Minnesota Broadband: Land of 10,000 Connectivity Solutions

By Ry Marcattilio-McCracken
and Christopher Mitchell

July 2021

Community Networks

ILSR Institute for Local Self-Reliance

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Acknowledgements

This report was the result of hard work across many years at the Community Broadband Networks Initiative at the Institute for Local Self-Reliance. Many thanks to Rebecca Toews, Tom Anderson, John Farrell, Olivia LaVecchia, and David Morris, as well as to Michelle Andrews, Atlas (Chenxiao) Guo, Katie Kienbaum, H. Trostle, Emma Gautier, Ibrahim Ahmed, Jericho Casper, Maren Machles, and Sean Gonsalves for their recent work in updating the report to 2021. Lisa Gonzalez was the primary author on the report released in 2014.

This report was updated with support from the Blandin Foundation, Open Society Foundations, and Ford Foundation. Alli Urevig was essential in reconstructing the report from a broken PDF and laying it out for publication.

Additional thanks to the many who provided guidance and feedback for this report along the way, including Merton Auger, Joe Buttweiler, Mark Erickson, Pamela Lehmann, Danna Mackenzie, David Milavetz, Kay Roth, Chris Swanson, and Erick Lampland.

Final thanks to the individuals who were generous with their time in speaking with us about their work in expanding Internet access across the state. Any errors within are ours, not theirs. Thanks to Clint Pires, Chief Information Officer for St. Louis Park; Sara McManus, Member Services Manager for True North Broadband; Brent Christensen, President and CEO of Christensen Communications; Travis Carter, CEO of USI Fiber; Joe Steffel, former Utilities Director for Buffalo, MN; Jeff Dahna, Telecommunications Department Manager for Windom; Kevin Beyer, General Manager at Farmers and Federated Telephone; Perry Mulcrone, Scott County Business Relationship Director; Gary Johnson, CEO and General Manager of Paul Bunyan Communications; Jeff Neisen, Le Sueur County Department Head of Management of Information Systems; Barbara Droher Kline, Consultant for Le Sueur County; Jake Reiki, Board Chair for RS Fiber; Jacquel Hajder, Economic Development Specialist for Anoka County; Nancy Hoffman, Executive Director HRA – EDA for Chisago County; David Asp, Network Collaboration Engineer for Dakota County.

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EXECUTIVE SUMMARY

In 2010, the Minnesota legislature established speed and access goals for broadband across the state. No later than 2015, it declared, every residence and business should have access to download speeds of 10-20 Megabits per second (Mbps) and upload speeds of 5-10 Mbps. In 2014, we **published a report** that said Minnesota was not on track to meet those goals, and showed through a series of case studies how Minnesota communities were building the networks they needed with and without state support.

Some of the barriers to local investment that we identified in that report remain today, most of a decade later. This updated report revisits the diverse range of approaches Minnesota communities and local Internet Service Providers (ISPs) have taken to meet the connectivity challenges of a broken marketplace shaped by large monopoly service providers that have an outsized influence on deliberations in Saint Paul.

Our original 2014 report was released the year before the Federal Communications Commission (FCC) recognized its definition of broadband was too slow, raising it from 10/1 Mbps to 25/3 Mbps. Even then, however, former FCC Chairman Tom Wheeler argued that a 25 Mbps Internet connection is "table stakes in 21st century communications."[1] Minnesota's current **broadband goals** are an acknowledgement that it has not met its previous objective, setting a nearly identical target to what it was supposed to have achieved by 2015. By 2022, the current goals say, every home and business should have access to the Internet at speeds of at least 25 Mbps/3 Mbps. Further, by 2026, those connections should meet or exceed 100 Mbps/20 Mbps.

The current goals also call for Minnesota to be by 2026 among "the top five states in the nation for broadband speed universally accessible to residents and businesses" and among "the top 15 when compared to countries globally for broadband penetration." Minnesota needs gigabit fiber networks to achieve that vision, which is what the communities and local ISPs in this report are doing. These solutions are fixing the problems created by the large monopolies like Frontier, Lumen, Comcast, and Charter Spectrum, some of which have invested well in some areas, but generally get poor marks for their service in satisfaction surveys and often engage in tactics to limit competition and investment from other ISPs.

This report updates the original set of community case studies, adds additional models that continue to offer promise in expanding fast, affordable, and reliable Internet access to all homes, and collects lessons learned from projects that have not achieved their goals.

All signs suggest that the FCC will soon update its minimum speed definitions again, with too many families having found their broadband connections could not reliably sustain working and learning from home—a reality exacerbated for millions by the recent Covid-19 pandemic, but one which no doubt existed long before. Today, middle-class and wealthy Americans are inundated with ads for gigabit home connections while millions of families remain stuck on broadband infrastructure considered obsolete a decade ago, and tens of millions more struggle to afford the connections that are available.

This report recognizes that solving these challenges remains a fundamentally local challenge. **Federal leadership and state governments are increasingly putting more money into large, sweeping broadband subsidy programs, but the best solutions have been—and will continue to be—locally developed.**

Among our first tasks in achieving our national Internet access goals is to agree on a common, good-faith groundwork for the policy solutions developed at the state and national level. DSL networks are widely considered obsolete. Though cable can deliver fast downloads, it has inherent physical limitations and remains much slower for the upstream needs of applications: especially with multiple people using the connection simultaneously. Further, while cable networks are reliable in many areas, accounts of regular outages and congestion plague cities and towns across the state. Nearly all the communities and companies in this report are building future-proof fiber optic networks that can stand the test of time, with some fixed wireless technology mixed in as a stopgap.

The profiled projects include municipal networks, public-private partnerships, cooperatives, and private investment. They run from the most rural areas of the state to Minneapolis.

There are an array of lessons which can be learned by following local approaches to broadband in Minnesota over many years. The projects in this report that connected homes and businesses with public investments and partnerships have continued to drive new investment, lower prices, and additional benefits for communities. The projects we had doubts about—which generally focused on middle mile networks that did not threaten the monopoly business models of big providers—have often struggled to achieve their goals. These efforts were often driven by public officials who were reluctant to make larger financial commitments and leaned too hard on private partners that had investment incentives the elected officials seemed to poorly understand.

Networks in **Anoka** and **Carver Counties** have done little to improve residential or commercial Internet access, though they have led to significant local government savings. **Dakota** and **Scott Counties** have fared better, the result of more conducive policies and reinvestment, with the result being a host of benefits which includes significant public savings for

internal operations and better connections for community anchor institutions. However, there, too, the majority of homes remain stuck with just one ISP from which to take service.

Le Sueur County is a new entry in this report, with a focus on how local organizing has led to multiple partnerships with local firms to expand fiber optic access across the region, and how that organizing allowed it to make the most of the CARES Act dollars that had to be spent quickly in 2020.

RS Fiber, a mostly-theoretical project centered in Sibley when we covered it in 2014, has brought fiber to local businesses and town residents in most of Sibley and parts of adjoining counties, with those in rural areas benefiting from RS Air, a fast wireless service available at affordable prices. Another benefit of the effort is that cable company Mediacom seems to have lowered its prices significantly in the newly competitive environment. Though the project failed to hit its revenue targets, resulting in towns modestly raising property taxes to cover some of the debt payments, residents and businesses seem content with the tradeoff, especially in the wake of the pandemic in a region that otherwise largely lacked broadband.

Monticello is again a public-private partnership, as it was first created, and has continued to drive remarkable savings in the community. As a direct result of public investment, TDS and Charter Spectrum run deeply discounted services in the city. This effort, designed to deprive the municipal network of subscribers and supported by the large profits that both companies pull out of markets where they are the only provider, nevertheless leads to widespread savings. Today, Monticello's network perseveres, paying its operating costs and expanding slowly as new houses are built in the area.

Chaska and **Windom** have changed little in seven years, with both continuing to derive benefits from the investments each made at their outset, though Southwest Minnesota Broadband Services has achieved its goals and continues to expand modestly after depending on WindomNet to get going.

Buffalo shuttered its low-cost municipal wireless network, and is now slowly expanding its fiber network to residential homes, while Charter has responded in the city with deep discounts to deter officials from a more aggressive build schedule.

Arrowhead Electric Cooperative's fiber network in **Cook County** has worked out well, beating projected take rates and bringing fast and affordable access to one of the most far-flung parts of the state. In contrast, the public effort in **Lake County** was ultimately privatized after years of cost overruns, in part due to successful strategies by Mediacom and Frontier to demonize the project and deny it access to utility poles. But both counties are far better off than when they were experiencing massive day-long outages of 911 services and public safety systems when they had to depend on the company that now calls itself Lumen.

The telephone cooperatives covered below have all expanded, with **Farmers** building out the majority of **Lac qui Parle County** and using creative approaches to make inroads in the city of Madison where residents and businesses desperately want the service. Newly profiled Paul Bunyan Communications has steadily expanded its fiber network across the north-central part of the state over the last decade and increased its number of passings more than seven-fold by aggressively reinvesting and taking advantage of anchor partnerships to bring service to new areas. Finally, we profile a collection of partnerships where Ely, Little Falls, and Long Prairie have collaborated on fiber networks with CTC to improve local access and set a foundation for a hopeful future.

Chisago County offers a look at how the community rallied to help Lumen (previously CenturyLink) to assemble subsidies from local, state, and federal funding to have taxpayers cover the vast majority of the tab for the company to build a new network it will own.

Christensen Communications offers a look at a 100+ year-old telephone company that demonstrated a strong commitment to its communities when the pandemic hit, and is now going above and beyond to build fiber with federal subsidies where the rules would have allowed them to be far less ambitious.

The **Fond du Lac Band** started off with plans to build a wireless solution, but after community engagement, found the capacity for strong planning and built a fiber-to-the-home network that is rare in Indian Country across the U.S.

The case studies below finish in the metro, where **St. Louis Park** offers lessons in long-term planning and developing partnerships with both ISPs and the builders of large condominium complexes. One of the providers working with St. Louis Park is better known as the fastest ISP in Minneapolis, **USI Fiber**. Created as a dial-up provider before transitioning to wireless and finally fiber, USI offers a glimpse at a rare home-grown fiber competitor rapidly growing in an environment more friendly to the biggest ISPs.

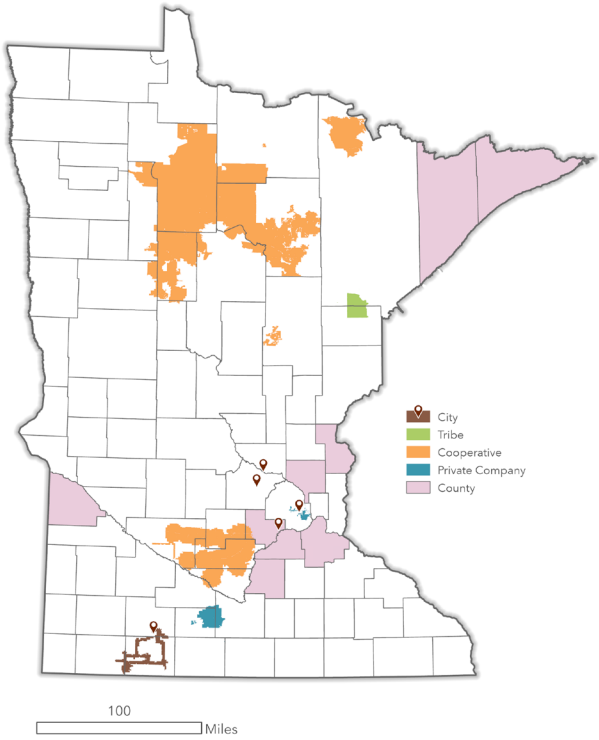
The majority of the fastest, most-affordable networks in Minnesota have come from locally-rooted companies and a commitment to communities rather than distant shareholders. Many of them benefited from resources and direct planning grants from the Blandin Foundation, which has admirers across the country for its successful strategies to create community engagement.

Nonetheless, the state of Minnesota continues to discourage municipal networks. Though the state is one of just 17

that limit municipal broadband, it is the only one that **requires a supermajority vote** to offer telephone service and **limits improvement districts** to areas without service, without regard to pricing from an existing service or other considerations.

Minnesota is on a trajectory to be above average compared to its peers on broadband, but by removing barriers and continuing to focus investments on local providers making long-term investments, it can set higher goals and continue its tradition of providing a great quality of life for residents and strong environment for businesses.

INTRODUCTION



This report explores a variety of models for communities and locally-rooted Internet Service Providers (ISPs), to build networks offering fast, affordable, and reliable broadband access to ensure residents and businesses are well-served. This report updates and expands upon an original report we released in 2014. Each case study has additional details, with several new communities and networks profiled.

Taken together, this report illustrates the continued creativity of public and local private approaches to expanding broadband infrastructure, while also demonstrating the many challenges that remain to getting universal affordable, fast, reliable Internet access to everyone. Currently, investments take place in an environment undergirded by state legislation that professes to want better broadband but seldom appropriates enough funds to move the needle any given year. While the Border-to-Border broadband subsidy program is considered a great success (and multiple states have used it as a model for their own programs), Minnesota maintains barriers to public investment that limit community authority to build their own networks if they believe it necessary. This is what it looks like when the state balances the desperate calls for more broadband from constituents across the state against the lobbying of some of the largest monopolies in the nation.

Minnesota's **broadband goals** call for 25/3 Mbps (download/upload) to all homes by 2022—this was the speed the Federal Communications Commission (FCC) declared to be the *minimum* Internet connection to be considered broadband in 2015. The FCC is widely expected to set a higher minimum standard in 2021 or 2022, given many years of advancing technology and the challenges households faced that had to rely on such a basic connection during the pandemic.

Minnesota has a further broadband goal of 100/20 Mbps to all homes by 2026. A bipartisan group of **U.S. Senators has urged** that the FCC adopt a more aggressive *minimum* definition of broadband today, at 100/100 Mbps.

Nearly all of the networks profiled in this report are already delivering speeds ten times faster than 100/100 Mbps today, because they have been built by communities and ISPs that are focused on providing future-proof essential services to the residents and businesses that depend upon them. These are the solutions that the state needs to support in order to surpass its tame goals.

Frankly, the most audacious goal set by Minnesota, which does not follow from its low speed targets, is to be among "the top five states in the nation for broadband speed universally accessible to residents and businesses" and among "the top 15 when compared to countries globally for broadband penetration." Achieving that goal would require a focus on networks that can deliver gigabit capacity symmetrically, which again, the communities and ISPs included in this report have almost entirely done already.

Most households in the metro region have access to comparatively fast cable options that meet these state goals, but for those living in pockets still stuck on DSL connections and the hundreds of thousands of families in greater Minnesota stranded on aging cable infrastructure, time is quickly running out. Modern cable networks can deliver 100/20 Mbps, but not 100/100 Mbps (though the upgrades are being developed to hit those goals and will be deployed in 2-8 years depending on analysts today). The problem is that most homes with this cable access have very little choice—the cable companies are effectively monopolies, with no other high-speed option available, and the prices reflect that truth. Of the networks profiled in this report, some are monopolies in their own right—operating in Greater Minnesota, often in areas abandoned by national firms like Frontier and Lumen (previously called CenturyLink, Qwest, US West, etc.). But even where these networks are the sole high-speed provider, they have kept their prices reasonable and transparent.

Many of the networks profiled below have taken advantage of the Border-to-Border broadband subsidy program administered by the Department of Employment and Economic Development. In 2014, the Minnesota Legislature launched that small competitive program to provide matching funds to expand Internet access. Senator Matt Schmit and Representative Erik Simonson share credit with a strong

grassroots mobilization led by the Coalition of Greater Minnesota Cities for refusing to give up on the fund in the face of strong industry opposition and consequently more than a bit of quiet reluctance from the leadership of both political parties. That neither Schmit or Simonson is still in the legislature helps to explain why the state has done so little on broadband since. The program's grants have mostly gone to local private companies and cooperatives, with national firms like Charter Spectrum and Lumen also taking part.

The Institute for Local Self-Reliance has more than 15 years of experience studying and working with communities to expand Internet access. Local governments can choose from a wide variety of strategies based on their unique mix of assets, challenges, and potential partners.

A commonality throughout the report is that, with some rare exceptions, the cities and counties partner with local firms or create their own ISPs. The national companies have tended to refuse to partner and often lobby against local investments and partnerships because competition will certainly threaten their market share and profits. An exception (in a few places) is Lumen, where it has been able to arrange for public funds to pick up the vast majority of the cost in a network it will own forever.

Tech Basics

Policy discussions about expanding Internet access require a basic knowledge of some relevant technologies. Understanding the limitations and tradeoffs of different technology is essential in crafting the right policies to ensure all Minnesota has appropriate access to essential infrastructure.

The current Federal Communications Commission definition for broadband is 25 megabits per second (Mbps) downstream and 3 Mbps upstream; it was set in 2015. Older technologies like DSL and cable are asymmetric, meaning users have much slower upload speeds than download speeds. Modern fiber optic networks tend to be symmetric, offering very fast upload speeds as well as download, which was crucial as children and parents had to learn and work from home during the pandemic. And in Greater Minnesota, if communities want to lure full-time work-from-home people to the area, they will need these modern networks as a precondition.

Most of Minnesota has access to DSL, a technology using copper telephone lines. Most national DSL service providers have **effectively abandoned investment (and sometimes whole footprints)**, after taking billions of dollars in federal subsidies for **upgrades that may not even have been made**.

Cable networks can offer much faster download speeds, but the upload speeds are also limited, and reliability can be all over the map. Some cable companies are simply better than others, but even within the same cable network in a single city, reliability may be great in one neighborhood and poor in the next. Unfortunately, prices are almost always high because these networks generally lack real competition.

Upload speeds from cable, DSL, and satellite are a particular concern for business clients. Businesses that need to share large data files with clients must plan accordingly, because slow connections extend upload times or fail before they are completed.

There are two types of satellite Internet access available today: the long-running traditional Geostationary Earth Orbit (GEO) access like that offered by ViaSat and HughesNet, and the new Low Earth Orbit (LEO) access like that offered by Starlink (and eventually Project Kuiper). GEO satellite Internet signals are at the mercy of the weather and exhibit significant latency or lag in sending and receiving information because the signal must travel into space and back. Communicating via Skype or other video applications is all but impossible due to latency. In addition, it is often quite expensive. We have never found a person using satellite for Internet access when they had access to DSL, cable, or fiber networks. LEO satellite Internet solves the problem of latency (because the satellites are much closer to the Earth's surface), with Starlink currently providing up to 150 Mbps service for $99/month with a $600 cost for hardware installation today. But capacity limitations mean that it will never be a solution for the urban broadband gap; nor is it likely to be able to connect every unserved rural home in Minnesota, given current technical limitations and the present regulatory landscape.

Fiber-to-the-home (FTTH networks are the most advanced networks, though fiber optic technology has been used for many decades in the industry. It is expensive to install, particularly in labor costs; however, it offers almost limitless capacity and the fiber strands have a useful life measured in decades.

While expensive to deploy (especially if the whole town has to be wired), fiber networks also have a lower operating cost than other network technologies, which makes them the best long-term investment for public dollars.

In our original report, we explained that 4G LTE was not going to change the need for high-quality wired solutions and we were proven correct. Nothing has changed, despite the mobile wireless companies now making extravagant claims about 5G. It will be available in some areas and some may use it, but most people will still require the reliability, capacity, and affordable prices more common to locally-rooted wired networks.

Fixed wireless networks have long been an option in some rural areas, often operated by local entrepreneurs. Increasingly today, large national firms backed by private equity have also

been pursuing fixed wireless projects. Some reliably meet community needs and are expanding to fiber and wireless combined networks. Others have struggled to consistently deliver a high-quality connection. This approach has a high "your mileage may vary" factor in speeds, reliability, and pricing.

Data caps are another important aspect of the modern telecommunications environment. Data caps are monthly allotments of bandwidth usage per subscriber. Users are typically charged for overages or their service may slow or end abruptly. In the case of a satellite connection, a business may find a transaction cut off if it exceeds its data cap before completing the file transfer. For example, HughesNet, a satellite operator selling services in Lac qui Parle County offering 25/3 Mbps service on all of its plans (including in the city of Madison), has actually imposed tighter restrictions on data caps for its basic service since the first time we surveyed them, seven years ago. Basic users used to be able to get 40 GB per month with their connections; today, the lowest tier comes with just 10 GB of data for $60/month. To get more, users can pay $70/month for 20 GB, $100/month for 30 GB, or $150/month for 50 GB. Connection speeds still top out at "up to" 25 Mbps, no matter what tier users choose.

The average American household wired Internet connection **is on track to use almost 440 gigabytes per month** in June 2021; usage has seen double-digit percentage increases each year in the recent past, and **shows no signs of slowing down**. Internet access via a capped connection—whether cellular or satellite—flies in the face of equitable, affordable service today and in the future.

POLICY SUGGESTIONS

While updating these case studies, we found that little has changed in terms of the best advice for policymakers. There is no infallible silver-bullet solution, but the best solutions consistently come from community-led solutions. Minnesota continues to limit such solutions for no good reason. Acting FCC Chair Jessica Rosenworcel, President Biden, and others have argued that state laws limiting local authority to build fiber networks unnecessarily limit competition and are counterproductive. Arkansas and Washington have just repealed their limiting laws and when language to discourage municipal broadband was introduced in Ohio in 2021, the Republican Governor and Lt. Governor announced that it would harm needed investment in new networks. To achieve border-to-border, high-speed Internet access, the state should remove barriers to public investment. Both public and private investment are needed to keep Minnesota competitive and maintain a high quality of life.

- A key barrier in Minnesota is the 65 percent referendum requirement to own or operate a telephone exchange. Minnesota should remove this barrier and join the majority of states that do not limit local authority.

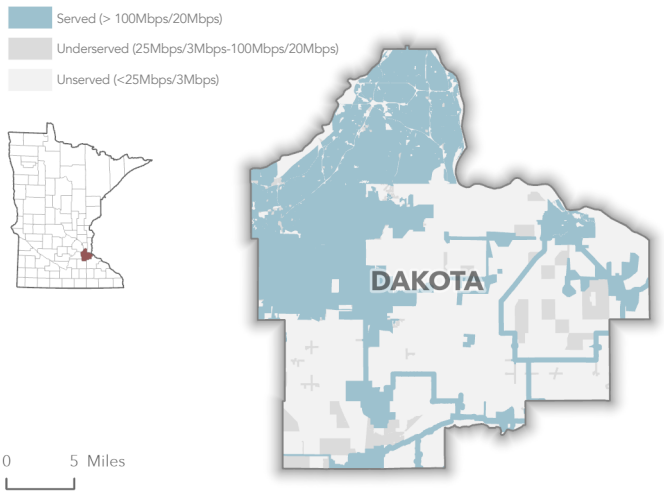
- The state's recurring Border-to-Border fund has disbursed around $20 million per year since its inception in 2014 (with the exceptions of 2015 and 2018) to projects in pursuit of increased Internet access. This fund should be increased in size until such a time as Minnesota achieves its broadband goals. Loans should come with conditions similar to that of the stimulus broadband programs, requiring interconnection and basic principles of nondiscrimination.

- The state should not limit broadband grant/loan opportunities solely to areas presently lacking access. New networks should be financially viable without perpetual subsidies, which may mean mixing in areas of higher density (that already have a broadband provider) with areas of lower density to ensure cash flow will support debt and operating expenses.

- The state should not assume that private investment is automatically superior to public investment. Many of the fastest, most affordable networks in the nation are owned by cities. Three of the **top 10 fastest networks** in the nation are municipal: Chattanooga, Cedar Falls, and Longmont. The rest of the top 10 all include ISPs that have some public-private partnerships or have used public infrastructure to deliver services.

CITIES AND COUNTIES

DAKOTA COUNTY



- **Dakota County has an impressive multi-decade "dig once" strategy that has allowed the county and area cities to connect their facilities with fiber at low costs for big savings.**
- **The county's fiber and conduit assets allow for innovative partnerships with local ISPs, which have been more common for school and institutional uses than residential or business connectivity.**
- **Dakota's next challenge is to leverage its network to bring much more investment to areas without broadband availability or areas with only one high-speed ISP.**

Located south of Saint Paul, Dakota County's northern half is part of the Twin Cities metro region, whereas the southern half tapers off into a less dense, more rural area. Dakota County offers an impressive model for expanding fiber and conduit assets on a tight budget while maximizing cooperation—both public and private.

The county's "dig once" approach to quietly expand fiber and conduit assets has impressed those who have known about it. Many metro counties have copied aspects of that approach and realized significant savings (see our sections on Scott, Carver, and Anoka Counties).

Starting in the late 1990's, Dakota County began to focus on laying conduit and/or fiber as part of the work involved with capital projects in which streets have to be torn up. By installing conduit or fiber during the construction of capital projects, the costs of building telecommunication networks can be as much as 90-95 percent less, because the most significant cost is tearing up the ground.

That was how Dakota County dramatically reduced the cost of high capacity telecommunications connections to schools, public facilities, utilities, and the like. At present, it is examining how it could also use its assets to best encourage economic development and increase investment in last mile services to businesses and households.

Dakota County Fiber Coordinator and Network Engineer David Asp is a guy who likes to put dots on maps, and it seems like he won't get a full night's sleep until the entire region is one solid color. Among all the entities we cover in this report, Dakota County staff has exhibited some of the highest levels of enthusiasm and commitment we've seen in pursuing better connectivity for government use (both at the city and county level). Over the last six years, it has led to quality connectivity for community anchor institutions, a jolt in economic development activity, and the ushering in of high-quality access options to new and existing residents in unserved and underserved locations by partnering with private providers.

Part of the network's success comes from a clear vision backed by a commitment to infrastructure projects achieved through a tried-and-true series of steps for new undertakings. It comes from a commitment to funding fiber and conduit installation wherever there are opportunities, but also in actively seeking out ways to join with public and private partners on upcoming infrastructure projects to share costs and maximize impact. However, the large scale of the county's network and the small number of residential and business homes that can take service from ISPs using the network suggests that there is a significant amount of potential left on the table, likely a result of leadership in the county that is wary of upsetting the powerful cable and telephone monopolies.

Dig Once Basics

The Dakota County Information Technology staff deserve credit for the county's success. They have developed their own award-winning software and built strong relationships with key staff in municipalities across the county, which have served as the two keys to their success.

The Cedar Avenue rebuild is an example of Dakota County's approach. A major thoroughfare into the metro area, Cedar Avenue was widened and rebuilt to accommodate a new Rapid Transit route for city buses. To Dakota County IT staff, it was the perfect opportunity to lay conduit and fiber under the streets at a fraction of the price for a stand-alone project.

David Asp coordinated with each city along the rebuild path to understand their needs and ensure enough conduit and fiber would be included in the project to meet demand well into the future.

Dakota County has custom-built software to facilitate collaboration on any project. Named the "One Stop Roadway Permit Shop," as soon as a permit request is put forward to work in the right-of-way (as well as requests for a number of other related permits), the software alerts all agencies that may have an interest.[2] Not only has this system streamlined the permitting process, it saves approximately $4,000 per year for each agency involved. Embedding that kind of efficiency in the process is why Dakota County won an award from the National Association of Counties for its development. More importantly, it gives the county more opportunities to place conduit and fiber in the ground at extremely low costs.

For example, in a number of areas, school districts may have laid conduit and 12 strands of fiber at a time when each strand was considerably more expensive than today. If that conduit is within an area that could help expand the county network, Asp can offer a trade, since replacing the 12 strands of fiber in the conduit with 144 strands may only cost a dollar per foot of fiber. Cutting the streets to place new conduit and fiber would cost over a thousand times more.

Following this agenda has become a regular part of Dakota County's deployment, and it is not unusual for IT staff to convert 12 strands of fiber in a conduit to 144 strands over the course of a weekend. The school district would own many of those strands, but others would be reserved for the county and perhaps other uses as well. If the route came close to state facilities, the state might want to lease a few strands in return for paying the "locate" costs of the network.

Locates are performed when someone notifies Gopher State One Call before they dig to allow any entity with fragile assets underground the opportunity to mark their location. These are just a few of the in-kind trades that Dakota County has used to build fiber and conduit throughout the county on a shoestring budget.

Benefits

The main benefit of Dakota County's approach has been tremendous cost savings. Replacing the old telephone system saved tens of thousands of dollars per year, as well as unified county facilities that were served by CenturyLink and Frontier. Now they are all on the same system.

According to its website, over 240 nodes have been connected with fiber at a cost of less than $1 million. However, a recent conversation with David Asp put the number of connections closer to 400. This includes everything from major facilities and water meters to SCADA systems and traffic signals. As an example, one of these nodes allows the Met Council to monitor video cameras and sensors in a bus shelter along Cedar Avenue for public safety purposes.

For the 15 years prior to the Cedar Avenue rebuild, slowly corroding copper cable connected devices at intersections with an extremely slow modem to download data and update signal timing. Now, multiple devices need some 12-15 IP addresses per intersection, allowing sensors in the concrete to work their magic so that traffic lights can stay green an extra few seconds to let a bus through. In the event of an incident that needs to be managed, traffic engineers can access the intersection from anywhere on the planet. The benefits add up across hundreds of intersections, resulting in less pollution, lower tempers, and a generally higher quality of life.

An added benefit is that the network is redundant and reliable, though the county is continually working to make it even more so. There are now connections out of the county over three different directions, each at 10 Gbps. On one of those routes, the county partnered with provider Hiawatha Broadband Communications (HBC), so a group of government agencies could share 12 strands of fiber and increase network resiliency in the event of a disaster.

All of this work means that Dakota County is well prepared for a worst-case IT scenario. To test disaster preparedness in 2014, it shut off the power in its main Hastings facility and the system immediately re-routed data to servers in West Saint Paul. Leasing this level of connectivity from an existing provider would cost considerably more annually than Dakota invested in its network over the past 10 years. And because the network stretches into other counties, they only need to set up server racks in each other's facilities for remote backup purposes—yet another cost savings.

Lastly, the county had been paying $49,200 per year to a private provider for two strands of fiber to one county facility. Asp explained to ILSR that he structured a deal that required $113,000 in one time construction costs for 48 strands. Some of those are already connecting facilities from school districts, to the University of Minnesota, the Minnesota State Colleges and Universities System, as well as state-owned facilities. On that route, there was plenty of fiber left over to boost the local economy as county officials are working with a consultant to develop a policy for the fiber network to encourage economic development throughout the county and increase investment in rural areas.

Tripling Its Footprint

In 2014, Dakota County had about 120 miles of fiber in the ground, with strand counts ranging from 12-288. Today it has 331, which has dramatically increased its average strand count by adding 144- and 288-strand runs in projects since. This does not include the array of projects (like in South Saint Paul) where the county has been laying four-inch conduit in anticipation of pulling fiber in the future.

Dakota County projects are never just one-offs. Local officials endeavor to bring service to community anchor institutions, state buildings, businesses, or new developments whenever they expand the network into count fiber to new areas or facilities. The philosophy at Dakota County is not to maximize revenue, but rather facilitate high-quality infrastructure. The County has also been successful in getting various groups to chip in and share the install costs so that the sum is greater than the whole of its parts.

For instance, both Lakeville High School and Burnsville High School recently sought better connectivity on and off campus. The schools were able to negotiate an agreement with local ISP Arvig to use E-rate funding to bring in new fiber. To save the schools money, and because it already had fiber running between buildings and to the curb, the county provided Arvig access via two strands at no cost.

Public-Private Partnerships

In addition to working with local anchor institutions, Dakota County has been vigorously pursuing partnerships with private ISPs (sometimes going for state grant money as well) to bring better connectivity to those in the region.

This is happening in multiple places with different providers. The first **is in Rosemount,** where the county partnered with Charter Spectrum to apply for and win a $500,000 DEED grant to expand access. Charter Spectrum agreed to cover half the cost of the project, with the county contributing $50,000—a significant investment multiplier to bring better broadband to 40 unserved and 225 underserved locations in the northwest part of the city.

A second project **uses CARES Act funds** from 2020 in combination with Dakota County dark fiber via a partnership with Hiawatha Broadband. By using $800,000 in public funds paired with investment from Hiawatha Broadband Communications and the county's existing infrastructure, the partnership will allow the ISP to expand its fiber footprint to 800 homes in the northeast portion of the county and bring future-proof Internet access to residents living there.

The third project has the county working with Arvig to facilitate high-speed connections for residents in the Knob Hill development of about 400 homes. In this instance, the county is providing fiber to traffic signals and then working with developers to connect homes, receiving a small amount of money to cover the locate costs.

The final effort is a fixed wireless project. While in an ideal world, local officials would like to see fiber infrastructure passing every premise as soon as possible, it was determined that fixed wireless offered a short-term, cost-effective solution to bring better access to harder-to-reach portions of the region. At the start of the pandemic, Dakota County worked with neighboring Scott County. The latter was in the process of putting up ten 900 MHz towers in partnership with a private local provider, with the signal bleeding over into the southwest part of Dakota County. To take advantage of the project for its residents, local officials re-allocated CARES Act money to extend that coverage to farms in the area. Part of the agreement meant that two town halls in Dakota County received free 140 Mbps, 20 ms-latency access connections. Dakota is also pursuing other fixed wireless projects, working with the local firm JTN Communications, to put up six towers at a cost of $300,000 in the eastern part of the county.

Overcoming Challenges and Planning for the Future

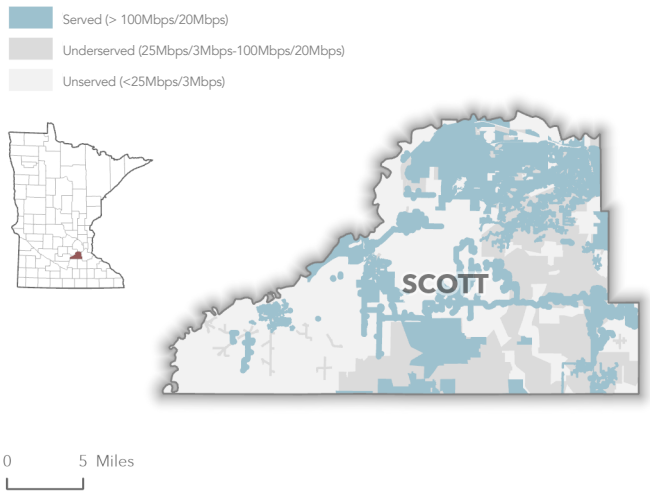
Dakota County's efforts have not been without obstacles. Around 2018, a DEED grant the county applied for in conjunction with Hiawatha Broadband was denied after Lumen (previously CenturyLink) and Charter challenged it. Lumen noted that it had received money from the federal Connect America Fund to build much slower, less reliable DSL connections.

Still, the future of the Dakota County network looks promising for an array of use cases. In 2017, the county formed the **Dakota Broadband Board** to ensure that the network has the maximum impact possible while efficiently using available resources. The founding of the board accomplishes two tasks: operationally, it supersedes all of the individual Joint Powers Agreements made for individual infrastructure projects and folds all documentation and governing power under one roof.

Secondly, it serves as the vehicle for the county to pursue future collaborative projects, public-private partnerships, and other opportunities to incent business development using county infrastructure, especially considering the county has brought locate costs down to 19 cents per foot and lease costs down to $65 per mile, per month for two strands.

Most recently, in February 2021, the county **issued a Request for Information** from vendors to enable county officials to review its progress over the last five years and formalize a plan to guide future operational and policy decisions. What that future holds, we are excited to see.

SCOTT COUNTY



- **The county built a fiber backbone for less expense than continuing to lease connectivity from existing providers.**
- **The network has helped to lure new firms to the area, including Shutterfly and Emerson Process Management.**
- **The network has helped the county to partner with ISPs to improve broadband access during the pandemic.**

Scott County, located south of the Twin Cities, sits east of Carver County with the Minnesota River as the common boundary. Composed of both suburban and rural communities, the county has seen rapid growth over the past 30 years with a current population of 150,000 residents.

Scott County had long watched as its neighbor to the east, Dakota County, expanded publicly owned fiber and conduit assets to improve Internet access to schools and other community anchor institutions. When Scott County mapped publicly owned fiber in the community to determine assets and needs, it discovered that its only publicly owned fiber had been deployed jointly by the county, the City of Shakopee, and Shakopee Schools.[3]

Scott County learned from Dakota's approach and its Board of Commissioners approved a $4 million budget for its own 90-mile ring in 2007. The budget allocation was part of a larger capital improvement project designed to overhaul public safety communications in the county. Dakota County had been trying to connect its towers with fiber in addition to microwave because of occasional interference problems when the air held too much dust or moisture. Scott County also recognized that fiber would be more reliable as well as create many additional opportunities.[4]

The public savings from the project were estimated to be $500,000 per year, because the county would no longer need expensive leased connections from existing carriers.[5] In addition, the new fiber network would offer much higher capacity connections, a much lower cost per bit delivered, and greater reliability. The county bonded for $3.5 million, spreading the burden of building the network over many years. However, combining the debt payments and operating expenses, the county saves $35,000 per year compared to the cost of leasing connections.

The county connected all county owned facilities, including public safety towers, libraries, city halls, police departments, school districts, and the state of Minnesota's high capacity backbone. Ultimately, it also interconnected with Dakota and Carver networks, as well as provided redundant paths out of Scott County, including one to Mankato and one to the 511 Building in Minneapolis (where hundreds of carriers interconnect networks). Having that connection effectively meant that any carrier in the 511 Building could offer services to Scott County, rather than the county being dependent on the small number of carriers that already built infrastructure in that region.

Access Communications, now owned by Zayo, worked with a local provider to build the network. The partnership resulted in a lower cost to both parties – the county paid the capital costs to install the fiber and Zayo is responsible for ongoing maintenance. The state Office of Enterprise Technology has also agreed to manage portions of the network in return for access to some of the connections, lowering its own costs.

The School District has slashed its expenses, from paying approximately $58 per megabit to under $7 per megabit as of 2014. The schools have higher capacity connections that would be cost prohibitive to lease from a telephone or cable company, saving both local budgets and federal E-Rate expenditures.

The network is also responsible for job growth in the region. The network was 10 percent completed in 2010 when county and local municipal leaders began aggressive efforts to spur economic development with the fiber. When Emerson Process Management was engaging in site selection for a 500-job, $70 million investment, the firm narrowed down possible

candidates to Shakopee and Chihuahua, Mexico.[6] Scott County could offer the company affordable access to the fiber network. *Shakopee News* reported: "Dependent on projected usage and other assumptions, over a 20-year period, it is estimated this would result in a net present-value savings of between $1.1 million and $1.7 million for Emerson."[7] Emerson picked Scott County.

The subsequent decision from Shutterfly to locate in Scott County was also influenced by access to county fiber. Shutterfly planned to bring 329 new positions to the community, paying hourly wages of approximately $19 per hour. The online photo service also planned to employ an additional 200 people on a seasonal basis.[8] Ensuring that businesses will have an affordable and reliable Internet connection is increasingly essential to a healthy business environment.

The Dakota and Scott County conduit and fiber investments position them perfectly to ensure those connections are available.

Swapping for Fibers and Bartering for Bandwidth

Zayo maintains the network, and Scott County continues to have a positive working relationship with the firm, with the arrangement saving the county money on things like locates and break fixes. Since 2014, Scott County has continued to actively seek out partnerships with private and public entities to expand economic development in the region, diversify its route map, and bring cost savings to county residents and other public entities across the state. In 2015, the county partnered with Jaguar Communications (now MetroNet) and swapped four of its strands for two of Jaguar's to get a route down toward Owatonna. That saved the county money in Wide Area Network management.

That same year they formed a joint-build partnership with the Shakopee Mdewakanton Sioux Community, which saved both sides hundreds of thousands of dollars—Scott County got additional fiber infrastructure for its use, while the Sioux Community was able to connect with the existing fiber ring to support its own fiber-to-the-home (FTTH) network.

In 2016 the county continued to make steady progress towards its 2030 goal of having more than half the workforce employed within county limits, hitting an all-time high of 41 percent. In 2017, the county provided capacity on its route up to the Minnesota Technology Center (the 511 building) for Omaha-based Neutral Path Communications and in return got two strands on the latter's network. In addition to the route diversification the exchange provided, the hope is that the connectivity will help entice Nebraska-based businesses to Scott County.

Strategic Partnerships

In 2018 and 2019, Scott County partnered with Minnesota-based Arvig to light up and operate those strands to Omaha, which it did via Frequency Division Multiplexing, a method which splits a single strand of fiber into frequency bands (effectively subdividing that capacity into non-overlapping channels). Scott County was given a portion of that capacity to bolster their effort to attract Omaha business, while Arvig retained the rest in exchange for maintaining the route.

A bigger shift in approach came in 2018 when the county forged a relationship with Access Networks and turned over day-to-day management of its assets in order to free leadership up to pursue strategic work and additional partnerships. In the same way that Zayo handles maintenance, Access Networks handles things like splicing requests so the county can spend more time on economic development.

The following year in 2019 **the county began to pursue fixed wireless projects** using county-owned fiber backhaul in southern parts of the county, near Blakely and Belle Plaine, in order to connect rural households and farming communities. Then the Covid-19 pandemic hit, and in response the local officials teamed up with NetWave Broadband (which also began working with Le Sueur County) and exchanged four fibers which run to the 511 building in exchange for joining the effort.

With NetWave contributing one-third of the costs and the county the other two-thirds (all of which was ultimately reimbursed from its CARES Act funds) Scott County worked with area townships to put up three towers covering 3,600 homes in the first stage of a fixed wireless build. They've added more towers to the project to bring fixed wireless access to most of the rest of the rural parts of the county, with those installations ongoing in 2021. Part of the deal for residents was also lower installation costs. The county worked with NetWave Broadband to bring the one-time fees down from the regular rate of $199 to $100. Residents can now access the Internet at download speeds of 30-140 Megabits per second (Mbps) with reports on average of 70 Mbps for $49/month.

Scott County has a robust, redundant 300-mile network, and future progress is on the horizon. Local officials continue to put work into advancing smart-grid efforts, with **Phase 1 of the county's Advanced Traffic Management System** continuing in Shakopee over the summer of 2021, installing short laterals to connect into existing infrastructure. The **latest round of Border-to-Border grants** saw local ISP BevComm win $1.9 million for a project to bring fiber to 417 homes, 88 farms, 59 businesses, and four community anchor institutions sprinkled across Scott, as well as Le Sueur and Rice Counties.

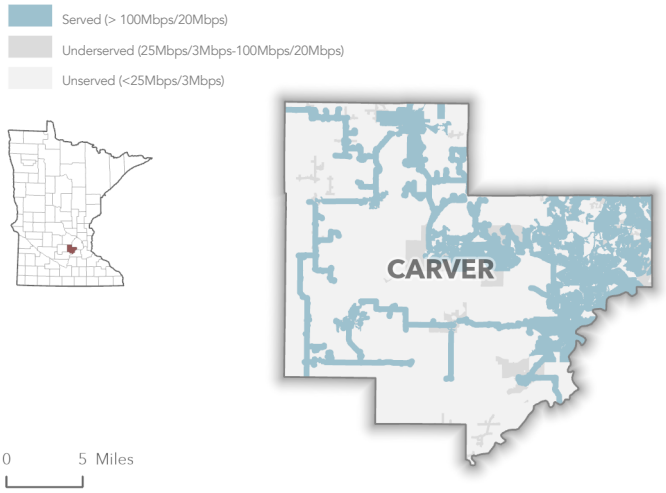
Conclusion

By investing in its own information infrastructure, Scott County reduced its telecommunications costs by $35,000 annually while dramatically improving Internet access for essential public facilities by replacing leased lines with its own fiber network. Costs for connectivity then contracted sharply for schools from $58 per Mbps to less than $7 per Mbps.

In order to reduce the cost of the network, the county partnered with Access Communications (now Zayo) which agreed to handle maintenance. Scott County also collaborated with the state Office of Enterprise Technology, saving both state and county public funds.

Two large-scale employers, Shutterfly and Emerson Process Management, have brought more than 1,000 new jobs into Scott County, citing the network as an enticement. Scott County has more tools at its disposal as it seeks next to spur investment in residential Internet access. However, the presence of a robust middle mile for 10 years has not yet resulted in the widespread ultra-fast connectivity that residents and businesses would like to see ubiquitous throughout the region.

CARVER COUNTY



- The county network was built with support from the 2009 broadband stimulus programs.
- Local anchor institutions and the county have improved their connectivity at far lower costs than leasing connections would have been.
- The county has not substantially used the network for improved residential or enterprise Internet access.

Carver County's 376 square miles lie approximately 30 miles southwest of Minneapolis. There are 11 cities in the county, 10 townships, and a small number of unincorporated communities. The population is now in excess of 100,000 people.

The county has experienced high levels of population growth as a result of the expanding Minneapolis and St. Paul metro. Based on the level of growth, local officials have estimated the population will reach 195,000 by 2030.[9]

Many new residents live in the eastern areas closer to the Twin Cities in order to commute to jobs in the metro. Lumen, Comcast, and Frontier are incumbent providers in the area.

Traditionally, many businesses and residents in the rural western regions of the county were underserved and had to get by with dial-up. Government facilities and other larger entities relied on T1 lines for connectivity. The county's network, a "patchwork" of fiber and T1s leased from private firms, was expensive and slow.

In 2008, the economic downturn, coupled with rapid population growth, put added stress on government operations. Unemployment was up, tax rolls were down, and the state had significantly scaled back financial allotments in the form of Local Government Aid (LGA). The county received less revenue but served more people than ever before.

As revenue decreased, Carver County's telecommunications budget increased. Prices for T1 lines grew each year; some were as high as $1,000 per connection. The escalating telecom budget burdened the entire county, leading to discussions about a better solution than leasing lines.

Faster Connections, Lower Prices

Recognizing the danger of further reliance on expensive leased connections, county leaders decided to act in 2008. They wanted a solution that would cut costs while still providing fast, reliable connections and ideally jumpstarting economic development. And they were well aware of the Dakota and Scott County approaches of targeted fiber investment.

Carver's first concept for the network was a 60-mile ring to connect county facilities, schools, libraries, police departments, and local government agencies.[10] The plan included 80 -100 sites, allowing the county to eliminate leased lines for voice and data. Steve Taylor, the Carver County Administrative Services Division Director, predicted they would save $150,000 - $175,000 per year.

At the time, administrative offices in Chaska were filled to capacity. The county planned to develop satellite offices but required high-speed connections between facilities. Without its own network, establishing satellites would be expensive and impractical.

As part of its new approach, Carver worked with Scott County to link government centers located across the Minnesota River from each other. A connection between the two would provide faster access to a range of state databases and Scott County provided access to the 511 building in Minneapolis. Direct access to the building means lower prices for Internet connections due to much greater competition.[11]

The county was not alone in needing better access; businesses considering moving to the area also required higher capacity connections than existing providers were offering at affordable levels. When presenting the idea to the County Board of Commissioners in June, Taylor noted that businesses sought locations with access to fiber: "It is almost a requirement

now," Taylor told the Board during a presentation. "There is a demand for this. I've had three companies ask me in the past six months if we have a fiber optic ring."[12]

Convinced the need and desire were present, the Board voted to instruct staff to develop and issue a Request for Bids (RFB) for a project developing a fiber network.

On June 6, 2008, the County released a two-part RFB.[13] The first option called for a county-owned network; staff estimated deployment costs of $2.5 – $3 million with $100,000 in annual costs.[14] The second option sought a public-private partnership to fund, deploy, and operate the network.

Three entities bid on the project; costs ranged from $900,000 for a public-private partnership to $2.4 million for a publicly owned network.[15] Jaguar Communications, headquartered in Owatonna (before being acquired by MetroNet), submitted the winning proposal with a 70-mile county-owned network that would connect all county facilities and nine additional community anchor institutions. The bid provided that Jaguar have an Indefeasible Right of Use (IRU) for several strands of the network and would not have to pay for access to county rights-of-way in order to offer business services.[16] In exchange, Jaguar offered to pay more than half of the cost of the proposed fiber build.

Over the next few months, Carver officials and Jaguar expanded the project's reach to connect more communities. The network would connect all eleven cities in the county, the length was extended to 85 miles, and Jaguar would also have the right to offer triple play services to residents and businesses. The Board authorized the county to spend up to $1.8 million and, planning to break ground the following May, approved the final contract in December 2008.[17]

Jaguar and Carver County hoped to use a loan from the Rural Utility Service to finance the network, but their application had not yet received a response when the federal government announced a $7.2 billion program to expand broadband as part of the American Recovery and Reinvestment Act (ARRA). With the unanimous support of the Board, the County applied for ARRA funding in August 2009.[18]

While waiting for the results of the 2009 application, it developed the Carver County Open Fiber Initiative (CCOFI), a collaboration with community partners to identify community anchor institutions to be connected. A Broadband Infrastructure Task Force was also formed, which included elected officials and staff from the county, representatives from local schools, and officials from cities and townships.

Carver County learned in March 2010 that it had not been selected for a stimulus award and quickly decided to apply for an award in the second round with a more ambitious network that would improve government efficiencies. It also focused on creating a better economic development impact and the promise of better access for residents.

Awarded in the Second Round

In August 2010, Carver County was awarded a $6 million Broadband Technology Opportunities Program (BTOP) grant in the second round of the stimulus program.[19] The county pledged $1.5 million to cover the remaining costs of the project.

Officials first decided to spend $400,000 from the county's Information Technology budget and finance the rest with a bond issue. At that point, costs for leased T1 lines had reached more than $230,000 and were expected to increase another $100,000 in 2011 for a total of $330,000 per year. Redirecting the T1 funds to the bond debt would allow the county to pay off the planned debt in fewer than five years. However, the county later found it could tap into its reserves to fund the project without bonding.[20]

Jaguar agreed to provide maintenance for the ring and be a service provider on the network. Jaguar purchased an IRU for 96 of the total 192 fiber strands; 24 of Jaguar's fiber strands would be managed as open access, per one of the stimulus plan requirements. The county would receive a one-time payment of $370,000 from Jaguar for the IRU. Jaguar would also perform splicing, testing, pre-engineering, and project administration during and after installation.[21]

While the network was being built, Carver County and Scott County connected their government centers with a fiber optic cable under the Minnesota River. The connection between the two government centers linked the two counties for public safety purposes. Scott County planned to transition to the statewide 800 MHz public safety radio system after creating a fiber connection to the tower in Carver County. The primary controller for a subsystem shared by Carver and Scott counties was located at the Carver County tower.[22]

The connection also created a fiber route to the state's Office of Enterprise Technology (OET) and Minnesota's Network for Enterprise Telecommunications (MNET), linking government offices and schools. Carver County paid $25,000 toward the total cost of the project, which came to approximately $200,000. Access Communications, Scott County, and the state also contributed.[23]

Construction on CarverLink began in early summer 2011, and the county was ready to light its network two years later. On September 4, 2013, federal, state, and local officials met for an official lighting up ceremony at Waconia High School. Superintendent Dr. Nancy Ranjanen emphasized that the new

network significantly reduced the school district's connectivity costs, allowing investment in other areas.[24] In keeping with the district's technology plan, the robust network permitted more students to access wireless web-based learning software.[25]

The entire network is underground, running along county rights-of-way for approximately 89 miles. 33 miles of laterals reach community anchor institutions beyond the main ring. The network connects all 11 cities in the county to the backbone ring with eight townships connecting via laterals. Capacity on the ring is 10 Gbps; laterals are 1 Gbps.

CarverLink has connected 55 sites, representing 86 community anchor institutions. 18 county sites, 28 public schools, 6 libraries, and the Carver County Workforce Center were also connected in addition to two colleges and a number of community centers.

Network Benefits

Carver County previously had to duplicate hardware at its Public Works facility in Cologne and at the Government offices in Chaska because CAD files were too large to send between offices through the county's limited network. CarverLink has solved that problem, and allows better use of the data center in Cologne because bandwidth is no longer a scarce commodity.

County and municipal public safety entities use the network extensively. Fire stations, police stations, city halls, and several public safety communications towers are all connected. Sheriff deputies now upload squad car video via the network; in the past deputies hand-delivered the videos.[26]

Waconia City Administrator Susan Arntz lauded the positive financial effects on Waconia's municipal budget, saying "Our communications costs have reduced by almost half, which has allowed us to add wireless capabilities for the public and our own operations to the Ice Arena, City Hall, and Public Services."[27]

Waconia schools, located in the center of the county, have found a way to save significantly. The community had three facilities connected with T1s and with wireless service from nearby **Chaska.net**. Reliability was not a significant problem for Waconia, but they were limited in bandwidth and sought a single solution. After converting to CarverLink and interconnecting facilities with fiber, Waconia reduced its telecommunications budget by 47 percent, which translated to $19,000 per year.

Schools in the county often purchase bandwidth via CarverLink. As a way to stretch the federal E-rate subsidy, CarverLink's infrastructure creates a connection between districts that allows them to purchase bandwidth as a collaborative. The consortium, the Carver County Schools Network (CCSN), is an agreement between the schools that increases their bargaining power and allows them to take advantage of opportunities that may not be available to the districts individually. In addition to obtaining a better price for bandwidth, the CCSN has collectively applied for and received E-rate funding.

Beyond the schools, libraries and county facilities, Crown College, Ridgeview Medical Center, and South West Metro Transit headquarters are also on CarverLink. But the most significant impact has come from the eight cities and two townships that obtain services for municipal offices. Randy Lehs, Business Operations Manager for Fiber Broadband Services in Carver County, anticipates more cities and townships will use CarverLink as currently connected communities share their experiences.[28]

Lehs noted that the primary purpose of the network was to increase efficiencies rather than reduce municipal telecommunications budgets. Many of the connected entities still pay what they used to but receive vastly superior service. CarverLink offers faster speeds that are symmetrical, reliable, and redundant. Being on the same fiber network also makes it easier to cut costs in other departments with more collaboration.

The city of Chanhassen can now also take advantage of the county's extensive GIS mapping data. Before CarverLink, Chanhassen did not have GIS at their disposal because it did not have the necessary expertise.

The small town of New Germany (pop. 400) has boosted its access four-fold compared to its old Frontier service, and the direct connection from City Hall to the Fire Department allows for much faster transfers. Purchasing services from the county allows for more stable budgets, because large providers have been known to increase prices with little warning.

At the outset, CarverLink offered 20 Mbps connections for a flat rate of $75 to public entities that connected a small number of facilities like New Germany. The option aimed to serve small communities where there were only two or three connections. It also provided access to what CarverLink describes as a "community ring." In other words, these facilities can communicate directly with any public entity on CarverLink.[29] In 2015, New Germany paid $150/month in total for better service: $75 to CarverLink and $75 to Frontier for phone service. (It previously paid $300/month to Frontier alone).

Larger communities paid $150 to connect their first site and $75 to connect each additional site. CarverLink also provided the dark fiber connections between

facilities if they chose this option and were comfortable managing their own network. Several communities with technical staff opted for this system and managed their own needs, limited only by the equipment they chose to employ.

Update

We have no significant updates on CarverLink in 2021 despite efforts to reach them for new information. The network celebrated its five-year anniversary in 2018, but the only activity we could find was **a partnership signed in the fall** of that year with Jaguar Communications for the private ISP to use the CarverLink backbone to bring new last-mile service to the communities of Hamburg, Mayer, and New Germany along the western border of the county. Service for the roughly 3,000 residents across those three communities was slated to start early 2019. Aside from **deploying free public Wi-Fi** with the onset of the Covid-19 pandemic in the spring of 2020, there was no new news from Carver County we could readily find.

Conclusion

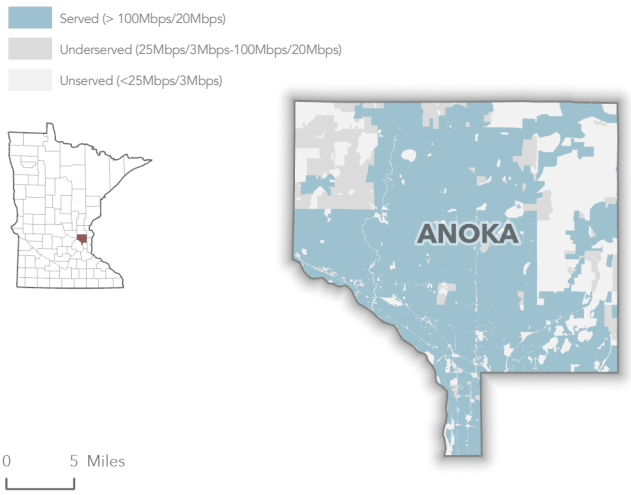
Carver County and its municipalities had hobbled along with outdated, slow, and unreliable connections until community leaders closely examined their options. The primary goals were to increase government efficiency, take control of telecommunications costs, and better serve the people of the county.

Carver County had aimed to help Jaguar Communications to expand, and may see more opportunities for that as the rapidly-growing regional ISP MetroNet explores where it can expand. It is not clear that the county has much interest in using its assets aggressively to encourage new broadband investment for residents or businesses.

Instead of limping along with a collection of "patchwork" connections, Carver is able to efficiently and affordably serve the community. By eliminating leased lines, it was saving $330,000 per year in 2014, and no longer faces the threat of major unanticipated rate increases.

Local governments also benefitted when they transitioned to more affordable service with better connectivity. Waconia schools reduced their telecommunications budget by 47 percent, saving over $19,000 per year. New Germany, with less than 400 people, can enjoy the same or better Internet access and voice service available in much larger cities for half of what it used to pay to the incumbent.

ANOKA COUNTY



- **Anoka County built a network with a partner that has focused on connecting large enterprises and anchor institutions.**
- **The county has not been able to incent partnerships to use the network for improved residential or enterprise Internet access due to limitations set by its original arrangement, despite warnings that this was a likely outcome from its choice of partners.**
- **The county is now seeking new approaches to resolve access gaps.**

Approximately 350,000 people live in Anoka County's 423 square miles located north of the Twin Cities Metro. The county includes densely populated communities in the south with rural areas in the north. Anoka County is home to the largest school district in the state, Anoka-Hennepin, along with 20 cities, one township, and eight other school districts.[30] Hoping to cut telecommunications costs, encourage economic development, and improve access in rural areas, Anoka County developed and executed a plan to work with a partner to deploy a fiber network connecting community anchor institutions. While the county retains the right to use the network for internal needs, the infrastructure is owned and controlled by its partner.

Connectivity in Anoka Lacking for Business, Government, & Residents

Despite its size and proximity to the metro, large institutions and businesses in Anoka County were limited to DSL service, cable connections, or T1 connections from the existing providers in the 2009 timeframe. T1s, providing speeds of 1.5 Mbps were slow, expensive, and did not provide redundancy. In limited areas, providers offered connections up to 10 Mbps, or DS3 connections that supplied 45 Mbps service.

Other challenges also remained. Several school districts used fiber for private WAN connectivity, but did not make that fiber available to other entities.[31] Municipalities were limited by whatever technology was available in their areas; often there were limited connections between facilities. The city of Circle Pines used Comcast lines for data transport but did not have direct connections between police and fire locations; the Lino Lakes Correctional Facility used a T1 but needed more capacity. The City of Ramsey, located on the western edge of the county, paid almost $1,100 per month for a T1 connection to its fire station.

In rural sections of the county, residents and businesses still depended on dial-up. In some instances, when entities contacted providers to request T1 service, providers told them that it was not available due to the deteriorated condition of copper lines. On the more populated southern edge of the county, a limited number of businesses and anchor institutions had some access to fiber links, but many others repeatedly requested fiber connections from incumbents. Qwest (later CenturyLink and now Lumen) and Comcast required the requesting entity to pay prohibitive construction costs to install fiber or simply refused to deploy it. Businesses, residents, and local governments were trapped; they needed better telecommunications options.

In seeking stimulus funding, the county used an example to illustrate its need for more investment.[32] A large medical device company located in the southern part of the region paid Qwest $30,000 per fiber mile to connect facilities in Hennepin County.

When the county issued an RFP for a five mile gigabit fiber connection between the County Government Center and its primary Sheriff's building, Qwest's bid included a monthly charge of $9,320, or $111,840 per year. That would be in addition to the construction charges which Qwest did not include in the bid.[33] At these prices, the county had little hope of connecting all the facilities that needed modern Internet connections.

Seeking Partners

In response, in 2009, Anoka County created the "Connect Anoka County" project. It called 800 residents in a random survey and sent paper surveys to 1,300 local businesses seeking feedback. Residents reported that they would not have moved or built in the county if they had known dial-up was their only choice.[34] Large businesses reported that their bandwidth use had tripled or quadrupled since 2007; they expected usage to rise even higher in the future. Some reported driving files to customers rather than emailing because it was faster. 80 percent of residential and business survey respondents favored action to improve broadband. To get a more complete picture, the county held meetings with residents, businesses, cities, school districts, and colleges.

In 2009, local officials also met with Qwest and Comcast to discuss the increasing need and to review solutions. While the incumbents did not offer suggestions or identify specific areas of service, other ISPs expressed interest in participating in a project.[35]

On November 4, 2009, Anoka County released an RFP to solicit partnerships for broadband development.[36] It intended to find a private partner willing to apply for Broadband Technology Opportunities Program (BTOP) funding, offered through the American Recovery and Reinvestment Act of 2009 (ARRA). Five companies responded to the RFP, two were interviewed, and Zayo Bandwidth LLC won the contract.

Zayo is based in Boulder, Colorado. The company provides a variety of dark fiber and lit services in most states and Washington, D.C. The privately owned company also supplies carrier-neutral co-location and interconnection services to government entities and private providers. Zayo had already received a first round ARRA grant for $25 million to develop a fiber network in rural Indiana, so it had experience working with the federal stimulus process.

In 2009 and 2010 Anoka County representatives provided information about the proposed project to local elected officials. Their proposal would allow cities to connect municipal facilities to the network for $75 per month per site for 100 Mbps; the price for 1 Gbps connection would be $400 per month per facility.[37] A 2009 survey of county cities indicated municipal governments in the county then paid approximately $200,000 per year cumulatively to connect their facilities to the Internet and to connect municipal facilities to each other.[38] At the time, county facilities also paid approximately $200,000 per year for similar connections.

County officials explained that cities could connect and receive lit service as soon as Zayo completed the network, or choose to only have equipment placed at their facilities. If they chose the latter option, they would not be charged until they established service. Participating cities needed to provide necessary rights-of-way access, space for equipment on location, and access for maintenance.

Some local leaders were concerned that Zayo had received an unfair advantage over incumbent providers because it received stimulus funds. Though this concern ignored the many ways big incumbents have often received government tax breaks and subsidies, county officials assured them the network would *not* provide last-mile connectivity and would be available to incumbents to use if they wished. The incumbent providers had refused to apply for stimulus funds for projects in Anoka even though entities in the county had requested infrastructure upgrades for years. Nevertheless, Zayo's network infrastructure would remain open to them.

Over the years, many local leaders around the country have hoped that building open access, middle mile infrastructure would entice incumbents—particularly the big national cable and telephone companies—to invest in better last-mile connections. Unfortunately, there are very few examples of that dynamic actually occurring (see Alberta's SuperNet, multi-county middle mile efforts in New York state, or the MassBroadband 123 project). Regardless, Zayo's core business lies in leasing dark fiber to large entities, not being a service provider to businesses or residents.

County officials stressed to local leaders that the network was a cost-effective, long-term strategy: "We think we can repay the bond for what we are paying now and save taxpayers money," Anoka County Deputy Administrator, Dave Minke said. "We've gotten support [resolutions] from most county cities."[39]

Anoka County obtained resolutions of support to submit with the BTOP application. In communities with poor service, residents went door to door with petitions encouraging local government action.[40] Some community leaders hesitated, wanting more information before they would support the BTOP application.[41] Eventually, officials obtained over 80 resolutions and letters of support from local businesses, school districts, libraries, cities, townships, colleges, elected officials, and public safety entities.

From Idea to Implementation

Zayo and Anoka County planned a 286-mile fiber network to serve 145 community anchor institutions. The list included 56 public safety entities, 11 K-12 schools, three community college campuses, the Anoka County Sheriff's Office, and city and town halls. The network would significantly reduce connectivity costs to the county because each facility would pay only $1 per month per facility to connect initially and each facility would receive a minimum of 100 Mbps for $74/month.

With 61 percent of the fiber deployed in underserved areas, the partners estimated the network *could* bring better connectivity to over 141,000 homes, assuming that some other entity or incumbent provider would pursue investment in those connections. Anoka and Zayo also predicted private last-mile providers would eventually bring better connections to over 11,000 businesses and 600 additional anchor institutions. This was a more reasonable assumption, as businesses and anchor institutions are higher margin customers for service providers than residents.

The partners stated in the BTOP application that they had met with providers interested in delivering residential services via the network, but the only provider mentioned by name in the application was Omnicity, a wireless Internet service provider that later filed for Chapter 11 bankruptcy protection.[42] Omnicity had produced a Letter of Intent to serve county residents with wireless service, but the plan dissolved when another wireless provider acquired Omnicity's assets through bankruptcy.

Ultimately, Zayo would own the infrastructure while the county would have an Indefeasible Right of Use (IRU) of 12 fibers. The IRU, however, restricted the county to governmental and quasi-governmental uses, limiting its opportunities to generate revenue through commercial relationships.[43] More importantly, if no incumbent provider or other entity decided to connect the 141,000 homes, the county would be in no position to step up and make sure they were connected. Zayo and Anoka County submitted the BTOP application in March 2010. Four months later, they were awarded $13.4 million for the $19.1 million project. Stimulus funding paid for 70 percent of the project costs. While the original plan was to issue approximately $3 million in bonds, the county was able to tap into its capital reserves instead and eliminate the need to bond for the project. Zayo contributed the remaining $2.7 million. On September 13, 2011, Zayo and the county officially broke ground on the new network.[44]

Challenges surfaced along the way. For instance, pole attachment fees proved to be higher than expected, so Zayo made the decision to bury fiber in certain areas to keep the project moving forward. The changes required the company to amend environmental assessments for permits to go underground. This process created minor delays but did not significantly slow the project. Attaching to poles and environment assessments challenged many stimulus projects during the period, both public and private alike.

By the end of May 2013, Zayo connected the last community anchor institution—the Coon Rapids Head Start building.[45] Every municipality in the county connected to the network, in addition to 145 anchor institutions. At completion it consisted of 84 aerial and 192 underground miles in three 10 Gbps core redundant rings. The project extends into Ramsey County and also into Isanti County to connect the Isanti Campus of the Anoka Hennepin Community College.

Savings, Efficiencies, & Benefits for Anoka

Anoka County's telecommunications costs in 2015 were a fraction of what they were when it leased lines from incumbents. As planned, local governments paid nominal user fees to the county based on type of use, capacity, and the number of facilities connected. The Anoka County Internet Technology Department can back up large amounts of data in minutes; daily backups had previously required more than 10 hours due to the lack of bandwidth. Even though staff scheduled them for overnight hours, backups were often still processing each morning when employees returned to work. As a result, county staff contended with slow computers every morning.[46]

Other savings were also realized. The Centennial Fire District main office in Lino Lakes come to use the network for data and voice, connecting it to remote stations in Circle Pines and Centerville. The Fire District paid a $187 monthly fee to Anoka County; the old, slower connection was $400.

Other community benefits likewise surfaced. Fridley's Springbrook Nature Center began offering Wi-Fi for visitors. Staff used to find other tasks to keep them occupied while they waited for search engine results on the old connection. The Center now receives results immediately via a gigabit connection. The city removed the old electronic storage server at Springbrook because the Nature Center now connects to City Hall's server via the network. Fridley now uses VoIP service via the network instead of old phone lines, saving $987 per month – almost equal to the city's user fees to Anoka County.

Fridley, Circle Pines, and Centerville are a few of the municipalities in the county who now have fast, affordable, reliable connectivity. For its part, the county saves significantly through its partnership with Zayo and enjoys better connectivity than it did when leasing lines from incumbents.

Update

Anoka County's Zayo-owned broadband network has changed little since the spring of 2013, and aside from seeing some internal upgrades has not undergone any major expansions. The network, originally 276 miles, is now 287 miles long. Despite the county's hopes, the network has not brought any significant economic development to the region; nor has it led to another Internet Service Provider (ISP) entering the market to provide last-mile service to the roughly 158,000 households (350,000 people) in the county. Zayo remains hesitant to share the network with competitors, nor does the company seem to want to invest in last-mile access—even to

those homes or businesses which want and need it. This includes significant local business like the Running Aces Casino, Hotel, and Racetrack (which has 650 employees).[47]

Pursuing Other Avenues

In light of this, the county has been pursuing broadband projects in the region via two other routes. With nothing additional materializing on the Zayo network in the near future, it has pursued other means of economic development.

In August of 2019 it helped **launch a project** called the Minnesota Technology Corridor, situated in the cities of Centerville, Columbus, Forest Lake, Hugo, and Link Lakes. **A partnership** between Anoka County, Washington County, the cities above, three electric utilities, and five ISPs, the aim of the Corridor is to attract technology companies like data centers, engineering firms, and research and development facilities by bringing affordable electric infrastructure, a trained workforce, and fiber connectivity to a cluster of locations along Interstate 35.

The Corridor includes development sites ranging from 20-250 acres (with 1,000 acres total available), and the five participating cities have formed a partnership with six ISPs, which have agreed to joint trenching projects. Companies can take advantage of trained workforce and opportunities in the nearby Twin Cities, as well as low-cost energy from Great River Energy and Xcel Energy, plenty of broadband bandwidth and speed from Arvig, Midcontinent Communications, Zayo, Comcast, and CenturyLink, and integrated infrastructure firm Parallel Technologies. The cost to get it all started was $20,000, shared equally by the two counties and Connexus Energy, and there are an array of development site projects in various stages of completion.

The second effort made has been in helping towns with poor connectivity pursue available options as a facilitator by pushing those ISPs participating in the Technology Corridor to extend into nearby communities, and has led to construction in three neighborhoods in Nowthen (pop. 4,700).

In addition, there are similar projects in East Bethel (pop. 11,900), Saint Francis (pop. 7,600), Ham Lake (pop. 16,400), and Columbus (pop. 4,100). Each of these towns, County Economic Development Specialist Jacquel Hajder shared, has at least one neighborhood-level project underway as of 2021, with more to come as they are able in the future.

Structural Problems Require Practical Policy Solutions

Part of the problem for places like East Bethel, Hajder further explained, is that they are hamstrung because the state's Department of Employment and Economic Development (DEED) maps the area as served, which cuts off DEED funding. Linwood Township (pop. 5,400) is working with Midcontinent Communications to pursue better connectivity there as well. But these small towns in Anoka County **don't have the bonding capacity** to undertake any major projects, and the county is not prioritizing its funding in these low-density, high-cost areas.

Further, the area is not competitive for grant programs (including the state's Border-to-Border program) because premises are too spread apart, with 20- to 150-acre properties common. The county board showed no interest in using their proportion of the CARES Act money to pursue projects for cities with poor or no connectivity during the Covid-19 pandemic. Without an overarching plan, the county Office of Economic Development has been helping where it can, like in the town of Andover where a small neighborhood of 16 homes had been skipped over by Comcast when first installed. The county facilitated a negotiation between the homeowners and Comcast in order to get those homes connected to the ISP's network over the course of two months in early 2020.

Conclusion

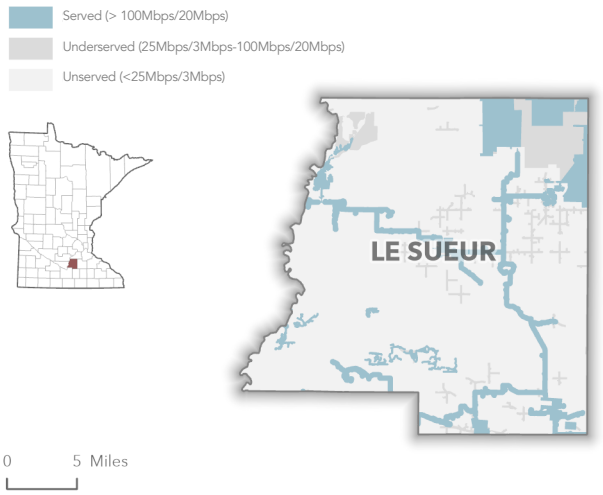
Anoka County expected its countywide fiber optic network to create local government savings, spur economic development, and attract providers willing to offer better residential options. Though the network has clearly created savings for local government, it has yet to achieve the other two goals. Local businesses and residents have seen little change due to the network, which we predicted when it was proposed. Looking back, it seems that in worrying that subsidizing Zayo would be unfair to the existing providers, local leaders missed the point concerning what it would take to actually connect local residents and businesses to fast, affordable, and reliable Internet access.

The county depends heavily on Zayo to reach out to businesses and work with potential residential providers. The arrangement satisfies its desire to shift operation and maintenance of the network to an outside party, but relinquishes much of its control over the use of the network as a result.

Zayo describes itself as a bandwidth provider that works with most of the largest global telecommunications carriers. It is known for providing middle mile fiber infrastructure and bandwidth to many of the large carriers, not for working directly with businesses that use the infrastructure. In short, the county seems to have unrealistic expectations for its partner. This is an important lesson in partnership: know thy partner.

As Internet access has become essential infrastructure, local governments have to take a stronger role in ensuring residents and businesses have appropriate access. For some, this will mean a partnership, but local governments must understand the business model of potential partners. Zayo has a core business focus of providing big pipes to big customers, not ensuring suburban residents and businesses have high quality Internet access. Encouraging investment in small business and residential fiber networks is incredibly difficult; Zayo should not be blamed if Anoka sees little progress in that area.

LE SUEUR COUNTY



- The county network was built with support from the 2009 broadband stimulus programs.
- Local anchor institutions and the county have improved their connectivity at far lower costs than leasing connections would have been.
- The county has not substantially used the network for improved residential or enterprise Internet access.

From 2017-2020, a task force of citizens, local officials, and business leaders in Le Sueur County succeeded in dramatically improving broadband for thousands of residents who previously had poor or no connectivity. They also forged relationships, inventoried local resources, and created a model which is likely to see the landscape go from nearly all residents in the county being under- or unserved by basic broadband at the beginning of 2018 to the majority of the community having some sort of access at 100/20 Mbps in the next couple years.

Le Sueur is located ninety miles southwest of Saint Paul, and had fewer than 29,000 residents and 11,000 households in 2019. There are 11 whole or partial cities in the county, of which Le Center and Montgomery are the largest at around 2,500 people each. The remaining communities sit between 200 and 1,000 residents. More than a thousand farms dot the landscape, and agriculture, along with some tourism and resort development centered on the lake communities, comprises the bulk of the county's economic picture.

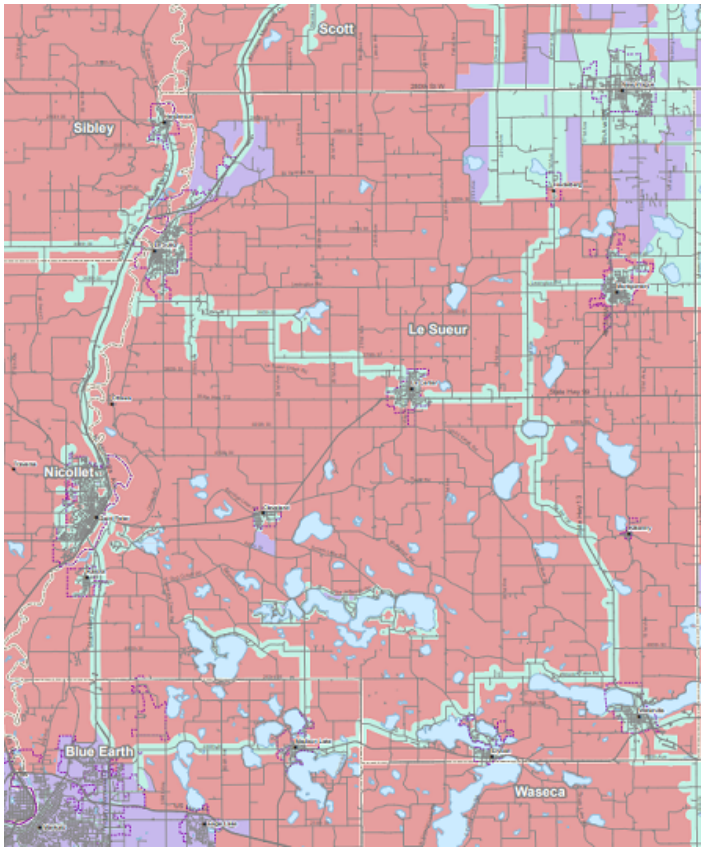
Broadband infrastructure outside of the population centers in Le Sueur was poor for many years, which was a problem for residents, businesses, and farmers looking to remain competitive and modernize operations. As **local officials put it**, "the lack of this service means students have trouble completing schoolwork and seeking future opportunity, small businesses have trouble connecting with customers and vendors, farmers have less efficient operations, home sales and development lags, and options for telemedicine are closed."

Until the middle of the last decade, residents were largely on their own to find solutions. Starting about five years ago, however, things began to change. One Le Sueur resident, who had paid individually to bring better Internet access to her home so she could run her small business, took the initiative to bring up the issue to the county board. Shortly thereafter, a diverse and energetic group came together to form the local broadband task force, including community residents, the IT Director for a collection of the town school districts, IT Manager for Le Sueur County Jeff Niesen, local business leaders, the county board, and the county administrator. All agreed that there was a case for better broadband for homes as to drive economic development. The result of their work over the last three years has been four complementary projects resulting in much greater connectivity options for all. Among these are a fiber buildout that they hope will serve as the basis for a model to bring wireline broadband to everyone in the county. It also includes three projects, supported by almost a third of Le Sueur County's CARES Act funds, undertaken in 2020. This includes a fiber-to-the-home project via a partnership with MetroNet, a large fixed wireless network, and temporary public Wi-Fi canopies and student hotspot initiatives to further provide options to residents, travelers, and students during the pandemic.

Working Together

Work to improve local connectivity began in 2017, when the county helped secure $50,000 from the Blandin Foundation to do a feasibility study and look for solutions. At the same time, in 2018 the county put out a broadband survey to get a handle on where service was and wasn't, illustrated in the map above where red areas of the county are unserved, purple areas underserved with connections between 25/3 Mbps and 100/20 Mbps, and green areas served by wireline broadband of at least 100/20 Mbps. By 2019 these preliminary endeavors were done, but the county (realizing that tackling the entirety of the $14 million project consisting of 800 miles of fiber in one attempt was unrealistic) approached broadband challenges in a targeted and incremental fashion instead.

Broadband Access and Speed in Le Sueur County, 2018



Red areas of the county are unserved, lacking any 25/3 Mbps connection. Purple areas are underserved, with connections available at between 25/3 Mbps and 100/20 Mbps. Green areas are served by wireline broadband of at least 100/20 Mbps, meeting the state's 2026 goals. Compare the two maps to see the progress made in the county from 2018-2020.

The first move was to use the feasibility study as the basis for issuing an RFP to partner with local ISPs to apply for a Border-to-Border Broadband grant operated under the Minnesota **Department of Employment and Economic Development (DEED)** program, which in 2019 led to a successful partnership with a local telephone company for a project covering 225-250 homes using 100 miles of fiber in Derrynane (pop. 525) and Lanesburg (pop. 2,100) townships on the northern end of the county, along with a handful of homes in nearby Montgomery and Lexington townships.

This represented an area of particularly high densities of unserved homes and businesses and is slated to be complete in the fall of 2021 (though in-home work was slowed by public health regulations). Residents gained access to broadband far in excess of what they did before: 1000/500 Mbps connections for $110/month, and 300/150 Mbps, 90/45 Mbps, and 50/25 Mbps cost $70, $60, and $50/month respectively.

Half of the funds come from the state and the rest were matched locally. In this case, the remaining half of funds were being borne equally by small ISP BevComm and Le Sueur County. In order to spread the cost equitably, the county spread half of its share of the costs across the entire tax base in Derrynane and Lanesburg, with the rest of its share paid by the local residents getting fiber installed to their homes, spread over a 10-year period.

The partnership with BevComm worked well for both parties, and both are looking to pursue expansions with state funds should they become available down the road, starting with townships to the west and the south (toward Kasota and Saint Peter) and, local officials are hopeful, the entire county over the next eight to 10 years so that ultimately every house has fiber connectivity available. Whether it happens through BevComm or another provider remains to be seen, but the county has a commitment to finding an entity to work with.

Confronting the Covid-19 Pandemic

Le Sueur had no more warning than did any other community in forecasting the pandemic, but the local broadband task force kicked into high gear when it began. Three projects were completed to bring better connectivity to the region.

The first of these was a partnership with ISP MetroNet using CARES Act funds for a fiber network expansion which has connected about 420 homes (including 59 unserved previously) using 49 miles of fiber in Waterville, Kilkenny, Montgomery, Cordova, Sharon, Lexington, and Kasota. This project is ongoing, will be online by the end of 2021, and **accounted for roughly half the funds expended**. In addition, this installed infrastructure will supplement existing networks between schools and for local law enforcement sites.

The second project is a partnership with NetWave Broadband to add wireless hardware to seven towers throughout the county in Cleveland, Cordova Township, Kasota Township, Le Center, Montgomery, Tyrone Township, and Waterbill, with a rough range of seven to 10 miles each to bring service providing up to 100 Megabits per second (Mbps) download speeds to the remaining 80 percent of the unconnected. These seven locations include two water towers and a sheriff's communications tower.

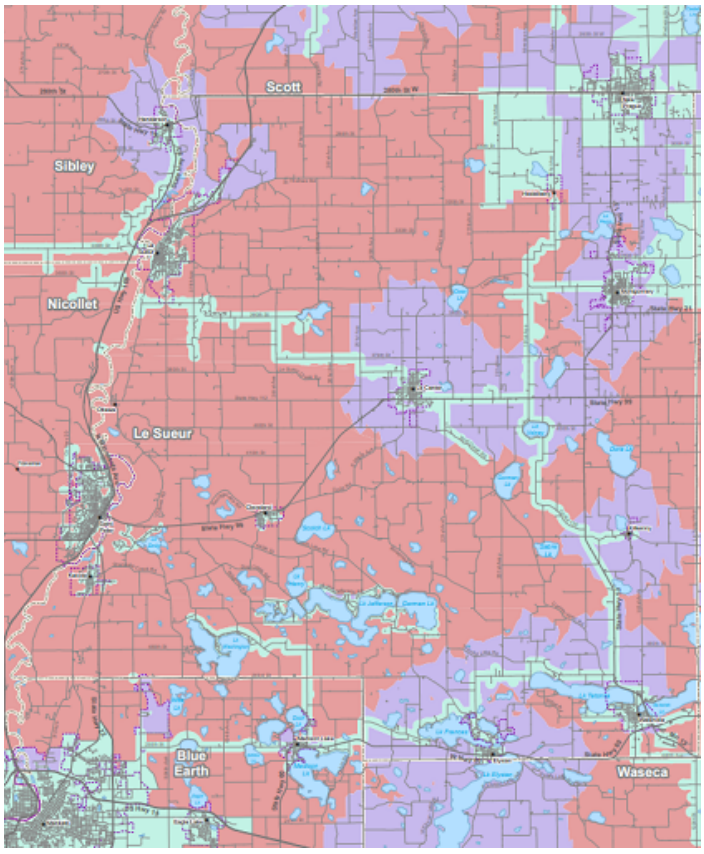
The CARES money paid for new fiber to towers and for expanded capacity at some that already had it. NetWave reduced the install cost for subscribers in the unserved locations to $100 for installation (half of what it normally is). The ISP set county residents' monthly cost at $49 (or $59 with a router) for speeds of 30-140 Megabits per second (Mbps). Judging from initial feedback to the county, speeds on the network average download of 70 Megabits per second (Mbps) for residents. The county would still like to bring fiber to each door, but this solution will help in the interim.

Third and finally, the county has installed free public Wi-Fi access to seven areas around the county, including boat landings, community parks, and campgrounds. These Wi-Fi canopies were pre-paid by the county using CARES Act funds with service contracts of one to two years. The county will later decide whether to continue the program with additional appropriations. School district leadership also used CARES Act funds to deploy hotspots for students over the last year.

In total, these projects accounted for $1 million of the $3.4 million CARES Act dollars Le Sueur County received, representing a substantial commitment to digital inclusion, economic development, and distance learning in the midst of the pandemic.

Much Done, Much Left to Do

Broadband Access and Speed in Le Sueur County, 2020



Red areas of the county are unserved, lacking any 25/3 Mbps connection. Purple areas are underserved, with connections available at between 25/3 Mbps and 100/20 Mbps. Green areas are served by wireline broadband of at least 100/20 Mbps, meeting the state's 2026 goals. Compare the two maps to see the progress made in the county from 2018-2020.

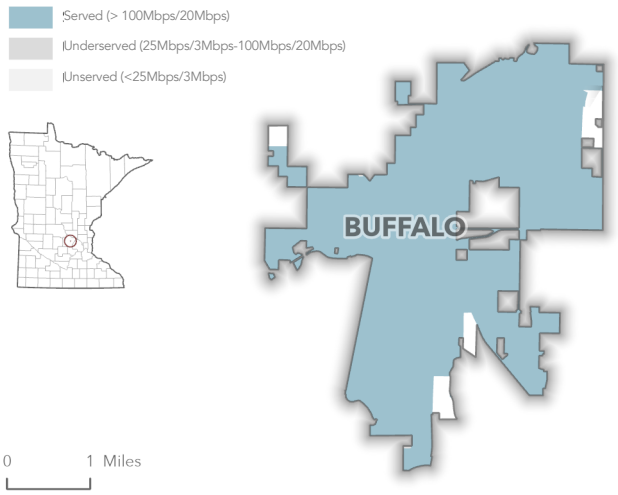
Gains are evident from this map, where red areas (unserved) turned purple and purple areas (underserved at <100/20 Mbps) turned green. Le Sueur is a **Blandin Broadband Community for 2020-2021**, and the county attributes its success over the last three years to the energy brought by local residents and county officials. A substantial part of its success has been in finding and forging relationships with local and regional ISPs to the benefit of both residents and those companies.

Because of the foundational work it did, Le Sueur County was well-positioned to move the needle when the Covid-19 pandemic hit. It **provided resources to help citizens determine their options**, offered mapping information and tools for evaluating the list of providers offering service in the area. One of the most important lessons from Le Sueur is that organizing, planning, and coordinating proactively with potential partner ISPs is important even if the community does not know how it will finance a network. If funds become available, a well-organized community will be at the front of the line and ready to act.

The county was hopeful for the future, with new DEED applications submitted in September 2020 for parts of Montgomery, Lexington, Kilkenny, Cordova, Ottawa, Sharon, and Kasota townships in partnership with two providers.

Its effort and the outcome shed light on the challenge in making sure that communities that work hard to put together competitive applications to solve well-defined connectivity challenges via state funding programs are not thwarted by federal funding. For instance, Minnesotans in at least two instances (but probably many more) have and will continue to miss out on Border-to-Border grant opportunities because of Governor Walz's decision to kill any application that overlaps with a project that could receive funds from the FCC's Rural Digital Opportunity Fund (RDOF). The county should have had four small awards from the Border-to-Border program, but only received two. In this case, LTD Communications may be awarded $1.3 billion in RDOF funding to bring fiber service to 500,000 locations across the country, including some in Le Sueur. **Experts have expressed significant doubt** that the small company can both find the financing to undertake such a massive expansion and successfully build connections for the subsidies available, but for those Minnesota communities it's academic at this point: Governor Walz's office has excluded such areas from state grants, a decision that could slow investment in relevant areas for most of the next decade, which is approximately how long LTD has to build if the FCC completes its award.

CITY OF BUFFALO



- **Buffalo built a fiber and wireless network that was used to offer affordable access to residents and high-speed services to businesses.**
- **In recent years, the wireless network has been retired but the fiber network is slowly expanding to serve more residents.**
- **The city is expanding fiber access slowly, but gets regular requests from residents to get them hooked up.**

Buffalo describes itself as a city "where the old meets the new." Buffalo was a resort town in the mid-19th century for affluent citydwellers, and its population would more than double in the summer months with tourists. Today, the community of 16,000 located 40 miles northwest of the Twin Cities Metro is a bedroom community well known for fishing and the many antique, boutique, and specialty shops in its quaint downtown area. Buffalo is the county seat and operates a utility that provides electricity, water and wastewater services, solid waste services and recycling, and both wired and wireless telecommunications. Lumen (previously CenturyLink) and Charter Spectrum Communications offer voice, cable TV and Internet access, but historically have not prioritized the town for investment. Prior to the city's telecommunications venture, Qwest (now Lumen) dial-up was the only type of data service in Buffalo.[48]

Businesses, Health Care, Public Facilities Approach the City

In 1996, local businesses approached the city and requested it take steps to improve Buffalo's connectivity. Dial-up did not allow them to conduct routine business. Some commercial transactions with wholesalers or national headquarters were transitioning to being only online.

In the mid-1990s, the downtown banks similarly approached local officials. In addition to better access to the Internet, financial institutions needed fast, secure connections between branches and headquarters. They reasoned that Buffalo was good at providing electric service and that the community would benefit from a municipal network. The financial industry knew it could trust Buffalo's utilities to provide these essential services.

Local healthcare facilities also became engaged for similar reasons, and Wright County saw an opportunity to improve communications between facilities, notably a jail and public safety offices on the edges of town.

Challenges of an Early Adopter

City leaders first went to Charter Spectrum and Qwest to request better data services for the community. Both companies replied that they were only interested in investing in high-density areas in the metro. Qwest and Charter told the city that "someday" they may be able to bring broadband to the community, but not in the near future. "Someday" was not sufficient for Buffalo. City Administrator Merton Auger and his colleagues considered broadband a necessary economic development tool. In 1996, a group of city and county leaders, local businesses, and educational professionals formed a technology task force.[49]

The utility wanted to take advantage of fiber and wireless infrastructure to establish a supervisory control and data acquisition (SCADA) system. SCADA capabilities would reduce truck rolls during electric outages, making the utility more efficient and keeping electricity rates low.

Buffalo had considerable assets that facilitated the development of a fiber network: an impressive feat at a time when the Internet had not yet transitioned from nicety to necessity. Through its electric utility, it had easy access to its rights-of-way via power poles. Buffalo was in the midst of several street projects so it could take advantage of the excavation to install conduit and fiber underground.

Community leaders wanted to focus on data services only, rather than offering the full triple play of telephone, cable television, and Internet access to the community. The city and the task force decided they wanted to offer carrier-class

services. Auger and the city aimed for a network that was highly reliable, redundant, and running "to the ten 9s; in other words up and running 99.99999999% of the time."[50] Though this is an impossibly high standard (industry typically aims for "five nines" or 99.999% or less than 6 minutes per year of outages), it shows the thinking of a utility that prioritizes reliability and quality of service far above profitability.

Deploying the Network

In 1996, the city established a plan to invest approximately $1 million to deploy a small amount of fiber.[51] The school district, which had a history of investing in technology, contributed approximately $100,000 to get the project started. Northwestern National Bank purchased a $1 million tax-exempt bond, and the two arranged a five-year municipal lease purchase with the city. Buffalo paid back the lease purchase agreement with revenues derived from the system. At the end of the term, Buffalo bought the system for $1.

The first design was a star topology, lacking redundancy, with the city offices at the center. Buffalo created a new communications and Internet division within the utility and planned a three-phase deployment. Planners intended to connect seven city buildings and utility sites, school district facilities, the county courthouse, the library, and three downtown banks. They planned to next expand deployment north from downtown to Highway 55 to offer connections to more banks, the local hospital, and the middle school. By the fall of 1997, district facilities used the network for data and telephone connections. Buffalo's educators found new ways to use technology in teaching. In July 1998, several teachers won an award for their WebFolios project.[52]

In 1998, Buffalo began to supply data services to Wright County facilities. The latter established a new Human Services building in abandoned retail space where offices needed access to broadband. The existing Wright County Government Center and the Public Works Building north of Buffalo were under renovation, so the county and Buffalo also collaborated to install fiber between those critical facilities. The two entities negotiated a lease wherein Wright County would pay $135 for each line for three years. According to Bill Swing, the County Information Services Director at the time, without Buffalo's network, the county would have had to install its own fiber optic cables.[53]

In 1999, the City Council put up the fiber network for sale in what Auger described as "a moment of cold feet."[54] It received low offers from Bresnan Cable Company and a local telephone company.[55] After weighing the pros and cons, the City Council decided to keep the network and develop it for the community.

In 2000, Buffalo began an incremental expansion of the fiber network. Over the next several years, the star design was slowly replaced with a redundant ring. The expansion allowed service to later be installed in county buildings on the edge of the city. Buffalo has continued to expand its fiber network incrementally. "We always put money back into the system," said City Administrator Merton Auger in 2010.[56]

Buffalo enthusiastically embraced new ideas for technology to make municipal operations more efficient for the growing community. The electric utility was upgrading, including building a new substation with new switching equipment. Police officers used mobile computer terminals in squad cars. Employees at the water plant used laptops to monitor and control pumps, valves, and holding tanks. City staff used GIS and GPS to map out water and sewer infrastructure to replace its antiquated paper maps. The city's rapid growth is what necessitated new approaches. Auger told a reporter in 2001: "We are dealing with growth by using technology to become more efficient without having to add more staff . . . We are getting quicker. We are getting to the point where we will know more about a problem before we even start to fix it."[57]

As more residents and businesses used the Internet, Qwest's dial-up service repeatedly struggled under the strain. In 2000, businesses and residents that used Qwest approached the City Council. Telephone calls were blocked, and callers often received "all circuits are busy" messages. The problem was so widespread that the City Council sent a letter of complaint to Qwest. The company responded with a letter in January 2001 attributing the problem to rapid growth in Buffalo and the increasing popularity of the Internet.[58] Residents and small businesses were increasingly dissatisfied with their limited options in Buffalo.

Expanding Access With An Affordable Wireless Complement

In response, Buffalo explored a fiber-to-the-home approach but found network deployment costs prohibitive. Auger and his colleagues decided to explore the wireless option for widespread residential service. The city released a Request for Proposals to reach potential partners.[59] Buffalo decided on a Waverider 900 Mhz point-to-multipoint system using non-line of sight wireless technology. This means the utility would put up antennas and subscribers would also need an antenna, but the system would still work even if trees or buildings were between transmission and receiver hardware. Buffalo also installed wireless antennas on community water

towers because they were already connected to the network for utility purposes.[60] The initial investment in the wireless system was $750,000.

The system was ready for residents and local businesses by November 2001. Customers within 1.3 miles of an antenna relied on an indoor antenna in their homes. Beyond that distance, homes usually required external antennas. Speeds were up to 1.6 Mbps; modems cost $550, or subscribers could arrange to pay $10 per month on a rent-to-own basis. The service cost $29.99 per month for residents; businesses paid $49.99 per month with a similar modem arrangement.[61]

The city continued to invest incrementally in fiber whenever roads were opened. By 2004, Buffalo also began offering dark fiber service to local businesses. Dark fiber service cost $149 per month and lit fiber services were $500 per month. The growing network connected approximately 35 commercial customers with fiber; 640 residential and business users subscribed to wireless service. Buffalo upgraded its wireless system in 2008 and named it Bison QuantumCONNECT. This was the fourth upgrade in order to serve more people with faster wireless speeds.

In 2010, residential rates were $14.99 per month for download speeds up to 512 kilobits per second (Kbps). In 2014, the network also offered download speeds at 5 Mbps for $39.99 per month, 3 Mbps for $29.99 per month, and 1 Mbps for $19.99 per month. Over 200 residential and small business subscribers used the wireless service at that point.

The same year the city launched the Buffalo Wireless Internet Group (BWIG), the support center for customers. The BWIG is the antithesis of traditional large scale ISPs that focus primarily on extracting revenue from communities and offer poor customer service. Customers could call or visit the administrative offices for help configuring equipment, setting up antennas, establishing email accounts, etc. Technicians could also come to a subscriber's home to perform installation or help orient antennas correctly for a nominal charge. The cost to launch the service was approximately $10,000; BWIG realized a return on the total investment within a year.

Economic Development With Fiber

In 2009, a Qwest line was cut, darkening every business subscriber in Wright County that relied on Qwest for service. After that incident, more business customers turned to the city to access its redundant network. Two independent providers bring their fiber networks into Buffalo; the city works with both. Automatic switching equipment at the head end ensures that if one line goes down, the other will automatically take over. In 2014, approximately 60 local businesses connected via dark or lit fiber and many were retail and manufacturing facilities.

PenRad, a software producer that makes products related to mammography, came to Buffalo from a Twin Cities suburb in 2012 because it needed the fiber network.[62] PenRad required greater capacity and especially reliability; because Buffalo could meet its needs, the company brought approximately 60 well-paying jobs to town.

The Centra Sota Cooperative, a customer-owned company that provides goods and services to the agricultural market and urban consumers, moved to a fiber-ready location in Buffalo around 2014. The site is a former car dealership: an ideal location for the cooperative's large farm to implement inventory, fertilizer, and gas for farmers. Centra Sota orders products from suppliers that only offer online catalogues. Slow dial-up made browsing and ordering tedious and almost impossible at their previous location.

In 2014, dark fiber services for businesses cost $175 per connection, a modest increase over the previous ten years. Banks, healthcare clinics, the hospital, and the county courthouse took advantage of the dark fiber. The city also had a 10-year contract with the State of Minnesota to provide connectivity to Wright County facilities through dark fiber connections.

Buffalo connects its facilities to the network for voice and data services. Each facility was paying $258 per month to the utility in 2014. The city also used the network for a camera system to monitor security at the airport, the electric substation, throughout its park system, and at several traffic intersections.

By 2014, the school district was managing its own network with minor assistance from the utility. As part of the original investment, Buffalo provided an IRU to the district for one strand of the original fiber. The district only had to pay $129 per facility. In addition to a dark fiber connection between facilities, Buffalo provided an Internet connection, continuous monitoring, and maintenance.

The city keeps expansion costs low with a dig-once policy; whenever public works excavate streets, it also installs conduit. As of 2014, the network had expanded to over 29 miles, with over 80 percent underground.

Since the beginning, Buffalo has reinvested revenues from fiber and wireless data related services back into the network. By 2013, revenues exceeded expenses by approximately $90,000 per year.[63] Auger estimated the city had invested approximately $3 million in the fiber system in total by 2014.

Today, the wireless network (**BWIG**) is no longer being used for residents of the city, having been transitioned to internal municipal use after a lack of hardware support from the manufacturer and a combination of other factors made the network untenable. It was discontinued around 2019.

Regrouping to Serve Business

Buffalo did not give up on bringing quality broadband service to those who wanted and needed it. A renewed effort began in 2019 after the utility department fielded repeated questions coming from local businesses fed up with poor service from the cable monopoly.

In response, local officials decided to revisit once again whether they should embark on the citywide fiber-to-the-home network. A feasibility study from Finley Engineering in 2019 indicated that it would cost around $13 million for a ubiquitous build. It was too much to take on at once, Utilities Director Joe Steffel told us. Furthermore, despite widespread discontent with the cable broadband provider, there was no focused citizens group or mandate from the City Council to take on such a large project.

Shifting gears, the utility department decided to opt for a slow expansion in targeted areas centered on places where there are a lot of businesses and, at the same time, bring fiber to homes in those areas. It did not take long for that work to attract attention from the existing providers. Within weeks of city of Buffalo crews canvassing neighborhoods for service, Charter Spectrum representatives showed up too, with low prices attached to long-term contracts. Nonetheless, as an entity focused on what is best for everyone rather than just a narrow sense of municipal utility objectives, the city has been inviting Charter Spectrum to lay infrastructure when it opens up new trenches.

The biggest obstacles to a citywide FTTH build in Buffalo are from the high capital costs identified in the first engineering study and the strong opposition from Charter Spectrum. As a result, local leadership has decided that a firm but slow expansion provides the best path to long-term success. Without (so far, at least) vocal, organized, energized support from residents and a large pot of funds, the city has to focus on areas where it can get a high enough rate of return to operate the network and drive additional expansion, and so it has been looking for areas that will yield take rates between 30 and 40 percent. That expansion is being funded out of reserves from the electric utility, but also supplemented by strong subscriptions from local businesses on its Active Ethernet infrastructure. Though many outside of town want to be connected to municipal fiber, local officials are staying within city limits.

Quantum Fiber is Live

It may be growing slowly, but Buffalo has been making progress where it can. Rights of way continue to be tight in Buffalo, so the new network—QuantumFiber—has been laying as much fiber as it can, installing 192 strands in places and 218 where able. To date, the network has been deployed in all or parts of six areas clustered in two places: on the east side of Lake Buffalo, and on the east side of Lake Pulaski. It has not been charging installation fees.

The city has about 70 businesses connected to its Active Ethernet fiber infrastructure, and the prices for both business and residential services are outlined in Tables 1 and 2.

Table 1.

Buffalo Quantum Residential Speed Tiers	Buffalo Quantum Residential Price Per Month
30 Mbps	$30
200 Mbps	$60
400 Mbps	$75
1 Gbps	$105

Table 2.

Buffalo Quantum Business Speed Tiers	Buffalo Quantum Business Price Per Month
100 Mbps	$120
200 Mbps	$140
400 Mbps	$160
1 Gbps	$180

QuantumFiber's Gigabit Passive Optical Network (GPON) for residents currently has 26 subscribers out of about 100 total passings. **Homes can opt for** symmetrical 30 Mbps, 200 Mbps, 400 Mbps, and 1 Gbps tiers for $30/month, $60/month, $75/month, or $105/month, with managed Wi-Fi options and additional mesh routers available for between $7 and 15/month. Cursory investigation shows that some of the homes in this area appear to be getting offered remarkable deals from Charter Spectrum as a competitive response, and getting connections at prices that may not be available in the monopoly's non-competitive areas.

Policy questions for large-scale future deployment remain for the city of Buffalo, but the utility plans on continuing to slowly expand in areas that are likely to generate enough revenue to recover the network build costs. The community desire is there; the utility department regularly gets calls from dissatisfied residents and businesses, especially during the middle of summer when the cable company's speeds seem to deteriorate, perhaps due to some equipment struggling in the heat. Meanwhile, Charter Spectrum has moved its customer service office out of town.

Buffalo completed another rate study in 2020 with the help of CCG Consulting, and put a communications head end on the south side of town that can handle 500 homes. While it has no dollar amount committed for the next phase of its life, it plans to do residential surveys in the future to help it expand to interested areas more quickly. For more than one hundred years the utility department has been bringing residents affordable, reliable electricity, and the infrastructure is in place for it to do the same with broadband in the future.

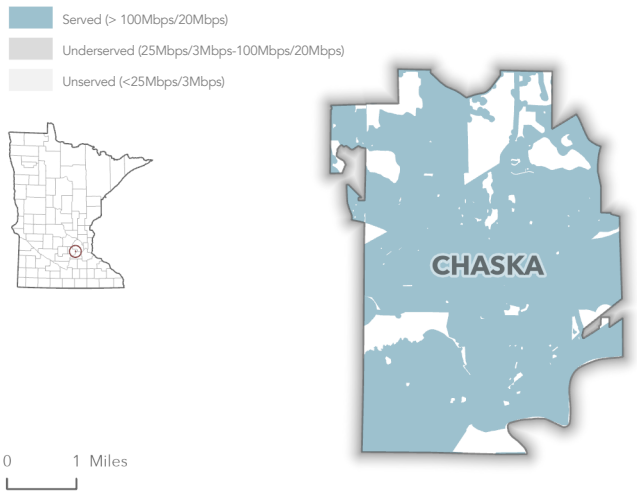
"Just like with electric [more than a hundred years ago]," Joe Steffel told us in an interview, "our presence controls prices. Every day I'm more convinced we should be in this."

"This is the next utility," he remembered saying at a meeting with staff in the utility department. "It's going to be so intertwined and integrated into everything we do, we can either develop it for ourselves or we can pay somebody else for it. We have to decide."

Conclusion

Buffalo began its network with a limited investment but has compounded the benefits by reinvesting network revenues and taking advantage of other capital projects to expand conduit and fiber. The results are impressive, from attracting new employers to town to improving government efficiency. The schools have the capacity they need and can upgrade without breaking their budgets. By making smart investments and retaining control of essential infrastructure, Buffalo can chart its own course in the new economy.

CITY OF CHASKA



- **After waiting for the existing cable and telephone companies to improve services, Chaska worked with the schools to build their own network and ensure high-quality service at reasonable and predictable prices.**
- **The city developed a wireless network that offered affordable Internet access and benefits for internal applications like utility monitoring.**
- **The city retired the wireless network when it could not longer offer competitive speeds but has not expanded its fiber to residents.**

Chaska (pop. 26,000), located approximately thirty minutes southwest of Minneapolis, has experienced steady population growth since the 1950s. The city provides water and wastewater services in addition to electricity; the Chaska Municipal Electric System has served the community since 1914.

Growing Pains in the Schools

In the 1990's, Chaska schools found incumbent providers unable or unwilling to invest in higher capacity school connections than the T1 lines that provided 1.5 Mbps. In 1998, community leaders decided they could wait no longer and took action.

"We were tired of waiting for [cable companies] to provide bandwidth at competitive prices," said City Administrator Matt Podhradsky.[64]

In 1999, KMC Telecom (later CenturyLink and now Lumen) was installing a fiber optic network along major city corridors. In exchange for free access to the rights-of-way, KMC installed municipal fiber to connect city facilities.

By combining opportunities to deploy fiber in some areas with wireless complements, the city of Chaska and the school district partnered to improve access. With a $100,000 Urban Challenge grant from the 3Com Corporation, the city launched a point-to-multipoint wireless wide-area network to complement the leased T1s as an initial investment in a wireless network.[65]

In 2000, the city and the school district expanded the fiber optic network to connect all the existing schools and public facilities. The district agreed to pay construction costs and ongoing maintenance costs, with the city owning the lines.[66] The city would also retain a number of strands for its own use. The goal was to interconnect the school facilities and to provide connections for existing public facilities in Chaska.[67]

The network connected city hall, a community center, the government center, and its municipal facilities. The city created **Chaska.net**, an independent telecommunications utility, to serve as the ISP for the district.[68] At the time, the latter paid $3,000 per month for connectivity through the fiber network.[69]

In 2001, **Chaska.net** expanded to begin offering high-speed Internet services to local businesses via the city-owned fiber installed by KMC. By the end of the year, **Chaska.net** had connected seven businesses, demonstrating demand for better commercial telecom options. **Chaska.net** decided to meet the demand with a line-of-sight point-to-multipoint wireless service.

Chaska.net placed antennas at the city hall, the community center, and city water towers to provide service to local businesses; monthly rates ranged from $99 to $450 per month. In an effort to bring connectivity to the surrounding towns, **Chaska.net** installed additional antennas in Victoria, Waconia, Norwood Young America, and Shakopee. By April of 2004, 71 businesses subscribed to the wireless service, creating $16,400 per month in revenue.

At a cost of $621,000, the city felt it was time to experiment with low-cost, self-service Internet access for the entire community.[70] **Chaska.net** mounted 378 routers on city light poles in order to deploy residential Wi-Fi.

Chaska financed the Wi-Fi network with general obligation equipment certificates, which were ultimately backed by taxpayers. Chaska's certificates were for a four-year term at 4 percent interest. **Chaska.net** predicted that it would pay off the certificates through subscriber revenues and still have revenue for investment.

Unfortunately, the initial launch was not very successful, in part because they overestimated customer expertise. **Chaska.net** was overwhelmed by customer calls from new subscribers who did not know how to use their computers. The goal was to offer a self-service, low-cost option for the community, but the community needed more hand-holding.

City Administrator Matt Podhrasky said: "The service desk calls overwhelmed us . . . there was a lot of 'We don't know how to use our computer.'" Customer service issues coupled with technical glitches were slowly ironed out and spurred the wireless service to improve over the next several years.

Education Benefits

Prior to developing a fiber network with the city, the school district leased six 1.5 Mbps T1 lines at a cost of $280 each; there was no wide area network (WAN). In other words, it paid $1,120 per Mbps per month for six connections and all internal data went out to the Internet before reaching its destination at a building across town.

After developing the fiber network with the city and engaging **Chaska.net** as its ISP, the district connected its facilities. Since 1999, the district has expanded and managed the network incrementally on its own. In 2013, **Chaska.net** provided 300 Mbps Internet access for $4,500 per month to a total of sixteen facilities, lowering the cost to $15 per Mbps for Internet access.

In addition to Internet speeds 200 times faster, the schools benefited from the addition of a fiber Wide Area Network at speeds of 4 – 40 Gbps. This means transferring files between schools can happen far faster than downloading or uploading Internet content. Students and staff expanded their use of distance learning and cloud based applications. The WAN improved staff efficiency too, sharing large files and participating in video conferences (a time-consuming struggle over the old T1 lines) became routine operations.

The district used capital improvement bonds to finance additions to its initial network deployment. As the student body grew, it includedthe cost of the fiber optic infrastructure in construction costs for new facilities. Over time, it has continued to exchange fiber strands for access to the city's ROW, growing the network to 18 miles.

When Carver County officially lit the CarverLink project, discussed above, the school district was among the first entities to use it – both to increase redundancy for some facilities and prepare for future expansion. In general, Chaska had already developed the expertise and assets to take full advantage of investments like CarverLink.

Chaska.net's Wi-Fi network has been the subject of multiple case studies, celebrated as one of the first municipal Wi-Fi networks to provide affordable service to the entire community. While the service has benefitted a large segment of the population, it would not have existed if the city had not first invested in fiber infrastructure for backhaul. On the flip side, **Chaska.net** has been targeted by opponents of municipal broadband investment who ignore any social or efficiency benefits of the network. They focus narrowly on its revenues and costs to claim it was an unwise investment. An interesting wrinkle is that Chaska connected new educational facilities to the network as they were built—if it had done the same with new residential developments, it could have introduced robust broadband competition through much of the community today with very little public expenditure.

Update

In December of 2014, **Chaska.net** had 1,100 users on its Wi-Fi network, but impending equipment upgrades served as the nail in its coffin. The decision to shut it down came in December 2014. City staff proposed, and the council agreed, not to charge users for the last four months of service, and began working with them to change email services over to other alternative providers.

In the meantime, local officials began looking around for someone to whom to sell the network. An early $5,000 offer for the equipment was rejected, as it was seen as an attempt to get access to the city's water towers, **City Administrator Matt Podhrasky told the Bell Plaine Herald** in December 2014.

Though its residential services were shuttered, the network's fiber infrastructure continues to bring savings, efficiency, and capability to internal government use. **Chaska.net** also remains the Internet Service Provider (ISP) for the Eastern Carver County School District, bringing faster and more affordable service for educational use. However, residents are mostly dependent on the big monopoly providers for service rather than their own utility or a local ISP.

Conclusion

The city's long-term investment in fiber continues to meet its needs and will for the foreseeable future. **Chaska.net** has expanded the fiber to a total of 26 miles throughout the city, monitored and maintained by Zayo. Chaska also uses the fiber and wireless networks for SCADA to monitor and control water, wastewater, electric, and flood control measures. The municipal electric utility is in the process of installing smart meters to use the network for automatic metering.[71]

Chaska's students began benefiting from superior connectivity years before students in peer communities. In addition to lowering the costs from $1,120 per Mbps to $15 per Mbps, the schools increased their Internet speeds 200-fold. The schools were also able to implement a WAN, greatly enhancing staff efficiency.

While some early citywide Wi-Fi projects (either via private enterprise as with USI Fiber or municipally owned as in St Louis Park) used those experiences to jumpstart broadband down the road, that does not seem to have happened in Chaska.

Chaska's future is its own to chart. With the fiber assets already in place, it could choose to become a citywide gigabit community. Or it can simply enjoy knowing that the telecom bills of its municipal facilities and anchor institutions are far lower than they otherwise would be.

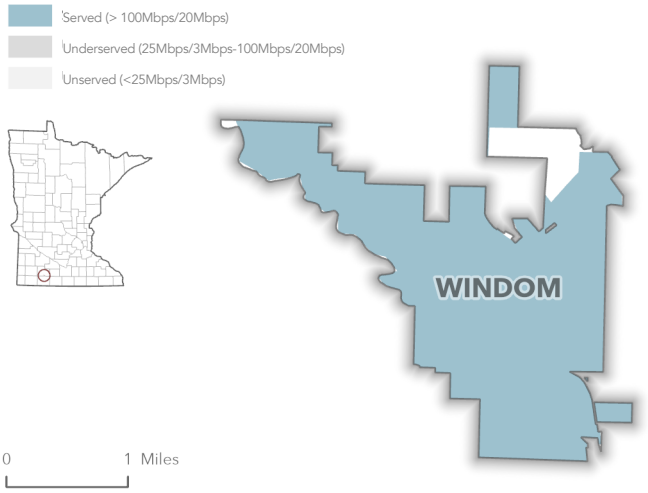
LOCAL AUTHORITY

The US National Broadband plan recognizes the importance of local authority to build networks as necessary. Recommendation 8.19 says, "Congress should make clear that Tribal, state, regional and local governments can build broadband networks."

Minnesota has barriers against municipal networks, as do 16 other states. However, Republican-dominated Arkansas and more liberal Washington state both entirely removed their laws discouraging municipal networks in 2021 after recognizing the focus of the state should be encouraging more investment, not less. Arkansas, for its part, voted unanimously to remove existing barriers. In Ohio, after an anonymous Republican Senator added an amendment to kill municipal broadband to the must-pass budget bill, no one would admit to being the author, and both the Republic Governor and Lt. Governor spoke out against such limitations. It was later stripped in conference committee.

President Biden has endorsed municipal and cooperative approaches as one of many important and viable solutions to expanding fast, affordable, and reliable Internet access to all, just like President Obama before him. President Trump and the Republican-dominated Congress during his tenure ensured that the ReConnect broadband subsidy program in the Department of Agriculture was open to community solutions. There are few credible voices today that want to limit local authority to make needed investments.

CITY OF WINDOM AND SOUTHWEST MINNESOTA BUSINESS SERVICES



- **Windom built its own fiber network after the cable and telephone companies refused to offer high-speed Internet access locally.**
- **The network has helped local businesses get the connectivity they need to thrive and been embraced by the overwhelming majority of residents.**
- **Southwest Minnesota Broadband Services built a fiber network connecting local towns and leveraged WindomNet's investment to keep their costs down in a very low-density region.**

Windom lies approximately 135 miles west of the Twin Cities Metro and is the county seat of Cottonwood County. The community of 4,500 near the Iowa border is home to several manufacturing plants and many agricultural interests.

Windom Municipal Utilities (WMU) began providing electric services to the community in 1895, a time when private electricity companies regularly claimed that electric networks were too complicated for local governments to manage. The city also provides water and wastewater services. In 1985, WMU also began offering cable television services, as a number of other municipal utilities in small towns had long done throughout Minnesota and Iowa.

By the late 1990s the community was frustrated at the lack of private investment in broadband Internet service, and considered upgrading its cable network to begin offering telephone and Internet access in addition to cable. However, Minnesota state law required Windom to pass a supermajority 65 percent referendum in order to "own or operate" a telephone exchange.[72]

After the town placed the measure on the ballot in 1999, the incumbent telephone company, US West (later Qwest, CenturyLink, Lumen), campaigned heavily against it, insisting it would upgrade facilities in Windom at some indeterminate point in the future. In an off-year election with poor turnout, only 48 percent of voters supported the measure. Local leaders labeled it dead.

However, after Qwest announced the following July that nearby communities (but not Windom) would be upgraded to DSL, an outraged local citizen wrote the paper to call for another referendum. In the ensuing conversation, residents reflected on their reasons for demanding a revote. They had been previously confused about the question. Some thought the issue would pass easily and hadn't voted. Others had initially voted no but with the latest action by Qwest had changed their mind. After several weeks of community discussion and a petition with 800 signatures, local leaders put the question on the 2000 ballot.

Two-thirds of the voters approved the measure, allowing the community to begin examining its options. Just because they had the authority did not necessarily mean the upgrade would be financially feasible.

Local leaders convened a telecom working group in 2001, tasked with educating the community on options for upgrading the cable network and feasibility of adding new services. Over two years, the group considered twelve approaches before settling on building a fiber-to-the-home network offering the "triple play" of television, Internet access, and telephone. For its part, Qwest finally began offering DSL in Windom toward the end of 2003.[73]

In 2004 Windom sold $9.5 million in revenue bonds. Of this, $650,000 created the bond reserve account and another $600,000 was earmarked for paying the first two years of capitalized interest. Another $240,000 covered financing costs, leaving approximately $8 million to build the network and pay the startup costs until revenues would support the effort. The bonds were backed by the project's future revenues, not taxpayer dollars.

Demand for WindomNet services turned out to be even higher than expected, with most of the town subscribing to at least one of the three telecommunications options. Rather than installing equipment for 1,500 premises as forecast, they installed 2,000. The entire network was built underground, which has protected the network from accidents. As of 2015, they'd never had a fiber cut, according to WindomNet General Manager Dan Olsen. Since it costs approximately $2,000 to hook up each household, the extra 500 installations demanded an extra $1 million not forecasted in the original business plan. Windom took out a $1 million line of credit from a local bank in 2005 to cover the difference.

Greater-than-expected demand came from businesses as well as residents. Fortune Trucking, an important local employer located just outside of town, decided to upgrade its IT systems in 2007 to remain competitive in a field which was rapidly integrating new technology. Potential customers would place bids online and expect a rapid response. Thus, a little downtime translated into a big "trucking" problem. Fortune first checked with the big telephone company that had thus far met its needs to see if it could upgrade the system. After being assured the telephone company would upgrade, Fortune purchased a $30,000 IT system.

The trucking company quickly found, however, that the telephone company either could not or would not provide the necessary level of service. Frustrated, Fortune began making plans to move its office to a location with better service in a different state. It also called Dan Olsen. In an interview with MPR, Olsen recalled some urgency to the call: "Dan, you need to get your butt out here now."[74]

Thirty days later, WindomNet had extended fiber over a mile outside of town, keeping 47 jobs in the community. After that, when any company tried to convince Fortune to switch away from WindomNet, they declined, saying: "It's a great relationship. When there is a problem, I call and it's taken care of. It's great to have a local company to deal with."[75]

After expending significantly more capital than expected due to higher than projected demand and the Fortune Trucking expansion, Windom sold $2.365 million in short-term general obligation bonds in 2007. Unlike the revenue bonds, these bonds came with the explicit backing of Windom's full faith and credit. The bonds repaid the line of credit from the bank and internal loans to the project from other city funds.

During the economic uncertainty of 2009, Windom chose to refinance its short-term bonds again using general obligation bonds. The $2.4 million GO bond repaid the 2007 debt. Meanwhile, Windom was working with nearby towns on a plan to apply for federal broadband stimulus funds to expand the fiber network throughout the region. That network, the Southwest Minnesota Broadband Service, began connecting households in 2012 and is discussed below.

Key Trade-offs

Windom's business plan did not call for breaking even financially until 2011, a challenge they came close to meeting. But rather than be a slave to financial mileposts, WindomNet struck a balance by continuing to invest in new capacity.

The largest local employer, a Toro manufacturing plant, upgraded from 100 Mbps service to 1 Gbps in 2010, giving it faster connectivity in Windom than company locations in the Twin Cities.[76] Despite the continuing impact of the recession, Toro added 75 jobs to that plant in 2010.

In the same year, the local hospital became an anchor-tenant on WindomNet after its long contract with the telephone company expired. Expanding connections to the hospital was costly, but it allowed the hospital to spend less on its 315 phone lines. With the higher capacity connections, the hospital began taking greater advantage of video conferencing and remote reading of diagnostic imaging.

Building fiber paths to Fortune Trucking and the hospital delayed the point at which WindomNet could break even. These are the kinds of trade-offs a community owned network often makes—improving connectivity for indirect community benefits rather than maximizing short-term profits. In this case, the result for Windom has been more jobs, a stronger economy, and more efficient health care.

WindomNet offers higher speeds at lower rates than CenturyLink (now Lumen). In Windom, as in many peer communities, CenturyLink's DSL in 2014 peaked at advertised rates of just 7 or 12 Mbps downstream and less than 1 Mbps upstream. However, many people reported that their speeds were considerably below advertised rates. CenturyLink's connections were priced from $47 to $52 before the fine print fees are factored in. By 2021, some local address checks suggested CenturyLink was offering 1.5 and 6 Mbps DSL connections, both priced at $49/month before additional fees.

By comparison, a 10/2 Mbps (down/up) connection from WindomNet in 2014 ran $38 and 30/20 Mbps was $68. They also offered a 60/40 Mbps connection as well as a full gigabit connection for those who needed it, whether a manufacturing plant or single entrepreneur.

By 2021, WindomNet had increased its speeds and prices, as shown in Tables 3 and 4.

Table 3.

Residential Symmetrical Internet Speeds (WindomNet)	Residential Prices (WindomNet)
12 Mbps	$52
20 Mbps	$67
30 Mbps	$77
60 Mbps	$87

"By 2021, WindomNet had increased its speeds and prices, as shown in Tables 3 and 4. The slowest two tiers of service are data packages only, while the top two include voice services."

Table 4.

Business Symmetrical Internet Speeds (WindomNet)	Business Prices (WindomNet)
20/20 Mbps	$70
70/70 Mbps	$100
125/125 Mbps	$175
250/250 Mbps	$250
1000/1000 Mbps/1Gbps	$300

Subscribers can add video packages for between $28/month and $88/month on top, with the top two tiers including voice service. Installation fees for new customers are $40. Symmetrical data packages for business users range from 20 Mbps to 1 Gbps for between $70 and $300/month.

WindomNet has continued to quietly offer gigabit service to residents that want it over the last few years, as well as gigabit and ten-gigabit service to businesses, but it is being cautious about managing existing resources. The network currently has two ten-gigabit lines running out of town, and traffic often settles between five and six gigabits at peak.

The network's price increases likely demonstrate the challenge of operating a system with so few potential customers and the benefits of ensuring that networks can operate at a larger scale, sharing fixed costs across many more customers.

Small Town Challenges

Given the challenges of its small size and remote location, Windom has been extraordinarily successful. Conventional network economics suggest that a triple-play network needs at least 4,000 subscribers to pay the substantial fixed and operating costs. But given its size, Windom has just over 2,000 potential subscribers between households and businesses. The small base left Windom with little margin for error, even given the fact that most residents took service from the network. Communities considering a triple-play municipal network are well-advised to partner with nearby towns and/or townships rather than attempting to recreate Windom's approach.

Compounding the challenge of its scale was its distance from an affordable Internet connection. Windom needed a high-capacity connection to the wider Internet to take full advantage of its fiber system. Rural areas often find the only connections out of town are maintained by the incumbent telephone and cable companies that use their monopoly power to price the circuits high. Until the 2009 broadband stimulus projects broke many of these backhaul monopolies in rural America, small towns with fiber networks had to offer far slower Internet connections than their fiber network could handle due to the backhaul bottleneck. Consolidation of middle mile networks could once again threaten smaller ISPs in many areas.

Windom solved its backhaul limitation by partnering with other ISPs and getting a fiber route all the way into Minneapolis. The network has a co-location facility in its network operations center that allows other ISPs to take advantage of its fast connections as well.

Another challenge Windom faced was the growing competition for video services from satellite television companies. Windom's total number of cable subscribers began decreasing in 2003 and never fully recovered in town, making it harder for WindomNet to meet its business plan goals. However, Windom began offering its services in neighboring communities. Supported by a federal broadband stimulus award, eight nearby towns joined together to build a fiber network managed by WindomNet.

Update

The network has mostly been expanding where new development takes place, including new apartment buildings and subdivisions around town. In general, it's seen sales of broadband services increase—especially over the last year—at the same time that video services have been on the

decline. They've expanded to homes in the region which previously only had electric service, including county roads not part of the original build. Currently, WindomNet has 1,600 broadband subscribers along 49 miles of fiber in total.

During the Covid-19 pandemic, the number of residents wanting to subscribe to broadband service increased considerably, Jeff Dahna said. They've met challenges in getting subscribers hooked up while following social distancing protocols by putting in hardware and handing Ethernet jacks through windows and then coming back to the homes when things are safer.

In the spring 2020 semester, WindomNet worked to bring 30 homes back online with the help of CARES Act money from the county so that students could learn remotely. They did the same for 35 more in the following fall semester. The city also continues to follow its upgrade path, updating electronics. 2020 saw the network refinance once more to take advantage of low interest rates.

WindomNet's service and leadership has earned it a number of awards throughout the years. **In October 2019** the Blandin Foundation recognized the network with a Courageous Leadership Award, and **in August 2020** the governor named Windom one of 23 "cities, townships, and counties across the state as...telecommute-friendly communities." Moving forward, the network will begin to roll out higher-bandwidth data packages as it is able, including gigabit service and tiers which include managed Wi-Fi for residents.

Southwest Minnesota Broadband Services-SMBS

The town of Windom was hardly alone in being left behind by the big, corporate telephone and cable companies. When the federal broadband stimulus programs were unveiled, eight nearby communities recognized an opportunity to finally bring modern telecommunications services to their areas by constructing their own fiber network that would build on WindomNet's success. They could pursue a rural fiber network without having to invest in the costly head end, voice switch, or other equipment that WindomNet already maintained.

Jackson, Lakefield, Round Lake, Bingham Lake, Brewster, Wilder, Heron Lake, and Okabena lacked access to broadband in 58 percent of the combined area, and another 34 percent only had access up to 1.5 Mbps down. Jackson and Lakefield had previously each built their own cable systems but decided not to upgrade to fiber due to the high costs relative to the small population. After being told by CenturyTel (now CenturyLink) that the community would "never" get faster than dial-up service due to their size, Round Lake built its own wireless network in 2002 to ensure broadband availability.

When commercial providers continued to ignore Brewester, Heron Lake, and Okabena, Round Lake expanded the wireless network to them as well.

The Southwest Minnesota Broadband Services (SMBS) network passes more than 3,500 residences (including 250 homes outside the towns, most of which are farms), 292 businesses, and 50 anchor institutions. Each participating town has a representative on the board of directors, and the subscribers from the pre-existing cable and wireless systems were transferred to SMBS.

The SMBS assets are owned by the eight communities via a Joint Powers Agreement. The $12.7 million stimulus award was split evenly into a grant and loan. To raise the rest of the cost of the network, five of the towns contributed an aggregate amount of just under $1 million. Jackson County, for its part, made an upfront payment of $500,000 in return for $1 million worth of services over the following 20 years.

SMBS began connecting users in early 2012, and by 2014 had well more than half of those passed taking services. As of 2020, they had 75 percent of their potential customers taking service from them.[77] They are even seeing significant demand outside of the territory they presently serve—Dan Olsen noted in 2014 they could have a full-time person just answering calls from people asking them to expand.

In addition to providing the region with Internet access far faster, more reliable, and more affordable than the big carriers would, the network has helped local governments to be more efficient. Having already implemented its own GIS system, Cottonwood County is now able to share the application with these towns and eliminate duplicated systems. Being a high-bandwidth application, local governments cannot use it unless they have high-capacity connections.

Private businesses were among the first proponents of SMBS, submitting letters of support to the federal government as part of the broadband stimulus application. The city of Jackson had been seeking a solution for better connectivity to its industrial park for some time because its paltry 1.5 Mbps service was unlikely to attract new businesses. In fact, when employees showed up to work each morning, "there [was] such a drain on bandwidth that the rest of the community's Internet users suffer."[78] It wasn't only businesses publicly lining up to support the investment: the First Baptist Church and Sanford Jackson Medical Center also endorsed the initiative.

Significant progress has been made **over the last eight years**. In addition to connecting every home and business within its eight founding communities, SMBS operates a 175-mile fiber ring which brings redundant and resilient connectivity across portions of three separate counties.

In addition, SMBS has partnered with **local wireless provider BackForty Wireless**, based out of Jackson, Minnesota, to leverage that infrastructure to bring connectivity to premises in the county—mostly farms set outside of the member towns—that are not passed by the fiber and otherwise had few options. Since originally working with WindomNet to get started, SMBS has grown enough to transition some services in-house. While it still works with the latter for voice service, it has made the investment to handle data on its own.

At the end of 2018 the network began transitioning users over from its legacy video service product to an app-based video service called Southwest Stream, with the help of a third-party provider that relies on its fiber infrastructure. Ultimately it succeeded in bringing 85 percent of those users over.

Today, SMBS has upgraded its original 1 Gbps ring with 20 Gbps of capacity, giving the network plenty of breathing room for increased use and growth down the road. Network operations and expansion are fully funded by subscriber fees.

As a result of SMBS, businesses have been able to stay in the area and, General Manager Travis Thies said, they've begun to see people who have moved away come back home in part because of the speed and affordability offered by SMBS. The network also gets regular calls from prospective homeowners and local real estate agents asking if they pass by homes and, if not, how much a new connection would cost. In 2019 the network won the Blandin Foundation's Courageous Leadership Award for the work it has done in the region.

Table 5.

SMBS Broadband Tiers

Network Speed for Residents	Price Per Month for Residents	Network Speed for Businesses	Price Per Month for Businesses
50 Mbps	$60	25 Mbps	$63
100 Mbps	$80	50 Mbps	$100
250 Mbps	$100	75 Mbps	$140
500 Mbps	$120	100 Mbps	$180
1 Gbps	$140		

Users on the network can choose between symmetrical 50 Mbps, 100 Mbps, 250 Mbps, 500 Mbps, and 1 Gbps tiers for $60, $80, $100, $120, and $140/month—see Tables 5 and 6. Managed Wi-Fi is included for every tier except the lowest, and residential subscribers can choose from a variety of bundle options that include VoIP and video as well. Business users can choose between symmetrical 25 Mbps, 50 Mbps, 75 Mbps, and 100 Mbps tiers for $63, $100, $140, and $180/month.

Success or Failure?

Throughout its first decade of operation, WindomNet has been regularly condemned in the state capital by lobbyists for large incumbent telephone and cable monopolies. Its financial losses in the startup years were offered as "proof" that it was a failure despite the fact that these kinds of networks always run losses in early years – it is built into the business plan. As WindomNet's financial numbers improved, critics claimed taxpayer dollars were supporting the network. However, the network has been overwhelmingly built with private investor dollars. More importantly, many of the big cable and telephone companies regularly receive subsidies, including tax incentives, universal service funds, and the benefits many cable companies received for decades from being a sanctioned monopoly. WindomNet likely benefited less from taxpayer subsidies than those who regularly attack it.

Our examination of Windom initially found that the network could potentially have received as much as $1.2 million from local taxpayers, as well as financial backing of lower-cost general obligation bonds for part of its history. But on closer examination, we actually found that some of taxpayer funds budgeted for the network were never used or came from net revenues from the cable service in earlier years.[79] We believe Windom has used less than $500,000 of taxpayer dollars to support the network since 2004. But as an indication of present day financial health, network expenses have been roughly in balance with revenues after depreciation in recent years.

Assuming Windom did spend some $500,000 of taxpayers' money, what are the benefits to taxpayers from that expenditure? If we ignored all the other benefits of WindomNet and solely focus on direct economic development benefits, saving 47 Fortune Trucking jobs translates into a cost-per-job saved of $10,600. This is substantially better than Minnesota's JOBZ Program to spur economic development ($27,000 - $30,000 per job).[80]

Yet WindomNet has benefited the community in many more ways than keeping Fortune Trucking in town. It connects many key employers, from Toro to the hospital, making them more efficient. And still more businesses currently lacking affordable, reliable, and fast Internet access in Cottonwood County will eventually be connected.

In addition to meeting business needs, the network supplies a 20 Gbps ring connecting both Cottonwood and Jackson counties to the state. The counties also use the network to

share IT resources and a phone system, helping to stretch taxpayer dollars.

Some of the network benefits are cultural. In 2013, with the Windom Robotics team in Anaheim for the VEX Robotics World Championship, residents could cheer their team on television after WindomNet "worked some magic" to put the live feed on a cable channel.[81]

MUNICIPAL NETWORKS & SMALL BUSINESSES

A 2014 report from the General Accounting Office (GAO) looked at economic development and publicly-funded broadband deployment, examining the impact it has on small businesses. It found these networks tend to have higher speeds and lower prices. Furthermore, the report found, municipal networks spur competition.

For example, following the construction of a fiber-to-the-home municipal network in Monticello, Minnesota, the two other broadband providers in the area made investments in their infrastructure to improve their broadband speeds. One of these providers stated that all of its networks undergo periodic upgrades to improve service, but upgrade schedules can change in order to stay competitive when there is a new service provider in a particular market.

The GAO findings dovetail with what the North Carolina League of Municipalities (NCLM) found among small business owners in North Carolina. In the NCLM report, it highlighted the experience of Aaron Carter, Director of Marketing for Rhino Shelf, a storage shelving manufacturer. Carter noted that "broadband is so important because no matter what your business is, efficiency is the bottom line. It doesn't matter if you have the greatest product in the world; if you're not manufacturing it efficiently, that's a loss. If you're not selling or marketing it efficiently, you're losing."

As of 2015, WindomNet provided IT services valued at $7,500 per year to the city at no charge. Municipal facilities and the library have access to much faster speeds than they would in WindomNet's absence, yet pay a fraction of what those connections would cost from a private provider. Assuming that difference saved only $20 per month per connection, the savings from all 37 connections would be **almost $9,000 per year.**

The WindomNet-supported SMBS expansion resulted in calls from one town to another being untolled rather than long distance. With over 2,500 households taking telephone service between Windom and SMBS, if the average household avoids just 30 minutes of tolled calling each month at $.10 per minute, the cumulative savings are **$90,000 per year.** Windom has over 1,000 subscribers to its Internet access service, which are priced about $10 per month below CenturyLink's advertised rates for the two common lower speed tiers. The savings per household are over $100 per month and in aggregate over **$100,000 per year.** SMBS also has approximately 2,000 subscribers to Internet access, some of whom would have been paying much more for satellite Internet access. This group represents yet another **aggregate savings in excess of $200,000 per year.**

Over 10 years, if taxpayers did expend $500,000, that investment has yielded millions in community savings and benefits. Those savings have rapidly increased since SMBS launched and will likely continue growing. With this full analysis, a possible $500,000 infusion into WindomNet looks a lot less like a subsidy and a lot more like a wise investment in the future of the community and the region. Given the benefits of expanding the network over more communities, the network's financial position should only improve over time.

The addition of so many additional subscribers from the SMBS expansion suggests that WindomNet will no longer need financial support from the town. Indeed, as WindomNet grows it will begin contributing back to the general fund in PiLOT (payments in lieu of taxes). Windom's municipal owned electricity utility, for example, has long paid $175,000 per year into the general fund.

In 2012, Windom refinanced all the network debt into revenue bonds with a term of 20 years. The $11,205,000 retired the previous debts and is not a general obligation of Windom, which means the investors are again assuming risk from the project, not taxpayers. The total cost of the WindomNet network is in the range of $12 million, the overwhelming majority of which will have been paid by subscribers to the system.

Conclusion

Building and operating a triple-play fiber-to-the-home network is a very challenging task, particularly for a small town. Windom shows that it can be worth the effort, but it is never easy and one focus should be on expanding the network to a larger footprint.

WindomNet has been delivering benefits to the community well in excess of $400,000 per year, a significant amount for the region. They have access to higher capacity connections than most metro residents and far better customer service than is found from any of the national companies.

Having helped to establish SMBS, WindomNet is now representing the larger region as a leader in connectivity for the state. We expected to see WindomNet expand in the years since we first published this case study, and we believe by not doing so it is missing opportunities to spread its fixed costs across more people, benefiting both Windom and the areas around it that still need better Internet access.

OTHER MINNESOTA EXAMPLES

Local governments have been more involved in delivering telecommunications than many realize. Crosslake and Barnesville long served as incumbent providers in the community, though Crosslake is now operated by a consortium of providers. Pine City built a fiber backbone and Eagan built a fiber loop, both to serve businesses. Alexandria's municipal fiber network is available to local businesses. Many school districts operate on publicly owned fiber, whether owned by the municipality, county, or themselves. More and more cities are considering municipal fiber investments with a partner, like these communities working with CTC.

The City of Long Prairie (pop. 3,300), county seat in Todd County, Minnesota, long struggled with connectivity, having issues with connecting students from their homes, losing parts of the local workforce, and in a lack of access to support larger healthcare institutions for their aging population.

In 2016, city officials decided to leverage their capacity to obtain low-cost financing and partner with Consolidated Telephone Company (CTC), a nearby former telephone cooperative that had started offering Internet access via DSL service in the late 1990s. It began building a fiber-to-the-home network for its members in 2008.

The co-op has spent the last 10 years getting as many people in the area fast and reliable connectivity as possible. But because CTC is just one firm with limited financial resources, it developed relationships with other towns, cities, and counties that could bloom into partnerships.

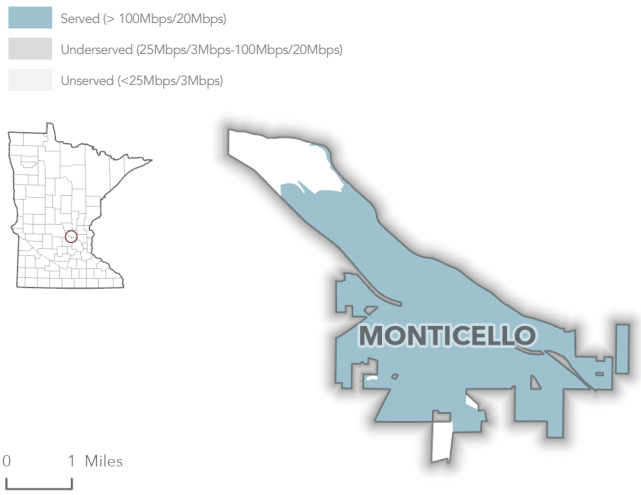
Long Prairie was one of the first to take advantage of it, issuing a bond to finance a fiber project. CTC and Long Prairie entered into a series of agreements. CTC would assume responsibility for the construction of a citywide fiber-to-the-home (FTTH) network and make payments on the $3.7 million loan over the course of 10 years. CTC leased the network from the city over those 10 years to provide services to businesses and residents. At the end of 10 years, CTC would automatically take ownership, or at any time during the lease agreement once the loan was paid off. CTC was able to build the 111-mile network from 2017-2018, passing 1,303 locations.

Likewise, in 2017 local leaders in the City of Ely began talking with CTC about how to bring better connectivity to local businesses. The two created an agreement where the city would do the necessary make-ready work for a new network, with CTC assisting with the construction and leasing the fiber from the city to provide businesses with up to gigabit Internet access. Ely funded the project using an Iron Range Resources & Rehabilitation (IRRR) Community Infrastructure grant of $120,000. The overall project, including make-ready work, cost a little more than $400,000

Finally, the City of Little Falls and CTC started their partnership around 2013. The city partnered with the Initiative Foundation, Region Five Development Commission, and the Morrison County Economic Development Corporation to pool $550,000 to lend CTC for the construction of a fiber network. CTC was already serving areas on the edge of Little Falls, and the co-op is based just 30 miles away in the Brainerd-Baxter area.The fiber ring ran through downtown into the two main industrial parks where the majority of the city's requests were coming from.

Today, CTC offers service across the region in Sullivan Lake, Randall, Pillager, Outing, Nokay Lake, Nisswa, Motley, Mission, Lincoln, Leader, Freedhem, Ely, Brainerd, Baxter, and Crosby, and has become one of the most aggressive rural fiber builders in the state of Minnesota.

CITY OF MONTICELLO



- **Monticello created a municipal fiber network and partnered with an independent ISP to operate it after local businesses demanded an improvement over unreliable and slow DSL options.**
- **The network was delayed by a lawsuit from the existing telephone company that the courts tossed immediately but nevertheless took a year from the business case.**
- **Monticello FiberNet offers very fast broadband tiers at affordable rates, keeping the prices of its competitors much lower than they are in nearby areas.**

Monticello is just off Interstate 94, approximately 40 miles northwest of Minneapolis. The city boasts nearly 13,000 residents. Monticello was one of the first cities in the United States, possibly on the planet, with two citywide fiber-to-the-home projects competing head to head.

Prior to the establishment of its FiberNet, most residents and businesses had a choice between telephone service and slow DSL from TDS Telecom (a Fortune 500 company headquartered in Madison, WI) and moderately faster Internet access and television from Charter Spectrum (the nation's second largest cable company).

Back in 2005, local businesses were complaining to elected officials about slow, unreliable Internet access. Bill Tapper, a local business owner, told MPR: "My employees would sometimes take the data home where they had a better Internet connection than we did and do their uploads at night."[82] TDS Telecom insisted it was meeting existing demand while Charter Cable refused to wire any industry or business park unless businesses paid an upfront connection fee that few felt they could afford.

In May 2005, the City Council appointed a task force to investigate options for the community. A feasibility study was completed in September 2006. As part of that study, a survey of residents and businesses found very strong demand for lower priced services. Residents were more interested in cable television than Internet access, but businesses focused on lowering the cost of Internet access. Judging from survey results, neither group particularly cared whether local government provided the service or not; each was focused on lowering their telecommunications bills.

In October and November 2006, the city held a series of educational forums to discuss a fiber network that would be available to every resident and business in Monticello. By the end of the year, the Industrial Development Committee passed a resolution recommending the City Council bond for the fiber optic project.

Unlike the vast majority of municipal fiber networks built in the U.S., Monticello did not operate its own municipal electric company. Instead it developed a partnership with HBC, a local telecommunications company. Monticello would own the network and HBC would operate it. To reduce risk to the city and avoid using any taxpayer dollars, Monticello planned to issue unbacked revenue bonds to private investors. If the network failed to generate sufficient revenues, then investors, not taxpayers would bear the losses.

In September, 2007 Monticello held a referendum, per Minnesota law, on whether its citizens wanted to own and operate a telephone exchange. TDS and Minnesota cable companies teamed up to oppose the network, producing glossy flyers and hiring an out-of-state firm to call potential voters with misleading claims that the network would cost taxpayers $26 million, which actually was the full cost of the system to be paid for by issuing bonds. Despite being wildly outspent, those in favor of a municipally owned network won 74 percent of the vote, far in excess of the 65 percent required by the antiquated Minnesota law for a network to provide telephone services.[83]

TDS Sues

After the referendum, Monticello focused on financing the network. They understood that offering unbacked revenue bonds would come with a higher interest rate because investors were taking on more risk than if they pledged the full faith and credit of taxpayers. Just as the city was selling bonds to investors, TDS filed a lawsuit, claiming Monticello was prohibited by Minnesota law from financing the project with revenue bonds. Forced to make a quick decision, Monticello decided to complete the bond sale and fight the lawsuit. They issued $26.5 million in bonds at a 6.75 percent interest rate.

In hindsight, the TDS strategy was devilishly brilliant: delay construction of the network, giving TDS the time to build its own network while increasing the cost of borrowing for Monticello and tying up city resources. It didn't matter that multiple courts eventually ruled against TDS; it didn't expect to win the case. By the time the final court had ruled against it, lasting damage had been done.

As the case began working its way through the legal system, TDS began rapidly upgrading its old copper network to fiber, despite its previous assertion that its DSL system was perfectly adequate. The *Monticello Times* described it this way: "Meanwhile, TDS announced it will be improving its own fiber optic services to Monticello, a move that is 'obviously in response' to the special election held last fall, according to spokesperson Drew Peterson, who is TDS' Director of Legislative and Public Relations."

Monticello, meanwhile, had to keep the bond proceeds in an escrow account while waiting for the outcome. Recognizing the court case would last longer than the 2008 construction season in Minnesota, the City Council decided to build a smaller fiber loop to connect community anchor institutions and businesses in its downtown and a business park. Unable to use the bond funds, they paid for the project out of the city's reserves, creating a loan that was repaid once the bond funds were available. Some on the City Council apologized to the public, noting that they had promised the network would not use taxpayer dollars but felt they had to move forward with at least a small project in 2008.

As part of that project, the city asked TDS to engage in joint trenching, where they would cooperate in placing conduit in the same corridors at the same time, potentially saving both entities millions of dollars. TDS ignored the first letter and then turned down the offer after a second letter, claiming it would be "anti-competitive" to coordinate in a standard dig-once fashion. Joint trenching is a common industry practice that violates neither the spirit nor letter of antitrust laws.

Without getting lost in the details, the TDS lawsuit against Monticello hinged on whether Internet access could be considered a "utility or other public convenience" and whether bond proceeds could be used to pay for the startup costs of a project. As other projects in Minnesota had used bond proceeds for startup costs and Windom had long operated a triple-play network, TDS stood on dubious legal ground.[84]

Judge Jasper dismissed the case with prejudice on October 8, 2008, opening a 30-day window for TDS to appeal the decision. On day 29, TDS filed the paperwork to appeal. After another six months of waiting, the Court of Appeals affirmed Judge Jasper's decision. A few weeks later on June 16, 2009, the Supreme Court denied the final petition for review from TDS, and Monticello was free to finally use its funds to build the network.

The end of the case was bittersweet for Monticello. Though it would ultimately recover some of the losses from the year-long delay in a settlement from TDS, it still had to pay interest on the bonds for an additional year without revenues. It was nearly a year behind in subscribers and assets relative to its debt costs – this would prove a significant factor in Monticello's subsequent financial troubles.

Fierce Competition

The other significant factor was the cutthroat competition that commenced when FiberNet Monticello began operating in mid-2010. It had a strong start, with some 1,200 subscribers despite the late 2009 commencement of citywide construction. HBC operated the triple-play network, offering television, telephone, and Internet services to residents and businesses at far faster speeds than were previously available, and at prices far lower than were previously available within the community.

Charter Cable and TDS Telecom both dramatically lowered their prices, while TDS Telecom also improved its network to offer triple-play services.

In most cases where municipalities have built fiber-to-the-home networks, the cable company remains a strong competitor by cutting rates and sometimes increasing available speeds. The telephone company typically continues offering a slow, low-cost DSL product, effectively ceding the high-speed competition to cable and fiber providers. But the TDS upgrade to fiber resulted in three high-speed competitors. FiberNet Monticello offered packages from 10 Mbps to 50 Mbps, symmetrical (both upstream and downstream). TDS offered up to 50 Mbps down and 20 Mbps up. Charter was stuck at 30 Mbps down and an estimated

5 up (cable companies often hide the upload speed as it is so much slower).

Charter responded to the newly competitive market with one of the most aggressive price cuts ILSR has ever seen. It sent sales people door to door with an offer of every cable channel in the lineup plus its top speeds for a two-year guaranteed rate of $60 per month. Tech news site Ars Technica called Charter and verified the offer was real.[85] That same package cost $145 per month in other Charter cities in Minnesota like Buffalo, Rochester, and Duluth. Either Charter was absorbing significant losses in Monticello or was making astonishing profits in its other cities. Channel contract costs are subject to non-disclosure agreements, but every expert we consulted concluded Charter must have been losing money every month for each household taking that offer. A company with revenues of over $8 billion in 2013, Charter decided to sell its services at a loss for years in an effort to deny market share to FiberNet.

After Charter took the offer door to door, FiberNet's growth stalled. When asked about the issue in the *Monticello Times*, City Administrator Jeff O'Neill said, "Predatory pricing and competitive pricing are two different things. We didn't expect the third largest cable TV company in the country to offer services at far less than it costs them to provide it. It's an effort to use the revenues from the Buffalos and Big Lakes to rub out their competition [in Monticello]."[86]

Neither the Federal Communications Commission nor the Federal Trade Commission evinced any interest in investigating these types of potential antitrust violations, a sad reminder of how cities are disadvantaged when competing against national cable and telephone companies.

In some ways, the initial survey of residents and businesses foreshadowed this possible outcome. The largest concern from respondents was price. Residents wanted to pay less and businesses both wanted to pay less and have better Internet access. FiberNet forced the prices down from all providers but the entrenched incumbents could lower prices below FiberNet's cost by cross-subsidizing from other communities where they did not face real competition. The question was whether enough people would support FiberNet due to better customer service or simply because they recognized that if FiberNet failed, the great deals from its competitors would quickly evaporate. Since 2014, evidence has suggested that most of the population prefered to take the deals from TDS and Charter.

Having lost an entire year to the lawsuit and then facing predatory pricing, FiberNet was unable to sign up enough subscribers to meet its revenue projections, forcing local leaders to make a difficult choice. The network was not producing enough revenue to make debt payments. Though they had no legal obligation to contribute to the network to ensure bondholders were repaid on time, they also wanted to make sure the network would continue to ensure residents and businesses benefited from the newly competitive market.

To make up the difference between revenues and what bondholders were owed, Monticello began loaning itself funds from a municipal account consisting of profits from the municipal liquor store. Over time, they would ultimately borrow approximately $5 million from other city funds to make debt service payments before deciding on June 1, 2012, to cease subsidizing the network. Additional challenges came after the city's and HBC's relationship fractured.

On May 30, 2012, HBC announced it would step down as the network service provider, leaving Monticello to find a new partner. Though both HBC and the city have been relatively quiet about the reasons for the separation, the biggest factor must have been the incredible stress resulting from the lost year, price war, and resulting inability to pay the full debt service from network revenues.

Monticello went on to hire a new manager, Mark Pultusker. Unhappy with his performance, Pultusker was ultimately replaced in 2014. The network was then managed by Dan Olsen, who built and ran both the WindomNet and SMBS networks for years. Olsen finished a series of upgrades initiated by the previous manager that improved FiberNet's service before he moved on to a consulting company, and Monticello ultimately partnered with regional ISP Arvig to continue offering services.

Service Improvements

In 2014, FiberNet announced that without increasing prices, those who subscribed to either the 10 Mbps or 20 Mbps tiers would be upgraded to 50 Mbps, and those on higher tiers would be upgraded to 100 Mbps. Additionally, they could deliver a gigabit to any subscriber in town. Those upgrades helped some in its competition with its rivals, but it has never achieved the market share it expected when getting into the business. Charter and TDS seemed intent on making Monticello an example to other municipalities that were considering their own investments—they have continued to run stronger promotions than we commonly see in order to make sure the partnership could not gain ground.

It should finally be noted that FiberNet was launched in the trough of the significant economic recession the nation experienced in 2009-2012. Any one of the above factors alone may not have so derailed the business plan, but together they were disastrous.

The city resolved its debt problem with a one-time payout of $5.75 million to bondholders. Though it was a major loss for those bondholders, investors understood they faced more risk from an unbacked revenue bond, and that general obligation debt is more secure.

The city's bond rating took a hit during the uncertainty in 2012, with Moody's downgrading it from Aa3 to A2 – from a high grade rating to upper medium. In the years since, the credit rating has recovered to A1.[87]

Cost–Benefit Analysis

By 2015, Monticello had spent some $10-11 million on the network between the bondholder payout and the total amount spent on debt service when revenues were insufficient to pay it prior to mid-2012. Note that Monticello taxes have not increased by this amount but that some of the liquor store funds, for example, could have been used to offset taxes to pay for services like street repairs. (It is worth noting that given Charter Spectrum's promotional pricing, extra investments in advertising and door to door salespeople, it also is probably spending more than it generates in revenue locally but as noted, makes up losses from its more profitable and less competitive markets.)

The investors were only repaid 22 cents on each dollar invested and no amount of future FiberNet success will benefit them. They have taken a significant loss, which is regrettable but not unusual in this business. For instance, Verizon shareholders lost $1 billion when telephone and DSL company Fairpoint declared bankruptcy in 2009.[88] As noted above, investors should have understood the substantially higher risk in purchasing a tax-exempt 6.75 percent unbacked revenue bond than other bonds.

Critics of municipal networks generally claim the taxpayers are taking on too much risk, so it is worth comparing the benefits to Monticello against the costs. A municipally owned enterprise uses a different cost-benefit lens than does a private enterprise. The latter's financial goal is to cover its costs and return profits, but cities invest in municipal networks to generate both direct and indirect benefits, from spurring job growth to cutting telecom bills.

The following analysis was completed in 2014. The easiest cost saving to calculate is in telephone service, because TDS charged over $40 per month prior to competition; Charter did not offer a telephone service.

Monticello had approximately 4,800 households. Using the then-national average of 65 percent of households having a landline connection, approximately 3,100 households had landline service, either from TDS or FiberNet.

TDS prices dropped to about $25. FiberNet had charged $21 per month since 2009. Because more households had landlines in 2010 than today, a conservative estimate for the total community savings from the residential landline cost reduction of $15 per month per household is $550,000 per year. Over the five years, this amounts to $2.5 million in residential savings alone.

Charter's best deal lowered the biggest package price from $145 per month to $60 per month, a savings of $85 per month. TDS has regularly run deals for a triple-play package with 50 Mbps downstream and 20 Mbps upstream for $70 per month in the first year and $90 per month in the second year, with an ongoing price of $110 per month.[89] FiberNet, like most locally owned networks, tends not to engage in promotional pricing but rather has a variety of triple-play combinations at various price points, many of which are in the neighborhood of $100. The average triple-play bill in the United States was $154 per month in 2014.[90]

Untangling the cable and Internet costs from the various possible combinations of savings is challenging. However, we have already accounted for savings to telephone subscribers above and Charter does not offer telephone. If we subtract $15 from the average U.S. triple-play bill, it creates a baseline estimate of $139 per month for television and Internet access. Given the level of price competition and promotional deals, it seems reasonable to assume at least half of all households were paying less than $100 per month for triple-play on average. Compared with the national average, this is a savings of at least $39 per month and likely more. 2,400 households saving $39 per month results in community-wide savings of $1.1 million per year. If another 25 percent of the population were paying the TDS rate of $110 per month, that represents still another savings of $400,000 per year. Over 5 years, these savings add up to $7.5 million. Combined with the telephone savings of $2.5 million, the network has kept approximately $10 million more in the pockets of Monticello residents over those 5 years.

Residential savings from the telephone and other home telecommunications services were roughly on par with the amount the city has contributed to the network. The network also reduced costs and dramatically increased both available speeds and options for a reliable connection to businesses; however, we could not develop a way to quantify these savings or put a figure to the benefits. Monticello's businesses have transitioned from being part of a poorly connected community to being among the top-connected communities in the nation. Building the network has clearly resulted in a much better climate for businesses that increasingly depend on Internet access.

Monticello is also more efficient as a local government due to the network. It has gigabit links between city facilities that better enable it to use mapping applications like Geographic Information Systems (GIS). Judging from the savings we found in Carver, Scott, and Anoka counties from municipal institutional networks, Monticello is likely saving tens of thousands of dollars per year by self-provisioning a gig rather than leasing from TDS or Charter.

When we published this paper originally, we expected the operating losses of the network to be at least an order of magnitude smaller than the savings to residents. Losses were likely to be at most in the low hundreds of thousands while aggregate cost savings each year are in the low millions. And given the upgrades at FiberNet, operating losses are expected to decline and disappear over time. Though the operating losses did decline and the network operates in the black, it has still not generated sufficient revenue to pay even its reduced debt costs.

Monticello is one of the most competitive markets for broadband in the upper Midwest. In 2014, we surveyed other cities in Minnesota with TDS connections and found the maximum residential speed advertised was 25 Mbps, half the commonly advertised rates for TDS in Monticello and a fraction of the top-end 300 Mbps TDS service. Charter had also slashed its prices. And the slowest connection a person could get from FiberNet was 50 Mbps symmetrical at incredibly competitive rates. This level of community connectedness should have resulted in higher property values over time compared to nearby areas reliant on slower DSL and non-competitive cable. In the years since, Monticello has remained a great market for broadband for residents. The network has expanded modestly as new homes are built in Monticello but has not gone much further.

Ultimately, the benefits of FiberNet seem to outweigh the costs, but not by the kind of margin expected.

Conclusion

Monticello's FiberNet is a cautionary tale for cities that want to improve their telecommunications services, especially those that believe a public-private partnership can broadly reduce risks. They may confront powerful monopolies that can use profits from less competitive areas to subsidize predatory pricing against a fledgling municipal utility. Incumbents can also use lawsuits to increase the cost and delay the introduction of muni broadband services. Nevertheless, more than 200 cities have managed to build sustainable citywide municipal networks nationwide.

Early into the life of this decades-lasting infrastructure investment, it appears that despite its financial challenges Monticello's network has saved its businesses and residents more money than it has cost.

The project has achieved a main goal in dramatically lowering the cost of telecommunications services in the community, but is not yet able to pay its own way. Given the economies of scale in telecommunications, expanding the network to nearby communities that have been left behind by existing providers would go a long way to help its finances. FiberNet's head end can support many more subscribers than even the full population of Monticello.

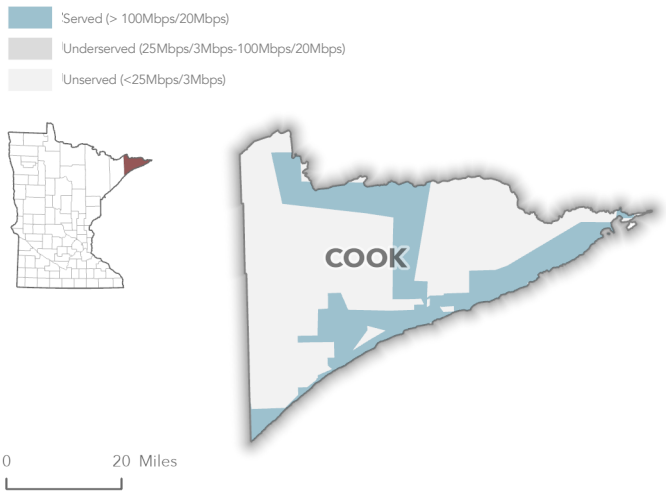
Oddly enough, one of the lessons from Monticello is that the 65 percent requirement in Minnesota law offers little predictive power as to whether potential subscribers will embrace a municipal network. One of the justifications for the law is that passing the difficult referendum demonstrates the kind of support necessary for a network to succeed financially. But as Monticello shows, there are many variables in whether a network succeeds (and on what timetable). The 65 percent threshold offers no predictive values and is simply an impediment to public investment in some types of fiber optic networks.

TDS: MONTICELLO VS. BUFFALO

The difference in TDS Internet access between Monticello and nearby Buffalo today is striking. TDS offers services in areas right around Buffalo where it faces much less competition. In 2014, TDS regularly ran better deals for service in Monticello: Paying TDS approximately $71 in Buffalo yielded a connection of 6-15 Mbps downstream and up to 768 Kbps upstream. In central Monticello, approximately the same monthly payment to TDS would have purchased 600 Mbps symmetrical. The regular, non-promotional price of the fastest speed TDS offers near Buffalo (listed above) was far slower and more expensive than the regular price of the slowest speed the company offers in Monticello (300 symmetrical for $58).

By 2021, the difference in TDS' advertised rates was even more significant. Including the additional modem fee, TDS offers ranged from 18-50 Mbps depending on location for a 1 year promotional rate of $40/month that goes up to $78/month regular price in the areas around Buffalo. In Monticello, TDS was promoting 2 year specials of 300/300 Mbps for $40/month; 600/600 Mbps for $55/month; and a symmetrical gig for $75/month. Prices would increase by $15-17/month after those two years, if TDS didn't renew the promo, a common practice of many ISPs in areas where they face competition.

COOK COUNTY



- **Cook County saw little broadband investment from the big out-of-state ISPs and suffered dramatic half-day outages that took down all commerce and even 911 service.**
- **The county worked with Arrowhead electric cooperative to win an award from the 2009 broadband stimulus for fiber to the vast majority of county residents.**
- **The network has brought faster broadband and much greater economic opportunity to the region, as well as much faster repairs after fiber cuts.**

Known for its rustic charm, Cook County sits along the shoreline of Lake Superior at the most northeast corner of the state and is home to roughly 5,000 people. In the summer, the area draws 5,000 seasonal visitors that fill cabins, resorts, and lodges to enjoy the surrounding wilderness.

The economic downturn during the Great Recession took its toll on tourism, and the lack of high-speed Internet access aggravated the situation for businesses that catered to visitors accustomed to high-speed Internet access while on vacation. In 2014, the county had the lowest availability of broadband in the state, at 37 percent.[91] At that time, CenturyLink (now Lumen) provided DSL in some areas and Mediacom offered cable connections within the larger towns via its aged coaxial infrastructure. Satellite was available in some areas, but service was costly, slow, and came with data transfer caps.

Dial-up had come to the area in the late 1990s thanks to the community-established nonprofit Boreal Access, which later began providing wireless Internet service to rural residents and businesses.

In areas popular with tourists, the only choice for lodges and outfitters was still dial-up as late as 2008. Proprietors could not take reservations online, so customers booked elsewhere, taking tourist revenue with them. Visitors came to the many lakes for fishing, but outfitters could not purchase licenses for their guests online.

Local businesses approached the incumbent providers for help. Lutsen Mountain Inn's provider, Qwest (then CenturyLink, now Lumen), told the owners that it was not possible to connect with a T1. The Cascade Lodge, located on the main Highway 61, asked for a cost estimate for installation of a T1 line to offer 1.5 Mbps download. Qwest quoted $600,000.[92]

Real estate agents reported that the lack of connectivity stymied their ability to sell homes. In one instance, a physician couple that worked at the Mayo Clinic was ready to purchase a home in the area. When they learned that the only Internet access was by satellite, they walked away. Both doctors needed access to reliable broadband to work remotely on occasion, and geostationary satellite could not meet their needs.[93]

In addition to lack of access, the conversion to digital television created another problem. Regional broadcasters did not plan to upgrade to digital equipment in Cook County. Many residents relied on television for local information because their Internet access was so poor. Television provided information on school closings, forest fire alerts, and local weather conditions.

Determining Need, Gauging Interest, Deciding to Act

For years, community leaders and activists had worked with elected officials to educate them on the importance of higher quality Internet access and the problems with dial-up and satellite. By 2008, the county took action to determine the extent of the problem, the level of interest, and possible improvement options. A $15,000 grant from the Blandin Foundation and a matching contribution from the county funded a feasibility study to examine the problem and potential solutions. Additionally, local electric provider Arrowhead Electric Cooperative, Inc., and Boreal pledged $10,000 toward the study.[94]

Joe Buttweiler, acting General Manager of Arrowhead, was Director of Member Services at the time. The co-op had been interested in bringing better connectivity to its members for some time but the expense of a fiber network and the expertise needed to run it were two challenging hurdles. Arrowhead had investigated WiMax wireless technology, but the geography was too rocky and hilly for it to work effectively.[95]

Based on the results of the feasibility study, the Cook County Board of Commissioners took up the idea of developing a fiber network for county residents, businesses, and government. The Board passed an ordinance in December 2009 declaring that a broadband network was in the best interests of the county and created the Fiber Optic Network Commission.[96]

The survey indicated a high need for better access in the county and a strong desire to get broadband service from a local provider. 91 percent of residents surveyed said that they believed the county needed a local broadband provider. 90 percent said they would subscribe to a local ISP, and an additional eight percent said they might subscribe to such an ISP. In other words, almost every respondent felt they needed broadband and would prefer purchasing it from a local company.

Multiple Plans, Same Goal

The county approached Arrowhead to discuss the possibility of building a fiber network. As its service territory covered most of the households and businesses in Cook County, the cooperative recognized the potential of a partnership. As Buttweiler put it, "Up here when the county or Arrowhead are spending money, we are spending the same person's money, no matter if its tax dollars or if its Arrowhead funds because our service area 99.9% matches the county boundary. Both entities are looking out for the exact same population."[97]

The feasibility study estimated a fiber network connecting every residence and business on the grid would cost approximately $50 million. That helped to develop a business plan aiming for take rates of 64 and 65 percent of households and businesses respectively. The proposed service area included over 3,152 homes, 236 businesses and 57 community anchor institutions.

Upon reflection, Arrowhead considered the cost of the project too risky for its members. It told the county that it was not interested in the project, so the county investigated using revenue bonds to fund the deployment.

In order to open as many doors as possible, the county also applied for funding made available through the American Recovery and Reinvestment Act of 2009 (ARRA). They sought $33 million in grants and loans. Local businesses, potential community anchor institutions, and government agencies in the proposed service area wrote letters of support. Schools, clinics, public safety, tribal councils, and even the U.S. Forest Service declared their need for better Internet access in Cook County.

While they waited for a decision on the stimulus application, the county approached voters on two questions in order to proceed with the project. In November 2009, community leaders asked voters to pass a referendum to grant the county authority to use the proceeds from a half cent local option sales tax to fund a variety of projects.

The project list included a fiber optic network that would be linked to the community's Boreal project in the 1990s. Years earlier, the voters had approved a similar measure to fund an expansion on the county hospital. The hospital project sales tax was reaching sunset, and the county asked voters to continue the sales tax, rather than letting it lapse. The measure passed in no small part due to the prospect of improving Internet access; the county estimated the tax would bring in approximately $20 million.

On the same ballot, voters needed to approve the question of whether or not the local government could own or operate a telephone service. A law from 1915 required local communities to pass a 65 percent supermajority referendum in order to grant the authority to local government, the only such supermajority requirement in the nation.[98] In order to offer triple-play of Internet, video, and voice, the county needed to pass the measure. Even though 56 percent of voters approved the ballot question, it did not meet the required threshold.[99]

Discouraged but hardly ready to give up, county leaders began developing another plan. In the revised model, it would again try to partner with Arrowhead to deploy a fiber network.

Meanwhile, a January accident in Duluth cut a fiber line that killed telecommunications in both Cook and Lake counties. E911 calls were impossible, credit card transactions could not go through, and Border Patrol agents had to rely on Canadian officers to transmit messages for them. The event underscored the danger of continuing to depend on the existing providers in the region.[100]

The Northeast Service Cooperative (NESC), a private nonprofit established by the Minnesota Legislature, did receive an award that would improve the situation along the North Shore. NESC received stimulus funds to deploy a middle mile fiber project connecting community anchor institutions along Highway 61. The fiber would run all the way to the border with Canada and provide much needed redundancy to the region.

The Partnership With Arrowhead Electric

Arrowhead became the project leader in the next plan devised by the county. In the project submitted for round two of the broadband stimulus awards, Arrowhead Electric would own the network. The projected costs were lower than those estimated for the round one stimulus proposal, coming in between $16 to $20 million.

Buttweiler was not familiar with the details of the original stimulus network architecture and equipment choices because Arrowhead stepped away from the project before the county filed the application. The revised plan included the "bare minimum" needed to serve all properties on the AECI grid.[101]

In September 2010, Arrowhead was awarded $4.8 million in a low-interest loan and $11.3 million in a grant through the Broadband Initiatives Program of the Rural Utilities Service under ARRA.

As a cooperative with little experience in providing this level of telecommunications service, Arrowhead sought help from Consolidated Telephone Company (CTC), a cooperative from the Brainerd and Baxter region in Minnesota which served a region with similar demographics, including a large ratio of seasonal properties and tourist establishments. Arrowhead began to learn from CTC in February 2011.

Arrowhead also collaborated with the NESC to lower costs and expand the footprint of both networks. The electric cooperative would complete all construction in Cook County and supply fiber space to NESC so its middle mile network could reach community anchor institutions in the county. NESC would connect Arrowhead to Duluth with its fiber line. The cooperatives signed a 22-year agreement, creating a zero-dollar transaction benefitting both entities.[102]

Buttweiler said, "The deal saves Arrowhead millions of dollars by avoiding costly transport of data from our office in Lutsen to Duluth using another provider."[103]

AECI began collecting pre-registration forms, leading to 550 prospective residential and business customers. Construction started in late July.

The County Board of Commissioners, excited by the project and recognizing the enthusiasm of local constituents, authorized up to $4 million of the 1 percent sales tax authorized by the voters. The funds were made available to Arrowhead in the form of a grant. In exchange, the cooperative would provide some services to the county at no charge, including Internet access to a number of facilities.

Throughout the summer, potential subscribers continued to preregister. The cooperative had distributed over 3,000 pre-registration packets; by mid-September, Arrowhead had signed up over 1,100 households and businesses.[104]

While waiting for the paperwork for federal funds to clear, Arrowhead began building the network but ultimately had to pause. Delays from state agencies also contributed to the decision to temporarily halt construction. The Minnesota Public Utilities Commission (PUC) was still in the process of approving the cooperative's ability to provide necessary phone services, such as emergency 911 and long distance calling.

Despite official delays, interest continued building and ultimately revealed a problem unique to rural communities. A significant number of residents living off-grid for the purposes of electricity wanted on to the Internet. On those properties, the cooperative had no property rights, rights-of-way, or even funds earmarked for providing access. AECI began considering a possible wireless solution using the fiber network for backhaul.

After waiting several months, Arrowhead got the needed approvals from RUS and the PUC. By late July they were building again, but winter weather and frozen soil slowed underground construction later that year.

In October 2013, Arrowhead held an open house at its Lutsen office to showcase the network. The cooperative had established a 100 Mbps connection between its office and the CTC office in Brainerd. The cooperative also set up a Wi-Fi hotspot from its office. The event drew over 300 people from all over the county, clogging Highway 61 with cars as people parked along the road to test the new service. As word spread, it became common to find people parked in Arrowhead's parking lot at all hours with their laptops using the fast, free Wi-Fi.[105]

The network was completed in 2015, but even in 2014, some 200 member-owners had already subscribed to the network. These included residential members, a few small businesses, some larger resorts, and several seasonal properties.

The service, named True North Broadband, provides voice and Internet access. Monthly prices for Internet access in 2014 included packages at $47 for 20 Mbps download, $60 for 30 Mbps download, and $100 for 50 Mbps download. All speeds included 10 Mbps upload speeds and symmetrical service is also available. Local unlimited calling phone service began at $16 per month; there are several long distance options. Additional telephone service features such as caller ID, call waiting, voicemail, and others were available in an a la carte fashion. A small discount applies when customers bundle both services.

Seven years later, monthly prices have risen modestly, but the available speed tiers have become an order of magnitude faster. Today, True North Broadband offers symmetrical 100 Mbps, 200 Mbps, 300 Mbps, 500 Mbps, and 1 Gbps connections for $66, $81, $101, $121 and $149/month, respectively. Managed Wi-Fi costs $7/month.

Table 6.

True North Broadband Residential Speed Tiers	True North Broadband Residential Price Per Month
100 Mbps	$66
200 Mbps	$81
300 Mbps	$101
500 Mbps	$121
1 Gbps	$149

Expectations for the network are high. In addition to improving the situation for existing businesses and providing an economic shot of adrenaline, county residents want to create an environment that will keep youth close to home. "We'll get an economic bump from the broadband pipe. We don't know how big or how long it will take, but it will happen," [Jim] Boyd said. "Kids who moved away to get an education can't move back and live on $9 an hour part time seasonal work, which dominates now. We don't have full-time, benefit-paying, livable wage jobs for them, and that's what I'm hoping broadband will make possible."[106]

True North Broadband's network consists of 800 miles of fiber across all of Cook County (pop. 5,200) and a small section of Lake County (pop. 10,600) as well. **In June 2018** the network had just under 2,800 broadband accounts; today that number has grown to 3,400. This is a take rate of 65-70 percent in the areas where they offer broadband service today (there are a couple small sections of the county that don't have service yet).

The fiber infrastructure they have laid not only brings Internet access to a rural part of the state that had no good options, but also **brings benefits to electric cooperative members** through automatic metering and voltage regulation (which helps identify lines that need service or upgrades). The network also brings operational flexibility to the cooperative while opening avenues for growth, including renewable energy initiatives and electric vehicle charging.

In the last six years there have been no significant expansions, with one exception. In 2018, the Minnesota Department of Transportation (MNDOT) added a new emergency services radio tower near Palm Lake and chose Arrowhead to bring both power and fiber to the area. The partnership allowed them to bring service to a few dozen homes in the area that were otherwise unserved. Beyond that, the network continues adding service as people add new properties. Outside of the city of Grand Marais, True North is the only broadband option, and even including Grand Marais they are the only fiber option covering 100 percent of the city.

Weathering the Pandemic and Looking Ahead

The network had planned a marketing campaign in early 2020, but after the pandemic hit and sales in their service footprint jumped, they canceled it. Throughout the rest of the year, True North continued its buildout but only did in-home installations for teachers, students, and county employees. The bulk of their new connections this year came from residents leaving the Twin Cities area and moving north to their second homes, where they needed better connectivity to work. While True North's network has handled the roughly 100 percent jump in traffic well (approaching 6 gigabits at peak usage), to accommodate and account for future growth they have added a second 10 gigabit transport circuit to Duluth.

Today, Arrowhead Electric Cooperative has 4,500 members, and services all of Cook County (except Grand Marais, which has municipal power utility, where it only provides broadband service). The network continues to make payments on its existing loans and is on strong financial footing, fueled by the phenomenal take rate. As it stands, True North Broadband subscribers are not cooperative members, and so do not get capital credits returned to them. A shift would require a change in the bylaws, but no plans are in place to do so at this time.

In the future, the network looks forward to conducting education and outreach programs in pursuit of a number of initiatives, including security, managed Wi-Fi, and working with existing members to upgrade old routers.

Sara McManus, Member Services Manager, attributes the network's success to the support shown by the community and the level of service they bring. In **the summer of 2019** damage caused by a construction crew led to a broadband and phone outage that True North repaired in less than two hours—a far cry from the day they lost to the fiber cut 10 years earlier.

Conclusion

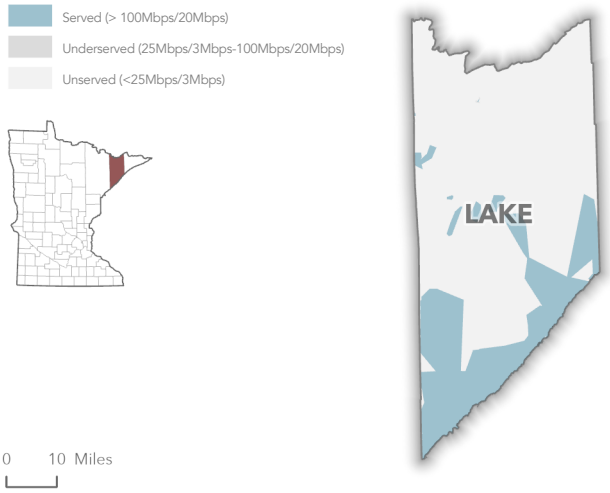
Danna MacKenzie, Executive Director of the Minnesota Office of Broadband Development, was Cook County Director of Information Services from 1999–2013. She also served as Administrator of the Cook County Broadband Commission and went on to lead the Minnesota Broadband Office in Saint Paul. As one of the community leaders spearheading the project, she advises other communities

to begin educating community leaders as early as possible. It is important, she said, to develop a local culture that broadband access is important for the community.[107]

Partnering with a cooperative offers rural communities like Cook County a proven model to build and maintain modern infrastructure that is equivalent or even superior to that in major metro areas. Cooperative members who use the service also own the service, establishing a clear path to accountability.

Young entrepreneurs no longer have to leave the area to establish businesses dependent on technology. Home-based businesses can thrive; existing businesses can reach out to people around the world. Though Cook County was once hurt by the refusal of distant corporations to invest in it, businesses and residents now have world class infrastructure that they control, restoring self-determination to the community. They have all the tools they need to thrive.

LAKE COUNTY



- **Lake County had slow, unreliable Internet access from ISPs headquartered out of state and won a 2009 broadband stimulus award to build its own network.**
- **The county tended to rely on outside experts more than developing internal expertise and it struggled to respond to efforts from Mediacom and Frontier to disrupt its plan.**
- **The network was ultimately privatized after not hitting many of its targets but local residents and businesses are no longer stuck solely with poor services Frontier and/or Mediacom.**

Lake County, located in the northeast Arrowhead region of the state, is one of Minnesota's largest by area. The county, with almost 11,000 people and approximately 2,100 square miles, contains pristine swaths of forest and water. Two Harbors (the county seat) and Silver Bay are the most populated communities, with 3,500 and 1,700 residents respectively. Both are located on the shore of Lake Superior. One small city, five townships, and nineteen unincorporated communities also lie within the borders.

Lack of Access in Rural Areas

As of 2014, in a region known for its tourism, local resorts with only dial-up access had to contend with visitors hoping for some level of broadband access. The poor connectivity limited resorts' options for booking, which limited their ability to advertise online. Even in areas served by cable providers, the service was notoriously slow and unreliable, which kept businesses in Duluth even when entrepreneurs wanted to relocate up the North Shore. Michael Stiff, owner of Hybridge Imaging of Duluth, described his dilemma: "Without it [broadband] we are handcuffed... We have wanted to move our business to Two Harbors for a number of years, but have been reluctant due to poor Internet service speed and bandwidth."[108]

Because the incumbents have focused only on higher density areas, more than half of households in the county did not have access to broadband under the FCC definition of 4 Mbps downstream and 1 Mbps upstream by 2015, when the FCC actually increased the definition to 25/3. Even in communities considered served by the incumbents, there were often no redundant connections to the Internet. As a result, network failures have been damaging to the local economy, public safety, and residents. Emergency 911 services have been severed on more than one occasion forcing customs border officials to rely on Canadian officers for communications. Outages have lasted 12 or more hours.[109]

Finding Partners and Establishing Plans

In 2008, Lake County began to address the region's lack of connectivity, recognizing it as a public safety, economic development, and quality of life issue. The broadband stimulus in the American Recovery and Reinvestment Act of 2009 offered an opportunity to improve Internet access throughout the region. County officials quickly issued an RFP with a rapid turnaround for a partner to develop a FTTH network throughout the county.

The county awarded the project to National Public Broadband (NPB), a firm comprised of Dr. Timothy Nulty and Gary Fields, who had expressed interest in the project when Lake County initially began searching for vendors.

The county submitted a Round 1 Broadband Initiatives Program (BIP) application, requesting an $11 million grant and $22.4 million loan to fund infrastructure to local government entities, 585 businesses, and 7,300 homes.

The Rural Utility Service (RUS) declined the application but encouraged the county to apply for the second round of awards. The county submitted its modified application in March 2010. This time, they included rural areas of neighboring St. Louis County, increasing the geographic area to almost 3,000 square miles. In addition to more than doubling the number of households, the plan included a total of 1,060 businesses

and 98 critical community facilities. The county requested a $56.4 million loan and $10 million grant; they still intended to issue $3.5 million in revenue bonds to help fund the project.

In September 2010, RUS announced the county was selected to receive a total of $66.4 million in combined grant and loans, the largest broadband stimulus award in the state. The project was also one of only a few stimulus projects that deployed last-mile fiber connectivity. While most ARRA funded projects created middle mile infrastructure, this project and neighboring Cook County planned to serve every premise on the regional power grid. Construction was scheduled to start the following spring; the county and NPB estimated completion within three years, offering a connection to 37,000 people in 15,000 homes.[110]

Early Difficulties

Within a month, the county first faced one of the many issues that challenged the project. In October 2010, the Lake County Board of Commissioners decided to establish a Fiber Committee. The Committee would have had spending authority up to $15,000 for the project without the need to seek Board approval. But when the Lake County Attorney pointed out that such authority made the Committee subject to open meeting laws, NPB expressed concern. Fields, the NPB Project Manager, considered it ill advised to risk revealing sensitive information that incumbents could exploit to sabotage the project.

A *Lake County News-Chronicle* article reported: "Fields said his concern is in revealing project aspects when it is competing with other technology companies. He said he would love to go to a Frontier business meeting to see what they are pricing things at—he can't do that."[111]

Rather than create vulnerability before the project commenced, the Board chose to withhold Committee purchasing power, allowing the Committee greater flexibility in keeping business strategies secret.

Publicly owned network projects are generally subject to open meeting laws that do not apply to private projects. This imbalance is a significant advantage to the more secretive cable and telephone companies, which have advance notice of business plan specifics for their public rivals.

Nevertheless, in communities where leaders actively engage citizens, as in Cook, Sibley, and Lac qui Parle counties, people tend to be much more engaged in the project and ultimately more supportive. Community meetings focused on educating the public about economic development, potential savings in the community, and the many benefits of fiber networks produce a pride of ownership. Lake County used a top-down strategy focused less on building grassroots support. That approach may have hurt its ability to withstand attacks from incumbent providers seeking to undermine the network and prevent new competition in the market.

Financing in a Troubled Economy

As a condition of the award, the county intended to issue $3.5 million in revenue bonds as a local match. When the project planning was in its infancy, elected officials had publicly assured county residents that funds to build the network would come from future network revenue, rather than from county funds. But high interest rates in late 2010 threatened to add almost $2 million to the final cost of the project.[112] County officials chose to tap into reserves rather than inflate the final cost of the project.

Changing the source of funds gave opponents an opening to challenge the project. The County Commissioners could be accused not only of using local taxpayer dollars, but of having misled the public. And this project had a few very motivated opponents.

Cable provider Mediacom serves Two Harbors and Silver Bay, but the towns needed better connectivity. Mediacom's aging cable infrastructure was slow and unreliable. Additionally, the cable network was not symmetrical; upload speeds were much slower than download speeds. Though Charter Spectrum and Comcast are regularly rated the worst cable companies in unscientific surveys, Consumer Reports consistently ranks Mediacom as worse.[113]

Community leaders also knew that future economic development depended on ensuring better connectivity for existing and potential job creators, especially home-based businesses. As the project moved forward, both Two Harbors and Silver Bay entered into Joint Powers Agreements (JPA) with the county to solidify their intent to cooperate.

Mediacom accused each community of fraud based on language in an early version of the JPA. It also accused the cities of lying to obtain RUS funding and demanded they rescind the JPAs. In keeping with the long tradition of cable companies abusing public records request acts to punish public rivals, Mediacom demanded copies of all correspondence relating to the project; the Minnesota statewide cable lobbying organization also filed similar requests. The New York-based cable company vowed to appeal to the Office of Inspector General of the United States Department of Agriculture (OIG) to request an investigation.[114]

Russ Conrow, Special Assistant Lake County Attorney, responded by pointing out Mediacom's factual errors and sharing the final JPA language. Conrow finished his response by inviting Mediacom to take advantage of the new network

rather than fight it: "It is a pity that you feel you have to resort to such heavy-handed tactics, rather than choosing to continue to work in partnership with the cities and join with Lake County to provide services on this new infrastructure."[115]

On February 11, 2011, Mediacom filed a complaint with the OIG.[116] It requested the RUS cease distributing stimulus funds while the OIG perform an official investigation. Mediacom also accused the county of expecting to default on the loan segment of the award, illegally transforming it into an unauthorized grant. However, it produced no evidence to back up its incendiary claim.

Mediacom's main objection was that the county was investing in better networks in its territory. According to the complaint, Beaver Bay, Silver Bay, Two Harbors, and Hoyt Lakes were considered served under federal guidelines because Mediacom was advertising rates of at least 4 Mbps downstream and 1 Mbps upstream at that time. However, large projects may serve areas that already have basic broadband as long as the overall service territory achieves a specified threshold of unserved premises. In industry parlance, building a new network where one already exists is termed "overbuilding," giving a sense of how welcoming industry is to competition.

Mediacom and others have vilified the concept of overbuilding (competition), but it can be necessary to give rural projects a fighting chance and bring service to homes that otherwise have no hope of seeing investment. Serving the more densely populated town areas (where the cost to operate is lower per household) creates the revenue needed to balance out the high cost of serving rural areas where broadband is most lacking (and the cost to operate is higher per household).

Disallowing overbuilding may result in unsustainable networks that may require ongoing subsidies like the Universal Service Fund. However, if networks have the appropriate mix of densities, nonprofit business plans may not need ongoing subsidization. Or, if they do require subsidization (as CenturyLink, Frontier, AT&T, and many other firms have used to their advantage), the ongoing amounts will be far less with a better mix of density.

Any argument of unfairness regarding the stimulus award must be balanced against the reality that Mediacom had every opportunity to take advantage of the program itself or work with the county on a mutually beneficial arrangement. It chose not to. Another balancing act is whether County Commissioners should have deferred to Mediacom's desires or the thousands of constituents that had no broadband and no realistic hope of getting it from an existing provider.

The OIG looked into Mediacom's allegations and determined that the complaint did not warrant an official investigation. But Mediacom was not the only source of problems as the project progressed. In late 2010 and early 2011, the relationship between the county and NPB deteriorated. Burlington Telecom, a municipal fiber project in Vermont that was run into the ground by a secretive-minded city hall, came to the attention of County Commissioners. Tim Nulty had created Burlington Telecom in Vermont and left the project in 2007 after a disagreement with the then-new mayor. County Commissioners accused Nulty and Fields of misrepresenting the success of Burlington and ultimately severed the contract.[117] Nulty went on to build the successful EC Fiber—East Central Vermont Fiber Network—while Lake County would sink deeper and deeper into difficulty.

By the end of February 2011, the Board had chosen Jeff Roiland and Gene South to head up the project. Roiland ran the En-Tel telecommunications network in Willmar, Minnesota. South served as CEO of Lakedale Communications in Annandale, Minnesota for many years, providing service in parts of central Minnesota. Together, they formed Lake Connections and became Lake County's partner.

The Board also took formal steps to authorize $3.5 million in county cash reserves for the project rather than pay high interest bond rates or risk losing federal funding. Lake County had previously contracted to work with the public finance firm ORIX for the bond issue, as part of the earlier financial plan. The move reduced final costs for the project, but prompted ORIX to file a breach of contract claim against the county. The ORIX lawsuit did not significantly delay the project, but increased the overall cost of the project due to legal fees.[118]

Lake Connections needed to obtain a license to operate as a competitive local exchange carrier before offering a telephone exchange service via the infrastructure. Minnesota Cable Communications Association (MCCA) objected on the grounds that the county would be offering telephone service without a referendum as required by Minn. Statute 237.19. That statute requires a supermajority referendum before a municipality may own or operate a telephone exchange. Similarly, MCCA argued that the state law precluded the county from using cash reserves to construct infrastructure on which it could offer voice services without voter approval.

Upon review, the Minnesota Public Utilities Commission (PUC) agreed with the county's argument that it would not be the entity owning or operating a telephone exchange; Lake Connections would be the third party provider. The MCCA withdrew its objection at the last minute but vowed to "chip away" at Lake County's authority to deploy a network.[119] The PUC determined that Lake Connections was in a proper relationship with the county to meet regulatory requirements and granted a conditional license.

Though it sent out glossy mailers to scare citizens away from the project, Mediacom announced in the summer months of 2012 that it would not sue to stop the project. What it did do was use its clout in Washington, D.C. to convince a House committee to look into the project. The Energy and Commerce Oversight and Investigations Subcommittee began a review that later led to congressional hearings that were used for partisan purposes more than for any substantial review or oversight.

But back in Lake County, everyone was reminded what the stakes were. In June 2012, residents, businesses, and government endured another loss of telecommunications service for thirteen hours when the only fiber optic connection to Duluth broke in flash flooding. All landline and cell phone service went out, including 911 service.[120] Regardless of the problems surrounding the Lake County project, the incident drove home the fact that the area needed better connectivity than the incumbents were willing to provide.

Even those who were hesitant to embrace the idea of a publicly owned approach realized the necessity. Dave Johnson, owner of outdoor gear design firm Granite Gear, would work from home two days a week due to poor office Internet access. The Two Harbors company needed high-capacity connectivity to transmit content rich catalog and design files. The firm's art director would work nights and evenings to avoid competing for bandwidth with other employees.

That all adds up to lost productivity, said Johnson, who noted that nothing has changed in the 11 years he's lived in Lake County.

"Generally I'm in favor of a market-based solution, rather than having a government come in and provide a service," he said. "This is one of those cases where the market hasn't met the need."[121]

Despite the obstacles created by incumbents, financing, and internal struggles, construction finally began on July 17, 2012, some two years behind schedule. Crews began by stringing fiber in the communities of Two Harbors and Silver Bay. Planners were criticized for commencing construction in an area where Mediacom already offered services, without consideration of the complexities that go into embarking on a network build.

Project leaders planned to first connect Silver Bay properties, then Two Harbors, and then move south toward Duluth in St. Louis County where the network would connect to the larger pipe and the Internet. Rural areas would be added in a later phase. Such an approach makes projects like this more financially viable—something critics are deeply concerned about—by ensuring it begins generating as much revenue as possible, as early as possible. However, it is a bitter pill for those who have waited years for broadband to have to wait another year when people in town are getting an additional connection.

Pole Attachment Problem

Once deployment began, they encountered still another major challenge. In August 2012, the county and Frontier entered into the pole attachment agreement required for the fiber to be attached to Frontier's poles. The agreements were premised on both parties' understanding that Frontier only owned poles located outside of city limits.

Frontier surprised the county, Lake Connections, and the City of Two Harbors when it claimed ownership of approximately half of the poles within the city limits. For decades, the city had maintained the poles, replaced the poles, and even billed Frontier for use of the poles. Nevertheless, Frontier traced ownership to two predecessors, forcing the city to engage in drawn out negotiations. The two entities eventually reached a settlement over who owned which poles but negotiation continued until July 2013.[122]

The county and Lake Connections continued construction during negotiations to keep the project moving forward. The partners had not submitted permit applications to Frontier before installing fiber because they assumed the poles were county property. During negotiations, Frontier raised a second issue, stating that Lake County had violated the hierarchy standards accepted in the industry because it had placed its fiber on the bottom pole position. After numerous county requests, they met and couldn't resolve their disagreement. They went back and forth, complained to the FCC, and eventually resolved it in June 2014 after much drama. This is par for the course of pole attachment minutiae and just one of the reasons there is little hope for robust broadband competition in the current regulatory-political landscape. Any method to delay a project or increase costs for a competitor is a tool in the toolbox of an incumbent provider.

While construction continued in 2014, approximately 100 of 836 households in Silver Bay began taking service in July. Beta testers in Two Harbors helped to identify and resolve problems before service is available to everyone. Lake Connections estimated that Phase One, covering Two Harbors and Silver Bay, would be finished in the fall of 2014. Phase Two was scheduled for completion before June 2015.

Continued Obstruction by Frontier

The summer and fall of 2014 saw both the persistence of old problems and the arrival of new ones for Lake Connections. The pole ownership problem which had plagued the project

remained, and over the summer the RUS halted all payments until a new plan was developed. Subcontractor Rohl Networks stopped work while the county developed a new plan that could meet the project's timeline and didn't rely on using Frontier's poles, and which would see fiber buried rather than hung on utility poles.

In October 2014, the county was forced to pay $500,000 in cash to Rohl out of the county's general fund while a new plan was developed for the USDA. Meanwhile, hundreds of applications for the new service continued to come into the Lake Connections office, highlighting how many in the community wanted it. In December of that year the RUS approved the new plan, which included the city pledging up to $15 million to finish the project ($13.5 million would eventually be used along with the 3.5 million from the FCC), and work renewed in earnest.

That year **the network got $3.5 million** from the FCC's Rural Broadband Experiment to extend to 845 additional service blocks, including 8,497 unserved locations (it wouldn't be until December 2016 when the money would finally arrive). Rohl, which had halted construction, began working again, with 600 miles complete at the end of 2014.

By the next June, the network had received 1,800 applications and was still averaging 100 new ones per week. That same month the county and Rohl Networks agreed to part ways, and **a new construction contract** was signed with MP Nexlevel, LLC. The start of September saw Lake Connections with 1,700 users, with leadership anticipating hitting 7,000 over the next five years. They'd already been asked to extend into Cloquet Valley and neighboring communities.

As the end of the month approached the 1,200-mile network was 95 percent complete, with construction crews working twelve hours a day, six days a week to finish by the September 30 deadline as outlined by the new plan. Unfortunately, when it did come, the **Fall Lake and Ely connections had not been made**, with the fiber stopping at the Ely city limits. The network passed 14,000 homes at that point and provided service to almost two thousand users. The pole agreement obstruction by Frontier, which had dragged on since 2013, was cited as a major factor by those involved.

"When we asked Frontier about the pole ownership, we received back some deeds from 1902 showing the telegraph lines and the railroad's ownership," Ely Clerk-Treasurer Harold Langouski **told the Timberjay in April 2016** of the effort. "This is more than pole ownership," he said. "[I]t is the position-on-the-pole ownership. Even though we replaced many poles and own them, it is the position on the poles that they claim their own. You can see why [they do this], because they can dictate what gets installed on their poles."

Ultimately, what had been a plan designed to use 30,000 poles for the Lake County network ended up being a buildout that only used 5,000. But burying fiber increased costs and slowed progress, and the project ran out of money after the deadline hit. Nevertheless, by the end of that spring 3,000 households had applied for service. "Me and my daughter used to arm wrestle over if she was going to be watching Netflix, I couldn't go on the computer. Now she's streaming on her phone and...on the TV and I'm on my computer, and there's never any conflict at all," said **Rick Goutermont, County Commissioner to the County News** in June 2016. Local outdoor company Granite Gear, based in Two Harbors, said the better connectivity increased productivity.

Internal disagreements, however, belied the strength of the network's offerings and the value users felt. In November of 2016, the County Board unanimously approved a resolution for cooperative Consolidated Telecommunications to take over operations and management of Lake Connections after the county and network leaderships couldn't agree on a fee structure, **according to the Lake News County Chronicle**.

Eventually, these stressors became too much to bear, and **in June 2017** the board unanimously decided to sell the network. Discussion began in May, at which point the county owed $48.5 million on the RUS loan, with the county citing a lack of appetite for the additional needed funding. With 2,500 subscribers on the network, they began to search for a new owner and **RUS agreed to discharge the loan** upon the sale of the network to a new owner.

The bidding process continued through November 2018, when five bidders in the running: Mediacom (which had spent by this point almost a decade demonizing and throwing obstacles in front of the network), as well as Hanson Communications, Pinpoint Holdings, Lake Parkers, and Cooperative Light and Power. In December **a final bid was chosen**, and **the network was sold for $8.4 million to Pinpoint Holdings**, a Nebraska-based company. Today, the Lake County fiber infrastructure still exists, bringing connectivity to the region under operator Zito Networks.

Conclusion

Lake County's struggles did not stop local residents and businesses from thriving with the connectivity they couldn't get from the DSL and cable networks. Granite Gear was testing the service in Two Harbors, and Dave Johnson said the new connection was affecting productivity "in big ways." The art director now works during the day with other staff. High-resolution images uploaded to customers' websites used to take several hours and degraded speeds for the entire operation; now the process takes a few minutes. Johnson says: "Every employee who uses a computer gains

a few seconds several times a day courtesy of the faster [I] nternet speeds, and cumulatively, this adds up to a significant improvement in productivity."[123]

The Lake County project offers important lessons for large-scale rural projects. While the geography creates a challenge in the physical sense, Lake County also teaches other communities to anticipate important stumbling blocks. While rural communities often have the benefit of strong community ties, it is important to self-scrutinize.

As previously noted, educating the community leads to stronger grassroots support. When projects face adversity from incumbents or other sources, citizen backing can help overcome such issues or breathe new life in a troubled project.

Due diligence is important too, as in the case of Lake County's pole ownership, because incumbents will not hesitate to use their ample resources to slow down or derail a project to maintain the status quo.

Fortunately, Lake County's difficulties are not typical. The timing of the project combined with the significant federal funding resulted in a top-down approach that is uncommon in these projects. In some ways, it is the opposite of the Renville-Sibley Fiber project, where so much effort was invested in educating and involving the public.

Lake County ultimately sold the network, but is better off for having tried to improve its service than many rural counties that have hoped the national DSL and cable companies would solve their problems. It still has an advanced network, even if the ownership is no longer local.

OVERBUILDING POLICY

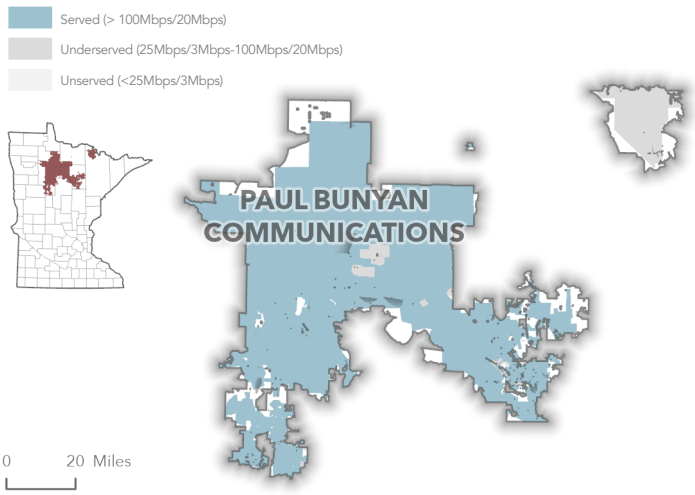
One of the frequent concerns in Internet policy is whether a government program should allow "overbuilding" or building a new network where another already exists. In Lac qui Parle County, the new fiber optic network avoided areas already served by much slower cable and DSL, which may have pushed people and businesses to move just outside town limits to get much better Internet access.

The Lake County fiber project decided to connect the entire county and portions of nearby St. Louis County, including the towns of Two Harbors and Silver Bay. Mediacom protested this action at all levels of government, saying it should not have to compete against a subsidized network. However, Mediacom's argument conveniently forgets the decades of protection cable networks got from monopoly franchise agreements with cities - they were created with government support and government policy should now fix the broken market that is harming millions of Americans.

The larger policy problem is that encouraging networks only in the hardest-to-reach areas increases the costs significantly. By including the more dense areas of Lake County, the project was much more likely to achieve positive cash flow—areas of higher revenue balance the areas of lower revenue. Without the higher density areas, the network may need ongoing subsidies, which is often decried by the same people demanding that no government investment occur.

The best question may be: what is the most fiscally responsible way to ensure we have high-quality, border-to-border Internet access. The answer will almost certainly involve some level of "overbuilding," though almost always where the existing ISPs have refused to upgrade to deliver modern services.

PAUL BUNYAN COMMUNICATIONS



- The telephone cooperative began offering broadband in 2000 but has installed only fiber since 2004.
- Paul Bunyan has expanded in many nearby areas left without high-quality Internet access by the national companies that historically operated there.
- As the network continues to grow, nearly a quarter of recent signups have opted for the gigabit tier, challenging common claims from operators of slower networks about what families need for the modern Internet.

Across northern Minnesota, residents enjoy some of the fastest, most affordable Internet access available in the state despite living in some of the least-populated terrain. And yet, Paul Bunyan Communications, which began as a telephone cooperative in 1952, has made it happen with a commitment to community investment and by leveraging partnerships.

A Giant of a Network with One Foot in the Future

Paul Bunyan began to offer VDSL services across its roughly 5,000-square mile footprint starting in 2000, where it entered the market as a Competitive Local Exchange Carrier (CLEC) in Bemidji (competing with a company that would be merged into what is now Lumen). In 2004, it made the decision to switch to fiber, and hasn't installed copper since then. From 2004 to 2014 it pursued this fiber build in both its existing footprint and any new expansion areas.

By 2009 that effort was about a third of the way complete, with the cooperative having connected roughly 4,000 premises to its fiber network and, at the time, offering symmetrical connections of 40 megabits per second (Mbps). Having the fiber infrastructure was already having a positive economic impact in the region too: Northwood DNA, Inc., for instance, was able to run its sequencing and genotyping operations for a list of customers that spanned the globe, based out of Becida, an unincorporated community of just 270 at the time.

CEO Gary Johnson, who began his tenure with the company in 1988, attributes the move to the forward-thinking culture of the cooperative's board and a deep investment in bringing fast and affordable Internet access to everyone in the region. While almost all rural telephone companies have received subsidies from a variety of programs, not all have been as good about turning those dollars into the best possible connections for their subscribers as Paul Bunyan. This is especially true of the national companies that have invested the least in rural communities, leaving local entities to build the desperately needed networks.

Launching the GigaZone

In the fall of 2014, Paul Bunyan had made enough progress that it was able to brand and officially launch a unified fiber Internet product it would call GigaZone, and the cooperative began switching members over in ever larger numbers the following spring.

Part of Paul Bunyan's strategy for pursuing long-term financial sustainability for broadband expansion has been to find partnerships and anchor tenants on its network where possible, and then use that foundation to bring gigabit service to small towns and communities along the way. Nowhere is this better exemplified than in Lake George. Partnering with the state of Minnesota to extend its fiber infrastructure to Itasca State Park in 2015, Paul Bunyan passed through the small community, and over just a short period of time residents went from dial-up service as the only connectivity option to having access to symmetrical tiers from 50 Megabits per second (Mbps) to 1 Gbps from the cooperative.

That year, Paul Bunyan won a Leading Lights National Award for Most Innovative Gigabit Broadband Service. In May, its GigaZone subscriber count hit 5,000, **and it reached** 7,800 by September. **In February 2016**, the network upgraded all the schools connected to its infrastructure to gigabit service at no extra charge, including public schools in Red Lake, Northome, Kelliher, Blackduck, Indus, Bemidji, Laporte, Littlefork-Big Falls, Park Rapids, Greenway, Nashwauk-Keewatin, Grand

Rapids, Deer River, as well as the TrekNorth and Voyageurs charter schools. That same month its fiber offerings passed 14,000 locations.

The end of 2016 saw the network hit another major milestone, with expansions to Turtle River, Puposky, and Tenstrike, and parts of Bemidji, bringing its total to more than 20,000 passings at the same time that Paul Bunyan **linked up with the Red Lake Nation** to bring service there, making it one of the rare Native Nations in the county to have fiber-to-the-home access.

2017 brought further expansions to the communities of Kelliher and Northome. The state of Minnesota helped with a $803,000 **Border-to-Border grant** to match with $981,000 from Paul Bunyan to expand into portions of St. Louis, Hubbard, and Itasca counties. All of this work brought not only faster, more affordable Internet access to residents in the region, but it lured business too. In 2018, Delta Dental opened a new operations and technology center in Bemidji to take advantage of the network's offerings, bringing in around 150 jobs in the process.

The **last major expansion** before the end of 2019 was to the Big Falls area. 2020 brought additional milestones, with construction routes completed to Grand Rapids, where Paul Bunyan opened a second office in March 2020.

To Infinity and Beyond

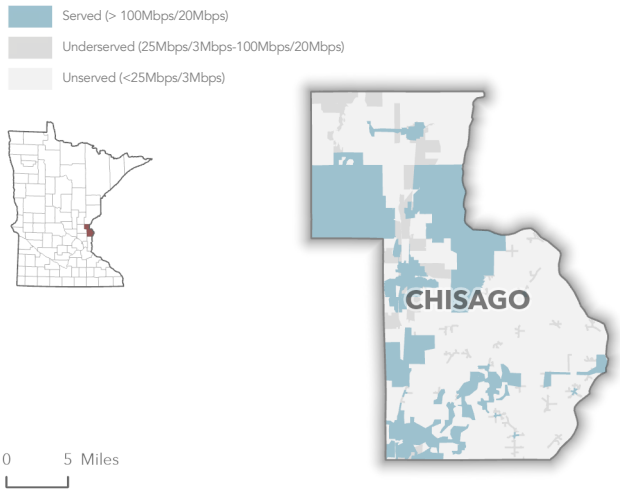
In the future, Paul Bunyan looks forward to expanding to the north and east as they are able. In part this effort will be aided by a significant **Rural Digital Opportunity Fund winning bid** for a total of $16 million to serve almost 5,100 additional locations.

CEO Gary Johnson attributes a good deal of Paul Bunyan's success over the last twenty years to having a progressively minded cooperative Board that is mission-driven, willing to invest in rural parts of the state to get un- and underserved households online. The cooperative has received four Border-to-Border grants, putting the funds to good use. It has roughly 30,000 subscribers across the 7,000-mile fiber network that can choose from symmetrical tiers of 250 Mbps for $60/month, 500 Mbps for $80/month, or 1 Gbps for $100/month.

About a quarter of new signups opt for the gigabit service, compared to about ten percent of existing members, which is likely a trend driven by the increased emphasis on connectivity brought on by the Covid-19 pandemic. Most of the remainder have chosen the 250/250 Mbps tier. Notably, the price of the network's gigabit tier **hasn't changed in more than five years** while, at the same time, monopolies serving more urban areas have **steadily implemented price hikes** and **data caps** at rates far exceeding the cost to deliver those services.

In an interview, Johnson felt optimistic about what he said were three important recent shifts. The first is that the cooperative no longer feels they have to make the case that broadband is essential infrastructure. The second is that the pandemic has shown that telework and telehealth are here to stay. And the third is that more and more funding is going out on the basis of prioritizing faster speeds, so that funds aren't going to infrastructure already past its use-by date.

CHISAGO COUNTY



Chisago County, Minnesota (pop. 57,000) sits on the banks of the Saint Croix River along the eastern border of the state. In the last half-decade, the county has taken significant strides to improve local connectivity in area townships through a combination of partnerships and a funding recipe that unites the power of local, state, and private money to bring fiber connectivity to households with few or no options.

Chisago County **became a Blandin Broadband Community in 2015**, which served to jumpstart current efforts to get better Internet access to residents and businesses throughout the region. Through 2017, local leaders worked to get a sense of the picture in the area, conducting a survey to determine where and at what speeds there was broadband service. The responses were striking.

More than one-third of residents told the county they would telecommute if they had a fast enough connection, one-fifth said they would use better broadband for telehealth, and nearly one-third said they would use it to run a business. The **county's 2017 Comprehensive Plan** emphasized Internet access as a key priority for the future.

Finding the Right Blueprint

It became clear early on that the nine townships in the county had the highest immediate need, largely because CenturyLink (now called Lumen) had not invested in the area the way the smaller telephone companies profiled in these reports had invested in their communities. These include Amador (pop. 900), Chisago Lake (pop. 4,700), Fish Lake (pop. 2,000), Franconia (pop. 1,800), Lent (pop. 3,100), Nessel (pop. 2,000), Rushseba (pop. 800), Shafer (pop. 1,000), and Sunrise (pop. 2,000). Through a combination of local funds, state provided Border-to-Border Grant funding, and a partnership with CenturyLink to use the latter's Connect America Fund (CAF) II awards, three of these townships have seen significant progress.

- **Chisago County became a Blandin Community in 2015, unlocking tools and training to help improve Internet access.**
- **A particularly motivated township, Sunrise, worked with Lumen to assemble a stack of local, state, and federal subsidies to massively underwrite an upgrade to fiber by the telephone monopoly.**
- **Other townships have iterated on the model, helping Lumen to maximize public dollars in its investments, but some areas outside North Branch and Harris don't appear able to replicate the model.**

One area of **particular need from the very beginning in Chisago County was Sunrise Township**, where local business Step Manufacturing, which employed 40 individuals, could no longer conduct business in an area where the cost for broadband constituted too much of a continuing burden. With the help of the Blandin Foundation and the state Department of Employment and Economic Development (DEED) office, township representatives partnered with CenturyLink to expand fiber service in the area.

To make it work economically, the plan called for a combination of funds from the township, a Border-to-Border grant, and CenturyLink using part of its CAF II subsidies in the area, and has brought fiber connectivity to around 700 locations. CenturyLink owns and maintains the resulting infrastructure, despite having contributed a small fraction of the overall cost to build it. Residents can opt for symmetrical 100 Mbps Internet access for around $65/month (after a promotional period) or symmetrical 1 Gbps access for around $85/month (after a promotional period). The quoted rates are before additional fees the telco tacks on.

In Sunrise Township the local financing portion is covered via a tax levy through a subordinated service district, since only half the town ultimately got service. In total it comes out to about $1,000/household, HRA-EDA Executive Director Nancy Hoffman shared, which residents can pay for right away or over a ten-year period.

In the absence of this partnership, CenturyLink would have likely done what it has done elsewhere with its CAF II subsidies —the bare minimum requirements of old DSL that would not meet the FCC definition of basic broadband for most of the families in the area.

Iterating for Success

With the Sunrise Township model appearing to have worked, local officials applied for additional Border-to-Border funding and won twice more, in Fish Lake Township and Nessel Township.

The Fish Lake project began after its successful grant **win of $1.8 million in 2017** (combined with $2.8 million in funds from CenturyLink and the township) to bring fiber to 919 households, 7 businesses, and one community anchor institution. In Fish Lake, the town has bonding over fifteen years, with the hopes that as more residents move into the area the costs will be shared over a larger population. Right now those residents pay around an extra $120/year to fund it.

Nessel Township won $1.7 million in the 2019 funding round for 956 unserved and 64 underserved locations, with $3.9 million in matching funds.

Local officials have had less luck in forging partnerships with others to advance broadband in the region. Frontier serves the southern portion of the county, and used its CAF II funding in the area to run fiber to its DSLAMs in the area a few years ago, but did not invest in any additional infrastructure. Despite repeated pleas and efforts by local leaders, it has not worked to bring better connectivity to homes or businesses, leaving residents on Frontier connections stuck on slow and unreliable DSL service.[124] Bill Coleman's report for the Blandin Foundation, **Impact of CAF II-funded Networks: Lessons From Two Rural Minnesota Exchanges Left Underserved**, offers a spot-in analysis of their predicament.

Changing tactics, Chisago County facilitated a partnership with Brainerd-based cooperative CTC in 2019 to apply for a **roughly $5 million** Border-to-Border grant in two more places: the Chisago Lake Township and Franconia. Chisago Lake Township provided the density needed to give leaders the best chance at success, and Franconia wanted and needed better connectivity badly enough that the application included them. The Chisago Lake Plan would have required $2,000 from each household for the local contribution. Franconia's original plan was on a per-acre basis. This application's initial round was unsuccessful, **as was a similar application in 2020**. While Franconia is regrouping, Chisago Lakes Township wasn't done yet. In 2020 **it won a $75,000 Blandin Broadband Grant**, and local leaders are in the process of meeting with residents and businesses to develop a plan to put it to the best use.

Community-Driven Efforts

In Franconia, local efforts were driven by a citizens group which had originally coalesced around a community solar initiative. Fish Lake also saw the formation of a group, with county officials announcing an initial Thursday meeting on broadband in the early stages of their efforts on a Tuesday, only to be surprised to see more than two dozen local residents show up. Franconia, for its part, is in the process of re-surveying township residents as a foundation for addressing concerns, distributing information, and planning for a stronger application in the future.

Robust residential response rates to the surveys has been key in showing the need and support for the current model Chisago County is undertaking. In the initial three townships of Sunrise, Fish Lake, and Nessel, local officials set an internal response-rate goal of 50 percent of households, assuming many would be in favor, to build a strong foundation. In the end, they often saw far more than half of households surveyed eager to join, with some areas as high as 80 percent. It has also revealed to local officials the number of microbusinesses that are scattered around rural parts of the county that are eager for and would make good use of better broadband.

For the townships in Chisago County covered in their entirety via the partnerships with CenturyLink, the agreement was that no one would be left behind on the old infrastructure and everyone would have access to fiber. The faster speeds have also allowed some residents—in addition to getting faster service—to eliminate other costs, like substituting streaming services for DirecTV. Residents have also talked with local officials about the opportunity costs lost prior to the new infrastructure, with high school students unable to take advantage of concurrent enrollment opportunities by taking college classes online, completing future credits at lower per-credit rates.

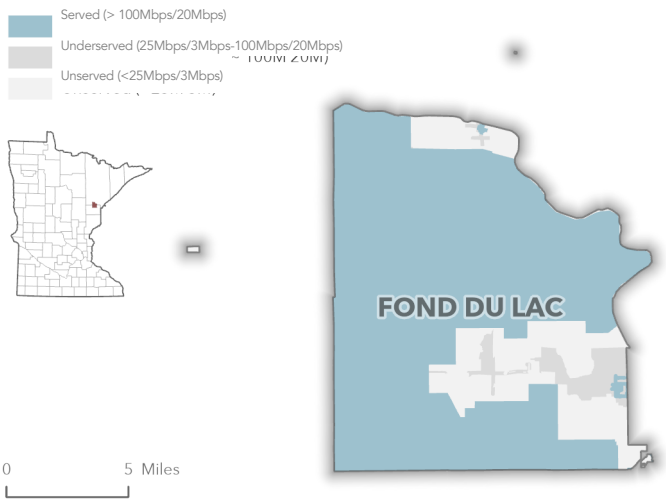
The Secret Sauce

In execution, the Border-to-Border grants have played a crucial role in making these projects happen, and Chisago County hopes to continue this model as time goes on by applying for one grant a year until everyone has service. Without them, households would entirely bear the financial burden at a rate four or more times than what has been achieved through the partnership and grant wins.

The problem at this point, Nancy Hoffman said, are the cities in the county stuck with poor service. North Branch and Harris, in particular, serve as examples. The outskirts of North Branch (pop. 10,000) are underserved, and nearby Harris (pop. 1,100) has unserved pockets too. A solution has yet to appear, largely because it has been hard to develop funding mechanisms to incent fiber-to-the-home expansion when the project covers only a portion of the community and has to be targeted at neighborhoods of 20 or fewer households.

Chisago County has found some solutions for expansion of fiber infrastructure in at least some areas of the county, even if it's not locally owned or accountable to the community. As a result, thousands of residents can get online who couldn't before, and those stuck on slow connections now have faster options.

FOND DU LAC



- One of the six bands of Ojibwe, the Tribe first planned to build a largely wireless service but ultimately worked with the Blandin Foundation to pursue federal grants for a more aggressive project.
- Aaniin Fiber Services now has more than 500 accounts, including more than 10 businesses.
- The network was built with local funds as well as grants from the Minnesota Border-to-Border fund, a HUD Indian Community Development Block Grant, and a USDA Community Connect grant.

The Fond du Lac Band is one of the six bands of Ojibwe, which together are federally recognized as Minnesota Chippewa. The Ojibwe have lived in the Great Lakes area for more than a thousand years. The La Pointe Treaty of 1854 established the Fond du Lac Band's reservation in Carlton and St. Louis County, Minnesota. The reservation is known as Nagaajiwanaang, "where the water stops" and there are more than 4,000 people in the Fond du Lac Band. They operate two casinos, Black Bear Casino Resort and Fond du Luth Casino. Fond du Lac also operates FDL Gas & Grocery, FDL Propane, and FDL Sand & Gravel as tribal enterprises.

This case study comes from a report that H. Trostle originally wrote for ILSR in **Building Indigenous Future Zones: Four Tribal Broadband Case Studies**.

Brief History of Aaniin Fiber Services

Aaniin Fiber Services was built through years of careful research and feasibility studies. Jason Hollinday, the Director of Planning at Fond du Lac Planning Division, explained how the Fond du Lac Band approached the problem of getting high-speed Internet service throughout their communities.

In 2006, they started to compare wireless and hardwired network types, such as cable and fiber. The original plan called for ten wireless towers throughout the reservation to deliver Internet service to people's homes. There were a few issues with this plan though, one of which was geography. Northern Minnesota has many hills and forests, and the available wireless technology at the time was not going to be able to penetrate to many remote areas. It was, however, fairly inexpensive, and Fond du Lac applied for grants for the project. They weren't funded, and Hollinday says they were told that the project was "economically infeasible."

Undaunted, they changed tactics and considered alternatives, allowing them to be prepared when the market changed drastically in 2010. The price of fiber and equipment for a fiber-to-the-home network fell enough to make a network pencil out. They worked with the Blandin Foundation in Minnesota and pursued grants through the USDA.

Filling a Need

Community members, however, needed Internet service sooner than the fiber network was likely to be built. The Fond du Lac Band already had an institutional network between government buildings. They added 13 wireless hotspots to several of these buildings in 2013. The hotspots have a range of about a quarter mile, and still serve as a stop-gap measure for community members without reliable Internet service at home.

In 2015, they finally received a USDA Community Connect Grant. Two Minnesota Border-to-Border Broadband Grants were later approved as well and one Housing & Urban Development (HUD) Indian Community Development Block Grant. In total, it was about $9 million in grants, and the Fond du Lac Band matched half that amount with $4.5 million in cash on hand. They had secured all the funding needed to build out a next-generation network.

Starting out, some of the grants required them to build to areas without Internet service of at least 10 Mbps download and 1 Mbps upload. Unserved areas were prioritized. Later

grants supported building the network to areas without 25 Mbps download and 3 Mbps upload, enabling further network expansion that has continued in 2021.

The Blandin Foundation assisted with community outreach for the project. In a series of public meetings, community members talked about what they would like to do with the Internet service. Hollinday recalled a bit of doubt from some members, such as "Well we'd never get that here, but if we did have it…," because the project sometimes seemed too good to be true. The network went live in fall 2019.

The network, however, continues to expand across the reservation, connecting more people. People are still learning all the capabilities of the Internet service. Since 2014, Fond du Lac has offered a summer camp for teens to create smartphone and iPad apps. Each student creates an app and is given an iPad to take home. The program also supports cultural knowledge. For instance, some of the apps from 2014 went into detail about beading, plants, and the Ojibwe language. The possibility of expanding outside of the reservation boundaries has been considered, but focus right now is on making sure all community members have access to a reliable connection. Using gaming money and possibly further grants to build a fiber network in nearby areas could create a long term diversified revenue stream for the community.

A Network Near the North Shore

As of 2021, Aaniin Fiber Services serves 510 accounts. There are about a dozen businesses connected to the network, not including home businesses. For residents, the following tiers and prices listed below include a $13 equipment rental fee. Symmetrical 50 Mbps, 100 Mbps, 250 Mbps, 500 Mbps, and 1 Gbps tiers cost between $68 and $140/month. Beyond the speed tiers, the network offers a different set of options: Essential Home, Advanced Home, and Automation Home. The Advanced Home service costs an additional $8 monthly (starting at $75.95) and includes a mobile app to manage the network and parental controls. The Automation Home option is designed for automating the home. It starts at $86.95 a month for 50 Mbps (an additional $19 more than the Essential Home service). It includes an Amazon Alexa and a home automation hub. The network is also planning a lower cost option called Essential Flats, starting at $60.95, for apartments.

The network cost approximately $13.5 million in total. About $9 million came in the form of grants from a USDA Community Connect grant, two MN Border-to-Border Broadband grants, and a HUD Indian Community Development Block Grant. The Fond du Lac Band contributed $4.5 million in funding up front.

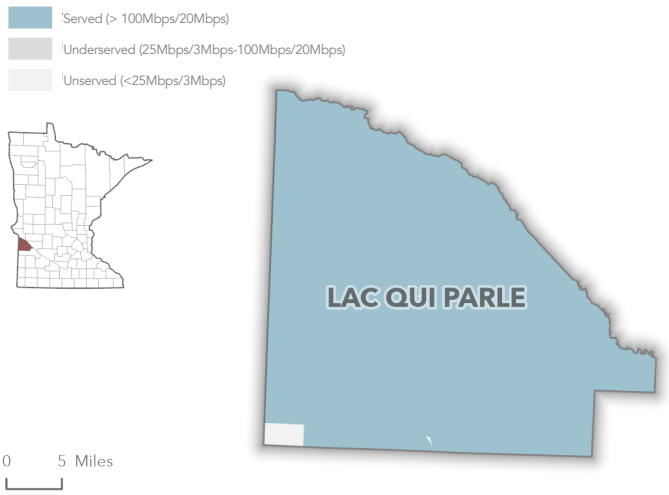
Aaniin Fiber Services is still working to bring the network to the whole reservation, and they may later consider expanding into neighboring communities. COVID-19 has created increasing demand for Internet service, but this is not straining the network. They are focusing on problem-solving issues common to any new network, such as doing customer service and adjusting to problems on the fly. For the first year of operation, they contracted out customer service, but if the problem is something physical, there are a couple of crews on call that will go out to fix it.

Hollinday found the key to Aaniin's success was a combination of background research and public outreach. Before embarking on this project, the Fond du Lac Band spent years digging into what would make sense in their community. They had considered multiple avenues to bring Internet service to remote areas and had weighed the full cost of building a network. They also made sure to fully include the community in their project. Working with the Blandin Foundation, they held public meetings to learn what community members wanted and designed the network to meet their expectations.

Doing background research and involving the community early in the process are all forms of pre-planning. This refers to the steps taken before officials decided to pursue a specific course of action for any project. All of these forms of pre-planning are useful for filling out grants. It creates a clear narrative that grant agencies can follow to see how an Internet service project will impact the community. Hollinday credits this pre-planning as "the difference between applying for early grants and now."

When the Fond du Lac Band had first applied for broadband grants in the mid-2000s, the Planning Division had not performed as much pre-planning. They knew that their community needed Internet service and that the wireless project made the best sense at the time. But without pre-planning, they were not able to communicate that to grant agencies. When the market changed in 2010, the Planning Division realized fiber-to-the-home was actually feasible. They did more background research and involved the community. This pre-planning activity showed grant agencies a clear narrative of why the community needed fiber-to-the-home.

LAC QUI PARLE COUNTY



- **Lac qui Parle County had little broadband access when it worked with Farmers Mutual Telephone Company, a cooperative, to expand fiber optics across its rural region.**
- **Despite Frontier hassling customers with early-termination fees if they tried to switch to the new fiber network, the network has succeeded in attracting many business and residential subscribers.**
- **Despite barely having broadband service, county seat Madison was not eligible for subsidies to get fiber from Farmers, though the cooperative is slowly expanding across the town as best it can.**

Lac qui Parle County rests on the border of South Dakota. Approximately 7,200 people live in communities of less than 100. Three thousand reside in equal numbers in Madison and Dawson.

In Minnesota, senior citizens comprise 14 percent of the population; in Lac qui Parle County, almost 25 percent of residents are over 65.[125]

In 2010, approximately 52 percent of all Lac qui Parle residential and business properties still depended on dial-up or satellite. A total of twelve K-12 schools, libraries, medical clinics, public safety facilities, public housing, colleges, community support organization, and government facilities also depended on dial-up or satellite for Internet access.[126]

Around 2014, Mediacom, headquartered in New York, offered the fastest telecom service in the county in the towns of Madison and Dawson. Mediacom's cable service generally outperformed DSL but during peak times, capacity was slowed by congestion. The cable monopoly advertised speeds of "up to" 15 Mbps downstream and 1 Mbps upstream, but customers consistently described much slower speeds.

Frontier Communications, headquartered in Connecticut, provides telephone service in the region and some DSL in some towns. Those speeds were up to 1.5 Mbps downstream with much slower upstream speeds at the time.

A Partner on the Prairie

When farmers sought telephone and electric service in the early 1900s, they banded together to create cooperative entities owned and operated by community members. Today, telephone and electric cooperatives are delivering the next essential utility.

Farmers Mutual Telephone Company (Farmers) was established in 1904 to serve the farming community in the northwest corner of Lac qui Parle County.[127] In 1949, an amendment to the Rural Electrification Act of 1936 allowed local telephone companies to receive federal loans to extend service deeper into rural areas; Farmers applied immediately.[128] In 1950, the company obtained a loan that allowed it to rebuild and upgrade its existing system. The following year, the entity reorganized from a stock mutual to a cooperative.

In 1995, Farmers began offering dial-up Internet access over its copper infrastructure; five years later Farmers shifted to HDSL, one of the earliest forms of DSL technology, to improve services.[129] The slowest HDSL speeds were approximately twice as fast as the fastest dial-up speeds.

Around that time in nearby Stevens County, the Federated Telephone Cooperative (Federated) began offering cable TV and Internet access to its 2,000 residential and business customers, charging lower rates than Mediacom.[130] In 2000, Federated decided to rebuild its entire network as a fiber-to-the-home system.

Taking advantage of like-minded leadership and close geography, in 2002 Federated and Farmers formed a partnership. The two entities maintained separate boards, but began sharing a General Manager, with Kevin Beyer serving both cooperatives. They later began calling the joint

effort "ACIRA," which is short for Advanced Communications in Rural America.

In 2007, Farmers deployed a fiber ring in Madison and Dawson to provide connectivity to area hospitals. Dawson, Madison, and Appleton hospitals connected to the ring to take advantage of high-bandwidth telehealth applications. Farmers also provided fiber service to the Lac qui Parle Valley Schools and to a small number of local businesses.

In places that lacked fiber, Farmers' copper infrastructure provided slow and inconsistent Internet access. The cooperative could not offer the bandwidth members needed because the long distances between households were ill-suited to DSL technology, which degrades significantly over distances as short as a few miles. When members requested better services, Farmers knew that fiber was the best option and piggybacked on Federated Telephone's fiber deployment experience.

Farmers used the proceeds from a sale of its interest in a regional cellular provider to finance a significant portion of a fiber upgrade. The project began in 2007, and the last of Farmers' 1,000 customers transitioned to fiber in 2010. The entire project cost $5.5 million. Approximately 63 percent of customers who received the fiber upgrade subscribed to Internet access in addition to phone service by 2014.[131]

A New Partnership

In 2007, Farmers attracted the attention of the newly appointed Executive Director of Lac qui Parle County's Economic Development Authority (EDA), Pamela Lehmann. She attended a Blandin Foundation conference and heard a presentation by Beyer. Lehmann was particularly impressed by Farmers' fiber upgrade project.

At the time, Lac qui Parle County was essentially separated into three geographies and levels of corresponding service: Madison and Dawson, where 3,000 people had access to cable or DSL connections; the northern 40 percent of the county, where 1,000 Farmers customers had access to fiber service; and the southern rural areas, where approximately 3,200 residents depended on dial-up or satellite.

The EDA quickly established a Broadband Steering Committee to investigate methods to improve connectivity in the community. Lehmann approached Frontier to discuss the possibility of bringing fiber to the underserved rural areas in the southern part of the county. In a meeting with Frontier's regional manager, they proposed applying for a feasibility study grant from the Blandin Foundation. Frontier made no commitment for any type of partnership, but the EDA did not abandon the prospect of working with Frontier.

In the spring of 2008, the EDA received a Blandin Foundation grant for 32 hours of technical assistance to investigate ways to improve services in Lac qui Parle County.[132] Blandin representatives, Lehmann, and the EDA convened a meeting of leaders from local government, education, business, and healthcare. Internet service providers also attended.[133]

In late 2008 and early 2009, the EDA approached Frontier again to suggest a joint American Recovery and Reinvestment Act (ARRA) application, but Frontier was not interested. In a National Public Radio article, Lehmann described the situation: "We had two meetings with some of the upper management. They said they didn't have the funds available for a project like this. When they are looking at the big picture, a small county in west central Minnesota was not their priority at that time."[134]

Faced with this reality, in early 2009 Lac qui Parle County and Farmers moved forward together. Their agreement encompassed three phases, each based on a 50/50 partnership. The two entities would jointly apply for a grant from the Blandin Foundation for the feasibility study. If the study suggested the need for better connectivity in the county and provided possible alternatives, Farmers and EDA would apply for ARRA funding. Their application would combine grant and loan funding; both entities would repay the loan dollars equally. If the project ultimately required more than the ARRA funding allowed, the partners would split the cost of the overage.[135]

Not wanting the burden of owning and managing a telecommunications network, in August 2009 the county sent a formal partnership request to both Frontier and to Farmers. Farmers responded while Frontier remained silent.

The EDA wished to stay informed of progress and participate in promoting the network, but wanted Farmers to hold the reins.[136] Farmers would own the physical infrastructure.

Farmers had already applied for ARRA funding in the first round of awards, but the application was not selected. The Rural Utility Service (RUS), the agency tasked with administering funds for broadband infrastructure, was required to award stimulus funding to projects that included at least 75 percent rural areas without access to broadband.[143] Farmers' first application included Madison, which was deemed sufficiently served for purposes of stimulus funding, and without Madison the proposal did not achieve the 75 percent requirement.[137]

Farmers' had the equipment expertise thanks to the 2007 fiber upgrade. When approached with the idea of expanding, cooperative members expressed uncertainty. Beyer described Farmers' assessment of the county's connectivity in the southern areas: "We knew that the towns

of Madison and Dawson had reasonable ability to get a broadband connection – 4 Mbps or 5 Mbps connections – [but] outside of town no one did. So we knew the rural residents were needing some form of broadband connection. They had simply no option."[138]

In October 2009, EDA commissioned a feasibility study. The study was funded with a $25,000 Blandin Foundation grant and $12,500 each from Farmers and the EDA.[139] The feasibility study's engineering, operational, and market development plans were later used to support the ARRA funding application.

As noted, the stimulus funding criteria did not allow infrastructure deployment in areas considered "served." Including both Madison and Dawson in the project had pushed the project over the "served" threshold. They decided to include Dawson in the project area and omit Madison to remain under the required threshold. This was despite the fact that Madison was not served well by any reasonable measure.

Farmers planned an underground network connecting directly to each property. In 2010, 1,561 residential properties, 165 business properties and 12 community facilities still depended on dial-up or satellite.[140] The project focused on replacing those slow, unreliable, expensive connections with broadband via the fiber network.

The county and Farmers were awarded a $9.6 million ARRA award in August 2010. As originally planned, the funds were equally distributed as grant and loan.[141] The 50 percent grant reduced the risk and encouraged Farmers' members to strongly back the plan.

However, they discovered a significant problem after finishing the final financial estimates. In the time since submitting the application, the estimated costs had increased dramatically, leading to a projected budget shortfall up to $3-4 million. According to Beyer, two main flaws in the original pricing created an inaccurate estimate: 1) the estimates did not calculate labor costs correctly; and 2) some equipment estimates were based on those obtained by large corporations with strong negotiating power.

For the broadband project, the federal government established labor costs equivalent to highway construction wages (at almost $40 per hour), considerably higher than the typical wages for such a project in western Minnesota.[142] That other stimulus projects faced the same dilemma was hardly comforting.[150]

Fiber optic cable was in short supply because of the high demand created by numerous stimulus projects and an increase in fiber-to-the-cell tower investments for 4G rollouts, driving up the cost. Suppliers would offer lower prices to large projects buying in bulk while relatively smaller projects had to pay more and wait longer.

Farmers considered abandoning the plan because it did not have funds to cover the shortfall. Under the terms of the original agreement, Farmers and the county had each agreed to cover 50 percent of any shortage. Because Farmers did not have the ability to contribute an additional $1.5 million, the county agreed to loan the cooperative its portion from county cash reserves.[143]

The eventual solution was to diligently keep project costs down, and ultimately the fiber network ended up costing just under $10 million, much closer to the original estimate than expected.

Once the project was back on track, Farmers and EDA launched an aggressive outreach plan. Farmers applied a well-considered two-pronged strategy. Before construction could begin, Farmers needed to obtain installation agreements from each property owner. If property owners failed to sign the agreement, they would be responsible for installation costs at a later date, likely in the neighborhood of thousands of dollars. Farmers also emphasized competition: "This will allow you, in the future," they said, "to have a choice for telephone, high speed data, Internet, and cable television providers."[144]

Farmers offered households and businesses the opportunity to sign installation agreements at the county fair. Radio ads, television ads, and flyers kept residents and businesses informed about the project. They contacted each property owner individually through the mail, over the phone, or with a home visit. Approximately 95 percent of property owners in the proposed project area signed installation agreements.[145]

Unfortunately, a March 2011 earthquake and tsunami in Japan interrupted fiber optic cable production in one of only a few manufacturing facilities. Demand from other stimulus projects strained materials supplies, delaying construction by approximately nine months.

When Farmers began construction in late 2011, it already had an extensive network in the northern part of the county and had fiber in the towns of Madison, Dawson, and Appleton to serve the local hospitals. Farmers integrated the new network by using the anchor institutions in Dawson, Madison, and Appleton as hubs. Spokes expanded out to serve new customers in Dawson and Boyd and to extend outside of Madison to reach areas where the partners could deploy fiber without "overbuilding," in accordance with stimulus requirements.

The network was completed in the summer of 2014 as Farmers continued to add subscribers. By the end of August, 320

new residential customers and 50 new business customers received services from the cooperative.

New subscribers were not immediately made members of the cooperative. Instead, both Farmers and Federated have a policy of waiting a number of years before allowing membership. The duration is based on the costs of expansion. During that time, the net income from the new subscribers compensates the prior member-owners for the risk and capital they offered to enable the new connections.

Services

Federated Telephone Cooperative offers cable TV but, today, Farmers does not. For rural residents, satellite TV is often the best or only option. Instead of offering video over its fiber network in 2012, Farmers and Federated became authorized DISH Network partners under a program offered by DISH. Customers were billed for the service through Farmers, and DISH technicians handled all installation or service calls.

Because of an exclusivity agreement between DISH and Frontier in the Madison, Dawson, and Boyd exchanges, however, customers in those areas did not have access to DISH through Farmers. Farmers could still offer DISH in the northern areas it already served before the Lac qui Parle expansion because there are no Frontier/DISH exclusivity arrangements there.

The situation created a fractured market and logistical problems for Farmers. Being unable to offer a triple-play package everywhere complicated advertising and hurt its ability to grow market share.

In order to provide a television option for subscribers in the Frontier territories, Farmers was negotiating with content providers to offer Internet Protocol television (IPTV)[146] via the new fiber infrastructure. However, the entire video market is structured in ways that reward large corporations and make it difficult for small providers, which is one of the reasons few Americans have robust choices for this service. Farmers ended up offering IP CATV from 2016-2019, but stopped the service as the result of increasingly high expenses coming from rate hikes and a lack of negotiating power with programmers. This, coupled with low take rates (at its peak only about 100 members took service), led the cooperative to discontinue the effort.

Fortunately, offering Internet access is comparatively simple to the complications of cable television. In 2014, most residential and local businesses subscribed to 20 Mbps symmetrical service for Internet, bundled with local and long distance service, priced at $68.45. Farmers also provided a bundle that includes similar features[147] with unlimited long distance for $100 per month.[147] For Internet only, 10 Mbps symmetrical service cost $70 per month.

By 2021, residential members could get symmetrical 25 megabits per second (Mbps) service for $70/month with a 12-month service agreement, which included local phone service. Symmetrical 100 Mbps Internet access plus local phone service cost $80/month, or Internet-only 100 Mbps service costs $5/month more. Business members can choose from symmetrical 10 Mbps, 50 Mbps, 100 Mbps, 300 Mbps, and gigabit service for between $30 and $360/month for those willing to sign contracts up to three years. Prices are higher for shorter contracts.

Resistance from Frontier

After Farmers began offering services, several residents and businesses contacted the EDA to report problems they encountered with Frontier when they tried to switch providers. After long periods on hold (up to an hour reported), Frontier told customers they must pay a $250-$300 per line early termination fee, according to the terms of their contract. When customers questioned the contract, Frontier told them accounts automatically renewed. If a subscriber pushed back and demanded a copy of the contract, Frontier representatives told them the company did not retain the physical contract.

Regardless of whether or not Frontier's behavior is illegal, it caused a cooling effect around 2014. Dawson and Boyd schools still contracted with Frontier for data and phone service. Schools have multiple lines so hefty early termination fees are a factor administrators must weigh when considering changing providers.

Residential and small businesses comprise the bulk of Farmers' users on the network. Downtown Madison was not included as part of the project area, so many government facilities in the county seat were still connected with Frontier or Mediacom.

Ironically, the county seat had become a reverse oasis – having access only to slower services rather than the ultra-fast fiber connections surrounding it. Lehmann was living in Boyd but worked in Madison. Her home connection is faster and more reliable than her work connection. According to Beyer, this situation is common in Lac qui Parle. This can cause businesses to abandon Madison for locations served by Farmers' fiber, rather than settle for slower cable and DSL.

As anticipated, the network has allowed home commerce to expand. Jean Menden of Boyd uses her fiber connection for her jewelry business. In addition to an improved online store, she now accesses video tutorials to improve her silversmith skills.

"If you had two hours, you could watch a 10 minute video," Menden said as she described the fitful connection that used to be the best available around Boyd, a town of 172 people not far from the Minnesota-South Dakota border.

"Unfortunately, I probably spend more time on the Internet than I would like to because when you'd be frustrated before it was easy to shut down and be done with it for the day," she said. "Now there's no reason to shut down."[148]

In addition to home-based businesses, a variety of small businesses in the area have benefited from the network. Madison Bottling Company, a wholesale beer and soda seller, was located near the edge of Madison. In 2007, the company became one of a handful of businesses connecting to Farmers' fiber installations in the area. Madison Bottling left Frontier DSL and switched to Farmers for data service because DSL did not provide enough speed and capacity to transfer daily sales and inventory reports to suppliers. Kay Roth from Madison Bottling described the transition as a "win-win" for the company. In addition to better rates and faster connections, she felt Farmers was more accountable to customers.[149]

Even as the network was helping other businesses, Farmers itself was also adding jobs. According to Beyer, Farmers added new positions to handle the increase in customers—new jobs created because of the presence and popularity of the new network.[150]

Filling in the Holes

After 2014, the reverse donut hole problem faced by the city of Madison in Lac qui Parle County remained the region's most troublesome broadband challenge. Those in town were relegated to slower, more expensive service while those in rural areas of the county served by Farmers Mutual Telephone Cooperative (as well as neighboring Federated Telephone Cooperative) had access to fiber at affordable rates.

Once its American Relief and Recovery Act-funded buildout was complete, Farmers Mutual Telephone Cooperative again approached the city to see if they could work out a partnership to bring connectivity to residents there, but after a year of work nothing concrete materialized.

With no other immediate options, Farmers moved to bring fiber to other underserved areas of the county. In 2017, **the cooperative applied for** and won a Minnesota Border-to-Border grant for two areas. The first project was in the southwest portion of the county. Residents there were served by a wireless provider that had received federal funding but had been unable to deliver high-quality service for residents, who wanted more. The second was near the town of Watson. The $761,000 grant required a matching amount and resulted in fiber connectivity for 136 households, 15 businesses, and five community anchor institutions across both areas, with the cost split roughly equally between the two areas.

Along the way to Watson, Farmers connected six households that would have otherwise been left behind, completing buildout in 2018. The cooperative had Madison residents calling and asking for help throughout this entire period. At the same time, it became clear that businesses were leaving the area without sufficient connectivity, and so Farmers once again went to the city to see if there was anything they could do.

Without city money to add to the pot, though, Farmers couldn't make a ubiquitous buildout work, even with the pressure of the local economy being drained by a lack of quality broadband. After years of efforts, Madison and Farmers Mutual hit on a compromise. The cooperative would extend an existing lateral through town where business locations were the densest. With an installation fee of $1,000 per premises, Farmer's could connect a business to its fiber and expand in a limited and targeted way through the town.

So long as enough businesses continued to sign up, Farmers would continue to progress block by block, with everyone involved knowing that the cooperative would have to stop if there wasn't enough interest. In recognition that residents in the town desperately needed it too, Farmers also told those households on the other side of the alleyway where they were laying fiber that they could sign up as well.

Going in, cooperative leadership knew this was going to be a controversial decision, and they did end up hearing from confused and disappointed residents in the rest of the town, but without additional funding from the city or an external source Farmers had few options. They continued to do this work throughout 2019 and 2020, connecting about 100 total new residential and business customers, but then had to stop. With renewed interest, the project could continue down the road.

Steadfast Commitment to Local Connectivity

CARES Act funds, unfortunately for Lac qui Parle County, have not borne fruit the way it has in other counties. When the pandemic hit there were some early conversations with local government officials about leveraging those funds to bring service to additional locations, but discussions were too slow to meet the December 2020 deadline and get fiber in the ground before it froze.

As of 2021, Farmers Telephone Cooperative serves about 2,500 members across its footprint in Bellingham, Boyd, Cerro Gordo, Dawson, Louisburg, Marietta, Nassau, Rosen, rural Madison, rural Montevideo, rural Ortonville, West Marietta,

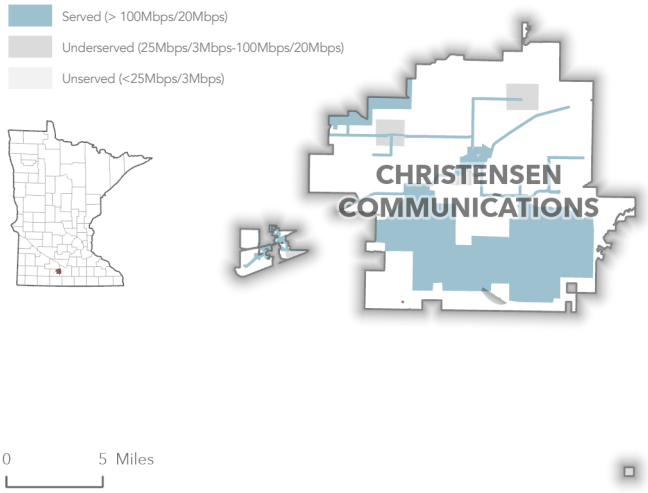
and Watson. Its partnership with Federated Telephone Cooperative through ACIRA remains strong, bringing cost savings, higher capacity, and a larger footprint from which to expand for both.

To date, Farmers Mutual Telephone Cooperative operates 1,300 miles of fiber with a take rate of 55 percent across its service area. The network frequently hears from residents that the service has become central to their lives, wellbeing, and ability to conduct business, with one family sharing a story with the cooperative that when family members from Chicago come to visit, they regularly extend their stay to work remotely because the Internet connection is far better than what they have access to back home.

Conclusion

Through a strong public-private partnership, Farmers Mutual Telephone Company and Lac qui Parle County brought the opportunity for fiber connectivity to locations that had no real access to modern connections. High-speed Internet access is now available in the entire county, except for areas of Madison. The project worked because when incumbent providers refused to invest, local leaders found a trusted partner. The project exemplifies the expansive role of local cooperatives as reliable partners in the expansion of broadband in Greater Minnesota.

CHRISTENSEN COMMUNICATIONS



- **A small, independent, family-owned telephone company in Madelia, Christensen has served the area for more than 100 years.**
- **With support from the federal broadband subsidy program A-CAM, Christensen is building fiber out to subscriber homes rather than the bare minimum required by the program.**
- **When the pandemic hit, Christensen met with the school district to help connect families that lacked home Internet access and brought 27 houses online in just 8 days.**

Christensen Communications started as an independently owned telephone company in Madelia, Minnesota in 1903 (pop. 1,300 at the time), in the northeast corner of Watonwan County. At the time, Madelia residents were getting telephone service from the city of Fairmont, 27 miles to the south (along what is now Highway 15). However, service did not extend to the rural areas surrounding the town.

In response, 48 residents came together to build their own telephone company, the efforts spearheaded by a blacksmith, as well as local flour mill operator C.S. Christensen. Over the years, the Christensen family increased its ownership of the telephone company, until the early 1980s when, at the time of his death, C.S. Christensen owned all but five shares. In 1984, the company **installed its first fiber cable** between Madelia and Mankato to support its telephone service.

From Telephony to Broadband

Today, Christensen Communications is a small, family-owned company with eight employees and around 1,300 subscribers. Broadband constitutes the majority of the business, operating in Watonwan County as well as parts of both Brown County (towards New Ulm) to the north and Blue Earth County (towards Mankato) to the east. Its philosophy is to expand in areas where residents have poor or no connectivity in the rural parts of south central Minnesota. It has done this over the last 20 years in two ways.

The company's footprint includes its historic monopoly territory as well as areas into which it has expanded as a competitive option, the former in its founding area of Madelia and the latter near the town of St. James ten miles to the southwest. Christensen entered the broadband space in 2000, when a local resident on a dial-up connection who sold snowmobiles for the Polaris dealership went to neighbor Brent Christensen and asked for help. As it stood, the neighbor had to print out sales applications for new sales, have the customer sign it, scan the document, and send it back to the dealership—an operating procedure that wasn't sustainable on such a slow connection.

The Polaris dealership became Christensen's first subscriber on a symmetrical 768 Kilobits per second (Kbps) connection: an important first step, but a long way from the capacity on the fiber networks the company has been building more recently to benefit local residents and businesses in the region.

A Dual Approach

Christensen began its formal **fiber buildout in 2008** with ten cabinets in Madelia, an effort expanded in 2016 with a Master Plan that called for fiber-to-the-home (FTTH) for all customers in Madelia. This work has also been supported by **Alternative Connect America Funds** (A-CAM) to underserved and unserved homes and businesses in Madelia and the surrounding area. Christensen gets $536,000 per year from A-CAM through 2028 to serve a total of 436 locations. A-CAM is a fund within the FCC's Universal Service Fund program that is focused on local telephone companies.

While it would like to do FTTH to every location it serves, population density and cost challenges have pushed the company to other solutions in some cases. Thus, the second method of expansion Christensen has been using has been to build fiber to businesses in areas near St. James, for instance, and then use that infrastructure to deploy fixed wireless access to residences over the last few years. This approach has been used in Lewisville, Long Lake, St. James, Sveadahl, and other smaller communities in the area.

By putting equipment in strategic locations with clear lines of sight on existing infrastructure like grain legs and using 11 GHz backhaul in the few places near the end of their lines where it doesn't yet have fiber in the ground, the network has been able to bring connections up to 25 Mbps symmetrical to households otherwise stuck on dial-up or slower DSL from incumbent carriers. As Christensen brings more and more subscribers onto the wireless network, the network anticipates bringing fiber to those access points to handle the increased demand.

Lewisville is a good example of how this approach has worked. The town has a population of about 250, with about ten businesses and an agricultural cooperative. To bring service Christensen ran a fiber line down to the water tower, hooked up local businesses with wired connections, and then installed wireless equipment on the water tower to serve residents in town and outside of town with wireless service. The response was immediately strong. To ensure a smooth rollout process, the network offers a managed Wi-Fi service for $8/month which allows it to diagnose and repair problems remotely, as well as identify areas in houses and businesses where a signal would have trouble reaching so they can add a signal booster to those rooms. Almost all of Christensen's subscribers opt for the service.

Connecting Students

The onset of the pandemic saw the network partnering with local schools to bring economically vulnerable households online. In early spring Christensen met with Madelia School District 837 to identify and bring free service to those homes. During the two-week shutdown at the end of March 2020, Christensen brought 27 houses online in eight days. Those households got access for free until June 1, and after, two-third of those families transitioned to paying for their connection.

This past fall when school began again, the seven families who turned in their equipment were reconnected with CARES Act funds, and almost a dozen more households were identified and likewise brought online. The same process has been unfolding in the St. James School District, where almost three dozen households are being transitioned from school-provided hotspots to fixed wireless connections from the same water tower with the help of CARES Act funds. Meanwhile, the network has been adding six to 10 new households each week as residents call for service.

Network President and CEO Brent Christensen attributes a good deal of the company's success to its commitment to providing fast, reliable service at an affordable price, and investing in a way that sets the network up for success down the road. Though A-CAM often only requires providers to build networks that (by today's standards) deliver obsolete speeds or the bare minimum of broadband at most, Christensen has committed to adding its own funds so that it can put fiber in the ground everywhere.

For example, premises in Christensen-awarded census blocks include 83 locations required to get connections of at least 25/3 Mbps, 28 locations required to get at least 10/1 Mbps, and 154 locations required to get at least 4/1 Mbps. Christensen's subscribers will have Internet access via fiber and be able to take advantage of increasingly higher download and upload speeds for decades to come.

Broadband Brings Business

The network has done a significant amount not only for residential connectivity in south-central Minnesota, but for economic development as well. Its broadband journey began with the local Polaris dealership, but it wasn't long before other local businesses came asking for better Internet access.

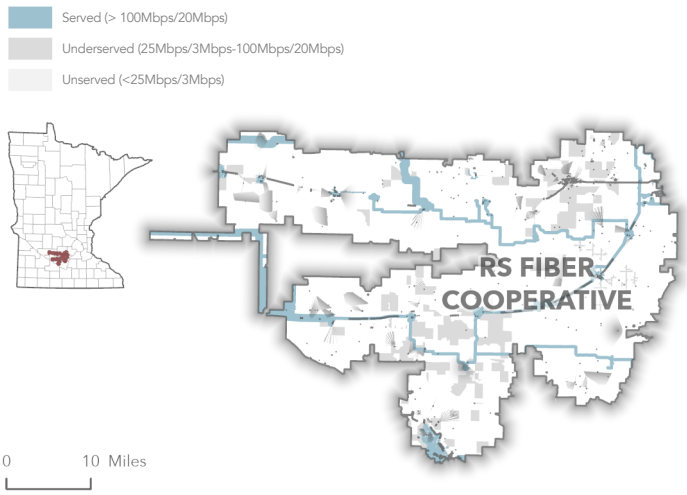
The House of Print is a family-owned printing business in Madelia that started life serving the local papers in New Ulm and Fairmount. In 2000, the business was handling accounts for dozens of newspapers and magazines, but had to ship hard copies of proofs and other supporting material by mail. Barely weeks after its first connection, the House of Print became Christensen's second wireline broadband customer, and in their first year the business increased sales by $3 million.

Today, Christensen's territory includes subscribers on older VDSL service, new fiber service, and fixed wireless service. About 250 households are on the wireless service, and the rest are on either VDSL or fiber.

Households on the first can get Internet access at 10/1 Mbps for $45/month, 25/3 Mbps for $60/month, and opt in to managed Wi-Fi services for $8/month. Households connected to fiber can choose between symmetrical 25 Mbps, 50 Mbps, and 100 Mbps for $45, $60, and $80/month, respectively. Managed Wi-Fi at $8/month is required for households on fiber. Finally, for subscribers on fixed wireless, the options are 10/1 Mbps, 15/1 Mbps, or 25/1 Mbps for $45, $60, or $80/month. Installation costs $100 for residents in the city and $200 for those in the county for all new connections except fixed wireless (unless installation requires the cable to be buried), though applicants can apply for it to be waived.

Christensen's approach to expansion has been one that avoids debt, which means while buildouts move slowly, the company stays on strong financial footing. This strategy also makes it more competitive for grant programs and gives it flexibility to draw on debt sources if it ever needs to weather an economic downturn or wants to adopt a more aggressive expansion strategy in the future.

RENVILLE-SIBLEY FIBER COOPERATIVE



- **Serving most of Sibley County and parts of neighboring counties, RS Fiber Cooperative owns a wireless and fiber optic network that has dramatically improved access in the region.**
- **Establishing the brand-new broadband cooperative took years of local education and organizing efforts.**
- **The network was financed in part with a partnership with local governments, and services are provided via a partnership with a local, independent ISP.**

Sibley County is located in south central Minnesota; Renville County is just to the north and west of Sibley. Sibley's population has steadily declined as the workforce has shifted away from agriculture. The U.S. Census estimates approximately 15,000 people in a little over 6,000 households. Sibley County is just under 600 square miles.

Like many other mostly rural communities across the U.S., large corporate providers did not deploy much broadband in the areas outside of Sibley's seven towns or even much within them; many of the smaller local providers were also providing only slow broadband. Mediacom Cable operates in some cities; Frontier Communications and Lumen (previously CenturyLink) offer DSL in some cities and to select surrounding areas. In 2014, some of the farms still relied on dial-up for Internet access but many had some form of wireless access that was both expensive and slow.

In addition to slow Internet access, farmers often complain about poor Frontier telephone service. Repairs could take weeks and some farmers had to pay long distance fees for every call. Since we first published this report, these complaints have been validated and expanded upon in a lengthy report by the Minnesota Department of Commerce **documenting Frontier's many failures in Minnesota**.[151]

Most of the jobs in Sibley County are either agriculture or service positions; grain farming contributed 16 percent of the county's total output in 2014. Farmers in Sibley County increasingly rely on Internet connectivity to do business in a highly competitive industry. The science of growing crops has advanced to include high tech insect and weed control, genetics, and state-of-the-art irrigation systems, not to mention the benefit of studying market conditions and opportunities.

To expand fast, affordable, and reliable Internet access, most of the cities and townships within Sibley County and some of the cities and towns in eastern Renville and nearby counties are working together to build a fiber-to-the-farm network called RS Fiber Cooperative. Renville County has been very supportive of the approach.

Seeking a Modern Network

Prior to taking a position as City Administrator for the City of Winthrop in 2008, Mark Erickson had spent years working in telecommunications. While he had previously served as City Administrator in the city of Lakefield, Minnesota, he most recently worked for Hiawatha Broadband Communications (HBC). HBC has built and operates fiber networks in southeast Minnesota and has partnered with communities to expand Internet access.

Seeking a stable position in a small town, Erickson took the Winthrop position expecting his biggest challenges to be "barking dogs and unshoveled sidewalks."[152] Erickson recalls that during the interview process, he was never asked about telecommunications.

But at a City Council meeting that same year, Mayor Dave Trebelhorn raised the issue of telecommunications. He suggested Winthrop look at the possibility of building its own network to improve Internet access speeds, service, and prices. At the time, Erickson did not take the comment to heart, but when Trebelhorn asked him to follow up, Erickson approached local provider Winthrop Telephone Company (WTC).

For historic reasons, Minnesota and Iowa have an unusually high number of independent telephone companies – private companies, often owned by local families, that were never a part of the AT&T "Ma Bell" system. Many of these are owned by people who still live in the community and continue to upgrade as they can. Winthrop Telecom Company's owners, however, lived far from the community in 2014 and their ties and perceived obligations to the city seemed to be weaker.

During the next year, the city discussed a possible FTTH project with WTC. At first the company appeared enthusiastic, but eventually they pulled out, stating that the project would be too expensive. However, even after Winthrop offered to finance construction of the network, WTC refused to further consider partnering, asserting prohibitive costs for the project though it would pay virtually none of them.

In fact, the following year similar offers to pay for construction of the fiber network were also made to CenturyLink, Frontier and Mediacom. All three rejected the idea, choosing not to cooperate with the project.

Knowing that Winthrop wasn't large enough to build a FTTH network (1,400 pop.), Erickson sought partners elsewhere. Winthrop approached the nearby city of Gaylord, where community members faced similar problems with poor connectivity and service. The two decided to join forces and reached out to other local governments, eventually forming a Joint Powers Board (JPB) that ultimately included all seven cities in Sibley County, as well as the city of Fairfax in Renville County.

In May 2010, the Blandin Foundation awarded the group a $40,000 grant toward a broadband feasibility study for Arlington, Fairfax, Gaylord, Green Isle, Henderson, New Auburn, and Winthrop. Tim Dolan, Executive Director of the Sibley County Economic Development Commission, suggested the feasibility study also include rural farms. In order to help fund the expanded study, Sibley County Commissioners approved an additional $40,000 for the grant match.

Because western Sibley shares a school district with eastern Renville County, the study also examined the area around the Fairfax telephone exchange. A few years earlier the Gibbon-Fairfax-Winthrop School District (GFW) approved a first-in-the-nation plan to distribute iPads to each student.[153] Without better connectivity at home, students could not take full advantage of the technology. Renville County and the Fairfax Economic Development Authority chipped in to extend the feasibility study to cover that area.

A statistically valid telephone survey in August 2010 indicated high interest in a local project. More than 60 percent of those interviewed voiced approval of a municipally owned telecommunications network.

To educate the public and seek support, the JPB created a marketing committee that hosted dozens of meetings in summer and fall 2010. The group scheduled multiple meetings in each community – a morning, afternoon, and evening meeting in each to maximize opportunities for public feedback. The JPB marketing committee sought citizen participation throughout the process, which became one of the hallmarks of the RS Fiber project. Meetings were overwhelmingly filled with locals that supported the project; one rural resident memorably called it a "no-brainer."

Starting in November 2010, the Joint Powers Board presented a feasibility study at a series of public meetings. The study first examined a triple-play fiber network in only the cities, assuming an ambitious 70 percent penetration for residential video service within three or four years and offering a $100 triple-play package including 20 Mbps Internet access.[154] With those assumptions, the network would break even after five years and create an aggregate community savings of $600,000 per year resulting from households paying less for far higher quality Internet access.

In order to build the network, the community would need to borrow $33.7 million; in order to extend the network out to include all farmers in Sibley County and everyone within the Fairfax exchange with the same assumptions, the group would need to borrow $63 million. It was projected the network would be cash positive in its 7th year, and community savings would increase to $900,000 per year. The Board recommended funding with a revenue bond, wherein the local governments issue bonds to private investors and repay them with revenue from the network.

The presentation highlighted the challenge: whether to include the farms or stick with the stronger business plan only connecting cities. Other questions were raised as well: should farms have to pay more due to the higher build costs? Ultimately, the overwhelming agreement was that the farms and cities depend on each other. If one were weakened, the other would suffer. Therefore, the JPB felt it necessary to stick together in building a network made available to all households on similar terms.

At a January 15, 2011 meeting in the Arlington Community Center, officials from Sibley County, Renville County, city councils, and rural representatives, gathered to discuss the project's next steps. More than 50 officials agreed to decide by the end of February whether or not to participate in the network project and become part of the JPB.[155]

By mid-February, four cities had unanimously voted to join the JPB. However, Sibley County had to sign on to build a

"fiber-to-the-farm" network rather than just fiber-to-the-town households. Without the county they would not be able to raise the necessary capital to connect all the farms.

On February 21, Renville County voted unanimously to join the project. The same day, Sibley County Board of Commissioners voted 32 in favor of joining the JPB. Many local farmers attended the standing-room only meeting. Minnesota Public Radio reported on the meeting: "[Linda] Kramer, whose husband is a corn, soybean and wheat farmer in Moltke Township, says their DSL connection of 1.5 Mbps is too slow. 'My husband tries to upload USDA maps,' she says. 'We stream the occasional movie. It's not nearly enough. We're as frustrated with that as we were with dial-up 10 years ago.'"[156]

Kramer noted that often her husband would begin uploading reports to business partners in the evening. When they awoke in the morning, they would find that the reports were still transmitting or the connection had failed in the night.

In March 2011, representatives from Sibley and Renville Counties, Fairfax, Gibbon, Winthrop, Henderson, Gaylord, Arlington, Green Isle, and New Auburn gathered for the first formal meeting of the full JPB. The group also established legal, financial, operations, and marketing committees to move the project forward.

Over the next several months, the marketing committee ramped up its effort to educate the public. In addition to distributing 7,200 fiber "primer"[157] booklets through a mass mailing and a series of community meetings, the committee mailed out pledge cards to every household in the proposed network area. The cards were not legal commitments, but were intended to confirm the results of the study and provide an accurate picture of the need in the region. At the time, the JPB hoped to obtain a minimum of 2,300 cards from households in the potential service area.

In October 2011, the JPB hired Hiawatha Broadband Communications (HBC) to operate the network they planned to build. HBC, a Winona firm, has a strong reputation as a service provider and had managed the publicly owned network in Monticello for a number of years.

While the public rallied strongly around the network, Frontier, CenturyLink, and others sought to persuade Sibley Commissioners to back out of the project.

An especially contentious meeting on March 27, 2012, resulted in the Commission suspending a vote in support of the project. The JPB had collected 3,500 pledges from potential customers, the amount the Commission had requested before deciding to back the project to the next phase. Rather than vote, the Commission voted to suspend the vote until the JPB could collect an additional 1,000 pledges. They also asked project backers to "poll" the 17 townships in Sibley County.

The decision inspired new volunteers to knock on doors, make phone calls, and reach out to others in the community. Within a month, the group obtained over 4,300 pledges representing over 56 percent of potential users in the project area. 16 of 17 townships voted unanimously in support of the county moving forward with the fiber project. In the rural areas, more than 62 percent of residents supported the project.

At a late April meeting, the Sibley County Commission Board passed a resolution to back the project in the next phase. The Joint Powers Board hired an engineer and a securities firm to put together financing and schedule a revenue bond sale.

Ultimately, the matter of the debt service reserve fund presented the biggest, and ultimately fatal, obstacle to funding that approach to the network. Revenue bonds often have a debt reserve fund, which serves as a safety valve in case the project falls behind its business plan. The reserve would give the network a chance to fix problems without having to default on bond payments.

RS Fiber was moving forward on a plan where the local governments would establish the reserve fund and if it were drawn down, they would have to replenish it with tax dollars from their community. Unfortunately, this was at the same time that Monticello and Vadnais Heights were requiring different sets of bondholders to take a loss, Monticello on revenue bonds issued for its broadband network and Vadnais Heights on revenue bonds issued to build a sports arena. As a result, bond attorneys adopted an extremely risk-averse perspective to the issuance of revenue bonds for the RS Fiber project.

In the worst-case scenario, if RS Fiber signed up no customers, the debt reserve fund would be exhausted in the fourth year. Replenishing it would require most cities to double their annual tax levies to replenish their share of the debt service fund. Given the overwhelming amount of interest in the project, the prospect of a dismally low take rate was extremely unlikely, but the bond attorneys nonetheless refused to sign off on the project.

From the beginning, incumbent telephone company Frontier expressed its resistance to the project. At a December 14, Board of Commissioners meeting, Frontier General Manager Todd VanEpps claimed their old copper infrastructure could compete with fiber: "We have had copper in the ground for many years and it is paid for already. What we can do is provide the same speed of service as fiber can provide."[158]

That claim could not withstand close scrutiny. Not only does copper have inherent technical restrictions that make it unable to compete capacity- or speed-wise with fiber, the long distances between households in much of Sibley County makes copper solutions almost totally infeasible. Further, as noted above, the state of Minnesota would later confirm that Frontier could barely supply the even slow speeds it advertised in many places.

Frontier warned the Board that "the county could write itself into quite a debt" and questioned the projections and cost analysis from the feasibility study. Frontier also regularly suggested that Windom's fiber network had been a failure, a claim we discuss in this paper in the Windom section.

The Minnesota Telecom Alliance (MTA), an industry group representing telephone companies from national companies like Lumen to locally rooted independents and cooperatives, also tried to stop the project. In a letter in the New Ulm Journal in October 2012, MTA's President and CEO Brent J. Christenson accused the JPB of withholding information from the public and criticized consultants working on the project. Christensen wrote that "30 percent of all households do not have a wireline connection and the number is growing." The number of households with wireline Internet access was actually growing. He was confusing telephone statistics with Internet access statistics.

The uncertainty took a toll on the unity of the JPB. On October 23, 2012, the Sibley Board of Commissioners passed a resolution by a 3–2 vote to withdraw from the JPB. But given the strength of the community support for the project, those heading it recognized they could not just give up in their goal of building the network to as many households as possible.

Immediately after the vote, a group of farmers approached Jeff Nielsen, General Manager of the local United Farmers Cooperative (UFC): "They said, 'We have to do something,'" recalled Nielsen. "I said, 'Let's go back to our roots and try to form a co-op.' Twenty-four hours later, we had an organizational meeting. We had about 30 people show up. This is really a credit to the grassroots people who have been working their heads off for the last two years to get this done. We were shocked the commissioners voted no."

"Clearly it's much more efficient to go into a city (with fiber)," Nielsen said. "But let's remember who paid the taxes in the county: the farmers and ag producers. Why are we leaving them out of the technology?"[159]

It was clear that a large segment of the community wanted to move ahead. Local municipalities, businesses, and schools still supported the project but without Sibley County and its contribution to the debt reserve fund, options were limited.

Over the next few months, the JPB worked to come up with a viable solution for the project that would be able to attract the necessary financing. Through the efforts of their financial advisor they decided the project should become a cooperative with the JPB providing a start-up loan to help them attract financing.

The JPB had already completed most of the financing and engineering and all of the members of the new cooperative had already been involved with the JPB. The cooperative was effectively a continuation of the JPB project in most respects but offered townships the ability to opt in or out. The residents and businesses within the jurisdictions of the JPB would be able to join the cooperative simply by taking service from it.

The new plan improved financial prospects for the project. Less money was required through the new financing scheme and the new estimate for total project costs was $55 million. With so much fiber expected to be built throughout the county, wireless Internet service providers would be able to offer faster wireless services to some of the farms if some townships chose not to participate. Such connections would not offer the speed nor reliability of fiber, but would be a substantial improvement over the status quo.

17 of the 21 eligible townships in Renville and Sibley Counties ultimately joined the project as well as the Renville County cities of Fairfax and Buffalo Lake. The Sibley County cities of Gibbon, Winthrop, Gaylord, New Auburn, and Green Isle also committed. Stewart and Brownton, located in McLeod County, and Lafayette from Nicollet County likewise participated. Arlington and Henderson opted out, to the frustration of a fair number of voters.

Cities and townships that opted out may have an opportunity to join the network later, when it could be under pressure to expand in many different directions to meet the growing needs of the neglected farms, towns and cities of Greater Minnesota. However, as of 2021, no new communities had yet joined.

The cooperative board decided to set higher goals for Internet service. The lowest Internet access would be 50 Mbps both downstream and upstream, instead of 20. Subscribers would be able to access speeds as high as 1 Gbps. The network planned to offer home and farm security systems, broadcast high school events live, and make telemedicine opportunities available to the many elderly people in the community. Because the capital costs decreased with the plan change, the cooperative was expected to break even after 45 percent of households and small businesses in the project area signed up for service.

RS Fiber already had pledges from about 62 percent of rural households from the proposed service area, and expected

more. If the co-op signed up 90 percent of rural households, it would only need half of city households.[160]

Financing the Cooperative

Financing for the network was split into two phases. The first, which totalled $16.1 million, came from a handful of different places and serves as a testament to the creativity and joint commitment in making a capital-intensive project like this happen in rural communities. It included a JPB-orchestrated $8.7 million loan from the nine member cities via 20-year General Obligation Tax Abatement Bonds at 4.5 percent interest (with Buffalo Lake providing its $600,000-share from existing funds). The loan was guaranteed by local governments' ability to raise taxes if the endeavor failed to make payments on the debt for the cities and townships.[161] That allowed the cooperative to pursue a total of $3.75 million from four local banks in the form of senior secured construction loans, as well as a State of Minnesota Broadband Development Grant of $1 million. Phase 1 financing also included some equity investments and intended to include roughly $3 million in New Market Tax Credits from the U.S. Department of Treasury that did not happen. The second phase of financing to get service out to the 17 townships would rely in part upon similar bonding but has not yet happened. For a deeper look at the financial package assembled by the cooperative, read our 2016 report ***RS Fiber: Fertile Fields for New Rural Internet Cooperative***.

Phil Keithahn, Chairman and CEO of Gaylord's ProGrowth Bank, took up the role of financial advisor to RS Fiber. Keithahn explored potential sources of financing, including New Market Tax Credits but ultimately was unable to access them, resulting in the cooperative having to borrow at much higher than anticipated costs - north of 10 percent. The higher costs of borrowing, coupled with higher costs of installing homes combined to create a cash crunch that HBC stepped up to fill to ensure the project was a success. Without HBC making an unsecured loan to the co-op, the fiber build would have stopped with three unconnected towns.

RS Fiber Cooperative did not qualify for RUS funding because Winthrop Telephone had previously received an RUS loan that was still being repaid. The agency would not lend funds to entities that compete with each other. Because Winthrop Telephone received funds to build a comparatively slow broadband system, much of the county faced a greater challenge to finance a modern network.

Keithahn approached a number of banks and possible private lenders and sought funds from several institutions because smaller banks have lower lending limits. Federal loan guarantees would have strengthened his ability to secure lending from private lenders.

Though cooperatives have been successful at providing these services, especially in the Midwest, establishing a new one had significant challenges - all the more so if that cooperative needs a large amount of capital to engage in business against entrenched competitors like Frontier, CenturyLink, and Mediacom. Investors see a new venture like RS Fiber as very risky. Local governments have well-established means of raising capital for essential infrastructure projects but some are uncomfortable with local government delivering a service that had historically been the province of private companies. The RS Fiber Cooperative approach is an attempt to use some of the advantages of both approaches.

The Board hoped the economic development loan would help secure loan guarantees from federal programs designed to encourage infrastructure investments, including the U.S. Department of Agriculture (USDA), the Small Business Administration (SBA), and the Department of Housing and Urban Development (HUD).

Keithahn calculated the costs to taxpayers in a worst case scenario. If the network signed up only one in three households, and all communities had to make the full bond payments, the additional tax burden to each home would be approximately $35 - $36 per month. But services from the new network will be approximately $25 less per month than what households now pay. In other words, if the network did not hit its projections, the net additional financial burden to each property owner taking service would be approximately $10 - $11 per month. They would also have the benefit of fast, reliable fiber connections. Even if a property owner chooses not to connect to the RS Fiber network, competitive pricing and services will improve their rates and their Internet access. Additionally, home values typically increase with a fiber connection available.

Because HBC is consulting on the project and would come to operate the network, Keithahn approached potential funders in the local communities where HBC manages other networks. In addition to understanding the ways a community network can jumpstart the local economy, local banks earn credibility with local customers for investing in the community.

RS Fiber Cooperative was established as a Chapter 308B cooperative. The designation makes it easier for cooperatives to raise equity by allowing non-patron investors - also known as equity members.[162] Equity members invest in the project but do not take services from the cooperative. But everyone who takes service from the cooperative will automatically be a member. A Board is elected each year and every member who attends the annual meeting gets one vote.

One of the principles of cooperatives is to cooperate, something RS Fiber has already experienced with an offer of assistance from Paul Bunyan Communications, a cooperative out of northern Minnesota. The Minnesota Telecom Alliance (MTA) even suggested that it would back off its opposition if RS Fiber were a cooperative rather than a municipal network, though it did not seem to after the transition.

RS Fiber hoped to start construction in 2015 but was busy pursuing financing, holding public meetings to educate residents, and signing up potential customers. In order to update community members about the new business plan, the co-op board's marketing committee distributed a second round of pledge cards describing the plans to pursue a cooperative model.

At that time, it was asking potential customers to commit to one year of service and to eventually take at least two of the three triple-play services. Those that signed up by a certain date would have the fiber installed at no charge; those who chose to wait would have to pay an installation fee. The costs of installing fiber connections is more cost effective when installers don't have to return to an area that already has customers hooked up - ideally, installers can stay in a single neighborhood for days.

Fiber Expansion Paying Dividends for Many

RS Fiber spent seven years overcoming the financial obstacles the network faced at launch, as well as **growing rapidly over the last three years**. Network construction really took off in 2015, beginning in Winthrop and moving out to Gaylord to the east, and the cooperative hooked up members along the way, ending the year with 81 people signed up. It won a **$1 million Border-to-Border grant** in 2015 as part of a $3.32 million project to connect almost 600 locations across both counties, which fueled future growth. RS Fiber went from having 100 broadband members in 2016 to 2,900 in 2020, and currently enjoys a take rate of 42 percent across the 6,500 households it covers, offering triple-play services. The network's approach has been two-pronged, including a fiber-to-the-home (FTTH) build and a fixed wireless one.

When it began building, it rapidly connected wireless towers with fiber to be able to offer a true broadband service to most of the homes in its footprint, called RS Air. RS Air uses 29 towers and repeaters in total, most of which are fiber-fed, dotting the landscape today from Bird Island in the west to Norwood Young America in the east, and Lake Allie to the north and Klossner to the south.

The towers largely follow the roadways, which has both facilitated expansion but also sometimes been a struggle (the network ran into some technical problems with high-voltage power lines along Highway 19). Wireless members can access the Internet at speeds of either 25/25 megabits per second (Mbps) or 50/25 Mbps for $45/month and $55/month respectively, plus $10/month for the equipment necessary. The network has also been working to expand this effort with CARES Act funds to extend into Renville County, planning to add a total of ten more towers by the end of 2021 to serve almost 50 percent of all rural residents in the county. Neighboring Nicollet County has also expressed interest in bringing co-op service their way.

The cities started getting fiber while RS Air was being built and that led to new discounts from Mediacom to prevent its subscribers from fleeing to the technically superior fiber network. As noted in ILSR's case study, ***RS Fiber: Fertile Fields for New Rural Internet Cooperative***, Mediacom was rumored to be charging as little as $30/month for cable TV, broadband, and telephone to keep customers on its network.[163]

By 2021, fiber Internet access was available across homes in 11 cities, including Brownton, Buffalo Lake, Fairfax, Gibbon, Gaylord, Green Isle, Lafayette, New Auburn, Stewart, and Winthrop. In some cases fiber is available, but in most cases RS Air serves residents of Sibley County's 13 townships, including Alfsborg, Arlington, Bismark, Faxon, Grafton, Henderson, Kelso, Moltke, Severance, Sibley, Transit, and Washington Lake. Finally, four Renville County townships likewise have access, including Bandon, Cairo, Camp, and Wellington.

On its fiber infrastructure, the cooperative offers symmetrical tiers from 50 Mbps all the way up to gigabit, starting at $55/month and topping out at $90/month. The cooperative also offers wireline and VoIP phone service, managed Wi-Fi, and video packages. Today, the cooperative considers its fiber buildout mostly complete, largely because it's not positioned to expand to new towns without significant help from state or federal grants. According to its latest projections, expanding additional fiber would cost $2,500-3,000 per premises in urban areas and four to five times that in rural ones.

Finding Firm Financial Footing

RS Fiber faced its share of funding challenges, but over the last two years has resolved them to emerge on solid ground. In **2018 it became clear** the network was not going to be able to make loan payments to its member towns, in large part because of the failure of co-op leadership to properly structure its debt. Though they were in the ballpark for expected number of subscribers, the costs of servicing the debt were higher than expected. Dealing with that situation was a tense time with a good deal of uncertainty regarding the future of the network, but they ultimately came to terms with all their creditors to preserve the cooperative. However, member towns had to step up for two years to cover the

original 2015 General Obligation Abatement Bonds issued, paying from $56,000 to $173,000 to make it work. They will likely have to cover the next 6-7 years as well, though there is surprisingly little bitterness about it - people simply value the Internet access that the project has provided.[164]

It helps that the network has continued to aid in keeping businesses in the area and spurring new development; in 2018, the high-quality connection allowed a 3D printing company **to set up shop in Gibbon**. Without fiber, moving around tens of gigabytes worth of files on a daily basis would be impossible. A similar story seemed likely to play out in Gaylord in 2019, when the network **played a critical role in luring** the Minnesota College of Osteopathic Medicine to town, but that deal appears to have fallen through. Nonetheless, local businesses and ag cooperatives report being extremely satisfied with the service and prices. All of this translates to stronger local economies and stable, rather than shrinking, communities.

In 2021, Board Chair Jake Reiki shared, the network is on strong financial footing and well-positioned for the future. Though the network encountered uncertainty, having to refinance starting in 2018, today members are paying the same for vastly superior service and Internet access speed.

Local industry, including Heartland Corn Products, United Farmers Cooperative, JTI Electrical, and WinField Agricultural Solutions have remained big supporters of the project, and there's anecdotal evidence that it has spurred local competition in terms of more fiber investment and increased speeds for (non-RS Fiber) subscribers to a local telephone company and Internet Service Provider (ISP) Mediacom.

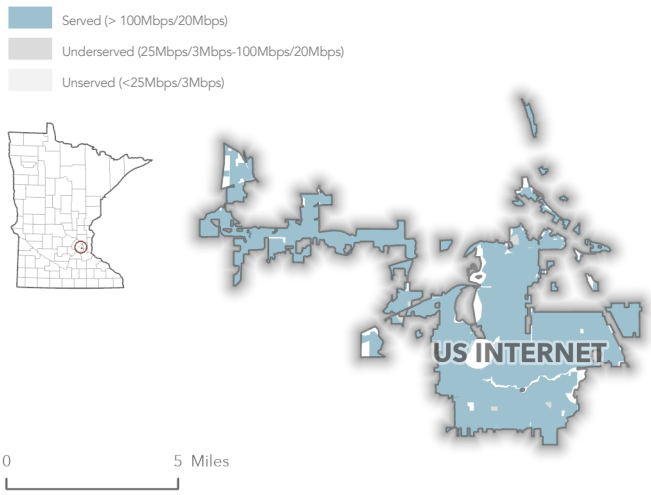
Conclusion

The experience of RS Fiber Cooperative provides many important lessons, particularly for rural communities. The most obvious is the importance of engaging and educating residents, businesses, and key stakeholders in the importance of and opportunity for improving Internet access. The cooperative faced daunting challenges and disappointing setbacks, but the community remained determined to find a solution that would provide fast, affordable, and reliable Internet access to all.

Though some cities and townships have elected not to join the effort, their populations are often still subscribing to RS Air where it is available. Sibley's effort to seed a cooperative with an economic development loan from local government bonds appears a unique and fitting solution for its mix of assets and enthusiasm.

As we wrote originally: "The project has risk, something that community leaders have been candid about. However, the risk resulting from doing nothing appears far greater to the community." Though property taxes have had to cover some of the debt servicing costs, the risks appear to have been well-worth, especially having had to deal with a global pandemic.

USI FIBER



- **USI Fiber is building a remarkable fiber network in Minneapolis that gets rave reviews from its subscribers.**
- **The ISP started with a Wi-Fi network built with a contract from the city of Minneapolis to help it get started. Despite testing every wireless system they could find, they decided only fiber could meet the long-term needs of residents.**
- **The network has been ranked among the fastest in the nation and USI Fiber is working with a partner in rural Wisconsin to find ways of expanding its services far and wide.**

USI Fiber (formerly US Internet) began life in 1995 when two friends quit their day jobs to start their own dial-up Internet Service Provider (ISP) in the Minneapolis area. In early years, USI could resell services that depended on the telephone network on equal footing with the telephone company that ran it. But when the regulations changed in Washington, D.C., the telephone company could privilege its own services against rivals in the market.

The network found itself at a transition point. USI could sell 3/1 Mbps service, but Qwest (then CenturyLink and now Lumen) denied USI access on its higher-speed product, which left hard decisions about what the future of the network would look like as subscribers pushed for higher speeds. Like other ISPs facing the same challenges, USI took the hint from the federal government that broadband would no longer be a truly competitive market and turned to providing data center and colocation services for businesses in the region.

Fortunately for the forward-looking company, an opportunity to diversify and lay the groundwork for future plans presented itself. Around 2007, Minneapolis bid a contract to build a wireless network in the city that residents could subscribe to in order to create more choice in a market that was dominated by the telephone and cable monopolies. With equipment from BelAir Networks (now Ericsson), USI bid against EarthLink and AT&T to provide fast and reliable coverage over a one-square-mile service area in the city. USI won.

Ultimately, USI ended up installing 2,500 access points and serving 40,000 customers **on a ten-year contract** over its wireless networks. The first network was Wi-Fi and offered comparatively low prices for speeds that tended to be slower and less reliable than those available from the cable monopoly, though the experience varied based on the location of the closest wireless access point. In 2015, **USI deployed an improved wireless network** using more advanced technology, offering 75 Mbps download speeds for $35/month and 25 Mbps speeds for $25/month, making it among the most affordable connection options in the city. And residents agreed, with the wireless network going smoothly until the entrance of Netflix with its streaming services on the scene in the early months of 2015. Shortly thereafter, subscriber bandwidth demands convinced USI that fiber was the only solution to meet the growing demand.

A Time of Transition

Fortunately for the company, its wireless deployment required significant fiber support and it had already been building some fiber to residents, as well as laying the infrastructure to backhaul wireless traffic. Though transforming to a FTTH network builder is a capital intensive process, USI was able to leverage its data center work and the revenues it brought in to support future financing.

By the **end of 2014** the network had 10,000 subscribers on its fiber network, the bulk of them choosing its symmetrical 100 Mbps service for $45/month with a smaller proportion opting for the symmetrical 1 Gbps tier for $65/month. The same year it maintained more than 20,000 subscribers on its wireless network, in its sixth year of the contract.

In early 2015 the network lit up its first 10 Gbps customer as it continued to expand; not an easy task in the Minnesota climate where underground work (necessitated because

Comcast and CenturyLink can play regulatory games to keep rivals off poles) can only take place for seven or eight months a year. That summer USI began an expansion **into five neighborhoods** south of Powderhorn Park, between Interstate 35 and Highway 55.

Navigating city regulations have also presented challenges from time to time. South of Minnehaha Creek, USI ran into **right-of-way issues** with the city of Minneapolis in 2016 as it looked for a way to make use of boulevard space **managed by the Minneapolis Park Board** to expand its network in areas of the city. (One problem was resolved **the following January** but the Park Board continues to prevent installations for some residents that want to subscribe). The same year **USI dealt with a zoning challenge** for a central office, with the city unsure how to zone the concrete buildings which served as nodes - collecting tens of thousands of fibers, one from each home in many nearby neighborhoods.

By early 2018 **the network had passed 65,000 locations**, with 25,000 users, hitting a take rate of 42 percent. It still operated the wireless network too, and **the same year initiated another hardware upgrade** for its system.

2018 likewise saw USI forge a 20-year agreement **with the city of St. Louis Park**, whereby the municipality gave the ISP access to extra dark fiber in exchange for access to USI assets that would support city utilities and school connections for the district. The move served as the jumping off point for an expansion into the Sorensen Neighborhood.

By the **middle of the next year**, it passed 10,000 more locations. When the pandemic hit in spring 2020, USI (like so many others) saw a significant, and then sustained, increase in use that went hand-in-hand with an increase in new accounts. USI **also opened up its wireless network** to the public for free. More than 7,000 people across the city made use of it.

Next Stage of Life

Today, USI is about 85 percent done building fiber to South Minneapolis on its active ethernet network, where each premises gets a dedicated strand. It passes more than 120,000 homes, including those in apartment buildings. It claims a take rate penetration across a multi-year period where 20-25 percent of passings take service the first year, 30-40 percent the second year, and by the third year 50 percent of households have signed up.

USI benefits from positive word of mouth driven by a pathologically conscientious customer service and a commitment to going the extra mile to keeping subscribers—as well as neighboring residents affected by its construction—happy. It has an incredibly low churn rate, maintaining 92 percent of subscribers after eight years.

This means it doesn't perform pre-sale surveys for adjacent areas it is considering building to, but rather expands beyond its current footprint where it has strong brand awareness and can rely on existing infrastructure to continue to provide fast, affordable Internet access. Due to the citywide wireless network, it knows where demand for access is the highest and where there is not enough to repay the costs of building the network. Though CEO Travis Carter has said publicly on many occasions that his goal is to serve every home in Minneapolis, private endeavors finance things differently than public entities. As founder and CEO of USI Fiber, Carter had to put all of his assets on the line with banks for the capital to build USI's network.

Thus, while he has plans to build everywhere, the network has to stage its construction efforts prudently. This is especially true given that local, state, and federal broadband subsidy programs have mostly ignored the needs of low-income urban families; economically vulnerable households are often forced to forgo wired Internet access at home, which reduces take rates and places additional stressors on the financing of private companies - dependent on bank loans but who want to provide service everywhere. Progress under this framework is often slower in many neighborhoods, and part of the reason there's a case for nonprofit models to get everyone in the country quality, affordable access.[165]

Until 2021, USI did not participate in any state or federal funding grant programs or auctions, preferring private financing as an alternative to pursuing programs which can entail overly onerous rules for small providers. However, it **joined the national Emergency Broadband Benefit program** and has also received a state broadband grant for a rural area in Wisconsin, where it has a partner to build fiber to a handful of small communities in Winnebago County.[166]

In an effort to bring its service to more households outside of Minneapolis, USI has developed a pilot project partnership structure where the partner does all the construction, outside plant work, and hooks up subscribers, with USI providing operations, customer service, billing, caching servers, NOC, and backhaul for the new network. The first of these is outside of Oshkosh, Wisconsin, and includes roughly 5,000 locations where almost 85 percent of homes have signed up in active areas. USI provided financing for the initial areas of this first pilot project before securing traditional financing from a bank. It is looking for more opportunities along these lines.

As a private ISP, USI's ability to expand is a function of its willingness to take on debt or sell equity in the company. Finding a lender can be problematic for new, small private ISPs given the capital costs involved and the slow rate of financial return during its first stage of life. "I would've started putting fiber in the ground sooner," CEO Travis Carter said in an interview when asked what, if anything, he'd do differently if he could go back and start all over again. Echoing the

Chinese proverb that says the best time to plant a tree was 20 years ago and that the second best time is now, Travis noted: "There's no day cheaper to build than today."

In 2021 the network plans on expanding to 20,000 to 30,000 more homes. It has seen strong growth since the start of the pandemic as workers across its footprint transitioned to working from home, often picking up those subscribers at higher-than-average service tiers.

A Local Provider for Locals

Subscribers on USI's fiber network can choose between symmetrical tiers of 300 Mbps, 500 Mbps, or 1 Gbps for $50/month, $60/month, or $70/month respectively, with no additional fees or charges. Installation is free. USI also offers managed Wi-Fi and VoIP service. Business subscribers can get connections up to 100 Gbps, and choose from VoIP and email services, cloud hosting, colocation, and data storage options as well.

In 2020, USI earned Second Place: North Central in **PC Mag's Fastest ISPs list**, losing out only to municipal network Cedar Falls Utilities, in Iowa.

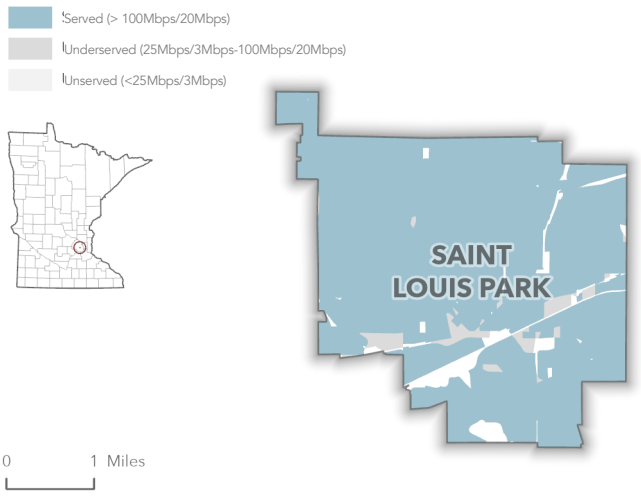
CEO Travis Carter has reflected that USI's success in Minneapolis is the result of the ISP's dedication to simplicity of service, transparency in billing, top-notch customer service, and a commitment to delivering reliable service at an affordable price for as many homes as want it:

Our metric of success is very simple. How many tech support calls do we get every day? We get 1 per 1,000 users. 90% of those are inside Wi-Fi problems. That's a good metric to work toward.

In an interview, Travis explained his motivation in building and running USI Fiber.

"We're not building this to sell it. We're building it to be a long-term, viable solution. I grew up in Minneapolis. My business partner grew up in Minneapolis. We went to Minneapolis South High School. A big goal for me next year is to wire up my family home that I grew up in. A lot of people want to spin these things and sell it off to some big entity and go sit on a beach. I'd get bored after a day on a beach. This is what I enjoy doing. If we built this and sold it, what would I do tomorrow? You've got to have a reason to get up every day."

CITY OF ST. LOUIS PARK



- **St Louis Park partnered with the school district in the 1990's to cut their telecom expenses while improving services with a jointly built network.**
- **The city took a bold risk with solar-powered Wi-Fi that didn't work out but set the base for fiber assets it would later use to improve connectivity for some residents.**
- **The city is a model for public-private partnerships in working with both Arvig and USI Fiber to bring more broadband choices to residents and businesses.**

St. Louis Park (pop. 49,000) has made significant strides in connecting community anchor institutions and its school district buildings to a fiber network. In supporting ongoing broadband infrastructure via an informal dig-once policy, by working with developers to construct new buildings with gigabit-or-better-capable infrastructure, and by using simple contracts to lease extra dark fiber to private Internet Service Providers (ISPs) like Arvig and US Internet, the city has improved connectivity options for local residents.

The journey for St. Louis Park began in the 1990s, when local government officials and the St. Louis Park School District began talking about replacing the aging copper infrastructure it was leasing from the cable and telephone companies with fiber optics to support educational use and municipal services. At the time **the city was paying** about $45,000/year to stay connected and online via T1s and partial T1s. It projected in 2003 that it could invest $380,000 to build its own network instead, taking ownership of infrastructure and seeing a full return on investment in less than a decade.

Fiber offered opportunities for the tools and bandwidth that would bring success. The school district led off in connecting its eight structures (four primary centers, one middle school, one high school, and two community centers) starting in 1996, with district-centralized maintenance and operational costs. This build followed a standard of laying 12 strands between each of the structures (with two projected to be used at the outset).

In 2004-2005, St. Louis Park built the first iteration of its own institutional network. Ultimately, the school network consisted of 6.5 miles while the city network covered 11.5 miles, with both laying extra strands and conduit along the way for additional future purposes as well as providing capacity for each other to access as needed.

This arrangement has benefitted both, with the school district and the city swapping fibers as remodels and relocations have led to farther-flung buildings needing high-speed, reliable access to the rest of the network. While the school district was done, the city decided to keep expanding as it saw opportunities. In 2006, it adopted an informal dig-once policy by adding conduit—and sometimes fiber—any time a street was slated for reconstruction and the roadbed was exposed.

Leveraging Assets for Citywide Wi-Fi

Among the city's first forays into getting better residential connectivity was a Wi-Fi project approved in December 2006. It began **with a pilot project** the previous April that demonstrated strong demand from residents wanting faster and more affordable options, with 21 percent having signed up. Feedback from users revealed a collection of implementation obstacles for a wider Wi-Fi network, including a strong need for help desk support, aesthetic concerns by residents, high fees by investor-owned utility pole-owner Xcel Energy, and line-of-sight challenges presented by the city's buildings and dense foliage.

In transitioning citywide, St. Louis Park selected Maryland-based ARINC to partner with, partly because of the latter's proposed solution to solve part of the pole problem by making the network's routers solar-powered, giving the city much more flexibility in terms of placement. The city did its best in addressing the other tasks, including colocating the new infrastructure (490 poles in the end) on existing street

signs and at intersections, as well as painting the equipment brown and increasing technical support. Despite public outreach and an informational open house, several residents after installation expressed opposition to new poles installed on boulevards by their homes.

Installation of Park Wi-Fi **began in April 2007** across four phases, with the first users brought online in July and work complete by early fall. Three speed tiers were available for residents (symmetrical 128 Kbps, 1 Mbps, and 3 Mbps for $15, $20, and $30/month), the latter two of which were also available to business. Total project cost was estimated at $1.7 million.

Even back then, residents, businesses, and cities more generally were concerned about the cable and telephone monopolies slowing investment and charging high prices. Wi-Fi was believed to be a third pipe into the home - businesses and sometimes cities would put hundreds of access points in the streets to deliver service to homes. However, the technology never delivered on the claimed specifications and nearly all of these business models cratered - both publicly pursued ones as well as private ones, because the networks could not offer sufficiently fast and reliable access to most homes.

St. Louis Park's problem persisted through the winter - primarily in terms of the speed and reliability of the resulting network. The city found ARINC in default of the contract that December, after it determined that only a small portion of the footprint delivered what was agreed upon. When six months of negotiations failed to produce a solution, it **filed a lawsuit** in Hennepin County in June 2008 to recover the $400,000 it had already paid, as well as compel the company to remove the infrastructure that had been installed. The suit **was settled that November**, with the city winning $1.05 million and returning the equipment and removing the poles itself, but keeping the eight miles of fiber laid during the course of the project.

What **Chief Information Officer Clint Pires remembered most** of that episode is that the City Council remained bullish on pursuing future projects to bring more competition to the area and that determination was driven by local residents and businesses who wanted the same. He had this to say **in a 2016 interview**:

"When you have a culture like that, it allows for these kinds of effort. I don't think it's about the technology itself, I think it's about creating the culture that says, 'We're willing to take some risks for the sake of succeeding, with the idea of succeeding.' The idea that you won't necessarily succeed every time but you're moving the ball down the field and you're thinking forward, you're not thinking back."

Lessons Learned, Next Phase of Life

By the beginning of 2012, despite the poor experience with the public Wi-Fi initiative, St. Louis Park had completed an array of other projects that solidified its city network. This included additional fiber and conduit constructed to a new development on the west end of town, co-trenching projects with Park Nicollet Health Services and MnDOT, wired and wireless connections to police substations and the Hennepin County Sheriff's office, and a new local fiber loop to two water towers.

A 2012 study by CTC Energy and Technology lauded the city's work in using its existing fiber for municipal use, and recommended further efforts be directed in two ways. The first was in incrementally expanding city fiber and increasing resiliency of the existing network when the opportunity presented itself, including between healthcare provider Park Nicollet facilities, to city parks, the library, public works facilities, the third city water tower, and targeted economic development areas like Knollwood, Texa-Tonka, and the intersection of Excelsior and Grand.

The second was in making those assets available to private Internet Service Providers (ISPs) to expand high-quality options for residents at home. Both recommendations were supported by the City Council and have largely directed efforts since.

Broadband remained near the top of priorities set by the City Council for the period between 2015 and 2025 for both better residential access and economic development, with the city council indicating in planning documents that it wanted the city to be a "technology connected community" moving forward. Between the city and the school district, it already had nearly 50 miles of fiber available, and had fiber buried along roughly 45 percent of its 120 miles of streets. Chief Information Officer Clint Pires **said in 2016**: "A community that is connected by a very robust and comprehensive broadband system will set itself apart and be better able to provide for economic growth, innovation and community development."

The city continued to pursue additional infrastructure deployment where available. In 2017 additional fiber was laid, and disaster recovery plans and systems were put in place for the future. A **2018 Capital Improvement Plan** called for the issuance of $2.5 million in General Obligation bonds over the next ten years to fund additional installation citywide, with another $700,000 to be reserved to a capital replacement fund for locates and asset management through 2027. **St. Louis Park links these efforts** to its **Connect the Park** initiative to add more trails, bikeways, and sidewalks to the city, first starting in 2015.

Another avenue of progress came through the first agreement with a private provider to lease excess fiber so it could expand in the area. In 2016, St. Louis Park **signed an agreement** with regional provider Arvig as a way for the latter to access city assets to facilitate and speed expansion of its footprint, bringing better connectivity options to the neighborhoods that needed it most.

In 2017 the city likewise **signed an agreement** with Minnetonka-based USI Fiber (formerly US Internet) to do the same. This agreement included access to St. Louis Park fiber so the company could begin a fiber-to-the-home (FTTH) build in the city. In return, St. Louis Park also got access to USI-owned fiber to provide redundant routes both in and out of town. It has been a **fruitful partnership**, benefitting city and school buildings **during updates, expansions, and remodeling**, and businesses and households as well. In 2017 USI brought two business corridors online as well as multi-dwelling units (MDUs), totaling almost 800 households.

2018 saw the debut of USI's expansion to single-family homes in St. Louis Park in the South Sorenson neighborhood as well as two more apartment complexes. By the end of 2019, USI fiber service was available to 30 commercial buildings, 43 MDUs (totaling more than 1,600 households), and enjoyed a take rate in Sorenson of around 25 percent. The company planned further investment down the road, with expansion into the Willow Park neighborhood, the acquisition of an office in the city, and 13 more MDUs.

In 2019 the city released its **2040 Comprehensive Plan**, which included fiber for the future. It called for leveraging the existing network to support municipal and school district connectivity, while leasing additional capacity to private providers to continue the task of bringing households online and encouraging further economic development. The city also shifted focus to additional **modest fiber construction**, adding conduit where available and **smart-city projects** like Wi-Fi, security cameras, remote locks at parks, environmental efforts, SCADA systems, and fixed wireless meter reading.

Responding to the Pandemic

With the onset of the pandemic, St. Louis Park's existing fiber assets and institutional network meant that the transition to working from home was easier than for less well-connected cities.

In addition, the city began hearing from residents at the outset that the connectivity they were able to access at home was either too expensive or insufficient for living, working, and learning remotely. Because it already had fiber installed to the city hall, the fire stations, the police stations, the recreation center, parks, and a community center on the west end for remote locking, sensors, and camera, the city considered it a small investment to install wireless hardware and advertise a free Wi-Fi network to the public at many of those locations. The response was immediate, with residents, as well as citizens experiencing homelessness, clustering around them to get online.

Conclusion

St. Louis Park's initial investment of less than $400,000 to uncouple itself from leased lines and take its infrastructure future into its own hands successfully redirected $45,000/year that would have left the community. That funding, instead, was put to work for the citizens of the city, drastically reducing network costs, increasing capacity, and fostering a culture of thoughtful, forward-thinking investment. Importantly, its initial return on investment (ROI) was based solely on replaced T1s or partial T1 services and data services only. The subsequent reality is that the fiber installed has provided much faster speeds and increased bandwidth, as well as supported citywide voice, video, SCADA, security, public safety, radio services, and more. Once fiber is in place, ROI only grows.

St. Louis Park's focus on MDUs has been particularly fruitful. Chief Information Officer Clint Pires revealed in a 2016 interview that with 40-45 percent of the city's households in such buildings, the city had been actively working since 2014 with developers (both MDU and mixed-use commercial and residential construction) to encourage the installation of street-facing conduit, in-building wiring closets, and in-unit wall connections at a comparatively low upfront cost, to incent ISPs down the road to bring infrastructure right into the building. These efforts made it much easier for ISPs to offer services in the buildings, creating competition rather than what is all-too-common in apartment buildings, where the first provider in the door can pull up the ladder and make it harder for residents to use other options.

Partnering with local private ISPs like Arvig and US Internet has been another ingredient to St. Louis Park's success, and a large driver of that is keeping those agreements as simple and short as possible.[167] By the start of 2020 the city owned almost 30 miles of conduit with fiber installed (at a cost of $500,000) and a little more than 15 miles of empty conduit (at a cost of $600,000). It also has access to approximately another 15.5 miles of fiber via agreements with the school district, Edina, Golden Valley, LOGIS, US Internet, and Arvig (at a cost of $0). All of its fiber infrastructure is underground, increasing its longevity and increasing its resiliency in the face of weather events.

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relationship to Burlington. Building a network is a technical area mixing telecommunications arcana, economics, and questions of policy - it ain't easy and often requires a trusted consultant. When that relationship is broken, it can be hard to proceed, one reason that opponents often attack consultants to discourage community networks. To be clear, ILSR does not engage in consulting.

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130 Email from Donna Eul, Marketing and Customer Service Manager for Farmers Mutual Telephone Company and Federated Telephone, April 7, 2014

131 Email from Donna Eul, Marketing and Customer Service Manager for Farmers Mutual Telephone Company and Federated Telephone, April 7, 2014

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