forks is an example of this system. The MDS system uses the 4.9GHz radios to carry traffic back and forth between repeater sites around town and City Hall. Mobile units are equipped with 900MHz radios that connect to the repeater sites. The network between repeater sites and City Hall is capable of carrying up to 18 megabits per second of actual data traffic, enabling multiple simultaneous sessions. The only drawbacks to this system are the cost per repeater site and mobile unit, and the fact

that the system is dedicated to public safety use. Why is the dedication of the system an issue? Because other solutions are available that could share infrastructure that could address additional telecommunications needs in the study region.

The third technology available to support public safety mobile data is commercial cellular data service using virtual private network (VPN) technology. Mobile vehicles are equipped with laptop computers which have cellular data network cards and VPN software installed. The mobile computer connects via the commercial cellular broadband network to the public agency network using the VPN software to secure the connection. The cost of vehicle equipment is relatively low and the network infrastructure cost is shared by the other cellular voice and data users through their monthly service plans. The disadvantage to the approach is the sparse cellular broadband coverage available in the study region. However, other communities have shown that the willingness of public agencies to act as "anchor tenant" has encouraged cellular providers to implement cellular broadband service in some rural communities. Missoula County, Montana committed to placing laptops with cellular broadband modems in the Sherriff's patrol cars as an incentive to Verizon Wireless to install broadband cellular data service throughout the County. The guaranteed revenue helped persuade Verizon Wireless to implement the service.

V. Implementation Strategies

The preceding analysis identified three telecommunications shortcomings that should be addressed: poor cellular telephone service in rural areas, poor or no broadband internet service in rural areas, and the absence of public safety mobile data service in much of the region. To address these shortcomings, two implementation strategies have been developed. These strategies identify different technologies that have the potential to address one or more of the shortcomings and suggest means to implement those technologies.

Plan A

Encourage cellular service providers to improve their coverage of the study area and add cellular mobile data services to the entire region. Cellular voice and data technology is the one commercially available system that can address all of the region's needs. This can be accomplished through the following tasks:

- Work with the North Dakota Public Service Commission's "Zap the Gap" initiative to identify gaps in cellular voice service in the region and potential customers who can be reached by filling those gaps. Work with the PSC staff to publicize this effort and raise community and provider awareness.
- Join the Connecting Rural America initiative to lobby against the restriction of USF funding for the expansion of rural cellular service.
- Expand this initiative to include both cellular voice coverage and cellular data coverage. Quantify the number and locations of potential broadband users that are not currently available to receive such service (except via satellite). Provide this geographic data to service providers
- Identify public infrastructure (water towers, etc.) that may be made available to cellular service providers and provide this data to those providers and the PSC.
- Identify possible co-development approaches that may reduce the initial costs of expanded cellular service.

- Develop and evaluate a region-wide plan to use cellular mobile data service to provide broadband service to public safety and public agency users. Define the total service required and work with other stakeholders, cellular providers and the PSC to identify opportunities for implementation.
- Evaluate whether the public sector mobile data need is large enough to serve as the "anchor tenant" in a region-wide expansion of cellular mobile data service. Consider using a competitive procurement to begin a staged deployment of this capability.

Plan B

The alternative to Plan A is a plan that encourages the use of different technologies to address the different needs. This plan would include the following tasks:
- Work with the North Dakota Public Service Commission's "Zap the Gap" initiative to identify gaps in cellular voice service in the region and potential customers who can be reached by filling those gaps. Work with the PSC staff to publicize this effort and raise community and provider awareness.
- Quantify the number and locations of potential broadband users that are not currently available to receive such service (except via satellite). Provide this geographic data to all fixed and mobile broadband service providers
- Identify public infrastructure (water towers, etc.) that may be made available to service providers and provide this data to the service providers and the PSC. Identify possible co-development approaches that may reduce the initial costs of expanded service.
- Develop a region-wide plan to expand the MDS system currently being installed in the City of Grand Forks. Identify and pursue resources available for funding this expanded implementation.

VI. Resources

USDA Rural Development Programs

The United States Department of Agriculture (USDA) Rural Development Telecommunications Program consists of three efforts to improve broadband availability in rural areas;
- The Broadband Access Loan program provides loans for funding the costs of construction, improvement, and acquisition of facilities to provide broadband service to eligible rural communities. North Dakota has five communities participating in the Broadband Loan Program, including Dickinson, Jamestown City, Hillsboro, Mayville and Portland,
- The Distance Learning and Telemedicine program is responsible for bringing electronic educational resources to rural schools and improving health care delivery in rural America. In FY 2007 the DLTM Grant Program awarded 78 grants to recipients in 31 states for a total of $23,300,000. There were no North Dakota recipients. A list of previous North Dakota DLTM grant recipients may be found at: http://www.usda.gov/rus/telecom/dlt/dltaward-summaries/dltawards-nd.pdf .
- The Community Connect Grant program provides financial assistance to eligible applicants that will provide currently unserved areas with broadband service that fosters economic growth and public safety services. This year USDA awarded

$10,300,000 in grants to 19 communities in 13 states and American Samoa. There were no North Dakota communities included among the recipients.

North Dakota Public Service Commission Wireless Outreach Initiative

The following description of the North Dakota Public Service Commission's Wireless Outreach Initiative is quoted directly from the PSC's website http://www.psc.state.nd.us/jurisdiction/pud/telecom/wireless/wireless-info.html :

"This initiative is designed to assist wireless phone customers in North Dakota. Telecommunications services like wireless phones are important to the economy of ND, and the safety and quality of life of its citizens. The effort is designed to help coordinate an effort on behalf of consumers and give them a place to turn when they have unresolved questions. The goal of this effort is to improve the quality of wireless services to customers in ND.

The "***Zap the Gap***" effort is designed to:
- Encourage wireless investment in ND, especially currently underserved areas. The PSC will collect information from consumers to determine areas where there is demand but low wireless coverage. The information will be forwarded to wireless providers to help bring attention to areas needing service.
- Provide a clearinghouse of useful planning information for wireless companies. The information will include approximations of the number of wireless phones per capita in different counties in ND, traffic counts on major roads, and lists of suitable structures for wireless antennas.
- Help facilitate discussions between communities that want wireless service, and providers that may be able to fill the gap. (While the PSC lacks authority to order wireless providers to change their service offerings or coverage areas, the PSC can offer providers consumer information and data that may aid them in improving their service offerings in the state.)
- Identify strategies to advocate for ND's interests in wireless matters with other government agencies. Many of the decisions that affect wireless investment in ND are made at the federal level. This component of the initiative will target federal rulemakings and opportunities with agencies like the Federal Communications Commission (FCC), (USDA) Rural Utilities Service and other state commissions that are of importance to ND's interests. North Dakota Commissioners regularly interact with colleagues from other states and with federal officials. This initiative goal will use those established relationships to identify and advocate for wireless policies that make sense for rural states like ND. The PSC will continue to monitor state policies to ensure ND's investment climate is the best it can be for expanded wireless as well.

To help carry out the goals of the initiative, the PSC will hold informal public forums as needed throughout the state to gather input from North Dakotans regarding wireless issues."

US Economic Development Administration – Public Works Program

The United States Department of Commerce Economic Development Administration (EDA) was established under the Public Works and Economic Development Act of 1965 (42 U.S.C. § 3121), as amended, to generate jobs, help retain existing jobs, and stimulate industrial and commercial growth in economically distressed areas of the United States. EDA assistance is available to rural and urban areas of the Nation experiencing high unemployment, low income, or other severe economic distress. Through September 30, 2004 EDA has provided $646,000,000 in assistance to communities impacted by earlier Base Realignment and Closure actions.

EDA'S Economic Adjustment Program

The Economic Adjustment Program assists state and local interests design and implement strategies to adjust or bring about change to an economy. The program focuses on areas that have experienced or are under threat of serious structural damage to the underlying economic base. The Economic Adjustment Program predominantly supports two types of investment activities:

- Strategic Planning - Strategy investments help organize and carry out a planning process resulting in a Comprehensive Economic Development Strategy (CEDS) tailored to the community's specific economic problems and opportunities. The Grand Forks Region has already developed a CEDS, so it may proceed to the next step in the EDA process.
- Project Implementation - Implementation investments support activities identified in an EDA-approved CEDS. Activities may include, but are not limited to, the creation of strategically targeted business development and financing programs such as, construction of infrastructure improvements, organizational development and market or industry research and analysis.

The EDA provides three other assistance programs for BRAC affected communities, including:

- Public Works and Economic Development Program: Public Works and Economic Development investments help support the construction or rehabilitation of essential public infrastructure and facilities necessary to generate or retain private sector jobs and investments, attract private sector capital, and promote regional competitiveness, including investments that expand and upgrade infrastructure to attract new industry, support technology-led development, redevelop brownfield sites and provide eco-industrial development.
- Local Technical Assistance: The Local Technical Assistance Program helps fill the knowledge and information gaps that may prevent leaders in the public and nonprofit sectors in economically distressed regions from making optimal decisions on local economic development issues.
- Trade Adjustment Assistance for Firms Program: EDA administers the Trade Adjustment Assistance for Firms Program through a national network of eleven Trade Adjustment Assistance Centers to help manufacturing and production firms, which have lost domestic sales and employment due to increased imports of similar or competitive goods, become more competitive in the global economy.

EDA activities in North Dakota are administered by the Denver Regional Office (303-844-4715). Information on economic strategy development and implementation can be obtained from that office.

Connecting Rural America

Connecting Rural America (www.connectingruralamerica.org) is a grassroots coalition of advocacy groups, community leaders and elected officials working to ensure that rural citizens have access to high-quality service and choices in wireless telecommunications offerings that are available in urban areas. The group is, at least in part, sponsored by cellular service providers. The group was formed to lobby against a proposed cap on the Universal Service Fund (USF) they believe would end the expansion of cellular service expansion in the rural United States. The USF was created by Congress in 1996 to help build telecommunications infrastructure in rural and underserved regions of the United States. All telecommunications users pay a percentage of their interstate telephone charges to the USF. Support from the fund is then provided to carriers who are committed to investing in infrastructure located in rural areas where the cost of establishing facilities is too expensive to justify investment otherwise. Connecting Rural America provides information to private citizens and local elected officials on how they may contact federal officials and the media to voice their support for USF funding for rural cellular service expansion.

Appendices

1. Initial site visit notes.
2. Service provider by community matrix
3. Cellular coverage maps from PSC.
4. Polar Communications Service Area Map
5. InvisiMax Service Area Map

Broadband Business Development Roadmap
Grand Forks, ND
Meeting Minutes – Initial Site Visit

Tuesday, April 24, 2007
w/ Lane Magnuson County Planning Office
- Provides planning services for areas outside the City of Grand Forks
- Zoning rules regarding towers:
    - Easiest to put towers in agricultural zoning areas
    - Not permitted in areas around airports and AFB
    - OK in residential areas with 40 ac. Parcels
    - Most of the study area zoned agricultural
- Cellular service is not good in the SW portion of the County. Most recent tower constructed at Northwood (Alltel). Tower height limited to 100' because of proximity to local airport. This limits coverage.
- Population Growth (Loss) areas:
    - Central County grows in direct relationship to Base employment
    - Agricultural areas losing population
    - Eastern County (City of Grand Forks) growing 1.2% to 1.6% annually
    - Population shifting away from river to avoid assessment for flood control
- City has 4 mile donut area of planning control
- Housing development: largest recent developments have been 30-40 lots
- No knowledge of public works projects that could benefit this project.
- Cell companies: Verizon is the largest. Alltel and Sprint are also present
- CATV: Midcontinent
- Telcos: Qwest, Polar, MLGC
- ISPs: Qwest (T and DSL), Polar (700MHz wireless CMTS), GF Wireless, MidCoNet (CMTS)
- County has three rural water companies (Grand Forks Traill, Agassiz, TriCounty)
- Public Safety: Mostly volunteer fire departments, Sheriff for unincorporated areas, some local police departments, AFB has own services
- Lane believes that most rural areas are still struggling by with dial-up. There are some wireless services, and some DSL thru telcos.
- No public libraries other than in Grand Forks City

W/ Major Mike Fonder, Grand Forks County Sheriff's Department
Subject: Public safety communications capabilities and needs
- VHF radio operations since 1974
    - Has telephone interconnect system
    - 800 MHz
        - City police, fire, ambulance also on 800MHz
    - Moving to digital system including digital voice protection
    - Fargo and Grand Forks received grant for system. Bid awarded to Tait Communications. Working in MN now, coming to GF next. Moving one repeater (County West) from Moraine Township to Larimore tower. Site in Larimore is "several hundred feet lower" than Moraine tower, limiting repeater range. County East Repeater at Stones Mobile Radio (47th Avenue South). Tait will move to East Grand Forks (Stan's Radio). New tower planned for Emerado on AF tower. One channel will be supported by the three repeaters. This channel will also be accessed by other public

safety agencies. There is a second channel used by County Road Department and school buses. It is not considered reliable enough for public safety because of their heavy use.

- o There is a back up 40-watt repeater at the AFB Communications Squadron. It is offline until they are told to power it up.
- o Deputies currently use UHF link to vehicle, repeated through vehicle VHF system. Each car repeater is on a separate UHF frequency to simplify proximity operations. A new 5-watt handheld should be able to reach the VHF repeaters, eliminating need for UHF repeater in car.
- o City of GF has started implementing a broadband mobile data system (see notes on meeting with Roxanne Fiala). County can not afford to join project because of cost (about $20K per site.)
- o Highway Patrol is on the State radio system. They have mobile data application that enables them to print citations in the car. Can not share it because of a lack of bandwidth.
- Staffing and duties
  - o Sheriff's duties include rural law enforcement, support to the court system (warrants, criminal and civil process serving, intrastate and interstate prisoner transport), mental health commitments, and cooperative actions with City and Town law enforcement.
  - o 0 to 2 deputies patrolling in the County on the day shift. The others are in the City doing warrants, mental health response, or transport of persons in custody.
  - o 3-5 deputies patrolling in the County during night shift
- Potential for County wireless hot spots for broadband mobile data: AFB Comm. Sqdn., City Halls, Rural Fire Departments
- Funding is the major hurdle to system upgrades. Most things are accomplished through grant funding. They are working on grant funding for two hot spots in Larimore and Emerado. Funding would cover car equipment, hot spot and backhaul.
- Major Fonder also suggested talking to the county highway engineer.

W/ Doug McDonald and Mark Schill, Praxis Strategies
Subject: Discuss background information and solicit their input into the study

- Doug recommended paying attention to the rural areas, identifying the applications. He feels access to broadband is not so much of an issue
- Several local providers were noted, including Invisimax, Midco, Qwest, Polar Communications, and GF Wireless (partnered w/ Polar)
- Mark stated that the issue may be affordability, not availability
- The State (government) network is contracted through the Dakota Carrier Network. The network touches every government facility, school and hospital. It is NOT available for private traffic.
- Doug recommended talking to Meridian Technologies (scheduled for later in this visit). He described their operations in supporting the 511 weather info systems in several states. He believes that they have the needed capacity and availability/reliability and that they can buy more as needed.
- UND is a major reason the City of GF is as well connected as it is. UND also provides a good source for technically trained support personnel.

- Mark mentioned that the State of ND has appropriated funding for their portion of the Northern Tier Network, a regional effort to light unused fiber to provide a very high bandwidth pipe from Minneapolis to Seattle to support research and education projects only. Only benefit to regional bandwidth is that traffic which it may offload from existing bandwidth. No new capacity construction is planned. The existing fiber that will be lit follows the interstate highway right of way. This will not provide any new capacity in rural communities.
- UM Crookston has a focused technology curriculum, also stresses business applications. Possible second source for trained support personnel.
- The North Dakota Telephone Association may be a good resource for information on local carriers and capacity. (Box 2614 Bismarck, ND, 58502, 701-223-6022)
- Local economic drivers: GFAFB employs ~2200, down from ~8000 in the 1980's. UND, agriculture and manufacturing are other major sectors. Manufacturers may/will have a need to connect local facilities with remote (out of area) mgmt, engineering, sales, purchasing. Manufacturing entities worth looking into include Cirrus, LM Glasfiber, Ideal Aerosmith.
- Economic growth areas include professional/business services, technical and scientific services, manufacturing.
- Job growth of 4000 to 5000 jobs since 2002.
- Record housing starts and taxable sales
- Low per capita income
- Other economic growth seen in healthcare, energy/environment (EERC @ UND)
- Healthcare: One major hospital and healthcare system (Altru). Some satellite clinics provided by MeritCare. The Crookston, MN hospital has a clinic in EGF, MN.
- Grafton, ND has Marvin Windows and a hospital
- The labor shortage is the biggest hurdle to economic development. Attracting skilled labor is a must
- Question: Study seems focused on Grand Forks County. Doug and Mark both asked "What about the other four counties?"

W/ Ed Nierode (County Director of Administration), Rick Duquette (City Administrator), Klaus Thiessen (GF Region EDC) and Diane Blair (BRIC)
Subject: Discuss background and objectives of this study
- Ed: The base is downsizing. There is the possibility of a new economic engine developing at the Base or in the City. There is a perceived lack of high speed connectivity in the communities surrounding the Base.
  - Initial goal: build a fiber loop linking Northwood, Hatton, Emerado, and Larimore. Now wireless could be a better choice
  - Hatton has Midco service, but there are still issues.
  - Possibility of building a network operations center (NOC) at the Base, possibly run by a private entity, providing wireless to rural areas surrounding the Base
- Klaus: There are two dynamics driving this study
  - Want surrounding communities to grow and meet the workforce shortage
  - These communities will grow if we can enable/encourage telecommuting, business startups providing necessary services in the communities, and the development of affordable housing in these communities

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- o Second dynamic is the realignment of the base to support the unmanned aerial systems (UAS) mission. GFAFB can become national center of excellence for this work, but surrounding communities have to be ready to support the job growth.
- Rick: City has made great strides w/ wireless public safety, public works, and public utilities services. (More on this in a later meeting w/ Roxanne Fiala, City IT Director)
- The impact of this work will be greatest in the western part of the (Grand Forks) County around GFAFB. This project is happening because of the potential impact to outlying communities.
- Need to also consider impact of/from the Red River Research Corridor efforts
- 42,000 post-secondary students within 75 miles of GF. Tremendous resource for workforce shortage if they can be enticed to stay/put to work
- Unemployment ~2%. Essentially full employment. Must be able to attract skilled/professional workforce from outside the region. GF can not provide enough housing, rural communities could take up the slack if the right services/amenities were available.
- Identify innovative partners in specific communities
- Identify available technologies and models of how it can be done
- Schedule: Phase I deliverable by 5/31. Final deliverable by 7/31
- Challenges that I foresee: Getting useful provider data. Klaus has identified a contact at Qwest. Diane and Paul will identify contacts at other providers.

W/ Roxanne Fiala City IS Director
Subject: Discuss City IT capabilities and public safety wireless network
- City is implementing a public safety wireless network. City holds 4.9GHz license for entire County. System purchased from MDS of Rochester, NY. Backbone consists of 4.9GHz radios on water towers (five total). Cars equipped with 900 MHz I-net radios. Fiber from Arena at UND (the Ralph) to City network. Repeater at Arena reaches Larimore. Mercury radio is coming in June, adds GPS and wireless remote with 300' range.
- The MDS system utilizes the licensed 4.9GHz frequency dedicated to public safety communications. While other City (or County) agencies may use the network, it will not be available for business or residential use. The support infrastructure (towers, electrical power, other common facilities) could be used to support additional wireless services (commercial broadband, cellular).
- Bandwidth between towers is 18 Mbps, half duplex
- MDS system uses NetMotion between towers
- MDS system can hit Thompson and Airport
- MDS system can be expanded to cover the entire county by adding towers and repeaters. Major Fonder indicated that funding was not currently available.
- There might be fiber to the Larimore tower
- Applications for wireless network include
  - o Mobile data to patrols
  - o 40 forms and databases developed in Lotus Notes, including incident reports briefing data
  - o Crisis Command: floor plans and 360 video for schools and major buildings
  - o SCADA

- o Limited internet access to white-listed sites
- o Car based access points for mobile laptop connectivity
- Budget for project was $750K including backbone, vehicle radios and SCADA
- City wired data network consists of PtP T-1s linking each facility
- Future applications for wireless network
  - o Public works geographic information system (GIS): size of water pipes, valve location
  - o Fire hydrant and supply information
  - o Traffic light data
  - o County Public Health Nurses
  - o County Assessors
  - o Sheriff
  - o Rural FD
  - o Distance Education (possibly with UND)

- Elert & Associates are the engineers that design and selected the MDS solution. Contacts are Roger Olwin 952-942-9996. Dave Kaun is their radio guy working on the GF project.

Wednesday, April 25, 2007

w/ Curt Dunn, NDDot Region 6
Subject: Discuss planned highway projects that might support simultaneous fiber deployment
- o Grand Forks is in NDDoT Region 6. Curt provided a copy of the Statewide Transportation Improvement Plan that identifies all projects planned through 2010. Only major project is Highway 81 between St. Thomas and Hamilton, which is outside our area of interest.
- o Construction types that impact RoW include vertical clearance improvement, median crossover, hot bituminous paving, grading /HPB/structure, PCL pave
- o State highway projects most commonly involve buried utilities. Little work is currently planned that could be leveraged for fiber deployment. Design guidelines are on the internet.
- o State permits are required to do utility work in the right of way. The Highway Department has some utilities in the RoW (lighting, signal control, weather)
- o Contact for permit database or utility location info: Monty Docktier 328-2162 (permits) One Call Locaters 800-795-0555

w/ Dorette Kerian, UND Director, Information Technology Systems and Services
Subject: State network, Northern Tier Network, UND IT
- o Higher Ed, K-12 Ed, County, and State Agencies must get fiber through DCN. It is optional for cities. State network is called StageNet. Website has network diagrams. StageNet is managed by DCN, an association of cooperating telecommunications companies. StageNet runs on fiber owned by DCN. This network is not available for private use.
- o DCN provides connectivity into every community that has schools. It may be as little as a T-1. DCN contact is Evan Haas. More info is available on the website.
- o UND has a 1 gigabit connection into Grand Forks.

- GFAFB has its own infrastructure. Devil's Lake Community College has a facility on GFAFB. Dorette thinks Midco provides service to the facility.
- Grand Forks City: Dorette believes the issue is cost, not access. Monopoly status is maintained in most communities.
- There is, in general, an absence of competition for telecommunications services. The State has one contract statewide, which does not encourage other providers.
- Midco may be present in Hatton, Northwood. May not be in Larimore
- Dorette offered to send Paul the Legislative language that restricts NTN usage
- Part of Northern Tier Network (NTN) funding is DoD. James Cook (DoD High Performance Computing Modernization Program) was in GF recently looking at other DoD uses that could justify NTN funding.
- All higher education institutions have some online courses/programs
- NDSU may be providing correspondence courses for high school students. Dorette will send the URL for a shared website on distance learning in ND.

Hatton Community Meeting

Attendees: Scott Cranston (realtor), Paul Ranier (computer support for Tri-County Health Center), Gale Skjoiten (banker), Tom Strand (banker), Scott Enger (AmPride & elevator), Terry Fladeland (realtor), Diane Blair (BRIC), Paul DeWolfe (Access Consulting)
- Invisimax provides wireless service from the elevator. Line of sight, range less than 5 miles.
- Bank is served by Midco. Paul Ranier says service is "really fast"
- Wild Blue and Hughes Satellite services available. Wild Blue $300 install, $50 per month. Hughes costs $700 for equipment and $80 per month
- Polar Communications is available in Mayville. $85-$90 per month for Polar cable modem service. Polar wants to get into Hatton area for wireless but problems with tower
- MLGC (Moore and Liberty Griggs County) is a private, family owned telco. Has DSL available in Finley
- General consensus: $40-$50 per month is "affordable"
- The Co-op Station pays ~$50 per month for Midco cable modem service
- There are new Verizon towers going in outside Hatton and outside Northwood.
- What needs to be done?
    - Improve remote connectivity. Farmers and non-farmers living outside town need access
    - Improve spotty cell service
    - Get Qwest to provide broadband
- Polar:
    - Appears to be willing to meet a demand, will follow up their promise with action
    - A co-op
    - Fiber runs along highway just outside Hatton, but not into Hatton
    - Easy to work with
- Invisimax:
    - Received funding through Griggs-Steel Empowerment Zone
    - Limited financial resources
    - Private company

Thursday, April 26, 2007

w/ Al Morken, Director, 911 Dispatch Center Director
- Goal 1 should be building out City public safety wireless to cover the rest of the County.
- Public safety must be highest priority on any shared resources
- Current 911 center has 3 main trunks, 3 rollover lines. There are four operator stations. A generator provides back up power. Connected to City fiber, StageNet.
- Police: There are up to 17 mobile data computers (MDCs) deployed at one time
- Sheriff: 4 to 5 MDCs at one time
- UND Police: 3 to 4 MDCs at one time
- Rural Police Departments: up to four MDCs at one time
- Total 28-30 public safety wireless users at one time. Bandwidth issues?
- Has E911 and Phase II cell enhanced 911
- System is dual redundant

w/ Leon Osborne, President/CEO and Doug Rand, IT, Meridian Environmental Technology, Inc.
- Meridian provides 511 weather service to nine states
- Also provides IT services to state DoTs
- Gathers internet and satellite data, formats, delivers via internet or computer telephony
- Fargo call center. Fargo chosen because GF could not provide needed path redundancy on incoming lines. Center has 1300 lines (two DS-3s). 24/7/365 operation, time sensitive delivery. Downtime can jeopardize contracts with States. Center served by Qwest and AT&T DIA service.
- Issues
  - Redundancy: there appear to be many points of failure in the telecom infrastructure
  - Meridian has questions as to whether local (GF) infrastructure can support their continued growth
  - Qwest monopoly: No redundancy in connection to Qwest GF central office or out of GF to Fargo
- States served include ND, SD, MN, NE, MT, KN, NV, GA, WY
- Coming applications include capability to predict type of road treatment required by weather that is coming, not just what is happening now

Northwood Community Meeting

Attendees: Ray Wiethers (banker & council), John Butz (police), Rick Johnson (mayor), Chad Peterson (health care), John Linnell (health care), Marcy Douglas (auditor), Ed Nierode (County Administrator), Diane Blair (BRIC), Paul DeWolfe (Access Consulting)

- Population ~1000. Discussed municipal internet, decided no. Wants to work with existing companies.
- City Council has written a letter to PSC about Qwest not being willing to upgrade services
- Polar Communications provides wireless service on a licensed frequency. Up to 5 Mbps down, 3 Mbps up. Based on wireless cable modem termination system (CMTS). City has an ICE 200 CMTS Modem.
- Polar also has DSL service along Highway 15

- MLGC provides cable, has fiber into town, is reported to be developing a broadband plan, reported to be meeting with City Council
- Invisimax has wireless broadband based at the elevator. Service "not great, $5 to $7 cheaper than Polar"
- The City owns the power poles. City owns electric utility. Has a two year franchise agreement w/ Qwest.
- Hospital has T-1 connectivity as part of a bio-terrorism system. Grant currently covers cost of about $250 per month.
- Hospital has four video conferencing applications.
- Hospital is looking at developing a consolidated data center for 18 hospitals.
- Schools are on DCN T-1s.
- MLGC has fiber to Finley. Will provide back up to Hospital's Polar service.
- Law Enforcement: All radios, pagers, base station new, paid for by Homeland Security grant. Radio coverage is spotty, "lots of dead spots". New Alltel tower built near the airport. Height reduced to 105' because of flight path. Reduces useable radius. Would like new tower west of town, where it could be 100' higher. Alltel provides push to talk capability. Do some mobile data, tough in town, outskirts better.
- Fire department has wider radius of operation. Has serious problems with radio coverage as well. Relies on cell phone dial in as back up, but cell phone coverage is spotty also.
- Citizens State Bank has T-1 connection to Finley. Costs $500 to $600 per month
- City on Polar wireless and satisfied. Costs less than $100/month. Residential service available $42.95 per month
- General consensus: Affordable means $30 to $40 per month
- Largest single issue is reliability/availability of public safety radio. Major improvements needed for fire radio

Larimore Community Meeting

Attendees: Spud Murphy (county commission), Bruce Melby (grocer), Deb Matheson (auditor), Bob Sobolik (banker), two additional individuals representing ambulance and emergency services, Ed Nierode (County Administrator), Diane Blair (BRIC), Paul DeWolfe (Access Consulting)

- Current providers include Invisimax wireless, Polar Wireless (700MHz wireless CMTS), Qwest DSL
- Qwest has fiber to central office
- Polar reported to be bringing in fiber
- Polar charging $46.66 + tax per month
- Qwest DSL: Residential $26.99 +tax, Commercial about $50 per month
- Limited cellular coverage from Alltell, has requested to put antenna on water tower
- Better cellular coverage from Verizon in town
- Public safety radio is working well, operates through County PSAP (911 center)
- Qwest has a virtual monopoly on voice service
- Midco offers CATV only, has 3-4 years left on their franchise agreement, may not renew
- Improvements:
  - Better cellular service

- o Competition for voice service
- o Better TV channel selection
- o Radio coverage in SW corner of County

Existing Telecommunications Landscape
Provider & Services by Community

Provider: Community:	Polar	Invisimax Wireless	Midco	MLGC	Qwest	GF Wireless
Grand Forks		Broadband	Broadband, voice, TV		Voice, DSL, TV	Broadband
GFAFB		Broadband	Broadband, voice, TV			
Grand Forks County		Broadband				
Emerado		Broadband	Broadband, voice, TV			
Hatton		Broadband	Broadband, voice, TV			
Larrimore	Broadband CMTS	Broadband	TV Only		DSL	
Northwood	Broadband CMTS	Broadband		TV, Broadband	Voice	
Thompson		Broadband	Broadband, voice, TV			

Coverage Channel A - Approx. 20 Mile Tower Radius - (ALLTEL)
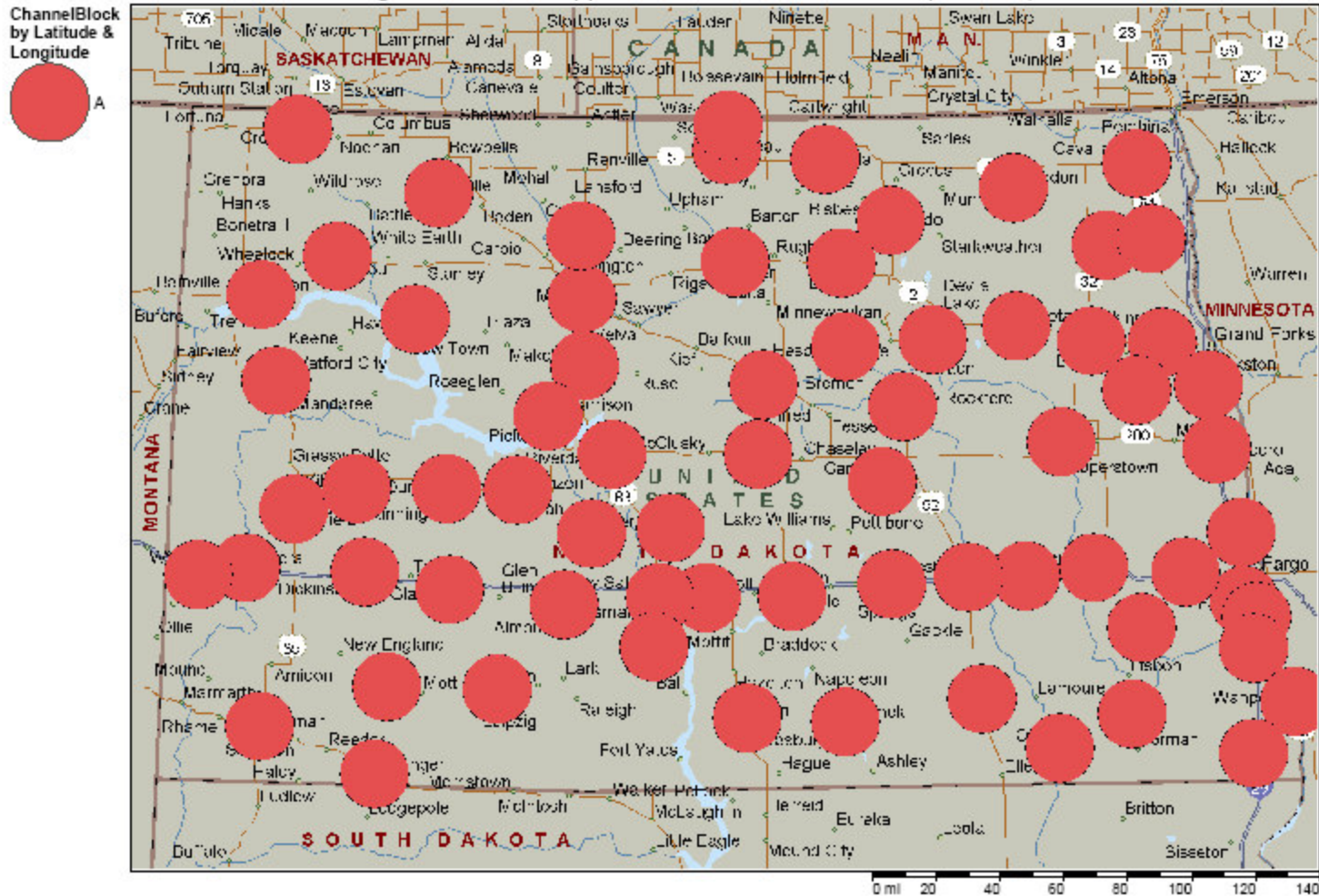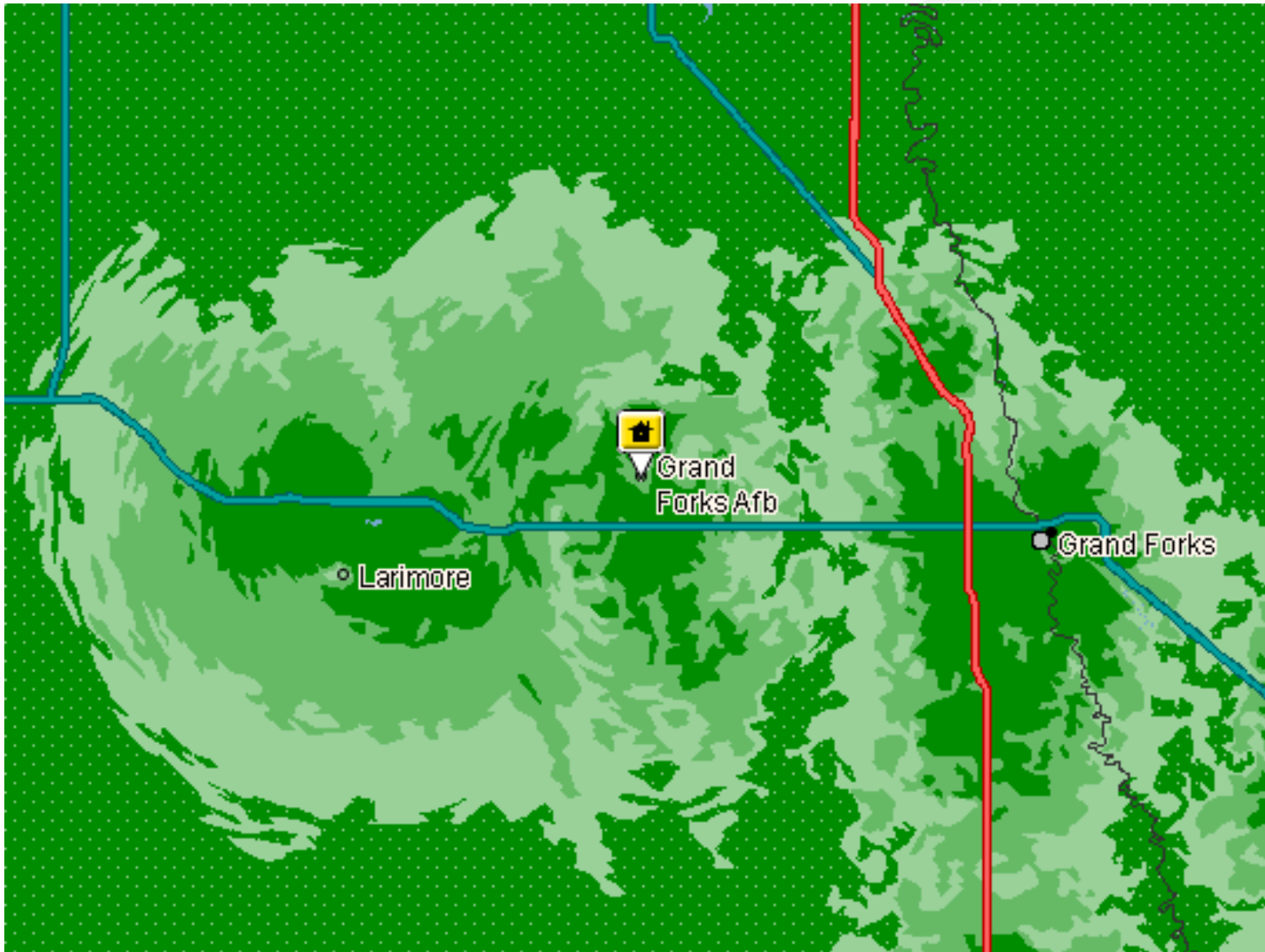
Figure 2: Sprint PCS Coverage Map

Coverage Channel B - Approx. 20 Mile Tower Radius - (Verizon-Others)
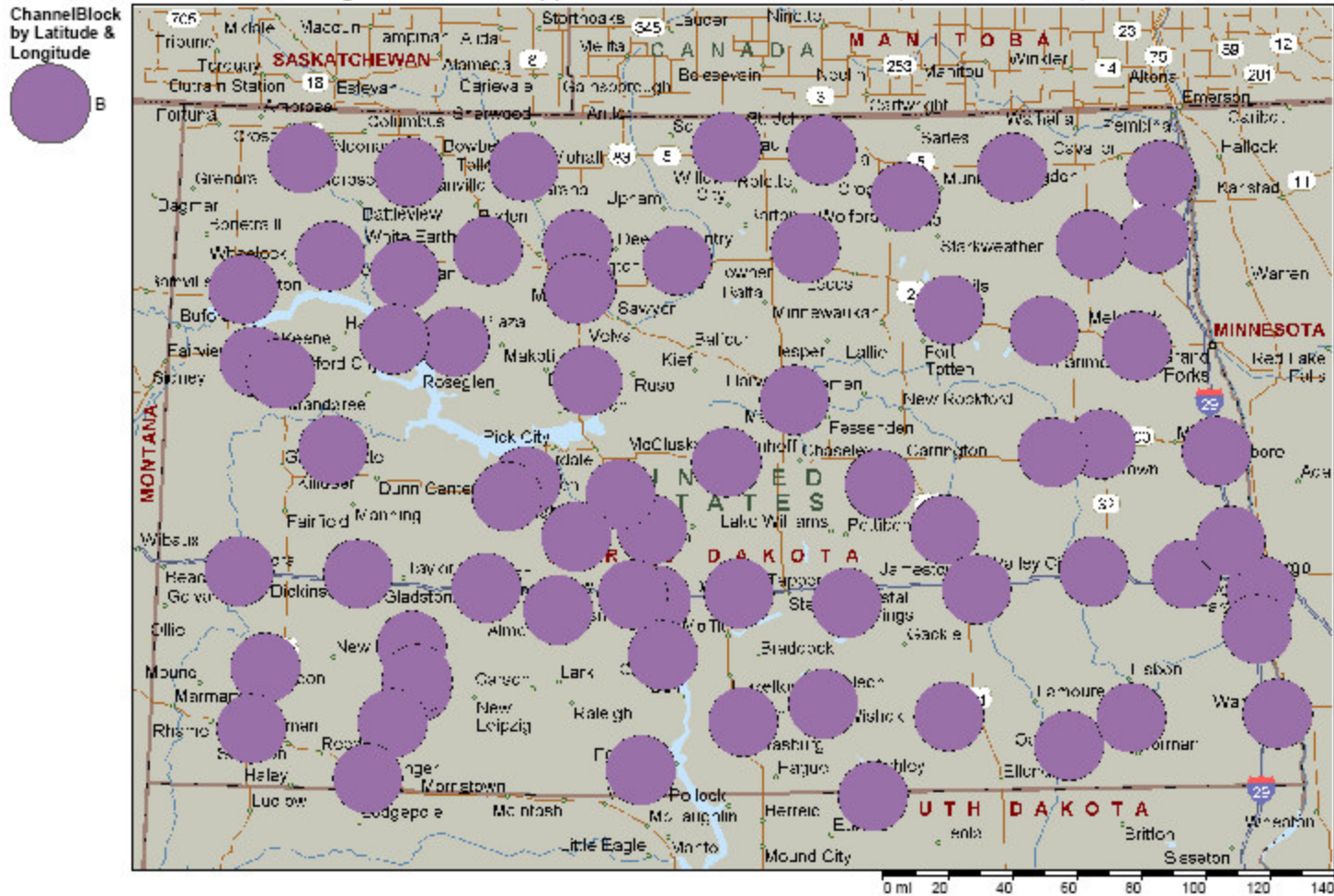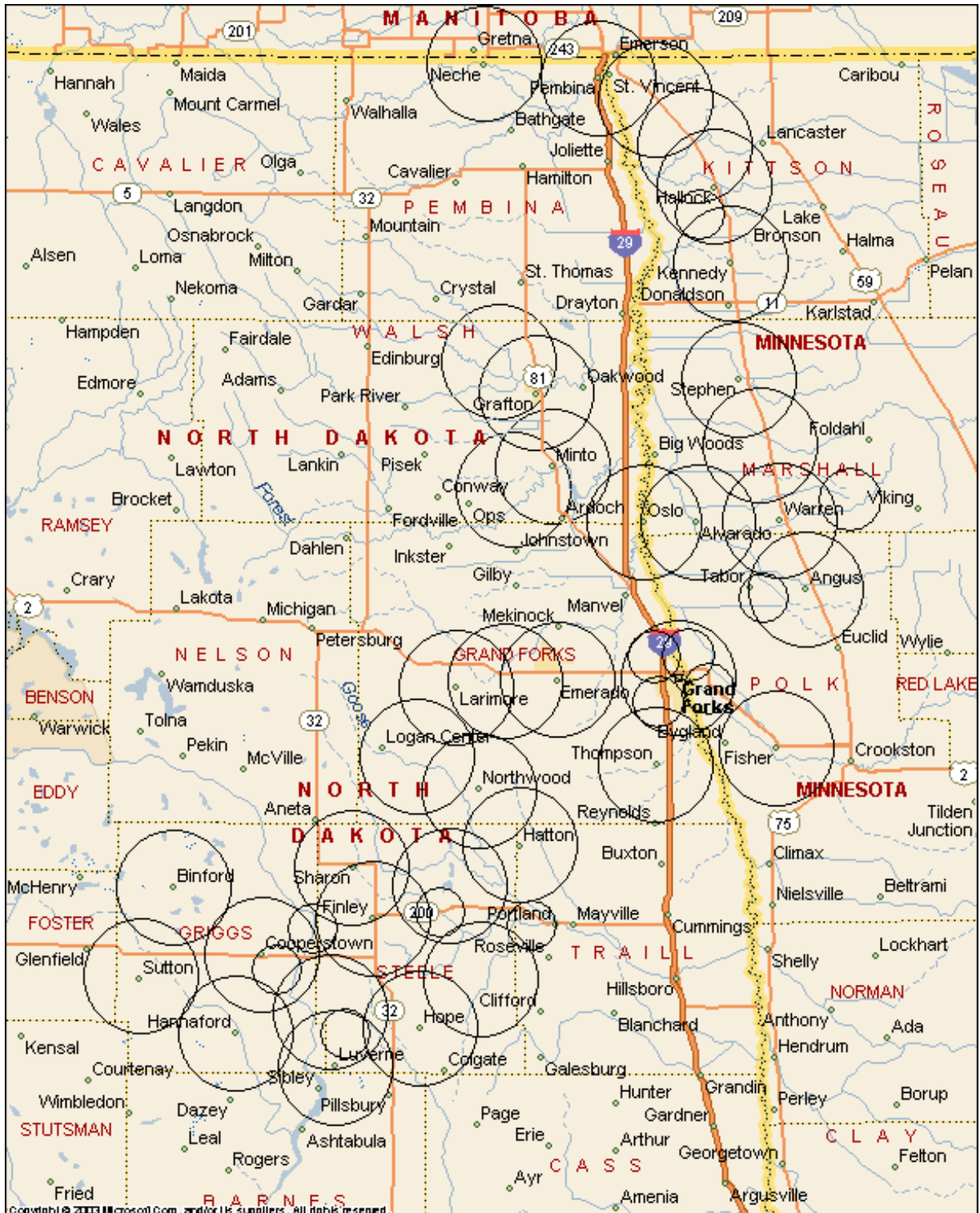
Figure 3 InvisiMax Tower Sites with Estimated Range
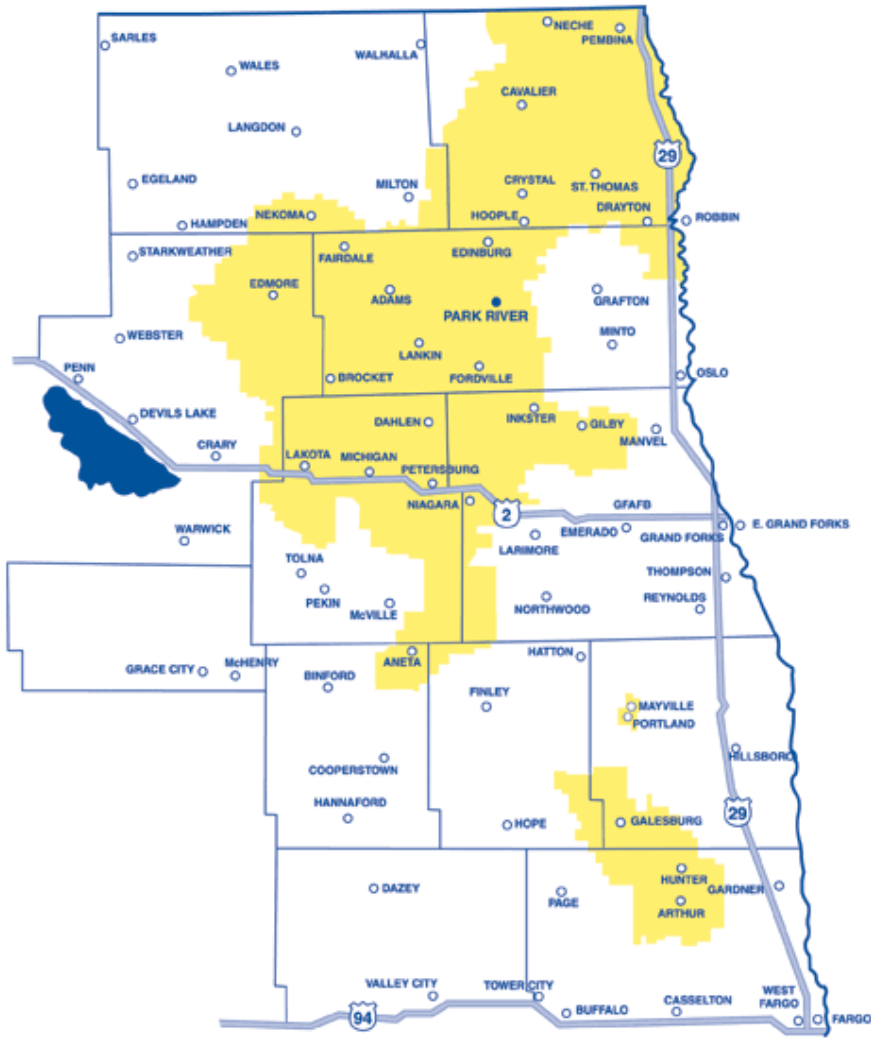
Polar Service Territory