
Northern Maine Lakes Region Internet Access Planning Document

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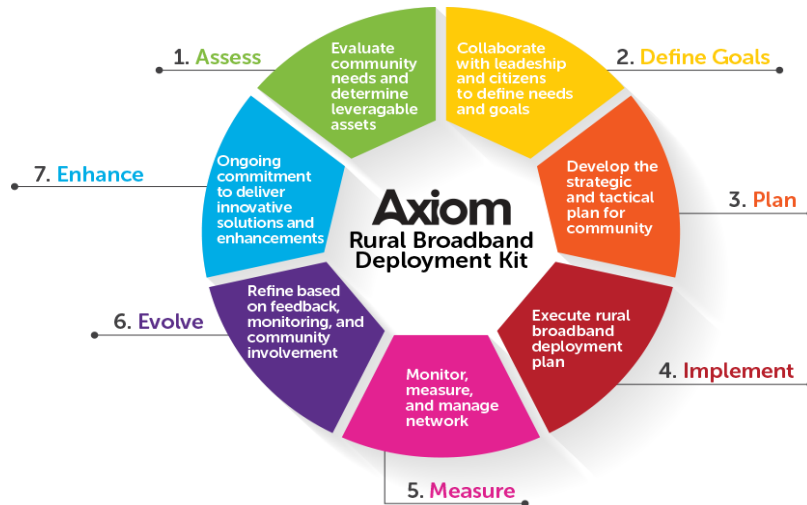
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Executive Summary

Axiom is a company that helps communities and regions plan and implement internet service solutions in unserved and underserved areas. Through an RFP process that was initiated by Northern Maine Development Commission (NMDC) and awarded to Axiom, this planning process assisted 10 towns collectively named the Northern Maine Lakes Region. The towns begin in the south from Portage Lake and continue north through Fort Kent and Madawaska. Our approach gives each community the tools and understanding they need to determine how to best meet their goals.

Axiom uses a planning and deployment process that helps move communities through the first three steps, with the goal of implementing a project based on the goals of the community and the planning created in this document. In addition to individual plans, a regional approach was engineered. While likely not something regional leaders would immediately embrace given the cost and complexity, this part of the plan can serve as inspiration for like-minded communities to join together in their efforts.



This planning document is meant to provide a springboard to implement the recommendations contained in this report. We provide options for communities to base their goals and we become a resource from our experience to help identify actionable projects to help build their internet capacity. To this end, we have included a list of potential state and federal grant programs that towns or the region may consider possible funding resources.

Axiom stands ready, long after this planning phase is completed to answer questions, attend meetings and work with NMDC or any community to implement these recommendations.

This document should be considered a beginning to a process of bringing better internet connectivity to the region or individual communities.

Individual Plans

Axiom has done planning in dozens of communities across Maine and has found that the technology choices really boil down to two options. First, to work with the incumbent

provider. If a community has Spectrum cable service and/or Consolidated Communications DSL, engaging either of the providers might make sense.

Pros:

- Builds on a system already in the community
- May save cost by cost sharing with the incumbent
- Reduces risk to community

Cons:

- Keeps status quo
- Will likely extend outdated and unreliable service technology
- Difficult to get the incumbents interested

Second, if working with the incumbent provider is not feasible or desirable, some communities in Maine have installed their own internet service using fiber optics. This approach can be preferable because fiber optics is state-of-the-art technology and futureproof.

Pros:

- World class reliability and speeds
- Opportunity to own the system and contract with an ISP that can create a partnership
- Fiber Optic systems can last well over 20 years, without having to change the network architecture- less expensive over time

Cons:

- Likely requires significant financial support from the community
- Up front cost and installation is expensive
- Some risk in owning the system- but might have the ISP take full responsibility

Each plan will explore these two options and have recommended steps to move forward. There is federal and state money that could help towns if part or all of their current internet service in the community is considered underserved or unserved.

Each community will need to evaluate our findings, consider their options and determine what is the best way forward. The ConnectME Authority can also offer guidance and resources to help move the process forward. There are several ingredients that are essential to a project successfully moving from planning to implementation.

- ❖ You must have a champion- someone who is passionate about this subject
- ❖ The town must be invested in a solution and any committee formed should include at least one Select Board or Council member
- ❖ A Broadband Committee that includes the above elements but also includes education, health care, key business, or other concerned citizens is essential to the process
- ❖ Must answer this question: Why? What are the underpinnings to your efforts, what are important outcomes the community wants to achieve?

Regional Approach

This section of Axiom's report explores the cost and viability of a regional approach that would create a common middle-mile fiber that would be shared among the communities interested in joining together.

For many small rural communities, the thought of improving internet connectivity on their own is a daunting task. With little municipal infrastructure or professional staff, these communities are hard pressed to assemble the right community leaders together to evaluate what needs to be done and agree on how to fix the problem.

One option facing the towns in Northern Maine is to consider banding together and forming a Regional Broadband Utility. This type of structure would create a legal entity that would manage and operate a fiber optic broadband system that would connect to communities along its proposed route (or potentially beyond) under one unified set of rules and that would ensure representation to participating communities. This approach would create a system whereby a community would not be forced to act on their own nor be left behind. Collectively they would share resources, learning and a common broadband infrastructure, as well as some percentage of revenues.

Typically, a Regional Broadband Utility is organized by creating an independent board of community members from each of the participating communities that would have oversight over the new fiber optic infrastructure. In this arrangement, the Utility can take several forms, but would most likely partner or contract with a Broadband provider to run the day to day operations and all of the different aspects of a fiber network.

Collaboration

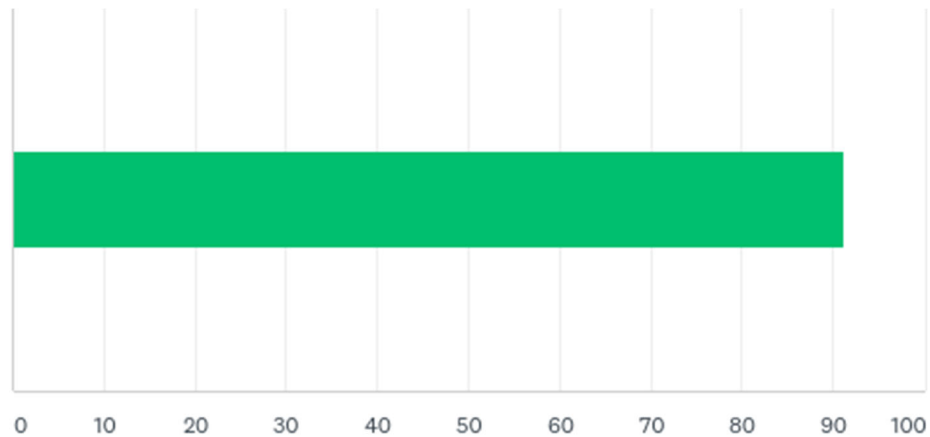
One important element to successfully implement a regional approach is to have strong regional institutions that can help pull towns and resources together to develop the plan to form a utility.

NMDC is a respected partner in the region and works closely with communities across Aroostook County. NMDC's mission is to bring a variety of local, state and federal resources to help create sustainable economic growth. Broadband internet, and the lack of connectivity is suppressing economic growth and affects retaining or attracting young people to the region- key mission drivers.

County Government is also a key collaborator, as the administrator for UT services. With several areas of the UT included in the planning, together, NMDC and Aroostook County government will be two key collaborators if a regional approach is of interest.

Through our surveys, survey responders indicated that they were strongly supportive of NMDC's efforts to help communities with this important issue.

Q20: On a scale of 1 to 100, with one being the least support and 100 being the most support, do you support NMDC's efforts to assist with internet improvements?



Total number of responses: 568 with an average score of 91 out of 100.

Forming a Municipal Broadband District

The Maine legislature has expanded the uses for forming a utility district beyond the familiar water, sewer and electricity to also include broadband. Municipal Broadband Districts can be modeled like other Municipal Utility Districts (MUDs) and would be formed to give communities maximum flexibility and control over public assets, while using revenues from new internet subscribers to help partially defray the capital cost of building and upkeep of the network.

A Municipal Broadband District would form a Board of Directors elected or appointed by the participating communities. The Board would oversee all aspects of construction and operations.

Broadly speaking, a Municipal Broadband District would have authority to:

- Form a Board of Directors, based on a set of criteria developed by participating communities
- Issue Bonds or other municipal finance instruments
- Develop and approve RFP(s) to manage or support various aspects of the fiber assets
- Accept subscriber payments to support debt payments or ongoing maintenance of the system
- Negotiate contracts with Internet Service Providers or other experts to operate the network on behalf of the Municipal Broadband District
- Set rates and oversee all or some of the utility district operations

Where do you start?

There are a series of questions that come with forming these types of districts and participating communities often can be hung up on representation issues, smaller communities feel they would want equal representation, and larger communities

typically prefer proportional representation. As the communities explore working together, they might want to access resources available to them from other communities that have done this before. In Maine, there is one current Municipal Broadband Utility- Downeast Broadband Utility. It was formed for Calais and Baileyville. Contacting them would help you understand the details of how they came together. Their email is downeastbroadband@gmail.com.

The Institute for Local Self-Reliance (ILSR) is a strong proponent of communities advancing their own future by investing and owning their own internet infrastructure. They have developed a Community Connectivity Toolkit and have highlighted a series of example communities around the United States that can help communities considering this approach learn what other communities around the United States are doing. Go to muninetworks.org to gather a host of information, click on the Initiatives tab/Broadband for a list of example towns and their experience.

The ConnectME Authority also has a myriad of support and resources that may help guide thinking at maine.gov/ConnectME/home.

Utility Formation Steps

A Municipal Broadband Utility District is a special-purpose district that provides internet service to residents of the defined district. Forming a new district takes time and money and requires the commitment of the involved communities and its elected officials.

- Start with champions- a group that will spearhead the effort
- Feasibility Study to determine if BB Utility is feasible and has community support
- Evaluate financing alternatives and feasibility- bonds or borrow
- Legal Analysis- Investigate the dos and don'ts of current statute
- Individual Community education and vote to support effort
 - Should the town be authorized to join the Broadband Utility?
 - Should the Utility be governed by an independent board?
- Negotiations with Internet Service Providers

Benefits of regional approach

Own your own

Creating publicly owned broadband infrastructure is typically a response to market failure, where the incumbent providers believe that they will not make a return on any new investments. Currently, the companies that serve the region do so based on market forces and their ability to maximize a profit. These leaves the region with uneven coverage, with the coverage area, price and amount of speed and reliability all dictated by current providers. Owning your own creates a new reality where the communities, speaking through the Utility, now can negotiate better terms, create more competition and be better positioned to provide access to the network on their terms.

Equal Access to All

Current internet connectivity is dictated by the provider of service, leading to inequitable service based on where a subscriber might live. In some areas, there is no

service at all. In others, a home can receive 100Mbps of service. When you publicly own the service, you can dictate that all homes are able to receive the same type of service and pricing, no matter where you live.

Cost Savings

Banding together can save cost as economies of scale are achieved. Larger projects can be less expensive when materials are bought in bulk or construction labor can do the full job all at once and not have to come back. It is hard to say how much savings, as so much is determined by market forces at the time of the construction project, but generally we would think that a 10% savings is achievable.

Open Access

Owning your own infrastructure allows you to offer access to multiple ISPs that can compete for subscribers and drive costs down. By banding together multiple towns, it creates enough scale to likely attract multiple providers to the network.

<https://muninetworks.org/sites/www.muninetworks.org/files/2017-07-Muni-Fiber-Models-Fact-Sheet-FINAL.pdf>

This fact sheet from the Institute for Local Reliance describes the ways in which communities are thinking about and implementing publicly owned networks.

And while all are viable, scale will matter. Meaning that the larger the number of homes and businesses that are passed with this new system, the more likely you are to attract multiple providers, or build a really good relationship with a single provider, willing to share revenue back to the regional entity.

Regional Construction Cost

Axiom has created a segmented approach to costing out a fiber optic network that would serve each of the communities. Each piece is priced out separately, so that they can be mixed and matched as necessary. We did not consider the whole county, as that is beyond the scope of our planning work here, but we did include some additional connectivity to form a continuous ring because it made sense to do so.

The regional plan is only to construct a middle mile fiber that can then be tapped into to serve the communities in which this fiber passes through. Along the path of the fiber, homes can be hooked up, but those cost are determined in each community plan.

The middle-mile fiber is intended to operate like a highway, to quickly move data across the region, it is up to individual communities to create off ramps that can connect to individual town businesses and residents.

While any resident or business can be served along the proposed middle-mile fiber routes, these routes are how a publicly owned utility might approach bringing capacity to each community. From these trunk lines, community projects that would bring fiber to each home would be built. Those plans for each community are in another section of this report. The following pages are the pricing for each section of this trunk fiber.

Cost of each Segment

Segment		Cost
Cross Lake		\$404,634
Eagle Lake		\$290,228
Fort Kent		\$562,442
Madawaska		\$443,748
Madawaska Lake		\$57,191
Other Segments	connections to complete loop	\$1,186,735
Portage Lake		\$290,928
St. Agatha		\$287,232
Van Buren		\$575,648
Wallagrass		\$280,382
Winterville		\$166,359
TOTAL		\$4,545,527.

PLEASE NOTE:

Make ready and pole replacement costs are estimates and will not be known until a Pole Licensing Application is submitted and the process is initiated. During the Make Ready process, each pole is evaluated to determine the physical capability of accepting a new fiber line and the cost of moving existing cable lines on the pole to accommodate the new system. This could change the estimated cost of make ready and pole replacement for each section. Should a regional plan be a consideration Axiom can provide the engineering specs for each segment of the construction estimates above.

Community Plans

Cross Lake Township

Cross Lake is an interesting study of rural connectivity across Maine. Spectrum mapping appears to provide service to the community, however, when Axiom requested a map of the service coverage, one was not provided. We have proceeded to give the community a Fiber-to-the-Home plan for them to consider. But, if Spectrum does serve all or parts of the coverage area proposed by this plan, the Unorganized Territory Administrator should work with the community to discuss each option.

Option #1- Work with Spectrum

Spectrum typically serves the densest parts of any community, typically requiring at least 20 homes per mile to consider an expansion. Given the density around the lake, it might peak Spectrum's interest in working with Cross Lake Township. One factor could be the percentage of homes that are seasonal vs year-round. Year-round homes derive more income, so the ratio of residential vs seasonal will matter. If the entire area is covered by Spectrum and the community considers the service to be good, then Option #3 below would be to provide world class service for 20-30 years or more that would significantly upgrade the current service available now.

Option #2- Consolidated Communications enhancements

We do not typically recommend Consolidated enhancements to their DSL service as it is unreliable and limited in upgrade possibilities. However, if there are areas that are poorly served by Consolidated, they may work with you to upgrade their equipment that would provide a limited increase in speed. Typically, these upgrades are \$70,000 or so according to Consolidated. This kind of upgrade could help the most remote customers who are typically suffering because they are at the end of the line.

Option #3- Full Fiber Build out

If the area is not served by Spectrum, we would recommend serious consideration to building out a fiber optic network. Because of the cost of the system, some combination of public subsidy from federal, state or local taxpayer money would be essential to make a project feasible.

Fiber systems meet three goals:

- Equal Access to All- no matter where you live, you are able to receive the same level of service as anyone else in the community, regardless of your address.
- Fast and Reliable- Fiber can offer the fastest speeds- by far. While at the same time giving subscribers unrivaled reliability.
- Futureproof- the system's capability can be upgraded easily without any changes or cost to the system architecture. As demand increases, the system can handle up to 1 Gig of service (1000Mbps) to each home, making the system futureproof for 20 years or more.

Cross Lake Fiber Route- with homes



Orange= Trunk line
 Green= Drop- lower count fiber
 Purple dots= Homes

The map does not depict each connection from the fiber to the individual homes. However, we have built into the pricing model connections to every home that wants service. All homes would be capable of receiving a connection from this construction design.

Cost

Category Description		Cost
Materials		\$555,556
Pole Licensing Application		\$19,454
Utility Pole Make Ready	Estimate	\$91,800
Utility Pole Replacement	Estimate	\$122,400
Regen Hardware		\$158,480
Customer Premise Drop Cable	Estimate	\$22,440
Customer Premise Installations		\$153,000
Total		\$1,123,130

The budget contains several line items that may change and lower the cost of the project overall. A lot of additional costing information will be learned by proceeding with the pole licensing process. For example, we have made some assumptions based on past experience, but the true understanding of the costs associated with pole attachments and make-ready - the cost of other users of the poles moving their lines to “make-ready” a space for a new cable - only will come through the licensing process. In addition, pole replacement costs are estimated and will not be known till the pole make ready work is completed. This budget contains the hardware for 100% of homes to be connected and our revenue modeling is based on a 90% take rate in year 5.

Breakdown of Cost Components

Materials

The materials line item is the total cost of all the materials and equipment needed to install the system minus the CO/Regen equipment and the Customer Drop Cable, which are located on separate line items.

Pole Licensing Application

This plan requires fiber optic cabling to be placed on existing utility poles across the community. In order to receive approval, a several step process of several months is required, but begins with the application. The cost of the application is based on the number of utility poles you would like to attach to.

Utility Pole Make-Ready

Make-Ready is the cost of making the poles ready (make ready) to accept a new fiber cable. In order to install new fiber optics cable on utility poles, a licensing process is in place that evaluates each pole for readiness to accept a new cable. Each provider (other than the electrical) would move the current lines to accommodate a space for a new cable. The cost of this process is estimated in our calculations and can change depending on the application process costs associated with each pole.

Replacement Poles (10%)

We estimate that 10% of the poles, through the licensing process might need replacement. There are two major reasons for pole replacements. First, the amount of equipment or utility lines on a pole deem it necessary to increase the height of the current pole to allow for an additional line to be placed on it (pole too short). Or the current pole is aged to the point where it would be unsafe to place the additional line strain on the pole without a replacement pole. (aged poles). We made an estimate, but the evaluation of each pole will take place during the pole licensing process.

CO/Regen Hardware & Installation

CO refers to Central Office, which is a term that Internet Service Providers use to describe where the equipment that would be needed to power the system and where the internet would be distributed from to each home. Regen hardware is the equipment that would be used to power the internet system and control each individual connection through this central system. These costs also include a heated and cooled utility shack that would house the equipment.

Customer Premise Cable

This is an estimated cost of the fiber to connect each home from the street to the home.

Customer Premise Installations

These costs are associated with the equipment needed at each home. This is the cost of connecting 100% of the homes.

Revenue and Expense Model

As part of Axiom's commitment to our mission to help rural communities more fully understand what ISPs are facing serving a small community, we have created a revenue and operational expense budget that helps the community and the ISP better negotiate an operating agreement through a Public-Private Partnership, should the community choose to own the fiber network.

It's important to understand that these are just an illustration of how Axiom would envision the feasibility of operating a system and what potential customer rates could look like. The potential revenue is based on service levels and take rates that are solely Axiom projections and are intended for illustration only, each provider will have their own revenue and cost models. However, these numbers can show you generally what a provider might expect if the town were to build a new fiber system and importantly, how much capital participation, if any, might be expected from the provider.

Revenue

Rate Group	# of Subscribers	Monthly Rate	Annual Revenue
25/5Mbps	71	\$69.99	\$59,631
50/10Mbps	20	\$79.99	\$19,198
100/20Mbps	10	\$109.99	\$13,199
Business Class-50/50M	5	\$109.99	\$6,599
TOTALS	102 (50%)		\$92,028/year

- The Rate Groups and monthly cost are entirely Axiom's and may differ depending on provider
- Take-rate is the estimated number of homes we believe would take service. In Cross Lake Township, we believe a 50% take-rate is achievable- in year one, with a steady rise as people in town convert slowly from Spectrum and Consolidated

Expenses

Estimated Operational Cost	\$42,438/year
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This includes the cost of:

Bandwidth is the cost of bulk wholesale internet.

Phone tech support is the estimated cost to maintain phone support for customers for the year.

Administrative Support is the cost of billing/collections and support for billing questions.

Local Field Crew is the cost of Axiom hiring a local person to conduct simple trouble shooting at the home. Field Crew (remote) is the cost of dispatching Field Crew from Machias to deal with more serious issues- breakage, splicing, etc.

Pole Licensing fee is the amount that the utility bills for yearly insurance and maintenance.

Three important takeaways of this section:

- ◇ How critical take-rate is to the overall viability of the project (less subscribers, less opportunity for profits)- When building in a rural area often a substantial subsidy is required
- ◇ The monthly operating expenses are generally fixed, no matter the number of subscribers (there is not a direct correlation between subscriber counts and expenses)
- ◇ Seasonal rates will bring revenue down, and needs to be determined

Final Thoughts

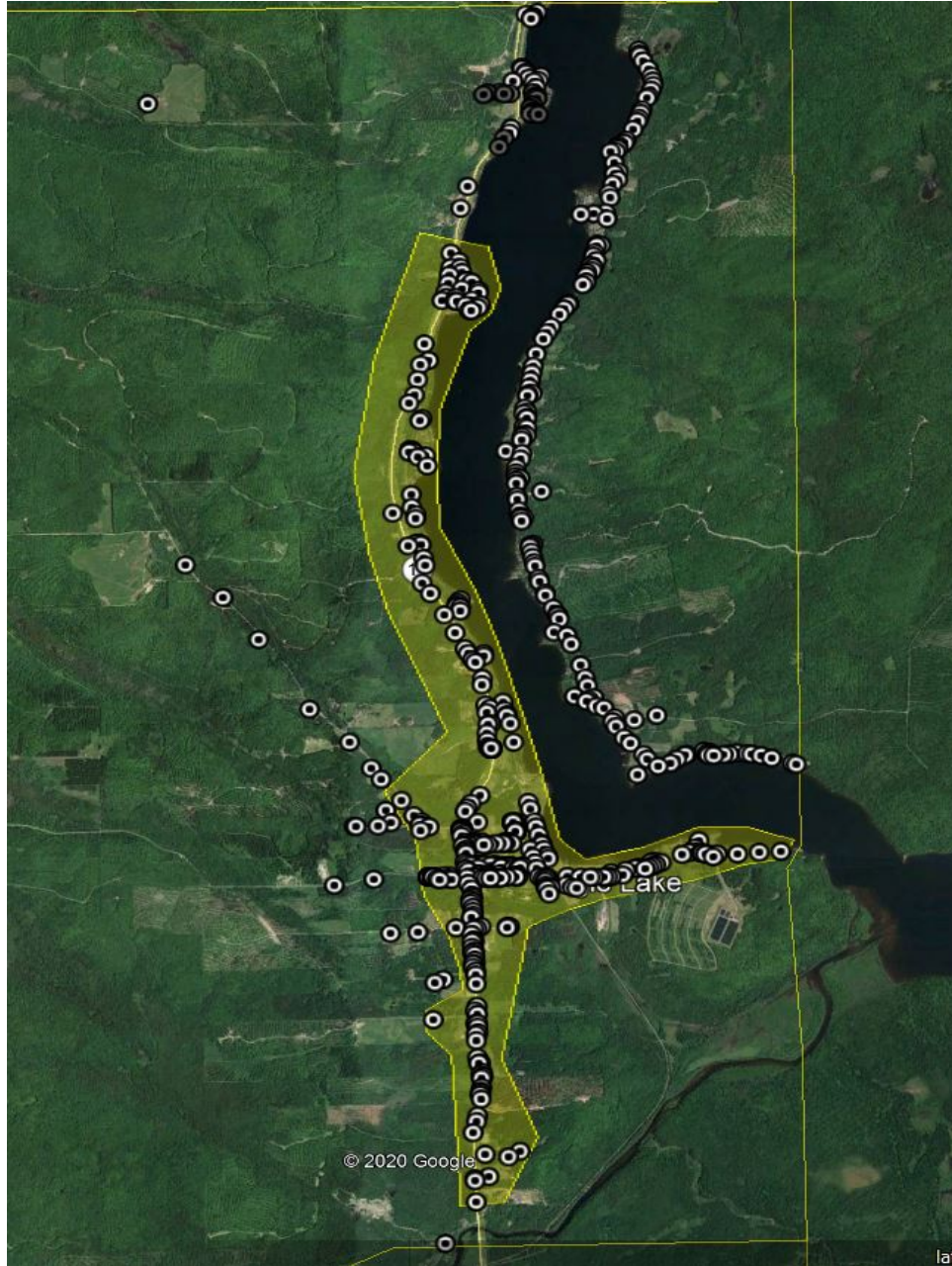
Options are limited for your community- all are dependent on strong support from Unorganized Territory Administrator, because all choices will require the participation (as a champion and as a financial supporter) to varying levels depending on the path forward.

- Working with Spectrum or Consolidated is the least expensive, least risky option
 - Spectrum service offers cable TV, typically our surveys show high interest in TV service, making an expansion of Spectrum more attractive potentially
 - Consolidated expansion likely comes with some enhancements to those with Consolidated service now, but DSL technology is outdated and will be difficult and expensive to scale in the future
- Installing new Fiber optic system
 - State-of-the-art system that will last for at least 20 years or very likely much longer
 - Gives Cross Lake Township a competitive advantage
 - Attract new families
 - Build home-based businesses
 - Telehealth and educational opportunities
 - Options for cutting cord and cost savings on communications bill
 - Builds economy by allowing camp owners to stay longer

Eagle Lake

The Town of Eagle Lake is bifurcated by the Lake with no crossings till Wallagrass, approximately 4 miles to the north. This makes a unified system more costly because of the additional road mileage that would be required to connect homes on each side of the lake with a unified system.

Eagle Lake Spectrum coverage area



Yellow Highlighted Area is served by Spectrum
White dots are homes

Western side of Eagle Lake

While Spectrum serves a good part of Rt. 11, the most northern part is not served, and some additional roads remain unserved. The most northern part of Main Street (Rt. 11) appears to have enough homes (20-25 per mile) to meet Spectrum's standard for building out. It is unclear if there is a technology issue, or if the rurality of the area (not enough homes) makes the capital investment less feasible for them. Other areas on the western side of the lake clearly lack the number of homes that would be required for Spectrum to build out. In order to determine what level of town financial participation would be necessary to help build out these areas with Spectrum service, and to determine if some of these extensions of service would qualify for state grant money through the ConnectME Authority, our recommendation would be to engage Spectrum in a discussion about the situation. Spectrum has partnered with eligible communities to apply for state grant money and would be open to a discussion, if the town was serious about participating.

Shelly Winchenbach: Shelley.Winchenbach@charter.com

Melinda Kinney: Melinda.Kinney@charter.com

Eastern Side of Eagle Lake

The eastern side of the Lake is accessed most easily at a bridge crossing in Wallagrass, approximately four miles from the beginning of camps/homes on the lake. This area contains approximately 100 homes, and we would suspect a good many of these are seasonal camps. We are not sure how they are served or how many, but likely Consolidated Communications DSL serves some of this part of your community. How much speed and reliability are determined by the proximity of a home to the equipment that serves the area. The closer you are to the equipment, the more speed and better reliability. Likewise, the farther away, the more problems- reduced reliability and minimal speeds, often less than 3Mbps. It is for these limitations that we often do not recommend working with Consolidated on upgrades, because DSL service is an old technology that is not really capable of modern communications. However, in the case of Eagle Lake they may be in a position to upgrade their current system or strategically place another piece of equipment that would produce better service for properties along the eastern side of the Lake. Consolidated has offered to discuss current coverage footprint and service levels with communities interested. The contact for Consolidated is Jeff Nevins, if the town would be open to discussing the situation.

Jeff Nevins: Jeffery.Nevins@Consolidated.com

Is a Fiber Optic solution feasible?

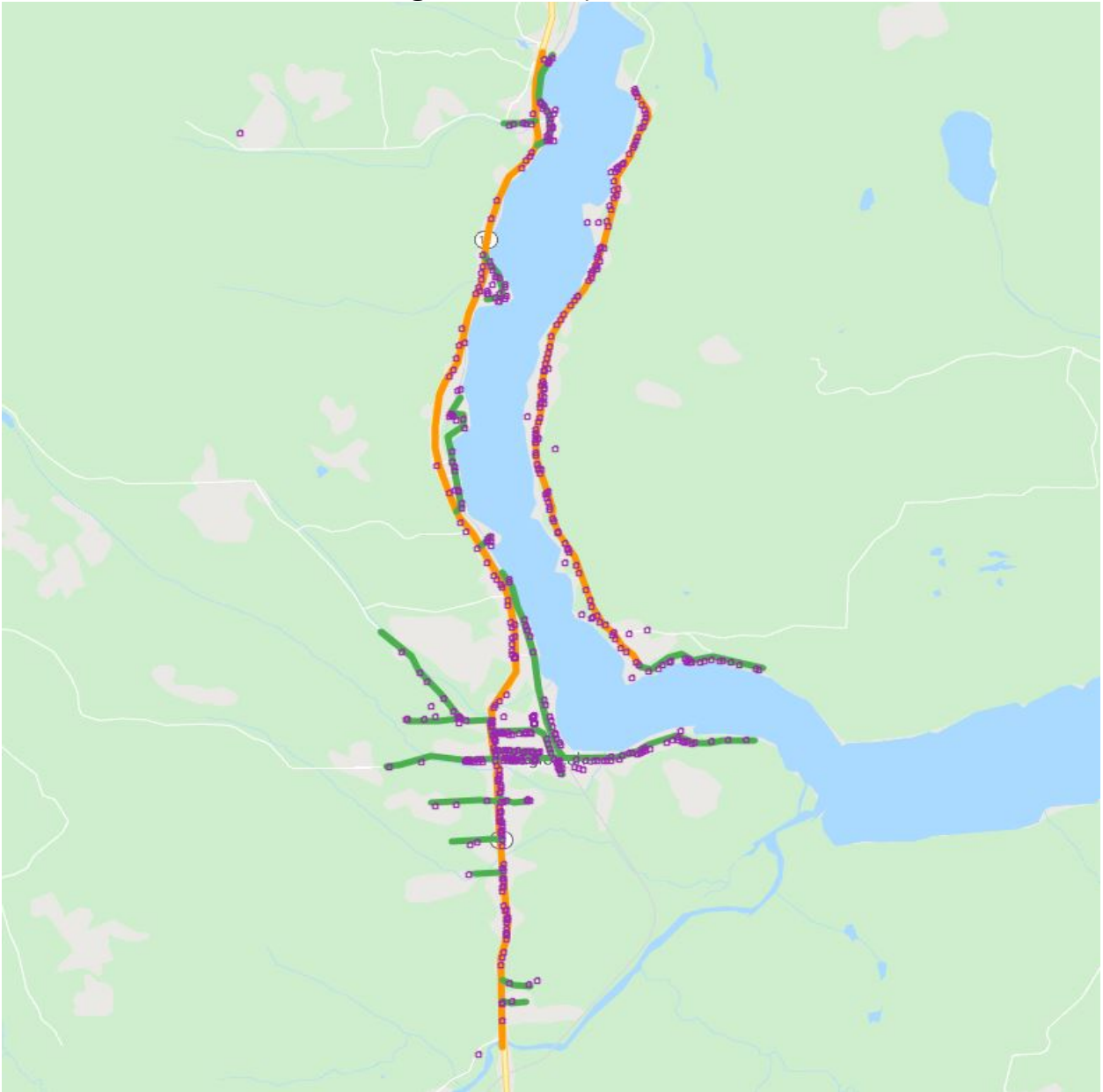
One of the superior attributes of fiber optic delivered internet is the capacity that fiber can bring to individual homes. Fiber systems, once constructed, can expect a life of well over 20 years- while being able to handle increasing demand from subscribers without any upgrades to the system architecture or delivery system. The bottom line is that while relatively expensive up front, a fiber optic system actually is

much less expensive over time, because the upfront cost of the system stays in place for 20, 30 or even 40 years, and the fiber can meet the user demand by simply pushing more internet bandwidth through the fiber optic cabling. A system that would serve the whole town is complicated by the Lake, and our design does not connect the two sides, because of the expense of running additional fiber up to Wallagrass and back down Rt. 11 to connect the two systems. However, this may be an opportunity to work with Wallagrass on a shared solution.

Fiber optic technology offers a world class solution- but it comes with a cost.

- State-of-the Art Reliability- No other technology can rival the reliability of fiber- it just works
- Futureproof- A fiber system offers up to a 1000Mbps to each home served, and can also deliver 1000Mbps of upload, an increasingly important attribute of 21st Century connectivity
- While expensive up front, the cost of the system is actually less expensive than other technology upgrades that will require additional investments for every step up in speed.

Eagle Lake Fiber path



Orange= Main Trunk lines
Green= Drop lines with lower count fiber
Purple dots= Homes

The cost analysis below provides for service to 100% of the homes, as you can see the service along each side of the lake is not connected so it's possible for us to price the cost of a solution only on the side of the lake that does not have Spectrum service. In order to connect both sides of the town, we would recommend a wireless link. That is not part of the price but would be more cost effective than the cost of running fiber around the northern tip of the Lake.

Cost

The cost for this project is based on a number of assumptions. Please remember, this is a desktop estimate and additional, significant work would need to be completed to give the community a final cost that eliminates all of the variables. The different cost components will give the reader a good idea of where estimated costs would possibly change.

Category Description		Cost
Bill of Materials		\$969,738
Pole Licensing Application		\$23,145
Utility Pole Make Ready	Estimate	\$124,650
Utility Pole Replacement	Estimate	\$166,200
CO/ Regen Hardware		\$183,965
Customer Premise Drop Cable	Estimate	\$62,590
Customer Premise Installation Labor		\$426,750
Link to connect each area not included		
Total		\$1,957,038

The total cost of the budget contains several line items that may change and lower the cost of the project overall. A lot of additional costing information will be learned by proceeding with the pole licensing process. For example, we have made some assumptions based on past experience, but the true understanding of the costs associated with pole attachments and make ready - the cost of other users of the poles moving their lines to “make ready” a space for a new cable - only will come through the licensing process. In addition, pole replacement costs are estimated and will not be known till the pole make ready work is completed. This budget contains the hardware for 100% of homes to be connected, however, we calculate the revenue on 50% of the homes taking service in year one.

Breakdown of Cost Components

Bill of Materials

This is the materials and equipment cost for the whole project with the exception of CO/Regen Hardware & Installation and the cost of the drop cable, which are separate line items.

Pole Licensing Application

This plan requires the placement of fiber optic cabling to be placed on existing utility poles across the community. In order to receive approval, a several step process of several months is required, but begins with the application. The cost of the application is based on the number of utility poles you would like to attach to.

Utility Pole Make Ready

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Revenue and Expense Model

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system and importantly, how much capital participation, if any, might be expected from the provider.

Revenue

Rate Group	# of Subscribers	Monthly Rate	Annual Revenue
25/5Mbps	200	\$69.99	\$167,976
50/10Mbps	114	\$79.99	\$54,713
100/20Mbps	57	\$109.99	\$38,277
Business Class- 50/50M	5	\$109.99	\$6,599
TOTALS	285 (50%)		\$260,966 / year

- The Rate Groups and monthly cost are entirely Axiom’s and may differ depending on provider
- Take rate is the estimated number of homes we believe would take service. In this case we believe a 50% take rate is achievable- in year one, with a steady rise as people in town convert slowly from Spectrum and Consolidated.
- We did not calculate seasonal homes, which would reduce the revenue by some amount

Expenses

Operational Expense Estimates	\$125, 082/ year
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Includes all of the cost of the Internet Service provider to deliver, service and maintain the system.

Two important takeaways of this section:

- How critical take rate is to the overall viability of the project (less subscribers, less opportunity for profits)
- The monthly operating expenses are generally fixed, no matter the number of subscribers (there is not a direct correlation between subscriber counts and expenses)

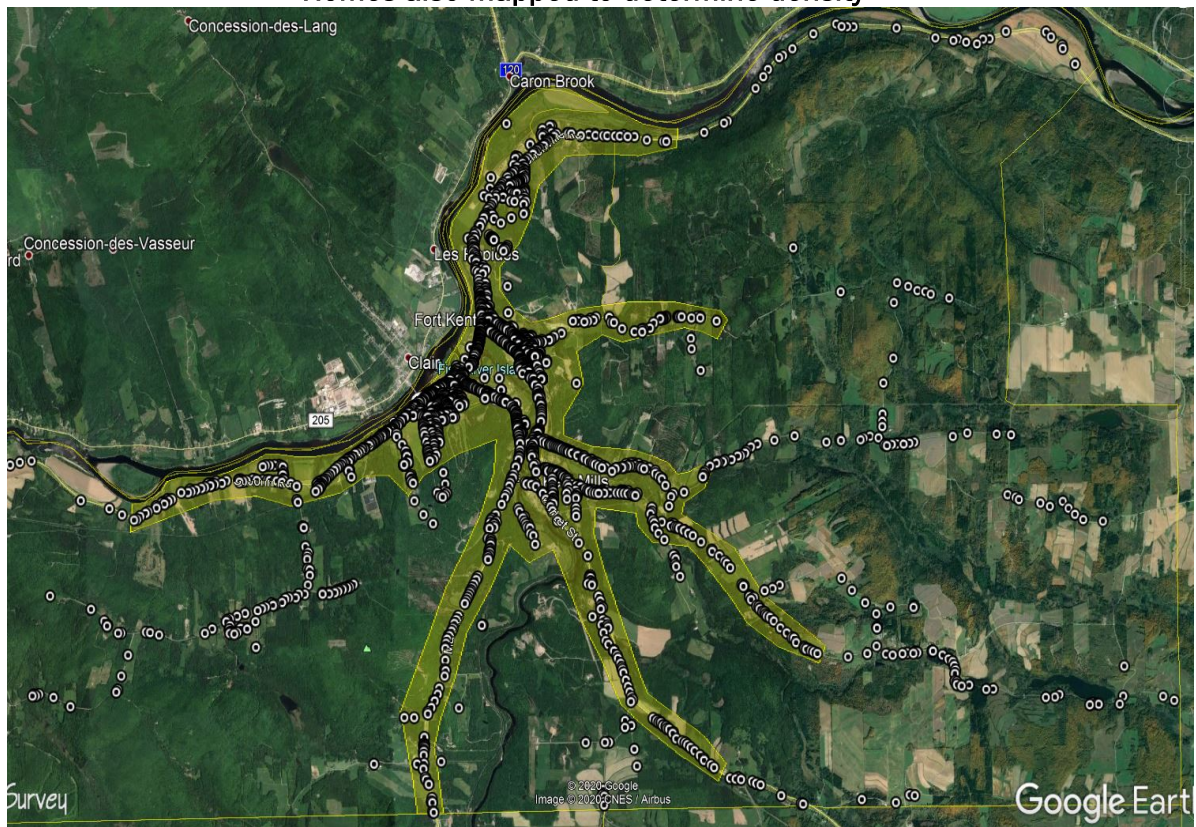
Final Thoughts

- Working with each incumbent provider could help fill in gaps in service at a relatively low cost
 - Axiom can help connect you to Spectrum and/or Consolidated
- Improving service on the eastern side of the lake could be an opportunity to partner with neighboring Wallagrass

Fort Kent

In the surveys that were returned from Fort Kent during Phase I of the planning process, there were an unusual amount of complaints about the quality of Spectrum service in the community. Axiom relayed those concerns to Spectrum. It is unclear if that report prompted Spectrum to improve the service reliability in Fort Kent. In 2019, Spectrum and the town partnered on an application to the ConnectME Authority for a grant to expand service to Violette Settlement, an area of 80 plus homes in the western part of the community. Unfortunately, that application was not funded. We understand the town is interested in applying for a ConnectME grant again.

**Spectrum Coverage Area highlighted in Yellow
Homes also mapped to determine density**



It is clear that Violette Settlement is the densest part of the community currently unserved by Spectrum. Reapplying for funding jointly with Spectrum to get this area served is a good strategy. The concerns with expanded service to reach areas beyond Spectrum's current footprint is difficult because those areas are geographically in different pockets of the community. Creating an alternative solution to serve all of those areas is expensive because any construction of a new system would necessarily include areas that are well served by Spectrum now. From a technology standpoint, this is not an issue, but the expense associated with stitching together the areas requires a significant amount of construction to occur through the town.

Spectrum Plan

Because the town has an ongoing relationship with Spectrum, we would recommend suggesting to Spectrum that they consider bringing service across the whole community in stages, perhaps using franchise fees and other grant opportunities to continually expand service. Much like a comprehensive plan, listing strategic objectives over a five-year period might help show Spectrum how serious you are about service upgrades and covering all homes in the community with Spectrum service. With the potential for additional state money to be available in the next fiscal year, this is an opportune time to create an action plan.

Consolidated Communications

Consolidated also serves the community and covers at least some, if not most, of the areas outside of the Spectrum coverage map. Consolidated service can be uneven because of the nature of the technology, giving relatively reliable and reasonable service to some, and others receiving poor speeds and reliability. We would also guess that there may be some small pockets of unserved. Working with Consolidated to better serve these areas is a possibility. It is not our first choice or key recommendation, but at relatively low cost and risk, you can engage Consolidated. They have agreed to provide towns interested with their current speed levels and customer counts at each speed level to help communities better understand their footprint. Here is the information received from Consolidated:

Speed/Bandwidth [Max Available]	# Locations	% available
2M/768K	157	8.8
7M/1M	130	7.3
12M/1M	177	10.0
15M/1M	102	5.7
20M/1.5M	115	6.5
20M/5M	124	7.0
25M/2M	578	32.5
30M/10M	90	5.1
50M/20M	282	15.9
NS	22	1.2
TOTALS	1777	100.0

This chart was provided by Consolidated and shows the total number of homes that can receive the speeds listed. This is not a chart that shows the number of homes that are actually served. Consolidated can provide a chart of actual number of homes that take service at each speed level.

Fiber Optics

A fiber optics system would upgrade the whole town and bring unrivaled reliability and blazingly fast speeds that would deliver service that rivals or surpasses the Google cities of Kansas City and Austin. A fiber system would put the community ahead of 99% of communities in Maine in terms of internet service. Fiber systems can bring enormous benefits, at a significant up-front cost. With the current Spectrum coverage, the town would need to balance these benefits against the cost of installing an alternative service to Spectrum and Consolidated. Typically, communities frustrated with one or both services consider taking matters in their own hands. In the case of Fort Kent, it's difficult to justify the cost of such a system given the large amount of homes served by Spectrum.

Benefits of Fiber Technology to the Subscriber

Speed and Capacity. Many experts say that FTTH connections are the only technology with enough bandwidth to support the projected consumer demands over the next decade.

Future proof. Because of fiber's capabilities, new technological innovations are being invented every day to utilize fiber's superior ability to transport tremendous amounts of data at blazingly fast speeds. Technologies such as 3D holographic high definition television and gaming will someday be everyday items in households around the world. FTTH will be able handle the estimated 30 gigabit-per-second needs of such equipment... and this is just one technology. Think about the new ways that you use the internet that seem commonplace now that were not even conceived of 10 years ago.

One delivery system. Right now, a consumer can receive telephone, video, audio, television and almost any type of data transmission using a single seamless FTTH connection. That trend will continue as consumers are given increasing array of a la carte choices for how they receive their various communication and data and streaming choices. Subscribers are also realizing that receiving bundled services through a fiber connection can save money.

Reliability. Fiber is the most reliable connection you can have. In surveys across the state of Maine, the #1 complaint is reliability. An internet connection is becoming a necessity, not a luxury. When connectivity is interrupted or slowed down unexpectedly or inexplicably consumers are furious that they cannot accomplish the on-line task, leading to a significant loss of productivity or time.

Community Benefits

Job Creation- There are many examples of fiber networks creating jobs by either supporting existing businesses or attracting new ones

Business Attraction- When we say business attraction, we really mean businesses that are looking for the kinds of connections that can move large amounts of data, quickly- architects, designers, banks and other heavy users

Entrepreneurship- Fiber helps induce young people to locate and work from anywhere

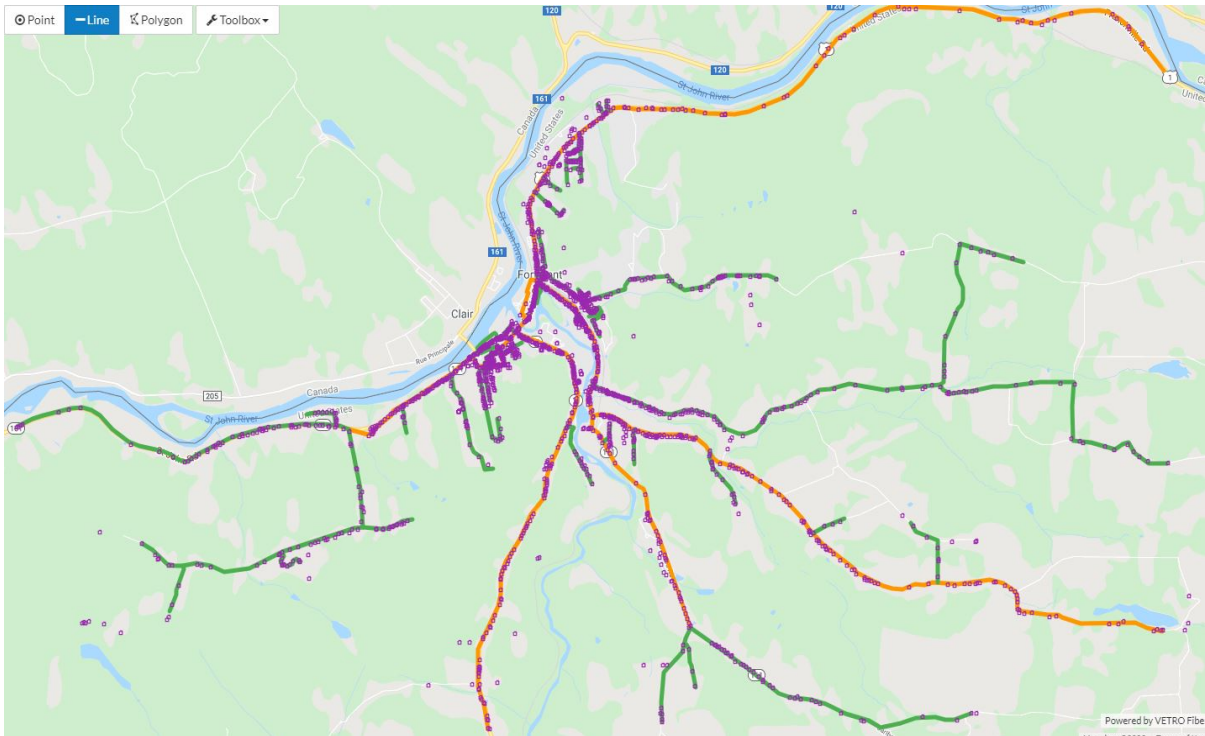
Telemedicine- The medical field and how patients and providers interact is undergoing seismic changes. One of those changes is the way patients are able to be seen, treated, monitored and are increasingly being given tools to manage their own health care, right from their home. A fiber connection has the capacity to manage these data transmission uses, which in turn facilitates our elders aging in place

Education- Creating equal access for all eliminates “the homework gap” for those students that are increasingly required to complete assignments on-line but are unable to do so from their home because of a lack of an adequate internet connection. Adult learners also benefit from on-line learning options that utilize interactive video or other tools that those with better connections can access

Increased Home Values- A Broadband Communities study indicated that FTTH networks increase the value of a \$300,000 home by an average of \$5,000-\$6,000. Another study by the FTTH Council in conjunction with the University of Colorado showed that homes with a FTTH connection are worth, on average, 3.1% more than homes that do not have a fiber connection

The cost of a fiber system can be prohibitive, but the benefits are unquestionable and for rural communities that are struggling fiber optics may offer the best economic development opportunity to the town and the people who live and work there.

Fiber Plan



This map represents a FTTP plan that would serve 100% of the homes in the community. The different colors of the lines depict different fiber counts, and as you move toward the edges of the community the number of fibers needed to serve those areas is not as great as in the densest downtown.

Cost

Category Description		Cost
Materials		\$6,936,405
Pole Licensing Application		\$71,396
Utility Pole Make Ready	Estimate	\$359,775
Utility Pole Replacement	Estimate	\$479,700
Regen Hardware		\$438,855
Customer Premise Drop Cable	Estimate	\$259,490
Customer Premise Installations		\$1,769,250
Total		\$6,936,405

The total cost of the budget contains several line items that may change and lower the cost of the project overall. A lot of additional costing information will be learned by proceeding with the pole licensing process. For example, we have made some assumptions based on past experience, but the true understanding of the costs

associated with pole attachments and make-ready - the cost of other users of the poles moving their lines to “make-ready” a space for a new cable - only will come through the licensing process. In addition, pole replacement costs are estimated and will not be known till the pole make ready work is completed. This budget contains the hardware for 100% of homes to be connected, however, we calculate a take rate (the number of homes passed that we estimate would take service) of 40% in year one, which would reduce the up-front cost of customer premise installations by approximately \$400,000.

Breakdown of Cost Components

Materials

The materials line item is the total cost of all the materials and equipment needed to install the system minus the CO/Regen equipment and the Customer Drop Cable, which are located on separate line items.

Pole Licensing Application

This plan requires the placement of fiber optic cabling to be placed on existing utility poles across the community. In order to receive approval, a several step process of several months is required, but begins with the application. The cost of the application is based on the number of utility poles you would like to attach to.

Utility Pole Make-Ready

Make-Ready is the cost of making the poles ready (make ready) to accept a new fiber cable. In order to install new fiber optics cable on utility poles, a licensing process is in place that evaluates each pole for readiness to accept a new cable. Each provider (other than the electrical) would move the current lines to accommodate a space for a new cable. The cost of this process is estimated in our calculations and can change depending on the application process costs associated with each pole.

Replacement Poles (10%)

We estimate that 10% of the poles, through the licensing process might need replacement. There are two major reasons for pole replacements. First, the amount of equipment or utility lines on a pole deem it necessary to increase the height of the current pole to allow for an additional line to be placed on it (pole too short). Or the current pole is aged to the point where it would be unsafe to place the additional line strain on the pole without a replacement pole. (Aged poles). We make an estimate, but the evaluation of each pole will take place during the pole licensing process.

CO/Regen Hardware & Installation

CO refers to Central Office, which is a term that Internet Service Providers use to describe where the equipment that would be needed to power the system and where the internet would be distributed from to each home. Regen hardware is the equipment that would be used to power the internet system and control each individual connection through this central system. These costs also include a heated and cooled utility shack that would house the equipment.

Customer Premise Cable

This is an estimated cost of the fiber to connect each home from the street to the home.

Customer Premise Installations

These costs are associated with the equipment needed at each home. This is the cost of connection 100% of the homes.

Revenue and Expense Model

As part of Axiom’s commitment to our mission to help rural communities more fully understand what ISPs are facing serving a small community, we have created a revenue and operational expense budget that helps the community and the ISP better negotiate an operating agreement through a Public-Private Partnership, should the community choose to own the fiber network.

It’s important to understand that these are just an illustration of how Axiom would envision the feasibility of operating a system and what potential customer rates could look like. The potential revenue is based on service levels and take rates that are solely Axiom projections and are intended for illustration only, each provider would have their own revenue and cost models. However, these numbers can show you generally what a provider might expect if the town were to build a new fiber system and importantly, how much capital participation, if any, might be expected from the provider.

Revenue

Rate Group	# of Subscribers	Monthly Rate	Annual Revenue
25/5Mbps	661	\$69.99	\$555,161
50/10Mbps	189	\$79.99	\$181,417
100/20Mbps	94	\$109.99	\$124,069
Business Class-50/50M	5	\$109.99	\$6,599
TOTALS	350 (40%)		\$860,647

- The Rate Groups and monthly cost are entirely Axiom’s and may differ depending on provider
- Take-rate is the estimated number of homes we believe would take service. In this case we believe a 40% take-rate is achievable- in year one, with a steady rise as people in town convert slowly from Spectrum and Consolidated.

Expenses

Estimated yearly expenses	\$350,000
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Long ago you stopped reading because of the cost of a fiber system. However, there is a lot to digest here. For example, looking at the yearly revenue vs the potential expenses, you would expect cash flow approaching \$500,000 a year. At least a portion of that might cover a low interest loan or municipal bond. In addition, any areas that receive 10Mbps or less of service is considered unserved and a federal USDA program called Reconnect may support serving those unserved areas.

Amount to construct system:	\$7,000,000
USDA 100% grant	\$3,000,000
Requires 25% match	\$750,000
Additional loan at 4%	\$3,000,000
State grant	\$200,000

In this scenario, the federal grant and the state grant would reduce the cost by \$3.2M, a \$3M loan for 15 years at 4% is approximately a yearly cost of \$266,256 a year. If the town pitched in the \$750,000 match to the USDA grant, and backed the loan, it appears that the revenue derived would cover the \$3M loan.

There are a lot of assumptions in these numbers and are here just to give a sense that a project of this size is closer to achievable than first glance.

Final Thoughts

- Develop a phased strategic plan for that would facilitate Spectrum expansion to every home
 - It's the least expensive option for the community while still delivering solid service for internet, TV and phone
- If expanded Spectrum service is too costly or will take too long, consider working with Consolidated to band-aid the worst underserved or unserved areas of the community
- Moon-Shot: Fiber optic plan for the community. Happy to discuss details.

Madawaska

For several years Madawaska town officials have been interested in pursuing options to better their internet connectivity in the community. Both Spectrum and Consolidated Communications serve the community currently. Working with either provider as a first step to connect all homes and/or upgrade systems would seem prudent, and potentially save cost versus a full buildout of a new internet system. However, upgrading to a fiber optic system- which neither Spectrum or Consolidated provides- would bring enormous benefits to subscribers and the community.

Spectrum



Yellow area= Spectrum coverage area

Beyond the concern that the town may have with the limited coverage area of Spectrum, which essentially creates speed and reliability differences in different areas of the community- the actual users of Spectrum service are all too familiar with the reliability of the system. There is a major concern with the fact that cable is a shared system, meaning that the signal strength you receive is dependent on how much bandwidth is being drawn by other users that are also connected to that line of cable. Cable companies commonly oversaturate their subscriber networks by a ratio of up to 100:1, leading to inconsistent speeds for the end user. This can be especially acute during peak demand times in the evening or after school. Complaints from Spectrum subscribers are generally that the cost of service is high, and that for that price the system typically does not deliver anything near the bandwidth that is being paid for. Other concerns are that compared to a fiber-optic system, cable is not nearly so scalable – for every step up in speeds, equipment needs to be upgraded both at the home and at the cable equipment. Furthermore, cable systems were designed primarily to push data down to the customer, a significantly different model than the emerging needs for telecommuting and interactive video, which require high bandwidth in both directions.

- Shared system- which can lead to unhappy user experience
- Expensive- to upgrade speeds requires expensive equipment upgrades
- Asymmetrical- the technology is not capable of equal upload and download speeds

While there are limitations to consider, Spectrum cable service offers an opportunity for the community to consider working with Spectrum to expand their system. And there are good reasons to consider Spectrum. While the technology has limitations, it is likely less expensive to expand their service than to install a new service of fiber optics. However, expanding Spectrum service to less dense areas of the community that do not meet their density criteria would require substantial public subsidy so the community would need to weigh the cost/benefit of such an arrangement, what sort of guarantee the company would give to commit to serving 100% of the community (if this was a goal) and obviously, what kind of cost-share would be involved.

- Is Spectrum interested in expanded coverage, how much money would that cost
- Would the Town be in a position to help raise demand from potential customers, if Spectrum were to expand?
- Is the Town able or interested in public support of a project that would benefit a private company?

Contacts at Spectrum:

Shelly Winchenbach: Shelley.Winchenbach@charter.com

Melinda Kinney: Melinda.Kinney@charter.com

Consolidated Communications

Consolidated offers DSL service to a good part of the community- but not to all. While Consolidated will not show us a map of their service coverage (because of proprietary reasons) they do provide a chart of the types of service that is available and how many locations and customers are served with each category of service. Should the town consider a serious meeting with Consolidated about current service and areas that might be improved upon, Consolidated officials have confirmed that they would be happy to come to the community and show a more detailed map and explanation of current coverage. Out of the approximate 3,369 homes that they can serve, they currently have 330 subscribers. This

chart shows the number of locations and the top speeds available. The chart below it shows actual customers.

Consolidated Current Speed Availability

Speed/Bandwidth [Max Available]	# Locations	% available
768K/3M	39	1.2
7M	97	2.8
10M	163	4.8
20M	203	6.0
25/2M	1188	35.3
40M	674	20.0
60M	340	10.1
80M	242	7.2
NS	423	12.6
TOTALS	3369	100.0

Current customers and speeds

Speed	# Subscribers	Percentage
768K/1.6M/3M	100	30.3
7M	88	26.7
10M	24	7.3
15M	61	18.5
20M	3	.9
25/2M	48	14.5
40M	4	1.2
60M	1	.3
80M	1	.3
TOTALS	330	100.0

There are a several highlights on these charts. First, Consolidated claims that over 1,200 homes are eligible to subscribe to speeds between 40M and 80M- that is significant. Second, only 11.2% of eligible homes take Consolidated service. And last there are 423 homes that are not served by Consolidated and are presumably unserved. This seems like a high number of homes and I believe should be confirmed.

Working with Consolidated

Another lower cost option would be to consider expanding their service to unserved areas or to upgrade their system that would improve service on the outskirts of town where their equipment cannot serve customers reliably or with speeds that users of internet are demanding.

Consolidated offers DSL service over copper lines that were originally meant for phone service only. In the case of DSL, not only is the driving technology outdated, but the old copper lines are susceptible to corrosion that can impact the reliability of a subscriber connection. Furthermore, DSL is severely limited in the distance it can push a signal (3-mile maximum), meaning those homes furthest from the telco equipment are faced with connections that often cannot reach even a paltry 3Mbps download speed. Last, it appears from the data provided that an upgrade to their current equipment has already occurred. This is how they can claim the number of homes that are able to receive higher speeds.

- Given that Consolidated has upgraded their equipment, do they have an appetite to expand service further and how much would that cost?
- Because DSL is not a technology platform for the future, does it make sense that the community invest in a technology that will likely have significant limitations in the future.

A discussion with Consolidated should explore the 423 homes that do not have Consolidated service and drill down on options for those particular homes.

Contact:

Jeff Nevins: Jeffrey.Nevins@consolidated.com

Fiber Optics

The community is in an awkward place because of the presence of Spectrum, whose service while limiting in many ways does provide reasonable customer satisfaction in the densest parts of the community. Building consensus in the community for a new system could prove challenging given the number of homes and businesses that can receive Spectrum service. On the other hand, the outskirts of town are poorly or not served at all. And these areas need to be a priority to close the digital divide and achieve full economic and social participation with on-line activities that are increasingly part of our every day lives.

The need for Fiber Optic systems often get questioned because of the upfront cost. However, over time other technologies would need to be replaced or enhanced while fiber is a long-term investment in the future of the community. No other technology can match the capacity and reliability of a fiber system.

Benefits of Fiber Technology to the Subscriber

Speed and Capacity. Many experts say that FTTH connections are the only technology with enough bandwidth to support the projected consumer demands over the next decade.

Future proof. Because of fiber's capabilities, new technological innovations are being invented every day to utilize fiber's superior ability to transport tremendous amounts of data at blazingly fast speeds. Technologies such as 3D holographic high definition television and gaming will someday be everyday items in households around the world. FTTH will be able handle the estimated 30 gigabit-per-second needs of such equipment... and this is just one technology. Think about the new ways that you use the internet that seem commonplace now that were not even conceived of 10 years ago.

One delivery system. Right now, a consumer can receive telephone, video, audio, television and almost any type of data transmission using a single seamless FTTH connection. That trend will continue as consumers are given increasing array of a la carte choices for how they receive their various communication and data and streaming choices. Subscribers are also realizing that receiving bundled services through a fiber connection can save money.

Reliability. Fiber is the most reliable connection you can have. In surveys across the state of Maine, the #1 complaint is reliability. An internet connection is becoming a necessity, not a luxury. When connectivity is interrupted or slowed down unexpectedly or inexplicably, consumers are furious that they cannot accomplish the on-line task, leading to a significant loss of productivity or time.

Community Benefits

Job Creation- There are many examples of fiber networks creating jobs by either supporting existing businesses or attracting new ones

Business Attraction- When we say business attraction, we really mean businesses that are looking for the kinds of connections that can move large amounts of data, quickly- architects, designers, banks and other heavy users

Entrepreneurship- Fiber helps induce young people to locate and work from anywhere

Telemedicine- The medical field and how patients and providers interact is undergoing seismic changes. One of those changes is the way patients are able to be seen, treated, monitored and are increasingly being given tools to manage their own health care, right from their home. A fiber connection has the capacity to manage these data transmission uses, which in turn facilitates our elders aging in place

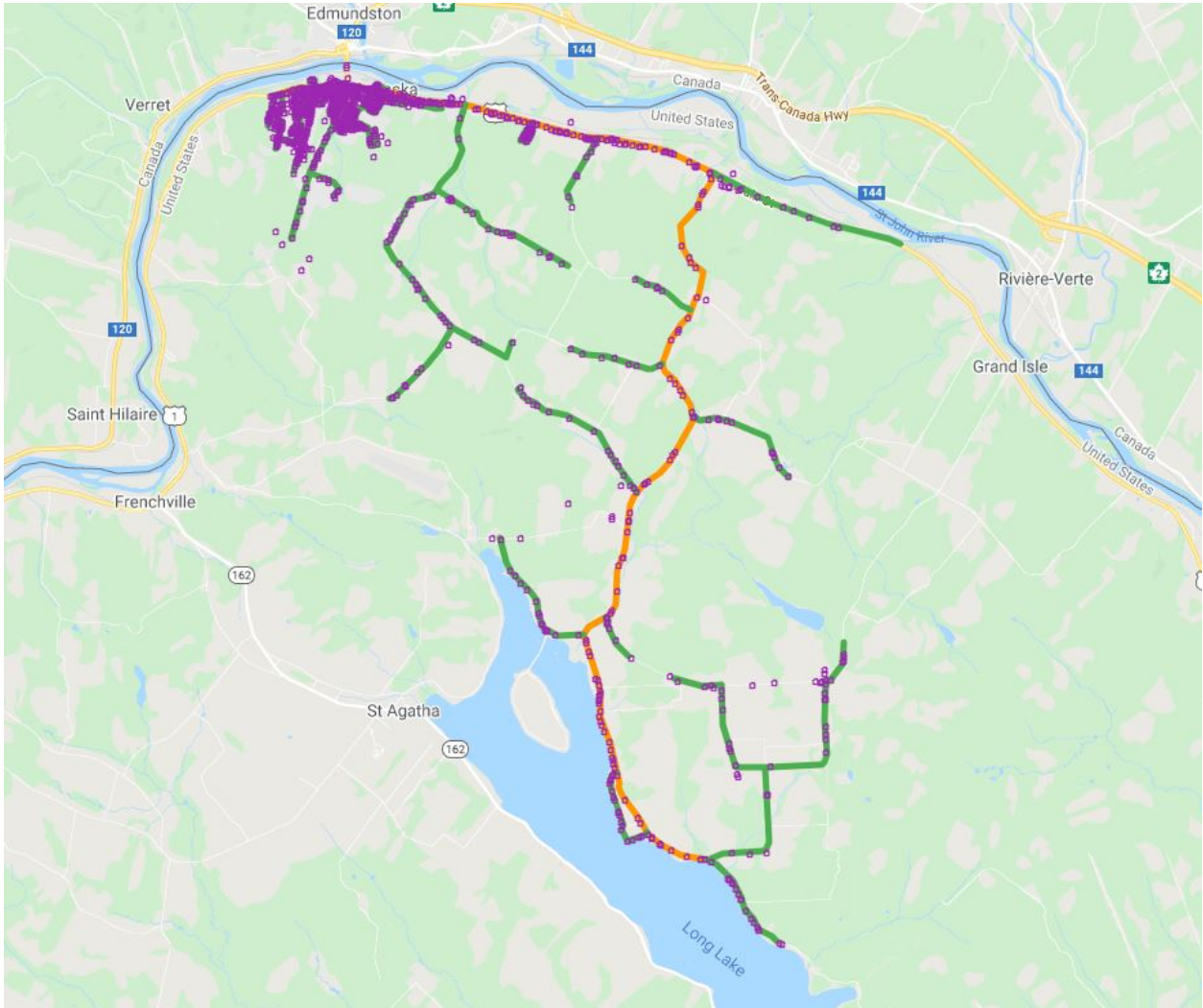
Education- Creating equal access for all eliminates “the homework gap” for those students that are increasingly required to complete assignments on-line but are unable to do so from their home because of a lack of an adequate internet connection. Adult learners also benefit from on-line learning options that utilize interactive video or other tools that those with better connections can access

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The Plan for Fiber

If working with Spectrum or Consolidated are not an option or cannot meet community goals, we have engineered a fiber optic solution that would have the capability to serve every home. This plan can be modified to serve only areas outside of the Spectrum served areas now or meet whatever goals the town decides. This is a good starting place to explore if the town is interested in upgrading their current service levels. Parts of the community may be eligible for Federal and State grant dollars, but local dollars would very likely be needed to subsidize any new service. The map is an illustration of what the project construction of the fiber lines would be and the locations of homes and businesses in the community. The density in some

areas of the community blot out individual premises but can serve to show community members where homes and businesses are located.



Madawaska Proposed Fiber Construction
Orange line= High capacity multi-count fiber
Green line= Lower fiber count drop fiber
Purple dots= E911 home and business addresses

Cost

The construction cost projections for this project are based on a number of assumptions. Please remember, this is a desktop estimate and additional, significant engineering would need to be completed to give the community a final cost that eliminates all of the variables. The different cost components will give the reader a good idea of where estimated costs would possibly change.

Category Description		Cost
Bill of Materials/labor		\$1,296,705
Pole Licensing Application		\$76,385
Utility Pole Make Ready	Estimate	\$362,925
Utility Pole Replacement	Estimate	\$483,900
CO/ Regen Hardware		\$275,230
Customer Premise Drop Cable	Estimate	\$139,370
Customer Premise Installation/Labor		\$475,125
Total		\$3,109,640

The total cost of the budget contains several line items that may change and lower the cost of the project overall. A lot of additional costing information will be learned by proceeding with the pole licensing process. For example, we have made some assumptions based on past experience, but the true understanding of the costs associated with pole attachments and make ready - the cost of other users of the poles moving their lines to “make ready” a space for a new cable - only will come through the licensing process. In addition, pole replacement costs are estimated and will not be known till the pole make ready work is completed.

This budget contains the hardware for 100% of homes to be connected, however, we calculate the revenue on 50% of the homes taking service in year one.

Breakdown of Cost Components

Bill of Materials

This is the materials and equipment cost for the whole project with the exception of CO/Regen Hardware & Installation and the cost of the drop cable, which are separate line items.

Pole Licensing Application

This plan requires the placement of fiber optic cabling on existing utility poles across the community. In order to receive approval, a several step process over several months is required, but begins with the application. The cost of the application is based on the number of utility poles you would like to attach to.

Utility Pole Make Ready

Make Ready is the cost of making the poles ready (make ready) to accept a new fiber cable. In order to install new fiber optics cable on utility poles, a licensing process is in place that evaluates each pole for readiness to accept a new cable. Each provider (other than the electrical) would move the current lines to accommodate a space for a new cable. The cost of this process is estimated in our calculations and can change depending on the application process costs associated with each pole.

Replacement Poles (10%)

We estimate that 10% of the poles, through the licensing process might need replacement. There are two major reasons for pole replacements. First, the amount of equipment or utility

lines on a pole deem it necessary to increase the height of the current pole to allow for an additional line to be placed on it (pole too short). Or the current pole is aged to the point where it would be unsafe to place the additional line strain on the pole without a replacement pole. (Aged poles). We make an estimate, but the evaluation of each pole will take place during the pole licensing process.

CO/Regen Hardware & Installation

CO refers to Central Office, which is a term that Internet Service Providers use to describe where the equipment that would be needed to power the system and location where bulk internet would be distributed from to each home. Regen hardware is the equipment that would be used to power the internet system and control each individual connection through this central system. These costs also include a heated and cooled utility shack that would house the equipment.

Customer Premise Cable

This is an estimated cost of the fiber to connect each home from the street to the home.

Customer Premise Installations

These costs are associated with the equipment needed at each home.

Revenue and Expense Model

As part of Axiom’s commitment to our mission to help rural communities more fully understand what ISPs are facing serving a small community, we have created a revenue and operational expense budget that helps the community and the ISP better negotiate an operating agreement through a Public-Private Partnership, should the community choose to own the fiber network.

It’s important to understand that these calculations are just an illustration of how Axiom would envision the feasibility of operating a system and what potential customer rates could look like. The potential revenue is based on service levels and take rates that are solely Axiom projections and are intended for illustration only, each internet provider would have their own revenue and cost models. However, these numbers can show you generally what a provider might expect if the town were to build a new fiber system and importantly, how much capital participation, if any, might be expected from the provider.

Revenue

Rate Group	# of Subscribers	Monthly Rate	Annual Revenue
25/5Mbps	444	\$69.99	\$372,907
50/10Mbps	127	\$79.99	\$121,904
100/20Mbps	63	\$109.99	\$83,152
Business Class-50/50M	5	\$109.99	\$6,599
TOTALS	(50%)		\$584,563 / year

- The Rate Groups and monthly cost are entirely Axiom's and may differ depending on provider
- Take rate is the estimated number of homes we believe would take service. In this case we believe a 50% take rate is achievable- in year one, with a steady rise as people in town convert slowly from Spectrum and Consolidated.
- We did not calculate seasonal homes, which would reduce the revenue by some amount

Expenses

Operational Expense Estimates	\$237,875/ year
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Includes all of the cost of the Internet Service provider to deliver, service and maintain the system.

Two important takeaways of this section:

- How critical take rate is to the overall viability of the project (less subscribers, less opportunity for profits)
- The monthly operating expenses are generally fixed, no matter the number of subscribers (there is not a direct correlation between subscriber counts and expenses)

Final Thoughts

- Working with each incumbent provider could help fill in gaps in service at a lower cost than a new fiber system.
 - Any expansion of Spectrum or Consolidated will have technology limitations
 - Spectrum has not been ready partners to bring service into areas that are not profitable, typically because they require 20-24 homes per mile to consider bringing service
- A new fiber system would keep the community connected for over 20 years and bring world, class reliability and speeds
- Forming a robust Broadband Committee to set goals and make choices would be a good next step
- Work on a plan that would be ready to be funded in 2021

Madawaska Lake Township



Yellow line illustrates a potential wireless Point-to-Point link
Orange line indicates fiber high capacity trunk cable
Green line is lower strand count fiber line that serves majority of customers
Purple dots are homes

Madawaska Township is part of Aroostook County's Unorganized Territories. The UT is managed by the UT Administrator as part of County Government. Because this area is likely to contain many seasonal homes, it's unclear how well or if at all it is served by either major provider in the area, Consolidated Communications or Spectrum. Consolidated may provide service that is not particularly robust but is affordable and works for the majority of seasonal visitors. On the other hand, if these homes are served by Spectrum, subscribers would have access to TV, internet and phone. If this is the case, it would be difficult to recommend an

upgrade to the latest technology, because of the cost and the limited number of homes that would likely take the upgrade. Because of its distance from organized towns and the cost of bringing fiber cabling to the Lake, Axiom has devised a plan that would save cost by utilizing an existing tower on Route 161 to transmit a signal to the lake over air. This would eliminate a costly amount of additional fiber optic cabling construction. While upgrading to world class fiber optic service should be a consideration, exploring all options with current providers should be seriously considered.

Consolidated Communications

Consolidated has not provided Axiom with current number of subscribers in Madawaska Township, but if the community decides they would like to discuss a possible relationship with Consolidated, officials at the company have agreed to share data directly with community/UT leaders. Consolidated offers DSL service to customers. This internet service runs on copper lines that were originally designed to offer only hardline phone service. In the case of DSL, not only is the driving technology outdated, but the old copper lines are susceptible to corrosion that can impact the reliability of a subscriber connection. Furthermore, DSL is limited in the distance it can push a signal (3-mile maximum), meaning those homes furthest from the telco equipment are faced with connections that often cannot reach even a paltry 3Mbps download speed.

While not the best technology in the marketplace today, upgrading equipment is relatively inexpensive compared to fiber. In the long run, fiber does pay for itself as it has almost unlimited upgrades in speed, at no additional cost over time whereas DSL's limitations make it difficult to justify upgrades as a long-term solution. A discussion with Consolidated would be a good starting point to learn more about their current service and what upgrades, if any, could be made to improve service.

Consolidated Contact: Jeff Nevins- Jeffery.Nevins@consolidated.com

Fiber Optics

In a nutshell, Fiber optics offers best-in-class reliability while also having the capability to deliver unrivaled speeds of up to 1Gig (1000Mbps). Beyond this, fiber is the only technology that can deliver true symmetrical service, with equal speeds both for download and upload. This key feature is expected to be increasingly important as more internet applications and business demands require the ability to upload large files quickly from your home desktop. Think of things like pictures you are trying to send family or teleconferencing in real time as two examples of how people would like to use their connection today. Slower uploads make productivity more difficult. Even entertainment, like gaming, is slowly evolving to more interactive play that requires significant upload speeds. The need for Fiber Optic systems often get questioned because of the upfront cost. However, over time other technologies would need to be replaced or enhanced while fiber is a long-term investment in the future of the community. No other technology can match the capacity and reliability of a fiber system.

Benefits of Fiber Technology to the Subscriber

Speed and Capacity. Many experts say that FTTH connections are the only technology with enough bandwidth to support the projected consumer demands over the next decade.

Future proof. Because of fiber's capabilities, new technological innovations are being invented every day to utilize fiber's superior ability to transport tremendous amounts of data at blazingly fast speeds. Technologies such as 3D holographic high definition television and gaming will someday be everyday items in households around the world. FTTH will be able handle the estimated 30 gigabit-per-second needs of such equipment... and this is just one technology. Think about the new ways that you use the internet that seem commonplace now that were not even conceived of 10 years ago.

One delivery system. Right now, a consumer can receive telephone, video, audio, television and almost any type of data transmission using a single seamless FTTH connection. That trend will continue as consumers are given increasing array of a la carte choices for how they receive their various communication and data and streaming choices. Subscribers are also realizing that receiving bundled services through a fiber connection can save money.

Reliability. Fiber is the most reliable connection you can have. In surveys across the state of Maine, the #1 complaint is reliability. An internet connection is becoming a necessity, not a luxury. When connectivity is interrupted or slowed down unexpectedly or inexplicably consumers are furious that they cannot accomplish the on-line task, leading to a significant loss of productivity or time.

Community Benefits

Job Creation- There are many examples of fiber networks creating jobs by either supporting existing businesses or attracting new ones

Business Attraction- When we say business attraction, we really mean businesses that are looking for the kinds of connections that can move large amounts of data, quickly- architects, designers, banks and other heavy users

Entrepreneurship- Fiber helps induce young people to locate and work from anywhere

Telemedicine- The medical field and how patients and providers interact is undergoing seismic changes. One of those changes is the way patients are able to be seen, treated, monitored and are increasingly being given tools to manage their own health care, right from their home. A fiber connection has the capacity to manage these data transmission uses, which in turn facilitates our elders aging in place

Education- Creating equal access for all eliminates "the homework gap" for those students that are increasingly required to complete assignments on-line but are unable to do so from their home because of a lack of an adequate internet connection. Adult learners also benefit from on-line learning options that utilize interactive video or other tools that those with better connections can access

Increased Home Values- A Broadband Communities study indicated that FTTH networks increase the value of a \$300,000 home by an average of \$5,000-\$6,000. Another study by the FTTH Council in conjunction with the University of Colorado showed that homes with a FTTH connection are worth, on average, 3.1% more than homes that do not have a fiber connection

Fiber Plan

If working with Consolidated is something community leaders decide is not the best option, we have engineered a fiber optic solution that would have the capacity to serve every home around the lake. It requires a high capacity wireless link that would broadcast over radio waves internet bandwidth that would then be transferred from a receiving dish on a corresponding tower that would then be distributed through fiber optic cabling that would be strung on existing utility poles.



With the distance from a connection to hook into fiber to serve the community and a significant gap in poles down Route 161, a pair of towers have been priced out as part of the cost to serve the lake community. If a tower could be located that is fiber fed and has line of site to the lake, it could reduce costs even further. A high capacity FCC licensed link can transmit 1Gig of bulk internet reliably. The yellow line is meant to illustrate the concept but would require a deeper, more significant review of tower assets and line-of-sight possibilities to determine the feasibility and cost of such a connection.

Cost

The construction projections for this project are based on a number of assumptions. Please remember, this is a desktop estimate and additional, significant engineering would need to be completed to give the community a final cost that eliminates all of the variables. The different cost components will give the reader a good idea of where estimated costs would possibly change.

Category Description		Cost
Bill of Materials/labor		\$313,546
Two 100' towers	Estimate	\$200,000
Pole Licensing Application		\$4,320
Utility Pole Make Ready	Estimate	\$36,000
Utility Pole Replacement	Estimate	\$48,000
CO/ Regen Hardware		\$135,985
Customer Premise Drop Cable	Estimate	\$15,180
Customer Premise Installation/Labor		\$103,500
Total		\$856,531

The total cost of the budget contains several line items that may change and lower the cost of the project overall. A lot of additional costing information will be learned by proceeding

with the pole licensing process. For example, we have made some assumptions based on past experience, but the true understanding of the costs associated with pole attachments and make ready - the cost of other users of the poles moving their lines to “make ready” a space for a new cable - only will come through the licensing process. In addition, pole replacement costs are estimated and will not be known till the pole make ready work is completed. The same is true for the tower budget line. Additional engineering would be required to determine final cost for tower locations and type of tower needed. Our hope would be to locate an existing tower to broadcast to the area, this would reduce the overall cost estimate by at least \$100,000.

This budget contains the hardware for 100% of homes to be connected, however, we calculate the revenue on 50% of the homes taking service in year one.

Breakdown of Cost Components

Bill of Materials

This is the materials and equipment cost for the whole project with the exception of CO/Regen Hardware & Installation and the cost of the drop cable, which are separate line items.

Towers

This is the line that contains the pricing and installation for two 100’ towers. If we were to locate an existing tower, this would reduce the amount of this line substantially.

Pole Licensing Application

This plan requires the placement of fiber optic cabling on existing utility poles across the community. In order to receive approval, a several step process over several months is required, but begins with the application. The cost of the application is based on the number of utility poles you would like to attach to.

Utility Pole Make Ready

Make Ready is the cost of making the poles ready (make ready) to accept a new fiber cable. In order to install new fiber optics cable on utility poles, a licensing process is in place that evaluates each pole for readiness to accept a new cable. Each provider (other than the electrical) would move the current lines to accommodate a space for a new cable. The cost of this process is estimated in our calculations and can change depending on the application process costs associated with each pole.

Replacement Poles (10%)

We estimate that 10% of the poles, through the licensing process might need replacement. There are two major reasons for pole replacements. First, the amount of equipment or utility lines on a pole deem it necessary to increase the height of the current pole to allow for an additional line to be placed on it (pole too short). Or the current pole is aged to the point where it would be unsafe to place the additional line strain on the pole without a replacement pole. (Aged poles). We make an estimate, but the evaluation of each pole will take place during the pole licensing process.

CO/Regen Hardware & Installation

CO refers to Central Office, which is a term that Internet Service Providers use to describe where the equipment that would be needed to power the system and location where bulk

internet would be distributed from to each home. Regen hardware is the equipment that would be used to power the internet system and control each individual connection through this central system. These costs also include a heated and cooled utility shack that would house the equipment.

Customer Premise Cable

This is an estimated cost of the fiber to connect each home from the street to the home.

Customer Premise Installations

These costs are associated with the equipment needed at each home to accept the signal.

Revenue and Expense Model

As part of Axiom’s commitment to our mission to help rural communities more fully understand what ISPs are facing serving a small community, we have created a revenue and operational expense budget that helps the community and the ISP better negotiate an operating agreement through a Public-Private Partnership, should the community choose to own the fiber network.

It’s important to understand that these calculations are just an illustration of how Axiom would envision the feasibility of operating a system and what potential customer rates could look like. The potential revenue is based on service levels and take rates that are solely Axiom projections and are intended for illustration only, each internet provider would have their own revenue and cost models. However, these numbers can show you generally what a provider might expect if the town were to build a new fiber system and importantly, how much capital participation, if any, might be expected from the provider.

Revenue

Rate Group	# of Subscribers	Monthly Rate	Annual Revenue
25/5Mbps	48	\$69.99	\$40,314
50/10Mbps	14	\$79.99	\$13,438
100/20Mbps	7	\$109.99	\$9,239
Business Class-50/50M	5	\$109.99	\$6,599
TOTALS	(50%)		\$62,992 / year

- The Rate Groups and monthly cost are entirely Axiom’s and may differ depending on provider
- Take rate is the estimated number of homes we believe would take service. In this case we believe a 50% take rate is achievable in year one, out of 138 homes, 69 would take service immediately once constructed
- We did not calculate seasonal homes, which could reduce the revenue by some amount

Expenses

Operational Expense Estimates	\$34,407/ year
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Includes all of the cost of the Internet Service provider to deliver, service and maintain the system.

Two important takeaways of this section:

- How critical take rate is to the overall viability of the project (less subscribers, less opportunity for profits)
- The monthly operating expenses are generally fixed, no matter the number of subscribers (there is not a direct correlation between subscriber counts and expenses)

Final Thoughts

- A discussion with the Unorganized Territory Director and the County would be a first step to see how they could support the community efforts
- If the Township is interested in a low-cost solution, working with Consolidated might make sense
 - It would not be Axiom's first recommendation, but could provide results to poorly served Consolidated customers in the near future
- Fiber Optics is the best option to fix the problem for 20 or 30 years- an investment now will pay huge dividends in the future as the community would have a generational project put in place while other rural communities continue to struggle with poor connectivity
 - State funding might help pay for a portion of the project

Portage Lake

Portage Lake, like many rural communities, finds itself in a situation that serves most of the community well (with Spectrum service) and a small part of the community served by Consolidated Communications DSL service, with perhaps a handful of homes that may not be served at all. This situation creates a difficult path forward because the number of homes outside of Spectrum's service area is estimated at less than 30 homes. This leaves the community with three choices.

- Do nothing
- Engage Spectrum to expand or Consolidated to enhance current service
- Build a new system of Fiber Optics

Do nothing

Because there appears that most homes are served, with only a handful that do not have service or must use cellular hotspots or satellite service, it may be that town residents are generally satisfied and have little complaint over the current situation. If that is correct, then perhaps doing nothing is the best option for the foreseeable future.

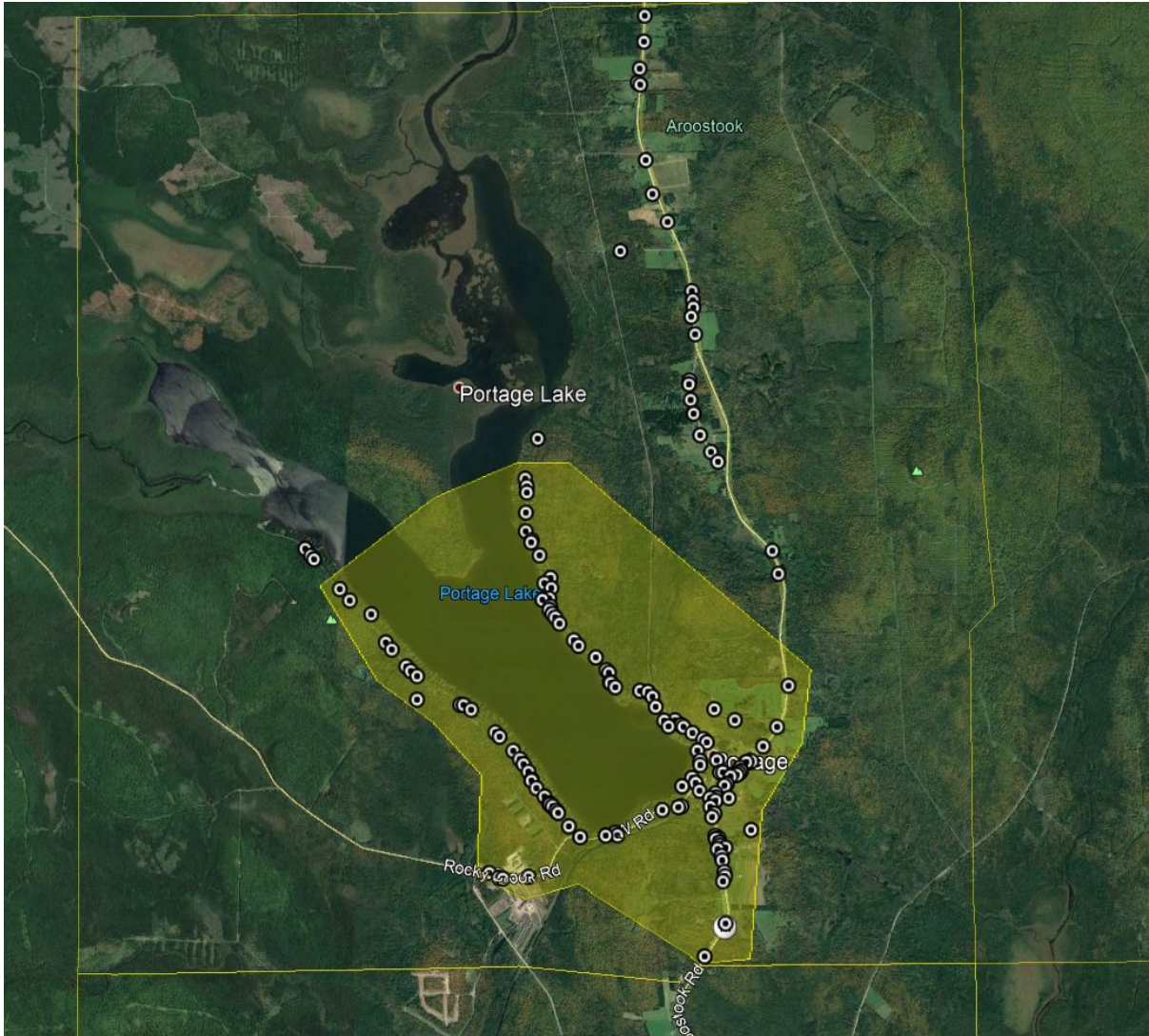
Engage Spectrum or Consolidated

If, however, town leaders are hearing complaints from those served by Consolidated DSL or are unserved, perhaps an approach that engages the current provider of service in the areas not served by Spectrum does make sense. In this case, the approach would be to reach out to Consolidated and request a visit or a remote Zoom meeting where Consolidated could discuss their current service and what it would cost to increase service to trouble areas. Mostly 30 or so homes up Aroostook Road heading north and perhaps a handful of camps on the eastern or western shore of the lake.

Jeff Nevins- Jeffery.Nevins@Consolidated.com is Consolidated Communications' contact and has indicated a willingness to work with any community to identify and work on solutions for troubled areas. He would be the contact that would be able to describe the current service levels in the community and begin an engineering plan and cost to upgrade those areas of need.

Spectrum would be the preferred choice for expansion, because their system is more robust for internet service and offers TV and phone with one stop shopping, making it easy for consumers to purchase a bundle of services from one provider. While convenient, consumers across Maine consistently complain about the high cost of Spectrum service. However, their technology, while not as good as fiber optics, is a noticeable upgrade from Consolidated DSL. The map gives you a general idea of the homes that are served by Spectrum. Those outside of the yellow highlighted area are likely served by Consolidated DSL or by satellite service or are unserved.

Spectrum service area in yellow



Spectrum typically requires 25 homes per mile to justify an expansion of service. It would be up to the town to work closely with Spectrum to determine if the area running north of the town center would qualify. If not, the town could ask Spectrum for a cost to complete service to the town.

Franchise Agreements

Most towns have not had much luck with leveraging their franchise agreement with Spectrum to get them to build out service to the remainder of the community, however, we would recommend reviewing the current franchise agreement which may stipulate a promise to serve the whole community. If so, the town may have legal standing to push Spectrum to comply with the franchise agreement. The town is likely receiving some amount of franchise fees yearly from Spectrum and could forgo those fees in the future for a promise to expand service across the remainder of the community currently unable to obtain Spectrum service.

If the town would like to discuss current Spectrum service, willingness to expand service or updating or better understanding the current franchise agreement, the contacts at Spectrum are:

Shelly Winchenbach: Shelley.Winchenbach@charter.com

Melinda Kinney: Melinda.Kinney@charter.com

Fiber Optics

The community is in a difficult position to introduce a new internet system that would compete with current providers given the amount of coverage already provided. A new internet system would likely require substantial town resources to build and a strong community spirit to come together and agree to this approach. Our recommendation would be to work with your current providers even though their services are not as technically advanced or futureproof as fiber. However, it may be helpful to community leaders to understand what a fiber system would be capable of delivering to subscribers and how much it costs. A new fiber system would have the advantage of delivering the same levels of service to every home, deliver consistent speeds and the best reliability of any technology in the marketplace.

While the upfront cost is considerable, fiber optics has the benefit of being futureproof, providing ongoing service with no major equipment upgrades necessary to meet the demands of the community for 20 years- or more likely 30 years into the future. Not only do the subscribers reap the benefits of fiber optics, but there are many community benefits to consider also.

Benefits of Fiber Technology to the Subscriber

Speed and Capacity. Many experts say that FTTH connections are the only technology with enough bandwidth to support the projected consumer demands over the next decade.

Future proof. Because of fiber's capabilities, new technological innovations are being invented every day to utilize fiber's superior ability to transport tremendous amounts of data at blazingly fast speeds. Technologies such as 3D holographic high definition television and gaming will someday be everyday items in households around the world. FTTH will be able to handle the estimated 30 gigabit-per-second needs of such equipment... and this is just one technology. Think about the new ways that you use the internet that seem commonplace now that were not even conceived of 10 years ago.

One delivery system. Right now, a consumer can receive telephone, video, audio, television and almost any type of data transmission using a single seamless FTTH connection. That trend will continue as consumers are given increasing array of a la carte choices for how they receive their various communication and data and streaming choices. Subscribers are also realizing that receiving bundled services through a fiber connection can save money.

Reliability. Fiber is the most reliable connection you can have. In surveys across the state of Maine, the #1 complaint is reliability. An internet connection is becoming a necessity, not a luxury. When connectivity is interrupted or slowed down unexpectedly or inexplicably consumers are furious that they cannot accomplish the on-line task, leading to a significant loss of productivity or time.

Community Benefits

Job Creation- There are many examples of fiber networks creating jobs by either supporting existing businesses or attracting new ones

Business Attraction- When we say business attraction, we really mean businesses that are looking for the kinds of connections that can move large amounts of data, quickly- architects, designers, banks and other heavy users

Entrepreneurship- Fiber helps induce young people to locate and work from anywhere

Telemedicine- The medical field and how patients and providers interact is undergoing seismic changes. One of those changes is the way patients are able to be seen, treated, monitored and are increasingly being given tools to manage their own health care, right from their home. A fiber connection has the capacity to manage these data transmission uses, which in turn facilitates our elders aging in place

Education- Creating equal access for all eliminates “the homework gap” for those students that are increasingly required to complete assignments on-line but are unable to do so from their home because of a lack of an adequate internet connection. Adult learners also benefit from on-line learning options that utilize interactive video or other tools that those with better connections can access

Increased Home Values- A Broadband Communities study indicated that FTTH networks increase the value of a \$300,000 home by an average of \$5,000-\$6,000. Another study by the FTTH Council in conjunction with the University of Colorado showed that homes with a FTTH connection are worth, on average, 3.1% more than homes that do not have a fiber connection

Fiber Plan



Orange Line= High Capacity trunk fiber
Green lines= Lower fiber count secondary lines
Purple Dots= E911 home and business addresses

Cost of Fiber System

The construction projections for this project are based on a number of assumptions. Please remember, this is a desktop estimate and additional, significant engineering would need to be completed to give the community a final cost that eliminates all of the variables. The different cost components will give the reader a good idea of where estimated costs would possibly change.

Category Description		Cost
Bill of Materials/labor		\$580,492
Pole Licensing Application		\$13,653
Utility Pole Make Ready	Estimate	\$79,425
Utility Pole Replacement	Estimate	\$105,900
CO/ Regen Hardware		\$135,985
Customer Premise Drop Cable	Estimate	\$16,720
Customer Premise Installation/Labor		\$114,000
Total number of Premises	152	
Total Cost		\$1,046,175

The total cost of the budget contains several line items that may change and lower the cost of the project overall. A lot of additional costing information will be learned by proceeding with the pole licensing process. For example, we have made some assumptions based on past experience, but the true understanding of the costs associated with pole attachments and make ready - the cost of other users of the poles moving their lines to “make ready” a space for a new cable - only will come through the licensing process. In addition, pole replacement costs are estimated and will not be known till the pole make ready work is completed.

This budget contains the hardware for 100% of homes to be connected, however, we calculate the revenue on 50% of the homes taking service in year one when the service is introduced.

Breakdown of Cost Components

Bill of Materials

This is the materials and equipment cost for the whole project with the exception of CO/Regen Hardware & Installation and the cost of the drop cable, which are separate line items.

Pole Licensing Application

This plan requires the placement of fiber optic cabling on existing utility poles across the community. In order to receive approval, a several step process over several months is required, but begins with the application. The cost of the application is based on the number of utility poles you would like to attach to.

Utility Pole Make Ready

Make Ready is the cost of making the poles ready (make ready) to accept a new fiber cable. In order to install new fiber optics cable on utility poles, a licensing process is in place that evaluates each pole for readiness to accept a new cable. Each provider (other than the electrical) would move the current lines to accommodate a space for a new cable. The cost of this process is estimated in our calculations and can change depending on the application process costs associated with each pole.

Replacement Poles (10%)

We estimate that 10% of the poles, through the licensing process might need replacement. There are two major reasons for pole replacements. First, the amount of equipment or utility lines on a pole deem it necessary to increase the height of the current pole to allow for an additional line to be placed on it (pole too short). Or the current pole is aged to the point where it would be unsafe to place the additional line strain on the pole without a replacement pole. (Aged poles). We make an estimate, but the evaluation of each pole will take place during the pole licensing process.

CO/Regen Hardware & Installation

CO refers to Central Office, which is a term that Internet Service Providers use to describe where the equipment that would be needed to power the system and location where bulk internet would be distributed from to each home. Regen hardware is the equipment that would be used to power the internet system and control each individual connection through this central system. These costs also include a heated and cooled utility shack that would house the equipment.

Customer Premise Cable

This is an estimated cost of the fiber to connect each home from the street to the home.

Customer Premise Installations

These costs are associated with the equipment needed at each home.

Revenue and Expense Model

As part of Axiom's commitment to our mission to help rural communities more fully understand what ISPs are facing serving a small community, we have created a revenue and operational expense budget that helps the community and the ISP better negotiate an operating agreement through a Public-Private Partnership, should the community choose to own the fiber network.

It's important to understand that these calculations are just an illustration of how Axiom would envision the feasibility of operating a system and what potential customer rates could look like. The potential revenue is based on service levels and take rates that are solely Axiom projections and are intended for illustration only, each internet provider would have their own revenue and cost models. However, these numbers can show you generally what a provider might expect if the town were to build a new fiber system and importantly, how much capital participation, if any, might be expected from the provider.

Revenue

Rate Group	# of Subscribers	Monthly Rate	Annual Revenue
25/5Mbps	53	\$69.99	\$44,514
50/10Mbps	15	\$79.99	\$14,398
100/20Mbps	8	\$109.99	\$10,559
Business Class- 50/50M	5	\$109.99	\$6,599
TOTALS	(50%) take rate		\$69,471 / year

- The Rate Groups and monthly cost are entirely Axiom's and may differ depending on provider
- Take rate is the estimated number of homes we believe would take service. In this case we believe a 50% take rate is achievable- in year one, with a steady rise as people in town convert slowly from Spectrum and Consolidated.
- We did not calculate seasonal homes, which would reduce the revenue by some amount

Expenses

Operational Expense Estimates	\$36,110/ year
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Includes all of the cost of the Internet Service provider to deliver, service and maintain the system.

- Take rate is critical to the overall viability of the project (less subscribers, less opportunity for profits)
- The monthly operating expenses are generally fixed, no matter the number of subscribers (there is not a direct correlation between subscriber counts and expenses)

Final Thoughts

- Working with the incumbent providers, either Spectrum or Consolidated is likely least expensive, least risky path forward and would be our recommendation
- A fiber solution is our preferred technical solution and will bring the biggest benefit, but cost and difficulty competing with Spectrum would require community-wide buy in

St. Agatha

St. Agatha is served by the two major providers of internet in the state- Consolidated Communications and Spectrum. Each service is different and Consolidated, while having service across the majority of the town does not have many subscribers. On the other hand, Spectrum only serves the downtown, most densely populated areas and leaves out important parts of the community. This makes it more difficult to produce a manageable plan for the town, because the areas not covered by Spectrum include an island of what we presume are seasonal homes on Long Lake and an area of what appears to be farmland homes scattered to the west of the main cluster of homes. Understanding the data from each of the providers and developing a smart strategy to address homes that are poorly served is a strategy we would recommend. We have also developed a fiber optic plan for the town to consider if either of the providers is not responsive to town goals.

Consolidated Communications

Consolidated Communications is the provider of hardline telephone service throughout the state. Over time Consolidated has utilized those copper lines to also provide internet service commonly called DSL. DSL has inherent limitations that make the service less than ideal. First, because it runs on those old copper lines, it is susceptible to corrosion leading to signal loss and unreliability. Second, because the technology relies on electrical signal, it cannot provide equal service to all of its customers. As the service emanates from the equipment location it is able to provide a decent amount of bandwidth close by, but out to about 3 miles the bandwidth that a subscriber is able to obtain diminishes very quickly, leaving those subscribers at the outer limits of a signal with very poor speeds and reliability. Over the past few years Consolidated has used a federal program to upgrade its facilities and it appears that has occurred in St. Agatha.

Below is information provided by Consolidated.

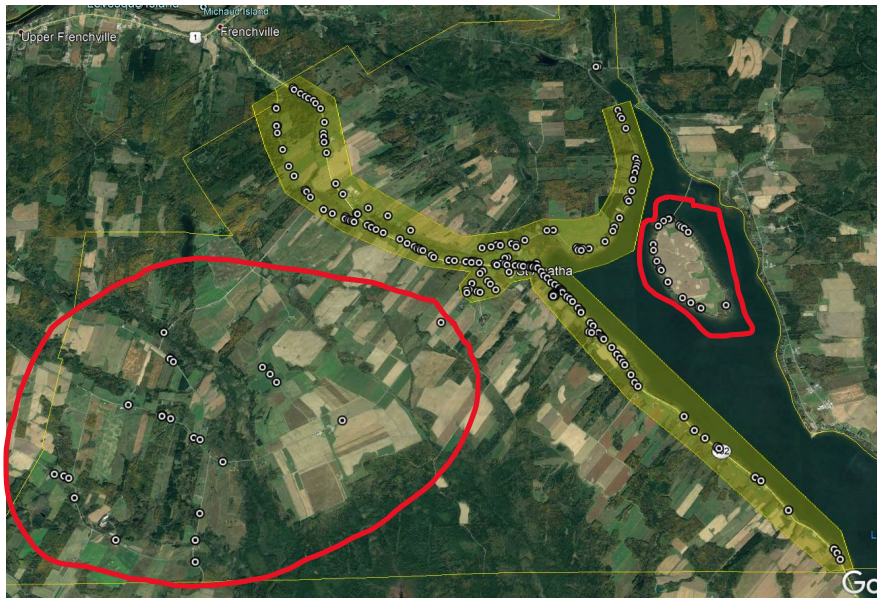
Speed/Bandwidth [Max Available]	# Locations	% available
768K/3M	33	6.0
7M	67	12.2
10M	46	8.3
20M	23	4.2
25/2M	81	14.7
40M	80	14.5
60M	58	10.5
80M	59	10.7
NS	104	18.9
TOTALS	551	100.0

The chart above provides data for the number of homes that can receive the listed maximum speeds available. While Consolidated tends to focus on the number of homes that can achieve higher speeds, Axiom looks at the data a bit differently. In analyzing the data, over 45% of the town cannot receive the federal standard of broadband- 25/3Mbps. In fact, the last number is the most alarming, with 104 out of a possible 551, unable to receive service from Consolidated at all.

These concerns explain the low take rate, along with the presence of Spectrum that is very likely serving those areas that also have the higher Consolidated speeds available. Below is a chart depicting the actual number of subscribers and at what speeds.

Speed	# Subscribers	Percentage
768K/1.6M/3M	18	46.3
7M	9	23.2
10M	3	7.7
15M	5	12.8
20M	1	2.5
25/2M	1	2.5
40M	1	2.5
60M	0	0
80M	1	2.5
TOTALS	39	100.0

Approximately 9% of eligible locations take service from Consolidated.



Most likely it would be those homes outside of the Spectrum service area, which we will describe in more detail in the next section. The areas circled in red would be areas that requires more investigation and understanding of the type of service that is currently provided there. A conversation with

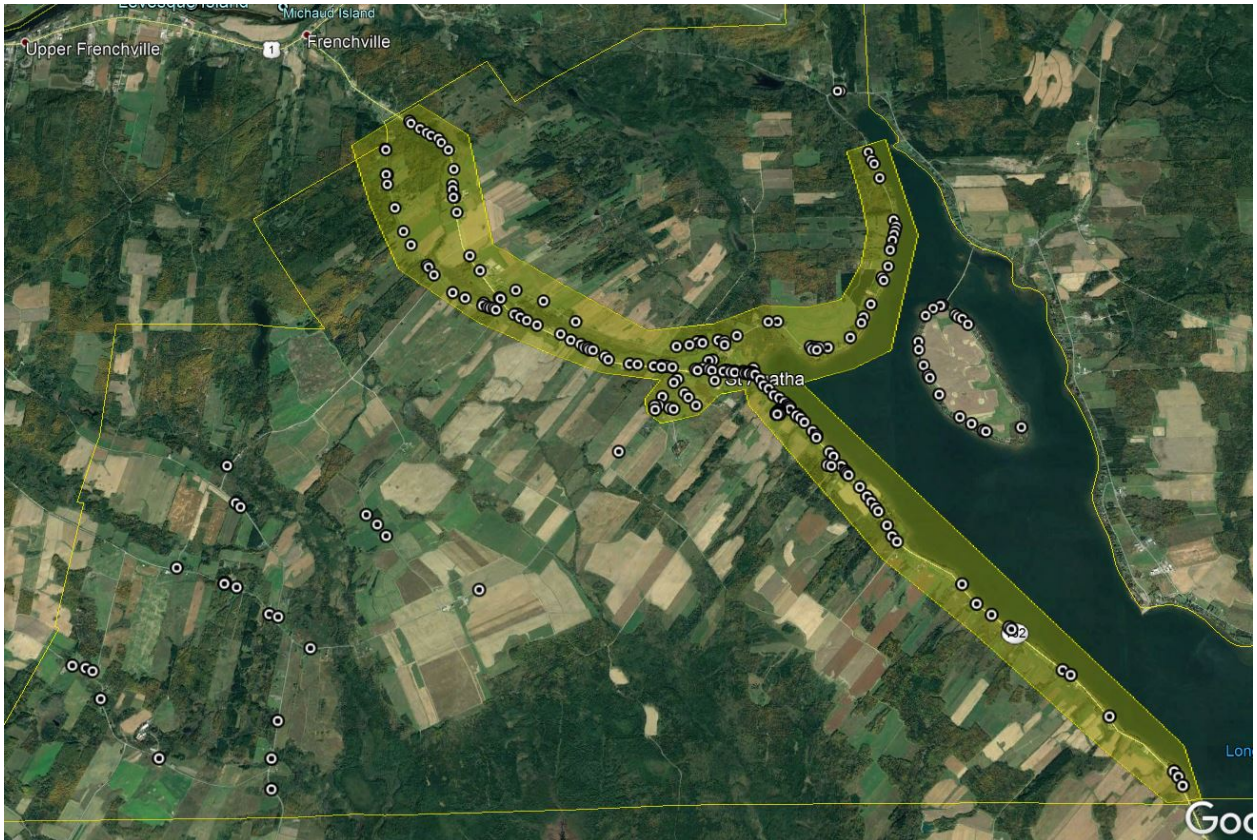
Consolidated would help better understand what types of speeds and reliability are currently in these areas and if deemed inadequate what it would cost (if possible) for Consolidated to bring increased speeds to those homes. Focusing exclusively on areas outside of Spectrum service (highlighted in yellow) would be a good objective of the town.

Next Steps:

- Invite Jeff Nevins, the main contact at Consolidated to discuss the situation with those homes in the circled areas- Contact: Jeffery.Nevins@Consolidated.com
- Possibly interview or survey homes in those areas to determine need

Spectrum

Spectrum is the major cable TV provider in the state using coaxial cable (commonly called co-ax) to deliver cable TV content and phone and increasingly internet service at speeds of 100Mbps or more. With the convenience of all three services being delivered by one provider, Spectrum can be a strong competitor in any area where it operates. That is the case in St. Agatha.



Spectrum's coverage area highlighted in yellow

Most subscribers of Spectrum when surveyed are relatively satisfied with the service but also complain that the service is expensive. The second issue with Spectrum service is their tendency to serve only the most populated areas in rural communities, while leaving the remaining, less profitable areas to other providers. Typically, Spectrum requires 20-25 homes per mile to consider expanding, and it does not appear that either of the areas outside of their current coverage would qualify.

Franchise Agreement

If the town's goal is to work with Spectrum to cover the whole town, the first step would be to review the franchise agreement that is in place with the town to determine if within the agreement there is an indication/promise that the franchise agreement was granted with the expectation that the service would be expanded to serve the whole town and that never happened. This would give the town more leverage if the agreement needs to be renewed. At the very least, understanding the franchise payments to the town would be a good start to possibly divert those dollars to a project that would contribute to a Spectrum expansion.

Beyond that, it's possible that Spectrum would work with the community to apply for state grants to help subsidize the expansion.

Next Steps if community is interested in opening up a dialogue with Spectrum would be:

- Review current Franchise Agreement for contents that might give town better leverage
 - Understand current (if any) franchise fees paid to the town
- Contact Spectrum representatives to discuss Franchise- Shelly Winchenbach at Shelly.Winchenbach@charter.com or Melinda Kinney at Melinda.Kinney@charter.com to discuss possible expansion options

Fiber Optics

A third option to working with either Consolidated or Spectrum would be to build out world class fiber-optic broadband. A system such as this would likely require substantial town resources and would compete with the existing service providers. This brings risk that the system would not be as successful in attracting subscribers in a competitive environment falling short of revenue projections. However, fiber brings outstanding speed and reliability and is the technology of choice for new projects. Those handful of communities in Maine that have moved forward with a fiber buildout have been successful, but did require substantial community member buy-in, typically voted on at Town Meeting.

While the upfront cost is considerable, fiber optics has the benefit of being futureproof, providing ongoing service with no major equipment upgrades necessary to meet the demands of the community for 20 years- or more likely 30 years into the future. Not only do the subscribers reap the benefits of fiber optics, but there are many community benefits to consider also.

Benefits of Fiber Technology to the Subscriber

Speed and Capacity. Many experts say that FTTH connections are the only technology with enough bandwidth to support the projected consumer demands over the next decade.

Future proof. Because of fiber's capabilities, new technological innovations are being invented every day to utilize fiber's superior ability to transport tremendous amounts of data at blazingly fast speeds. Technologies such as 3D holographic high definition television and gaming will someday be everyday items in households around the world. FTTH will be able handle the estimated 30 gigabit-per-second needs of such equipment... and this is just one technology. Think about the new ways that you use the internet that seem commonplace now that were not even conceived of 10 years ago.

One delivery system. Right now, a consumer can receive telephone, video, audio, television and almost any type of data transmission using a single seamless FTTH connection. That trend will continue as consumers are given increasing array of a la carte choices for how they receive their various communication and data and streaming choices. Subscribers are also realizing that receiving bundled services through a fiber connection can save money.

Reliability. Fiber is the most reliable connection you can have. In surveys across the state of Maine, the #1 complaint is reliability. An internet connection is becoming a necessity, not a luxury. When connectivity is interrupted or slowed down unexpectedly or inexplicably

consumers are furious that they cannot accomplish the on-line task, leading to a significant loss of productivity or time.

Community Benefits

Job Creation- There are many examples of fiber networks creating jobs by either supporting existing businesses or attracting new ones

Business Attraction- When we say business attraction, we really mean businesses that are looking for the kinds of connections that can move large amounts of data, quickly- architects, designers, banks and other heavy users

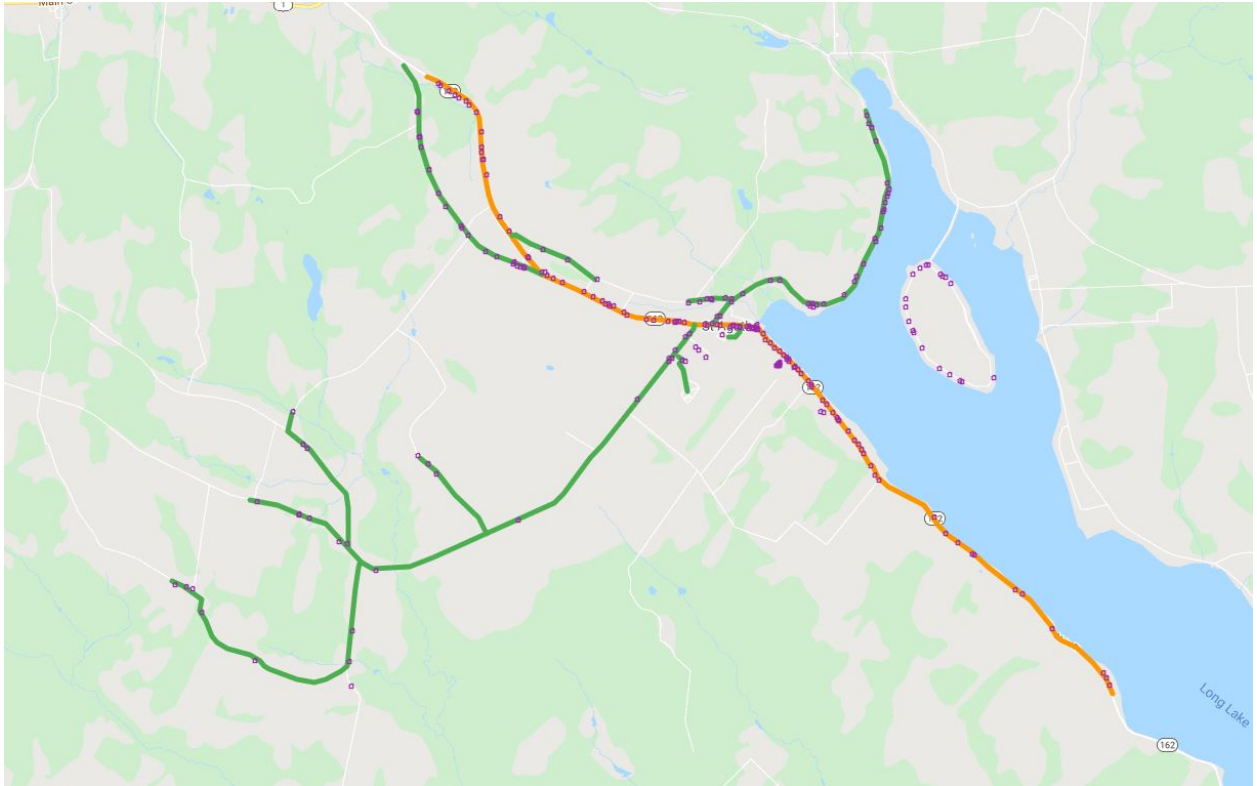
Entrepreneurship- Fiber helps induce young people to locate and work from anywhere

Telemedicine- The medical field and how patients and providers interact is undergoing seismic changes. One of those changes is the way patients are able to be seen, treated, monitored and are increasingly being given tools to manage their own health care, right from their home. A fiber connection has the capacity to manage these data transmission uses, which in turn facilitates our elders aging in place

Education- Creating equal access for all eliminates “the homework gap” for those students that are increasingly required to complete assignments on-line but are unable to do so from their home because of a lack of an adequate internet connection. Adult learners also benefit from on-line learning options that utilize interactive video or other tools that those with better connections can access

Increased Home Values- A Broadband Communities study indicated that FTTH networks increase the value of a \$300,000 home by an average of \$5,000-\$6,000. Another study by the FTTH Council in conjunction with the University of Colorado showed that homes with a FTTH connection are worth, on average, 3.1% more than homes that do not have a fiber connection

Fiber Plan



Orange Line= High Capacity trunk fiber
 Green lines= Lower fiber count secondary lines
 Purple Dots= E911 home and business addresses

We did not price out serving the island homes but would envision a wireless link from the shore to the island then running fiber on the island to each home.

Cost of Fiber System

The construction projections for this project are based on a number of assumptions. Please remember, this is a desktop estimate and additional, significant engineering would need to be completed to give the community a final cost that eliminates all of the variables. The different cost components will give the reader a good idea of where estimated costs would possibly change.

Category Description		Cost
Bill of Materials/labor		\$766,626
Pole Licensing Application		\$23,145
Utility Pole Make Ready	Estimate	\$124,650
Utility Pole Replacement	Estimate	\$166,200
CO/ Regen Hardware		\$158,480
Customer Premise Drop Cable	Estimate	\$25,410

Customer Premise Installation/Labor		\$173,250
Total number of Premises	231	
Total Cost		\$1,437,761

The total cost of the budget contains several line items that may change and lower the cost of the project overall. A lot of additional costing information will be learned by proceeding with the pole licensing process. For example, we have made some assumptions based on past experience, but the true understanding of the costs associated with pole attachments and make ready - the cost of other users of the poles moving their lines to “make ready” a space for a new cable - only will come through the licensing process. In addition, pole replacement costs are estimated and will not be known till the pole make ready work is completed.

This budget contains the hardware for 100% of homes to be connected, however, we calculate the revenue on 50% of the homes taking service in year one when the service is introduced.

Breakdown of Cost Components

Bill of Materials

This is the materials and equipment cost for the whole project with the exception of CO/Regen Hardware & Installation and the cost of the drop cable, which are separate line items.

Pole Licensing Application

This plan requires the placement of fiber optic cabling on existing utility poles across the community. In order to receive approval, a several step process over several months is required, but begins with the application. The cost of the application is based on the number of utility poles you would like to attach to.

Utility Pole Make Ready

Make Ready is the cost of making the poles ready (make ready) to accept a new fiber cable. In order to install new fiber optics cable on utility poles, a licensing process is in place that evaluates each pole for readiness to accept a new cable. Each provider (other than the electrical) would move the current lines to accommodate a space for a new cable. The cost of this process is estimated in our calculations and can change depending on the application process costs associated with each pole.

Replacement Poles (10%)

We estimate that 10% of the poles, through the licensing process might need replacement. There are two major reasons for pole replacements. First, the amount of equipment or utility lines on a pole deem it necessary to increase the height of the current pole to allow for an additional line to be placed on it (pole too short). Or the current pole is aged to the point where it would be unsafe to place the additional line strain on the pole without a replacement pole. (Aged poles). We make an estimate, but the evaluation of each pole will take place during the pole licensing process.

CO/Regen Hardware & Installation

CO refers to Central Office, which is a term that Internet Service Providers use to describe where the equipment that would be needed to power the system and location where bulk

internet would be distributed from to each home. Regen hardware is the equipment that would be used to power the internet system and control each individual connection through this central system. These costs also include a heated and cooled utility shack that would house the equipment.

Customer Premise Cable

This is an estimated cost of the fiber to connect each home from the street to the home.

Customer Premise Installations

These costs are associated with the equipment needed at each home.

Revenue and Expense Model

As part of Axiom’s commitment to our mission to help rural communities more fully understand what ISPs are facing serving a small community, we have created a revenue and operational expense budget that helps the community and the ISP better negotiate an operating agreement through a Public-Private Partnership, should the community choose to own the fiber network.

It’s important to understand that these calculations are just an illustration of how Axiom would envision the feasibility of operating a system and what potential customer rates could look like. The potential revenue is based on service levels and take rates that are solely Axiom projections and are intended for illustration only, each internet provider would have their own revenue and cost models. However, these numbers can show you generally what a provider might expect if the town were to build a new fiber system and importantly, how much capital participation, if any, might be expected from the provider.

Revenue

Rate Group	# of Subscribers	Monthly Rate	Annual Revenue
25/5Mbps	81	\$69.99	\$44,514
50/10Mbps	23	\$79.99	\$14,398
100/20Mbps	12	\$109.99	\$10,559
Business Class-50/50M	5	\$109.99	\$6,599
TOTALS	(50%) take rate		\$105,946/ year

- The Rate Groups and monthly cost are entirely Axiom’s and may differ depending on provider
- Take rate is the estimated number of homes we believe would take service. In this case we believe a 50% take rate is achievable- in year one, with a steady rise as people in town convert slowly from Spectrum and Consolidated.
- We did not calculate seasonal homes, which would reduce the revenue by some amount

Expenses

Operational Expense Estimates	\$45,844/ year
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Includes all of the cost of the Internet Service provider to deliver, service and maintain the system.

- Take rate is critical to the overall viability of the project (less subscribers, less opportunity for profits)
- The monthly operating expenses are generally fixed, no matter the number of subscribers (there is not a direct correlation between subscriber counts and expenses)

Final Thoughts

- Forming a Broadband Committee would help define goals and next steps
 - 3- 5 people- at least one board member
- Working with the incumbent providers, either Spectrum or Consolidated is likely least expense, least risky path forward and would be our recommendation
- A fiber solution is our preferred technical solution and will bring the biggest benefit, but cost and difficulty competing with Spectrum would require community-wide buy in

Van Buren

Van Buren is served by the two major providers of phone and internet in the state, Spectrum and Consolidated Communications. Spectrum serves the majority of the town but leaves out more distant homes outside of the downtown and more densely populated areas.

Consolidated has good coverage but leaves 74 homes without service and almost 30% of those covered with no service or service that does not reach the FCC federal standard of 25/3Mbps. We suspect that there is a group of Van Buren citizens who feel that their internet service is not very good. If this is the case, this report should provide a roadmap for considering what options are available to the community.

Step #1: Consolidated Communications

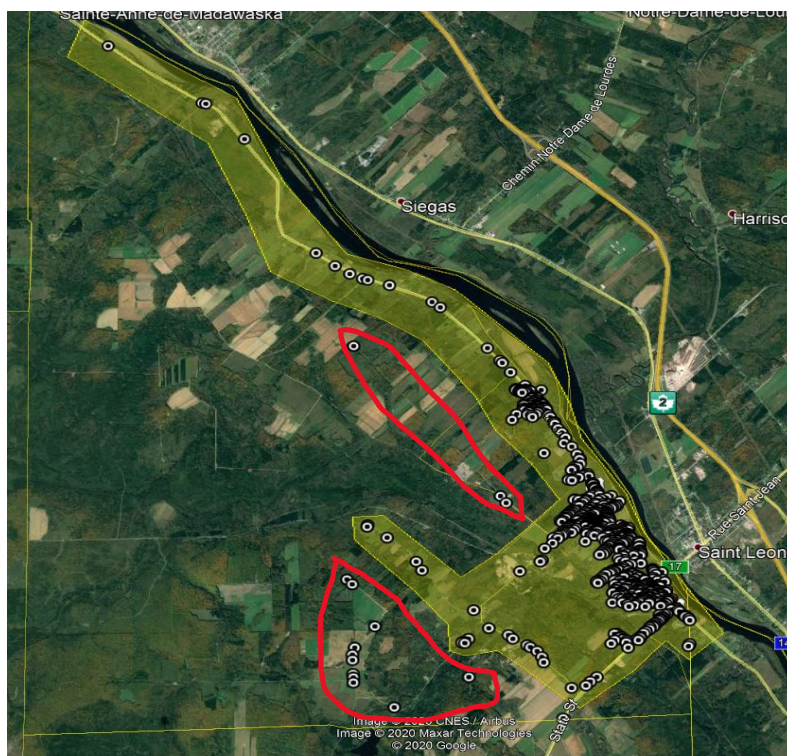
Consolidated Communications is the provider of hardline telephone service throughout the state. Over time Consolidated has utilized those copper lines to also provide internet service commonly called DSL. DSL has inherent limitations that make the service less than ideal. First, because it runs on those old copper lines, it is susceptible to corrosion leading to signal loss and unreliability. Second, because the technology relies on electrical signal, it cannot provide equal service to all of its customers. As the service emanates from the equipment location it is able to provide a decent amount of bandwidth close by, but out to about 3 miles the bandwidth that a subscriber is able to obtain diminishes very quickly, leaving those subscribers at the outer limits of a signal with very poor speeds and reliability. Over the past few years Consolidated has used a federal program to upgrade its facilities and it appears that has occurred in Van Buren. Below is information provided by Consolidated.

Speed/Bandwidth [Max Available]	# Locations	% available
768K/3M	97	5.6
7M	174	10.1
10M	151	8.8
20M	161	9.4
25/2M	482	28.1
40M	243	14.1
60M	180	10.5
80M	158	9.1
NS	74	4.3
TOTALS	1720	100.0

The chart above provides data for the number of homes that can receive the listed maximum speeds available. While Consolidated tends to focus on the number of homes that can achieve higher speeds, there remains a significant number of residents that cannot receive Consolidated service (74) and 29% (422) that cannot obtain the minimum standard for broadband set by the FCC at 25/3Mbps. Approximately 8.7% of eligible locations take service from Consolidated. See below.

Speed	# Subscribers	Percentage
768K/1.6M/3M	51	35.4
7M	43	29.9
10M	10	6.9
15M	12	8.3
20M	7	4.9
25/2M	18	12.5
40M	2	1.4
60M	1	.7
80M	0	-
TOTALS	144	100.0

Looking closely at the chart above, the majority of those that take service from Consolidated receive service that is below 7Mbps, this is likely because these subscribers do not have a choice of other providers (other than satellite service which is very expensive and unreliable) or have cost limitations that make Spectrum service out of their reach.



The Spectrum service area is highlighted in yellow. It leaves only a small number of homes outside of their service area in the community. With approximately 15 homes not served by Spectrum, the town has two options to help those homes get better service. One would be to invite Consolidated to discuss the actual service levels that can be obtained at those exact locations (circled in red) and to determine, if found inadequate, what the possibilities would be to increase service levels to those homes. If the community would consider talking with Consolidated

about current service and what options are available to increase service the contact at Consolidated would be Jeff Nevins- Jeffery.Nevins@Consolidated.com.

Ask Jeff Nevins to:

- Discuss the overall situation with Consolidated service and specifically the homes on the outskirts of the community
- Price out the cost to increase service to those homes

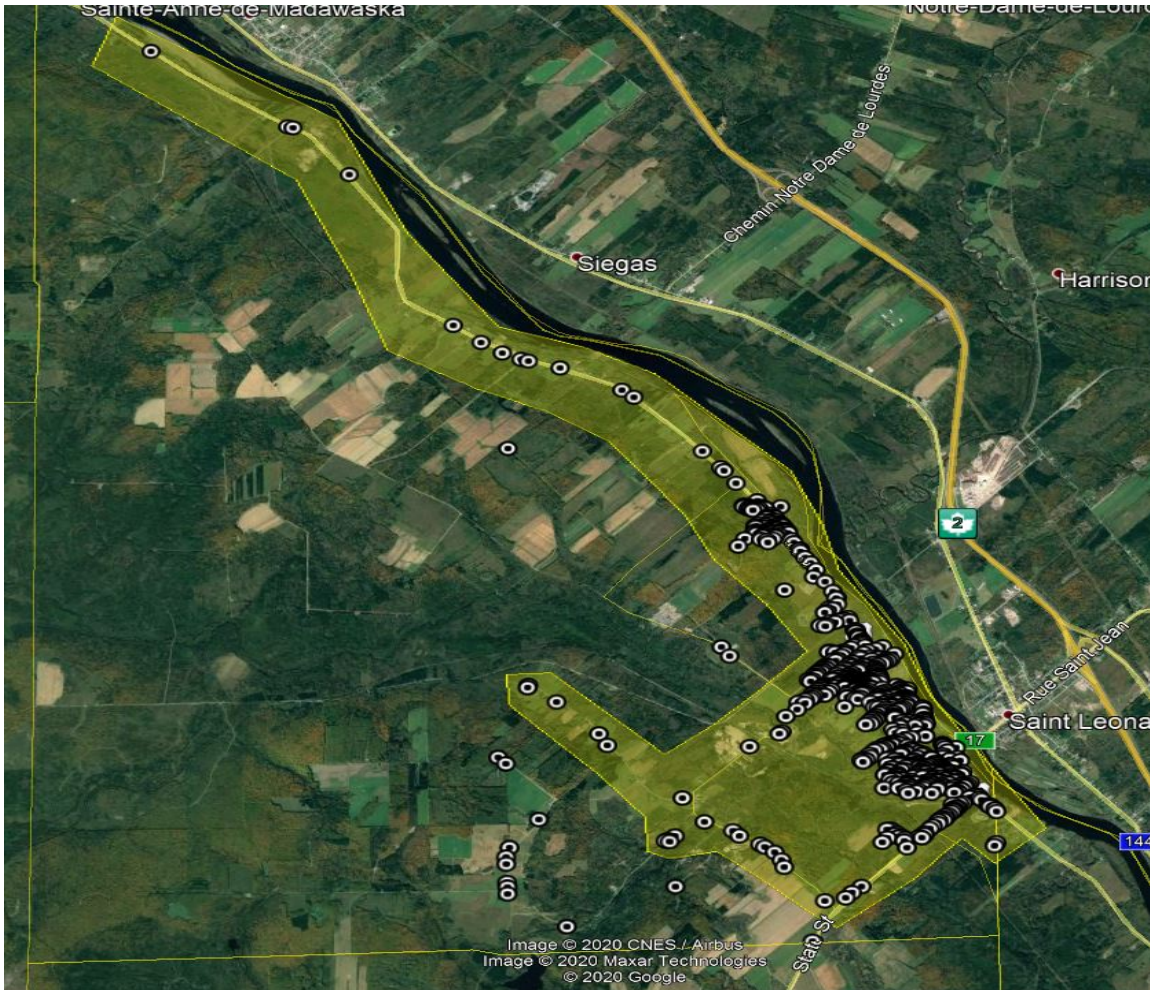
The Community:

- Create a survey to ask customers in underserved areas to determine their need

Spectrum

Given the small number of homes left out of the Spectrum service area, we would strongly recommend asking Spectrum what it would take to complete the service coverage area and provide service to every home in town.

Spectrum service area highlighted in yellow



Franchise Agreement

If the town's goal is to work with Spectrum to cover the whole town, the first step would be to review the franchise agreement that is in place with the town to determine if within the agreement there is an indication/promise that the franchise agreement was granted with the expectation that the service would be expanded to serve the whole town and that never happened. This would give the town more leverage if the agreement needs to be renewed. At the very least, understanding the franchise payments to the town would be a good start to possibly divert those dollars to a project that would contribute to a Spectrum expansion.

Beyond that, it's possible that Spectrum would work with the community to apply for state grants to help subsidize the expansion.

Next Steps if community is interested in opening up a dialogue with Spectrum would be:

- Review current Franchise Agreement for contents that might give town better leverage
 - Understand current (if any) franchise fees paid to the town
- Contact Spectrum representatives to discuss Franchise- Shelly Winchenbach at Shelly.Winchenbach@charter.com or Melinda Kinney at Melinda.Kinney@charter.com to discuss possible expansion options

Fiber Optics

Axiom has created a Fiber Optic plan for the community that would cover every home with blazingly fast speed and best-in-class reliability. Fiber is the gold standard of connectivity. However, given the internet coverage by Spectrum, we believe this is not an avenue to pursue. The cost, and the amount of local subsidy required would not be a recommendation from Axiom without significant support from the majority of Van Buren residents.

Below is an abbreviated Fiber plan so that you have an understanding of this approach. If, you would like to include this section in full, Axiom can easily incorporate more details at any time.

Estimated cost to construct fiber optic system:	\$2,614,329
Estimated Revenue at 50% take rate:	\$324,798
Estimated yearly expenses to run system:	\$142,117

While the benefits of fiber optic systems are undeniable, the cost and risk of such a system would be difficult to justify with good Spectrum coverage already available to over 95% of residents.

Final Thoughts

- Working with either incumbent provider is recommended
 - Preference would be to work with Spectrum to complete their service to the whole community
 - Identify needs of homes that are outside of current Spectrum-served area to determine if there is excitement to bring better internet to those homes
- If there is determined to be a need to focus on internet service, form a small Broadband Committee set goals and create momentum toward a solution
 - Surveys of residents outside of Spectrum served area
 - 3-5 community members with at least one board member appointed
 - Set one year to reach goals created by committee

Wallagrass

Wallagrass is currently served by Spectrum and Consolidated Communications. Spectrum serves the community with cable TV, phone and internet using a technology that is commonly referred to as co-ax cable. Wallagrass is also served through a legacy system of Consolidated Communications that is typically referred to as DSL. Both technologies have limitations, but generally Spectrum service is considered superior in reliability. Spectrum service can also generally deliver more bandwidth to a customer who purchases internet from them. The downside to Spectrum is the cost, which many survey respondents say is too high. On the other hand, Consolidated hardline telephone infrastructure suffers from poor reliability and internet service can be lacking, especially on the outer edges of their service. While the price is reasonable, the system can be lacking.

Spectrum

Unfortunately, Wallagrass was one of two communities that Spectrum was unable to provide a coverage map for. According to a Spectrum representative, the company is now getting charged for mapping requests. They were searching internally to see if they had a map on hand, but as of the date of this document, they have not been able to provide a coverage map. If the community was interested in obtaining this information, there are a couple of ways to do so. One would be to contact Spectrum directly. Contacts below:

Shelly Winchenbach at Shelly.Winchenbach@charter.com
Melinda Kinney at Melinda.Kinney@charter.com

Perhaps when you contact them, they may have access to the information needed to evaluate the coverage. A second possible approach would require Axiom doing a drive around looking at all of the utility pole attachments to get a general idea of where Spectrum service is. This along with antidotal evidence of community members who have Spectrum will allow Axiom to map out the service. This approach would require Axiom to travel to Wallagrass and physically investigate the infrastructure.

It may be because Wallagrass is a small rural community, community leaders may have a pretty good idea where coverage is, and where it is poor or nonexistent. If the community is serious about moving forward in investigating current service and setting goals, it will be important to understand what coverage Spectrum currently has, and if they would be willing to expand their service to areas they do not currently serve. Hopefully, when asked by the community, Spectrum will be able to provide the map for planning purposes. The advantage of partnering with Spectrum is demonstrably better technology and tripe play (TV, Internet and Phone) which can be bundled with one provider.

Consolidated Communications

The advantage of working with Consolidated would be to partner and upgrade their current system, bringing better connectivity across areas of the community that are more difficult to serve. This would involve little risk to the town, minimal match (hard to know without knowing how expensive a project with Consolidated would be) and probably a project that would qualify for state grant funds through the ConnectME Authority. However, there are some disadvantages, the biggest being that any upgrades would require a reinvestment in a few years and is likely to struggle to keep up with ever increasing consumer demand. This is because of the nature of the technology which is delivered over copper lines that are old and

have significant limitations in terms of the amount of internet that the system can deliver. Below is a chart provided by Consolidated which depicts the number of locations that can receive the maximum speeds in the left hand column.

Speed/Bandwidth [Max Available]	# Locations	% available
2M/768K	45	15.1
7M/1M	17	5.7
12M/1M	31	10.4
15M/1M	22	7.4
20M/1.5M	10	3.4
20M/5M	0	-
25M/2M	161	54.0
30M/10M	1	.3
50M/20M	1	.3
NS	10	3.4
TOTALS	298	100.0

Almost 45% of the community cannot receive the FCC standard of 25/3Mbps. And 15% can only receive a paltry 2Mbps/768K. This level of service might have difficulty at times even being able to perform simple email tasks.

A first step to better understand the connectivity in Wallagrass would be to contact Jeff Nevins- Jeffery.Nevins@Consolidated.com to discuss the current situation and if Consolidated would be open to considering partnering to enhance the current service available now. If this is not possible or will not meet the goals of the community, fiber optics would be the next step to investigate.

Fiber Optics

Fiber Optic systems that use state-of-the-art technology that can meet the internet needs of the communities in which they serve for decades with a unique combination of best-in-class reliability and the ability to meet customer demands for increased speeds for many years to come.

Fiber systems meet three goals:

- Equal Access to All- no matter where you live, you are able to receive the same level of service as anyone else in the community, regardless of your address.
- Fast and Reliable- Fiber can offer the fastest speeds- by far. While at the same time giving subscribers unrivaled reliability.
- Futureproof- the system's capability can be upgraded easily without any changes or cost to the system architecture. As demand increases, the system can handle up to 1 Gig of service (1000Mbps) to each home, making the system futureproof for 20 years or more.

One of the unique aspects of Wallagrass is its homes are spread across both sides of Soldier Pond, and the river that connects into Eagle Lake. A partnership with the community of Eagle Lake might make sense, because to improve service in Eagle Lake, new service may need to

come from a crossing in Wallagrass to serve the easterly side of the lake. A cost sharing arrangement and partnership may reduce cost for both towns, if you jointly decide to install a fiber optic system. Working together can be difficult and many regional projects have a hard time coming together because the towns have a history of not working well together. This may be the case with Eagle Lake and Wallagrass but is worth considering if it saves cost and enhances the regions' connectivity, especially on the eastern side of each community.

Fiber Optic Benefits

Fiber Optic internet systems are increasingly being deployed in rural communities who have suffered for years with poor service. All of the issues of poor reliability and deficient speeds are instantly fixed with fiber. While the upfront cost is considerable, fiber optics has the benefit of being futureproof, providing ongoing service with no major equipment upgrades necessary to meet the demands of the community for 20 years- or more likely 30 years into the future. Not only do the subscribers reap the benefits of fiber optics, but there are many community benefits to consider also.

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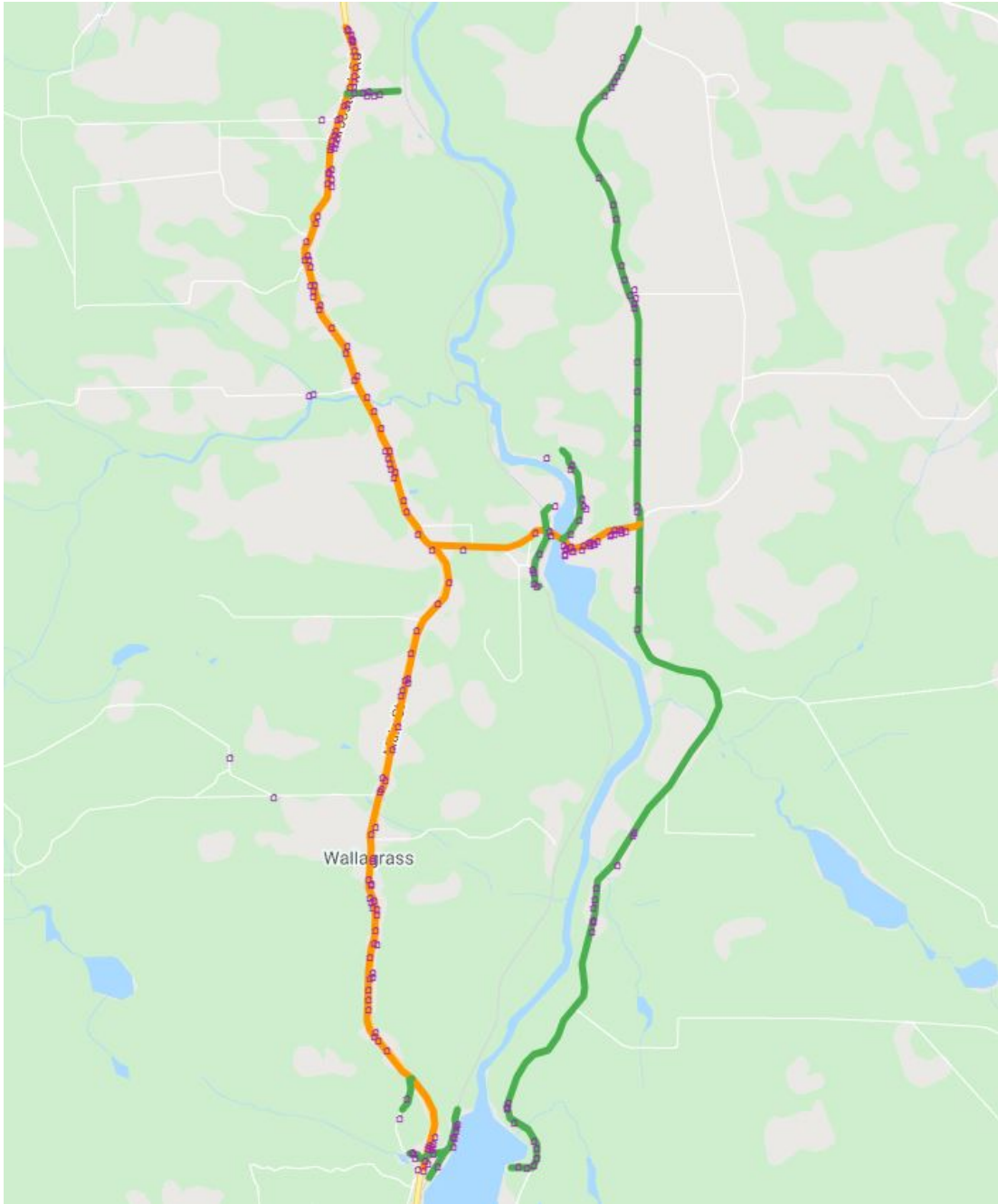
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Fiber Plan

A plan for fiber would cover every home in the community and deliver equal service to those homes. The current situation is that service is uneven and based on the location of your home, leaving some with considerably better service than others. The map on the next page visualizes how service would be delivered. The map is not designed to show each individual connection to the homes, but our pricing calculations includes an average price to connect any home who would want service.

The next page is a visualization of a fiber optic plan that would serve the community.



Orange line is high count fiber line
Green line is lower count fiber line
Purple dots= Location of Premises- Homes/Businesses

Cost of Fiber System

The construction projections for this project are based on a number of assumptions. Please remember, this is a desktop estimate and additional, significant engineering would need to be completed to give the community a final cost that eliminates all of the variables. The

different cost components will give the reader a good idea of where estimated costs would possibly change.

Category Description		Cost
Bill of Materials/labor		\$678,845
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Customer Premise Drop Cable	Estimate	\$24,640
Customer Premise Installation/Labor		\$168,000
Total number of Premises	224	
Total Cost		\$1,282,143

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Utility Pole Make Ready

Make Ready is the cost of making the poles ready (make ready) to accept a new fiber cable. In order to install new fiber optics cable on utility poles, a licensing process is in place that evaluates each pole for readiness to accept a new cable. Each provider (other than the electrical) would move the current lines to accommodate a space for a new cable. The cost

of this process is estimated in our calculations and can change depending on the application process costs associated with each pole.

Replacement Poles (10%)

We estimate that 10% of the poles, through the licensing process might need replacement. There are two major reasons for pole replacements. First, the amount of equipment or utility lines on a pole deem it necessary to increase the height of the current pole to allow for an additional line to be placed on it (pole too short). Or the current pole is aged to the point where it would be unsafe to place the additional line strain on the pole without a replacement pole. (Aged poles). We make an estimate, but the evaluation of each pole will take place during the pole licensing process.

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This is an estimated cost of the fiber to connect each home from the street to the home.

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These costs are associated with the equipment needed at each home.

Revenue and Expense Model

As part of Axiom’s commitment to our mission to help rural communities more fully understand what ISPs are facing serving a small community, we have created a revenue and operational expense budget that helps the community and the ISP better negotiate an operating agreement through a Public-Private Partnership, should the community choose to own the fiber network.

It’s important to understand that these calculations are just an illustration of how Axiom would envision the feasibility of operating a system and what potential customer rates could look like. The potential revenue is based on service levels and take rates that are solely Axiom projections and are intended for illustration only, each internet provider would have their own revenue and cost models. However, these numbers can show you generally what a provider might expect if the town were to build a new fiber system and importantly, how much capital participation, if any, might be expected from the provider.

Revenue

Rate Group	# of Subscribers	Monthly Rate	Annual Revenue
25/5Mbps	78	\$69.99	\$65,511
50/10Mbps	20	\$79.99	\$21,117
100/20Mbps	10	\$109.99	\$14,519

Business Class- 50/50M	5	\$109.99	\$6,599
TOTALS	(50%) take rate		\$101,147/ year

- The Rate Groups and monthly cost are entirely Axiom’s and may differ depending on provider
- Take rate is the estimated number of homes we believe would take service. In this case we believe a 50% take rate is achievable- in year one, with a steady rise as people in town convert slowly from Spectrum and Consolidated.
- We did not calculate seasonal homes, which would reduce the revenue by some amount

Expenses

Operational Expense Estimates	\$44,871/ year
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Includes all of the cost of the Internet Service provider to deliver, service and maintain the system.

- Take rate is critical to the overall viability of the project (less subscribers, less opportunity for profits)
- The monthly operating expenses are generally fixed, no matter the number of subscribers (there is not a direct correlation between subscriber counts and expenses)
- These are entirely Axiom calculations from our own operations, and are not necessarily reflective of another providers modeling

Final Thoughts

- Working with Consolidated Communications is least risky and least costly, if they are open to partner
- Installing a new fiber system is expensive up front- but will pay dividends for decades with unquestionable levels of speed and reliability
- Potential for grants to partially subsidize fiber system or enhancement of Consolidated DSL
 - DSL would likely be funded with state grants through the ConnectME Authority
 - Fiber Projects of this size have been successfully funded through federal grants in Roque Bluffs (a similar size community in Washington County) and is being pursued by Somerville (a similar sized community in Lincoln County).

Winterville Plantation

As one of three areas of the Unorganized Territories (Cross Lake and Madawaska Lake) that are in the planning grant, working with the Unorganized Territory Administrator who can provide support resources to help the community move forward will be important. Currently, Consolidated Communications covers the community with legacy equipment from the old FairPoint group. Coverage in the Plantation appears to be less than adequate, and an upgrade is in order. We have two options to consider. Work with Consolidated or consider a new system of fiber optics. Both options have advantages and disadvantages.

Consolidated Communications

The advantage of working with Consolidated would be to partner and upgrade their current system, bringing better connectivity across areas of the community. This would involve little risk to the Plantation, minimal match (hard to know without knowing how expensive a project with Consolidated would be) and probably a project that would qualify for state grant funds through the ConnectME Authority. However, there are some disadvantages, the biggest being that any upgrades would require a reinvestment in a few years and is likely to struggle to keep up with ever increasing consumer demand. This is because of the nature of the technology which is delivered over copper lines that are old and have significant limitations in terms of the amount of internet that the system can deliver.

Speed/Bandwidth [Max Available]	# Locations	% available
2M/768K	31	14.0
7M/1M	12	5.4
12M/1M	26	11.8
15M/1M	26	11.8
20M/1.5M	19	8.6
20M/5M	8	3.6
25M/2M	85	38.5
30M/10M	7	3.2
50M/20M	1	.4
NS	6	2.7
TOTALS	221	100.0

As you can determine from the above information provided by Consolidated, the vast majority of speeds available do not meet the 25/3Mbps which the FCC has determined to be the minimum level required to qualify as broadband. This leaves many in the Plantation with substandard connections that really do require upgrades and bridge the digital divide from those communities that have access to better internet service than is currently provided in the community. Because the system is not optimal, we suspect that is the reason that Consolidated does not have many subscribers, as illustrated below.

Speed/Bandwidth [Max Available]	# Locations	% available
15M/1M	1	4.5
20M/1.5M	2	9.1

20M/5M	4	18.2
25M/2M	8	36.4
30M/10M	6	27.3
50M/20M	1	4.5
NS	0	-
TOTALS	22	100.0

Less than 10% of home eligible to receive Consolidated service are customers. A first step to better understand the connectivity in Winterville Plantation would be to contact Jeff Nevins- Jeffery.Nevins@Consolidated.com to discuss the current situation and if Consolidated would be open to considering partnering to enhance the current service available now. If this is not possible or will not meet the goals of the community, fiber optics would be the next step to investigate.

Fiber Optic Benefits

Fiber Optic internet systems are increasingly being deployed in rural communities who have suffered for years with poor service. All of the issues of poor reliability and deficient speeds are instantly fixed with fiber. While the upfront cost is considerable, fiber optics has the benefit of being futureproof, providing ongoing service with no major equipment upgrades necessary to meet the demands of the community for 20 years- or more likely 30 years into the future. Not only do the subscribers reap the benefits of fiber optics, but there are many community benefits to consider also.

Benefits of Fiber Technology to the Subscriber

Speed and Capacity. Many experts say that FTTH connections are the only technology with enough bandwidth to support the projected consumer demands over the next decade.

Future proof. Because of fiber’s capabilities, new technological innovations are being invented every day to utilize fiber’s superior ability to transport tremendous amounts of data at blazingly fast speeds. Technologies such as 3D holographic high definition television and gaming will someday be everyday items in households around the world. FTTH will be able handle the estimated 30 gigabit-per-second needs of such equipment... and this is just one technology. Think about the new ways that you use the internet that seem commonplace now that were not even conceived of 10 years ago.

One delivery system. Right now, a consumer can receive telephone, video, audio, television and almost any type of data transmission using a single seamless FTTH connection. That trend will continue as consumers are given increasing array of a la carte choices for how they receive their various communication and data and streaming choices. Subscribers are also realizing that receiving bundled services through a fiber connection can save money.

Reliability. Fiber is the most reliable connection you can have. In surveys across the state of Maine, the #1 complaint is reliability. An internet connection is becoming a necessity, not a luxury. When connectivity is interrupted or slowed down unexpectedly or inexplicably consumers are furious that they cannot accomplish the on-line task, leading to a significant loss of productivity or time.

Community Benefits

Job Creation- There are many examples of fiber networks creating jobs by either supporting existing businesses or attracting new ones

Business Attraction- When we say business attraction, we really mean businesses that are looking for the kinds of connections that can move large amounts of data, quickly- architects, designers, banks and other heavy users

Entrepreneurship- Fiber helps induce young people to locate and work from anywhere

Telemedicine- The medical field and how patients and providers interact is undergoing seismic changes. One of those changes is the way patients are able to be seen, treated, monitored and are increasingly being given tools to manage their own health care, right from their home. A fiber connection has the capacity to manage these data transmission uses, which in turn facilitates our elders aging in place

Education- Creating equal access for all eliminates “the homework gap” for those students that are increasingly required to complete assignments on-line but are unable to do so from their home because of a lack of an adequate internet connection. Adult learners also benefit from on-line learning options that utilize interactive video or other tools that those with better connections can access

Increased Home Values- A Broadband Communities study indicated that FTTH networks increase the value of a \$300,000 home by an average of \$5,000-\$6,000. Another study by the FTTH Council in conjunction with the University of Colorado showed that homes with a FTTH connection are worth, on average, 3.1% more than homes that do not have a fiber connection

Fiber Plan

A plan for fiber would cover every home in the community and deliver equal service to those homes. The current situation is that service is uneven and based on the location of your home, leaving some with considerably better service than others. The map on the next page visualizes how service would be delivered. The map is not designed to show each individual connection to the homes, but our pricing calculations includes an average price to connect any home who would want service.



Wallagrass Fiber Map

High Count Fiber line in Orange
Lower count Fiber in Green
Purple dots= Location of Premises

Cost of Fiber System

The construction projections for this project are based on a number of assumptions. Please remember, this is a desktop estimate and additional, significant engineering would need to be completed to give the community a final cost that eliminates all of the variables. The different cost components will give the reader a good idea of where estimated costs would possibly change.

Category Description		Cost
Bill of Materials/labor		\$602,213
Pole Licensing Application		\$13,095
Utility Pole Make Ready	Estimate	\$77,625
Utility Pole Replacement	Estimate	\$103,500
CO/ Regen Hardware		\$158,480
Customer Premise Drop Cable	Estimate	\$22,330
Customer Premise Installation/Labor		\$152,250
Total number of Premises	203	
Total Cost		\$1,129,493

The total cost of the budget contains several line items that may change and lower the cost of the project overall. A lot of additional costing information will be learned by proceeding with the pole licensing process. For example, we have made some assumptions based on past experience, but the true understanding of the costs associated with pole attachments and make ready - the cost of other users of the poles moving their lines to “make ready” a space for a new cable - only will come through the licensing process. In addition, pole replacement costs are estimated and will not be known till the pole make ready work is completed.

This budget contains the hardware for 100% of homes to be connected, however, we calculate the revenue on 50% of the homes taking service in year one when the service is introduced.

Breakdown of Cost Components

Bill of Materials

This is the materials and equipment cost for the whole project with the exception of CO/Regen Hardware & Installation and the cost of the drop cable, which are separate line items.

Pole Licensing Application

This plan requires the placement of fiber optic cabling on existing utility poles across the community. In order to receive approval, a several step process over several months is required, but begins with the application. The cost of the application is based on the number of utility poles you would like to attach to.

Utility Pole Make Ready

Make Ready is the cost of making the poles ready (make ready) to accept a new fiber cable. In order to install new fiber optics cable on utility poles, a licensing process is in place that evaluates each pole for readiness to accept a new cable. Each provider (other than the electrical) would move the current lines to accommodate a space for a new cable. The cost of this process is estimated in our calculations and can change depending on the application process costs associated with each pole.

Replacement Poles (10%)

We estimate that 10% of the poles, through the licensing process might need replacement. There are two major reasons for pole replacements. First, the amount of equipment or utility lines on a pole deem it necessary to increase the height of the current pole to allow for an additional line to be placed on it (pole too short). Or the current pole is aged to the point where it would be unsafe to place the additional line strain on the pole without a replacement pole. (Aged poles). We make an estimate, but the evaluation of each pole will take place during the pole licensing process.

CO/Regen Hardware & Installation

CO refers to Central Office, which is a term that Internet Service Providers use to describe where the equipment that would be needed to power the system and location where bulk internet would be distributed from to each home. Regen hardware is the equipment that would be used to power the internet system and control each individual connection through this central system. These costs also include a heated and cooled utility shack that would house the equipment.

Customer Premise Cable

This is an estimated cost of the fiber to connect each home from the street to the home.

Customer Premise Installations

These costs are associated with the equipment needed at each home.

Revenue and Expense Model

As part of Axiom's commitment to our mission to help rural communities more fully understand what ISPs are facing serving a small community, we have created a revenue and operational expense budget that helps the community and the ISP better negotiate an operating agreement through a Public-Private Partnership, should the community choose to own the fiber network.

It's important to understand that these calculations are just an illustration of how Axiom would envision the feasibility of operating a system and what potential customer rates could look like. The potential revenue is based on service levels and take rates that are solely Axiom projections and are intended for illustration only, each internet provider would have their own revenue and cost models. However, these numbers can show you generally what a provider might expect if the town were to build a new fiber system and importantly, how much capital participation, if any, might be expected from the provider.

Revenue

Rate Group	# of Subscribers	Monthly Rate	Annual Revenue
25/5Mbps	71	\$69.99	\$59,631
50/10Mbps	20	\$79.99	\$19,197
100/20Mbps	10	\$109.99	\$13,199
Business Class- 50/50M	5	\$109.99	\$6,599

TOTALS	(50%) take rate		\$92,028/ year
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- The Rate Groups and monthly cost are entirely Axiom’s and may differ depending on provider
- Take rate is the estimated number of homes we believe would take service. In this case we believe a 50% take rate is achievable- in year one, with a steady rise as people in town convert slowly from Spectrum and Consolidated.
- We did not calculate seasonal homes, which would reduce the revenue by some amount

Expenses

Operational Expense Estimates	\$42,438/ year
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Includes all of the cost of the Internet Service provider to deliver, service and maintain the system.

- Take rate is critical to the overall viability of the project (less subscribers, less opportunity for profits)
- The monthly operating expenses are generally fixed, no matter the number of subscribers (there is not a direct correlation between subscriber counts and expenses)
- These are entirely Axiom calculations from our own operations, and are not necessarily reflective of another providers modeling

Final Thoughts

- Any option is strongly dependent on support of the Administrator of the Unorganized Territory
- Investigating all possibilities with current provider- Consolidated
- Installing new fiber system will need strong support from Planation residents but is achievable
- Potential for grants to partially subsidize fiber system or enhancement of Consolidated DSL
 - DSL would likely be funded with state grants through the ConnectME Authority
 - Fiber Projects of this size have been successfully funded through federal grants in Roque Bluffs (a similar size community in Washington County) and is being pursued by Somerville (a similar sized community in Lincoln County).

Grant Funding

What can communities do now to get ready and anticipate grant opportunities- and what are the grant opportunities available? This section articulates several areas of focus that communities can work on now, so they are ready when grant opportunities are available. In addition, we have compiled a list of the grant opportunities we are aware of, this list should help your communities investigate potential sources of funding.

Being Ready

Funding

Because most rural communities are governed through a town meeting, typically a warrant needs to be developed and approved several months ahead of the actual meeting. For these communities, we suggest that you begin exploring the possibility of getting something on the warrant.

For those communities that have a Town Council, the funding timeline may be different, but just as importantly all Broadband Committees should educate themselves on the process at council or town meetings. Often, funding opportunities don't line up with town processes and opportunities can be missed simply because of timing.

We recommend having a community set aside a small amount of money; \$5000-\$20,000 have been amounts that other towns have earmarked that can be used on activities to create grant applications, install HotSpots or used as a match for a future grant opportunity. In other cases, it was just as important to get language endorsing the work of a Broadband Committee and authorizing the Committee to explore any and all funding sources or to regularly report back on findings to town officials as to progress. All positive steps that can move the process forward.

Plans

Many of the communities have Spectrum recommendations to expand their service. For those communities, engaging Spectrum officials now to start a conversation will hopefully avoid the unfortunate situation that some communities have found themselves when they received the information they requested from Spectrum to support an application to the ConnectME Authority a day before the application was due and they missed the deadline. Starting early engagement with any possible Internet Service Provider is very important. Building trust, agreeing to common goals and roles and responsibilities will go a long way when opportunities arise to work together.

Goals

After looking at your town plan, you should consider and settle on your goals. "My internet stinks" is not a goal. Typically, communities that do well are able to articulate the answer to this fundamental question: Why? Why should the town focus on this? Why should we spend taxpayer dollars? Why is this important? The Broadband Committees in each of your communities must settle on their goals and be able to articulate those goals not only to their town leaders but to other citizens to build support. And speaking of support, find a champion- someone who I like to call EF Hutton- when they speak, people listen. This could be a town

elected official, but many times it's someone else who has significant influence in the community. This person can be critical to the success of any project. Start now and create a narrative for when you appear before the Select Board or Council and find a champion if you don't have one yet.

Explore the Criteria of Funding Opportunities

The Committees should look at each of the potential funding sources listed below to see if the criteria can be met by the community. Whether it's a cash match, or will only serve areas with minimal speeds, or a host of other eligibility requirements, many small communities are not used to the level of intensity required to successfully apply for a grant. Be prepared. Know what the requirements are and start to assemble the needed documentation to give your community the best chance.

Advisory resources: Beyond Axiom, Peggy Schaffer, the Director of the ConnectME Authority can be a good resource for communities. She is one person- be mindful of that- and can be reached at Peggy.Schaffer@maine.gov.

Grant Opportunities

The **ConnectME Authority** offers two types of grants- Infrastructure and Community Broadband Planning Grants. For the purposes of this report, the planning grant is not a consideration. We would recommend looking toward an Infrastructure grant, details can be found here: <http://maine.gov/connectme/grants/>

Axiom has extensive knowledge of these grants and have received many of these grants totaling over \$1M.

- ❖ Grant proposals must meet the state standard of 10/10Mbps
- ❖ Grant limits are suggested, but typically \$100,000, which must be matched 1 to 1 with a combination of cash and in-kind services
- ❖ Area targeted must be unserved or underserved (service that is less than 25/3Mbps)

Typically grant is open for applications in the March- April timeframe, but is not clear if this year will bring another grant round.

The **Maine Community Foundation** has regional grants that can support initiatives up to \$10,000 a year found here: <http://www.mainecef.org/GrantsNonprofits/AvailableGrantsDeadlines/CommunityBuildingGrantProgram.aspx>

- ❖ Grants available up to \$10,000
- ❖ Local decision makers by county
- ❖ Various criteria that needs review
- ❖ Deadline February 15th of each new year

The Foundation also has grants up to \$15,000 for Community Broadband related activities, the deadline just passed but details of requirements can be found here: <https://www.mainecef.org/apply-for-a-grant/available-grants-deadlines/community-broadband-grant-program/>

- ❖ Grant Awards up to \$15,000
- ❖ Typically, 10 awards every year
- ❖ Application deadline October 15th

Northern Boarder Regional Commission Grants located here: <http://www.nbrc.gov/>
 The Commission accepts grant applications from across the northern border regions of Maine, New Hampshire, Vermont and New York.

- ❖ Requires at least a 1 to 1 cash match
- ❖ Must be tied to quantifiable job creation
- ❖ Very competitive

Contact: Andrea Smith at (207) 624-9813 or andrea.smith@maine.gov for information on deadlines and program parameters.

Grant Funding Resources- Federal

U.S. Department of Agriculture (USDA) has several potential programs that would fund Broadband expansion opportunities. The most important of these is the **Reconnect Program** which is getting ready to announce next year's program (they are announcing winners from this year now). Details of the program can be found here: <https://www.usda.gov/reconnect/program-overview>

We expect a program of \$600M available to be divided in three categories- 100% grant, 50/50 grant-loans and 100% loans. Each of these categories have slightly different criteria. This year Axiom was a significant contributor to two 100% grant applications and one 50/50 application.

- ❖ Extremely difficult to apply for with lots of different document and eligibility requirements
- ❖ Most importantly, only 10% of the proposed homes being served can have the capability of getting service of 10/1Mbps or higher
- ❖ Even in the 100% grant, the municipality or applicant is required to have a 25% cash match

After looking through the program overview and other details, please contact Mark Ouellette, the author of this report, as he is familiar with this opportunity and can try to answer questions- mark@connectwithaxiom.com. Also available is the USDA Regional staff, Tim Brooks- timothy.brooks@usda.gov

USDA-RUS Programs offer a number of other potential opportunities to investigate located here: <https://www.rd.usda.gov/programs-services/all-programs/telecom-programs>. By far the easiest is the Distance Learning and Telemedicine Grants.

U.S. Department of Commerce- **Economic Development Administration (EDA)** provides funding for economic development projects across the state of Maine. Maine projects are reviewed and administered by EDA's local representative, Alan Brigham at (215) 316-2965 or abrigham@eda.gov. Programs and eligibility can be found at www.eda.gov

- ❖ Various funding programs

- ❖ Guidelines encourage regions to incorporate BB investments in their regional strategies (CEDs)
- ❖ Funding requires match

U.S. Department of Commerce- **Broadband USA** is helping communities nationwide ensure they have the broadband infrastructure, digitally literate workforce and engaged citizens to thrive in the Digital Economy. Details can be found here: <https://www2.ntia.doc.gov/>

- ❖ Provides direct (one-to-one) assistance to communities
- ❖ Resource rich website- no direct grants
- ❖ Building a self-assessment tool for communities

Final Considerations

Following the grant section and what communities can do to make themselves ready, this final section is to help regional leaders consider how to move projects forward. With over \$1.2 billion in recent rural internet spending and another \$600M likely available in 2021 through the USDA ReConnect program, and a reverse federal auction of \$16B to support the most expensive and difficult to serve regions of rural America, the time is now for Aroostook County to try and attract dollars to support projects. In addition to all of the federal funding, a state bond issue will be on the ballot in June that will increase the ConnectME Authority budget by \$15M. Over the next few months NMDC personal and the County government, specifically the Unorganized Territories Administrator should work together to assess the willingness of the communities in this report for readiness to partner and move forward. Whether those partnerships are with their existing providers or to move toward a new solution, the next few months will be crucial to preparing for federal or state applications for help. In some communities that are covered by Spectrum, these dollars will only be available to areas outside of that coverage that qualify as unserved (typically service below 10/1Mbps).

One way to make the region more attractive to potential funding would be to partner together. Certainly, the three communities in the UT (Madawaska Lake, Cross Lake and Winterville) have common governance through the UT Administrator who may be able to bring county resources to the table to assist these communities. In addition, it may make sense for communities that are next to each other to work together. For example, Wallagrass and Eagle Lake have similar geographic attributes and potentially could share equipment to serve each community or help share cost to serve each of their communities on the easterly side of Eagle Lake, and the river that cuts through both of the towns. These conversations are best facilitated by regional entities like NMDC or the County.

- State and federal money will be available in 2021- time to get ready
- The UT Administrator offers a good opportunity to bring together the communities in the Unorganized Territories to discuss mutual interest or how to support them
- NMDC can evaluate and support the other towns and get acquainted with the various programs that might help these communities move forward
- A goal would be to attract federal dollars in 2021 to at least one project, with a stretch goal to help two projects move forward

Axiom stands ready to assist and guide any community or NMDC with any additional support moving forward, including after the planning report is completed.

Contact: Mark Ouellette
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