10 Gbps residential service for several years. The Active Ethernet technology uses lower cost electronics than most PON technologies, but still can have higher costs than GPON due to the fact that there is a dedicated pair of lasers, and a dedicated fiber for each customer. A PON network instead uses one core laser to serve multiple customers.

It may be a number of years until this is resolved because most ISPs building FTTH networks are still happily buying and installing GPON. One ISP client told us recently that they are not worried about GPON becoming obsolete because they could double the capacity of their network at any time by simply cutting the number of customers on a neighborhood PON in half. That would mean installing more cards in the core without having to upgrade customer electronics.

The bottom line of this discussion is that we decided to not consider NG-PON2 for the primary technology to deliver FTTH services. The technology is still too expensive and since it has not yet been accepted widely in the industry it might never get long-term support by vendors.

However, our network design allows for an eventual migration to XGS-PON or NG-PON2 through what is called an overlay. That means introducing the new technology while maintaining the current network. This would allow for an orderly transition over time while bringing faster 10-gigabit connection to customers that need it immediately. The fiber network design can accommodate these future technologies and faster speeds.

5G Cellular Technology. Today's cellular network uses a technology called 4G LTE, although there are still many rural cell sites using 3G technology. Nationwide, the cellular carriers in the US average data speeds for 4G LTE is around 25 Mbps download, with the fastest cell sites usually located in major metropolitan areas. Like with all radio technologies, cellular data speeds drop in relation to the distance a customer is from a cell site and good cellular data speeds only are available for around 2 miles from a cellular tower. A customer that is more than 3 miles from a tower will get slower cellular data speeds.

The cellular carriers are in full 5G marketing mode. If you believe the TV commercials, you'd now think that the country is blanketed by 5G, as each cellular carrier claims a bigger coverage area than their competitors. However, almost all of their claims are marketing hype.

In 2020 there will be no cellular deployments that can be legitimately called 5G. Full 5G will not arrive until the carriers have implemented the bulk of the new features described in the 5G specifications. For now, none of the important features of 5G have been developed and introduced into the market. 5G deployment will come in stages as each of the 5G features reaches markets – the same thing that happened to 4G. For now, all of the major 5G improvements are still under development in the labs.

From what is discussed in the IEEE forums, most of the 5G features are 2 - 5 years away. The same thing happened with 4G and it took most of a decade to see 4G fully implemented – in fact, the first US cell site fully meeting the 4G standards was not activated until late 2018. Over time we'll see a new 5G features implemented as they are released from labs to field. New features will only be available to those that have phones that can use them, so there will be a 2- to 3-year lag until there are enough phones in the market capable of using a given new feature. This means every 5G phone will be out of date as soon as a new 5G feature is released.

Most of what is being called 5G today refers to the introduction of new bands of spectrum. New spectrum does not equal 5G – the 5G experience only comes with 5G features. Existing cellphones cannot receive the new spectrum bands, and so the carriers are selling new phones that can receive the new spectrum and labeling that as 5G.

Even when 5G is fully implemented, the cellular data speeds are not going to be blazingly fast. The 5G specification calls for a goal for 5G cellular speeds of about 100 Mbps – which was also the specification for 4G, but never realized. There will be reports of fast speeds using new spectrum, but that will die down quickly. At first, anybody lucky enough to grab new spectrum will likely have a great experience. This will mostly be because almost nobody else is using the spectrum at a given cell site. As more phones can use the new spectrum, the performance will drop back to normal 4G speeds – and maybe even a little slower. Much of the first wave of spectrum being released is in lower frequency bands such as 600 MHz for T-Mobile and 850 MHz for AT&T. These lower frequency bands don't carry as much data as higher frequencies.

5G Hot Spots. There are commercials on TV showing cellphone speeds of over a gigabit. This is not 5G. This is a phone equipped to use a new frequency band called millimeter wave spectrum. This is an ultra-high frequency and is 10-30 times faster than traditional cellular frequency.

It's easiest to think of this technology as a 5G hot spot, similar to a hot spot that might be found in a coffee shop, only mounted outdoor on a pole. The signal only travels a short distance, mostly under 1,000 feet from a transmitter. It needs line-of-sight and can be easily blocked by any impediment in the environment. The signal won't pass from outdoor transmitters into buildings. This technology only makes sense where there are a lot of people, such as downtown urban corridors, stadiums, and business hotels.

There is a lot of speculation in the industry that this is a novelty product being deployed to convince the world that 5G will be blazingly fast everywhere. The cellular carriers seem desperate to deploy something they can call 5G, and super-fast cellphones are a good way to get headlines. However, it's extremely unlikely that any carrier is going to invest in cell sites that close together outside of major downtown business districts. This technology is likely to never reach to residential neighborhoods in cities, suburbs, small towns, or rural America. A lot of industry experts are asking why anybody needs gigabit broadband for cellphone, and only outside since there are no high bandwidth applications for cellphones.

The need for Small Cell Sites. Communities of all sizes are seeing requests for adding small cell sites. These are small cellular sites that are placed on poles rather than on the big cellular towers. It's likely that when a cellular company, or one of their subcontractors makes such a request they will tell you this is for 5G.

The fact, is, for now these cell sites are being added to bolster the 4G networks. It's not hard to understand why the 4G cellular networks are stressed. The cellular companies have embraced the 'unlimited' data plans, which while not truly unlimited, have encouraged folks to use their cellular data plans. According to Cisco the amount of data on cellular networks is now doubling every two years – a scorching growth rate that would mean a 60-fold increase in data on the cellular networks in a decade. No network can sustain that kind of traffic growth for very long with becoming congested and

eventually collapsing under the load. While this is a definite problem in major cities, it might also be happening in Falmouth, particularly during the summer tourist season.

The cellular companies have a 3-prong approach to fix the performance problems for 4G. First, they are deploying small cell sites to relieve the pressure from the big cellular towers. A small cell site a busy neighborhood eliminates a lot of stress from the big cellular tower in the neighborhood.

The cellular companies also have been screaming to the FCC asking for new mid-range spectrum, because adding spectrum to cell sites and cellphones expands the data capability at each cell site. Unfortunately, it's a slow path between the FCC approving new spectrum until the time when new spectrum is installed in cell sites and enabled in smartphones. The FCC has awarded several bands of mid-range spectrum in the last year and are looking at more.

Finally, the cellular carriers are counting on 5G. There a few aspects of 5G that will improve cellular service. The most important benefit comes from frequency slicing that will right-size the data path to each customer and will get rid of today's network that provides a full channel to a customer who is doing some minor broadband task. 5G will also allow for a customer to be connected to a different cell site if their closest site is full. Finally, the 5G specifications call for a major expansion of the number of customers that can be served simultaneously from a cell site. Unfortunately for the cellular carriers, most of the major 5G improvements are still five years or more into the future.

There is a fourth issue that is a likely component of the degrading cellular networks. It's likely with expanding broadband needs that the backhaul links to cell sites are overloaded at times and under stress. It doesn't matter if all of the above changes have been made if the backhaul is inadequate – because poor backhaul degrades all broadband services. The big cellular carriers have been working furiously to build fiber to cell sites to eliminate leased backhaul. But much of the backhaul to cell sites is still leased and the lease costs are one of the major expenses for cellular companies. The cellular companies are reluctant to pay a lot more for transport and bandwidth, and so it's likely that at the busiest times of the day that many backhaul routes are now overloaded.

Low Orbit Satellite Technology

We almost didn't include this technology in the report since it is extremely unlikely that the companies selling broadband out of satellites will be selling services in urban areas. The technology is best suited to provide broadband in remote and rural locations. However, there has been so much hype about the satellites that it's worth discussing to dispel ideas that these companies could become a serious competitor in the cities. There are several major companies planning on providing fleets of low-orbit satellites to provide broadband service. This includes efforts by SkyLink (Elon Musk), Project Kuiper (Amazon), and OneWeb that have announced plans to launch swarms of satellites to provide broadband.

In March, OneWeb filed for Chapter 11 restructuring when it was clear that the company could not raise enough cash to continue the research and development of the satellite product. In July, a bankruptcy court in New York approved a $1 billion offer to take over the company filed jointly by the British Government and Bharti Airtel. Airtel is India's largest cellular company. The restructured company will be owned with 45% stakes by Britain and Bharti Airtel, with the remaining 10% held by Softbank of Japan, the biggest original shareholder of OneWeb. Other earlier investors like the founders, Intelsat,

Totalplay Telecommunications of Mexico, and Coca-Cola have been closed out of ownership by the transaction.

There is speculation that the British government purchased the company to create tech jobs in the country and that all R&D and manufacturing for OneWeb would immediately shift to England from Florida. There is also speculation that the mission of the company will change. Greg Wyler, the original CEO of the company had a vision of using the satellites to bring broadband to parts of the world that have no broadband. He chose a polar orbit for the satellites and was going to launch the business by serving Alaska and the northern territories of Canada like Nunavut. I've seen speculation that the revised company is likely to concentrate instead on wholesale connections to telcos and ISPs, such as providing backhaul for rural cell sites.

Elon Musk's satellite venture StarLink was recently in the news when the company said it was going to raise "up to $1 billion" to continue the development of the business. The company still has a long and expensive road to success. The company has raised over $3.5 billion to date before this latest raise, but a recent Bloomberg article estimates that the company will need to raise an additional $50 billion between now and 2033, which is when the company is projected to be cash-positive.

StarLink now has over 540 satellites in orbit, but the business plan calls for over 4,000 satellites in the first constellation. Keeping the first constellation in place will be an ongoing challenge since the satellites have an estimated life of 5 to 6 years. StarLink will forever have to be launching new satellites to replace downed satellites. StarLink has even more ambitious plans and has told the FCC that it might eventually launch over 30,000 satellites – but they need to fund and launch the original batch first.

The US government and the FCC seem to be in StarLink's corner. It's still not clear if the FCC will allow StarLink to participate in the upcoming RDOF grants auction in October. It would be incredibly unusual to award giant federal grants for a product that is still on the drawing board and for an ISP that hasn't raised 10% of their needed funding.

Just as this paper was going to press, we learned more about StarLink. The company announced that broadband connections would be priced at $99 per month and were expected to deliver speeds between 50 Mbps and 150 Mbps download. StarLink reemphasized that this is a rural technology and they don't expect to offer it in towns.

The last LEO player that is still active is Jeff Bezos venture that is still using the preliminary name of Project Kuiper. The FCC recently approved the concept of Project Kuiper to move forward and FCC Chairman Ajit Pai recently said he supported the company's plans to start the process of FCC licensing of the technology. Project Kuiper has one advantage over other competitors in that Jeff Bezos could self-fund much or all of the venture. It was reported that just for the month of July that Bezos's net worth had climbed by $9 billion. Funding is going to be a constant hurdle for the other two major competitors, but Project Kuiper might be the fastest to deploy if funding is not an issue.

The most recent announcement made at Christmas 2019 is that Apple is considering launching satellites that will provide only data for cellphones. This could free apple phones from having to rely on a cellular carrier.

Skeptics are doubting if the companies can launch all of the planned satellites. To put their plans into perspective, consider the number of satellites ever shot into space. The United Nations Office for Outer Space Affairs (NOOSA) has been tracking space launches for decades. They report at the end of 2019 that there have been 8,378 objects put into space since the first Sputnik in 1957. As of the beginning of 2019 there were 4,987 satellites still in orbit, although only 1,957 were still operational. There was an average of 131 satellites launched per year between 1964 and 2012. Since 2012 we've seen 1,731 new satellites, with 2017 (453) and 2018 (382) seeing the most satellites put into space.

While space is a big place, there are some interesting challenges from having this many new objects in orbit. One of the biggest concerns is space debris. Low earth satellites travel at a speed of about 17,500 miles per hour to maintain orbit. When satellites collide at that speed, they create a large number of new pieces of space junk, also traveling at high speed. NASA estimates there are currently over 128 million pieces of orbiting debris smaller than 1 square centimeter and 900,000 objects between 1 and 10 square centimeters.

NASA scientist Donald Kessler described the dangers of space debris in 1978 in what's now described as the Kessler syndrome. Every space collision creates more debris and eventually there will be a cloud of circling debris that will make it nearly impossible to maintain satellites in space. While scientists think that such a cloud is almost inevitable, some worry that a major collision between two large satellites, or malicious destruction by a bad actor government could accelerate the process and could quickly knock out all of the satellites in a given orbit. It would be ironic if the world solves the rural broadband problem using satellites, only to see those satellites disappear in a cloud of debris.

III. FINANCIAL PROJECTIONS

This section of the report looks at the detailed assumptions that were made in creating the financial business plans. The business plans created are detailed and contemplate all aspects of operating a broadband business. The business plan assumptions represent our best estimate of the operating characteristics for such a business. As a firm, CCG consults to hundreds of communications entities that provide rural broadband. This has given us a lot of insight into how rural ISPs operate. We believe that the financial results shown in these models are characteristic of similar operations elsewhere and we believe our assumptions are realistic.

The primary goal of the business models is to look at the various scenarios from the perspective of an ISP that would operate the business. The purpose of these models is to provide a way for ISPs to understand the broadband opportunities in the county. We've learned with experience that almost every ISP is theoretically interested in expanding. However, no ISP is really interested until they understand the numbers. Only then can they decide if the opportunity is something they can get financed and that meets their requirements as an investment opportunity. These studies help the ISPs understand the opportunity of expanding broadband into the rural parts of the counties.

A. Operating Models

CCG considered the following business plan scenarios. Every scenario used fiber-to-the-premise technology, described earlier in the report.

Retail Model – Single Provider as the ISP

This scenario considered the network being built and operated by a single entity. The results would be similar if the operator were the town or a single ISP.

We always study this scenario to understand if there are reasonably achieved scenarios that result in a sustainable business plan – defined as permanently cash self-sufficient. CCG has learned from experience that if a market can't be profitable with one provider, then other options like partnerships and open access also can't be successful. By definitions those scenarios divvy up profits among multiple entities. If there's not enough profit for one provider, there's not enough to support multiple parties.

A retail ISP is a single entity (could be the public entity or a single ISP) that operates a retail broadband network. A retail ISP normally owns the network, hires the staff, operates the business, and benefits from any profits.

Advantages

Profits. A single owner/operator can make all of the profit from a fiber business.

Flexibility. A single owner/operator can make instant decisions to change products or prices or to respond to competition that seem needed.

Disadvantages

Risk. The flip side of the ability to make all of the profits is that a single owner/operator also takes all of the risk. If the business doesn't succeed the ISP can lose their investment.

Financing. The primary impediment to building and operating a fiber ISP is the cost of building the fiber network. Cities often wonder why commercial ISPs don't build fiber network if the business plan to do so looks profitable. The fact is that there are not many entities capable of borrowing the money needed to finance multiple fiber networks. Most small ISPs are limited by the amount of equity they can bring to a new market and by the collateral they can pledge to a borrower.

Open Access

This scenario would open up the market to multiple ISPs, which would then provide retail products to customers. Under this scenario a municipal entity would build and operate the network and the ISPs would sell to and provide services to customers. A town's only source of revenue is fees collected from the ISPs for providing access to the fiber network. ISPs have the relationship with customers – ISPs sell, provide services, bill, and provide customer service.

The open-access model thrives in Europe but has had a more difficult time succeeding in the US. Europe has seen success with open-access networks because a significant number of the large ISPs there are willing to operate on a network operated by somebody else. This came about due to the formation of the European Union. Before the European Union, each country on the continent had at least one monopoly telephone company and a monopoly cable TV company. The formation of the European Union resulted in a change in law that opened up existing state-run monopolies to competition. All of the state-owned telecoms and ISPs found themselves in competition with each other and most of these businesses quickly adapted to the competitive environment. This contrasts drastically with the US market where there is no example of any large cable company competing with another and only limited competition between large telephone companies.

When a few cities in Europe considered the open-access operating model they found more than a dozen major ISPs willing to consider the model (large companies that would be equivalent of getting Comcast, AT&T, or CenturyLink agreeing to use the new fiber network). There are now open-access networks in places like Amsterdam and Paris as well as in hundreds of smaller towns and cities. The biggest networks have over a hundred ISPs competing for customers—many of the ISPs with niche businesses going after a very specific tiny slice of the market. Due to that level of competition, the European fiber networks get practically every customer in their market since even the incumbent providers generally jump to the new fiber network.

That hasn't happened in the US. There is not one example in this country of a large telco or cable company agreeing to operate competitively on somebody else's network to serve residential customers. The large ISPs in the US will lease fiber outside of their footprint to serve large business customers, but they have never competed for smaller businesses or residents in each other's monopoly footprints.

This means that open-access networks in the US must rely on small ISPs. These small ISPs are generally local and mostly undercapitalized. The small ISPs have all of the problems inherent with small businesses. They often don't have the money or expertise to market well. They often have cash flow issues that put restraints on their growth. In addition, many of them don't last beyond the career of their founder, which is typical of small businesses in general.

Open access network operators have struggled in this country due to the nature of the small ISPs on their network. Consider the example in Chelan County, Washington that today has only one primary local ISP that is selling to residential customers. The network originally had almost a dozen ISPs, but over the years the ISPs either folded or were purchased by the remaining ISP. It's hard to even call the Chelan County network open access any longer.

A similar thing happened in Provo, Utah before the city sold the network to Google Fiber. The network had originally attracted eight ISPs, but over time they ended up with only two. It's hard to make an argument that a network with so few choices is open access—because the whole purpose behind open access is to provide customer choice.

Examples of Open-Access Networks. Following is a list of some of the other municipal open-access networks in the country.

- The Public Utility Districts (PUDs) in Washington State. These are countywide municipal electric companies. The PUDs are restricted to offering open access due to legislation passed a number of years ago. There are numerous different open-access models being tried at various PUDs, with the largest networks in Chelan County PUD, Grant County PUD, Douglas County PUD, and Pend-Oreille PUD.
- Utah has a similar law that applies to municipalities. This led to the creation of an open-access fiber business in Provo and another network called Utopia that serves a number of small towns. The Provo network was losing a lot of money and the city decided to sell the network to Google Fiber for $1. Utopia is still operating a wholesale business but had significant financial problems since inception.
- A similar law was passed in Virginia after Bristol Virginia Utilities (BVU) built a retail fiber network. The legislation grandfathers BVU as a retail provider but only allows other cities to operate open-access networks. So far, the wholesale model has been adopted by a few cities, the largest being Roanoke, which offers open access on a limited basis to only parts of the city.
- Tacoma, Washington chose an open access model where the city is the retail provider of cable TV, but connections to the network for telephone and broadband are sold wholesale to ISPs.
- Ashland, Oregon operates an open-access network, but the city also operates as a retail ISP on the network and competes against a few local ISPs that sell on the network.
- There are a number of municipal networks that have built fiber rings, and which are promoting "open access" to carriers. For the most part these networks only service business customers.
- Other communities have tried to build open-access networks but then were unable to find any ISP partners. For example, Longmont, Colorado tried to launch an open-access network, but when they were unable to find ISP partners, they now offer full retail services directly to residents.
- One of the most interesting open access network stories is in Ammon, Idaho. The project is funded by asking homeowners to contribute $3,500 up front to pay to connect to the network. This has significantly lowered the cost of the network such that broadband prices are relatively low. The downside to this model that only homes that can afford the payment are connected –

and only neighborhoods where there are enough homes willing to pay the fee get connected. This results in a network where homes that can afford fiber get it while others don't. It's a model that works, but most other communities that have considered the model have decided that they must find ways to bring fiber to every neighborhood and to every home – many communities are aghast at the idea of the local government creating broadband 'haves and have-nots'.

Advantages

Customer Choice. The most appealing aspect of an open-access network for a community is that it offers a variety of choices to customers over the same fiber network. The further hope on an open access network is that having greater competition will lead to lower prices and better customer service.

Disadvantages

Retail/Wholesale Revenue Gap. There is a big difference in the revenue stream between collecting the retail revenue stream from customers versus collecting only the fees charged to ISPs. For example, the average retail revenues on a fiber network serving residential customers might be over $120 per customer per month. The average revenues on an open access network are far smaller, at perhaps $30 per customer per month.

There are some cost savings for the network owner in an open access environment. They don't have to provide the triple play products. They don't have to see, bill customers, or provide customer service. But it's still extremely difficult for the network owner to be profitable with open access. The network owner still has to cover the full cost of debt. The network owner still has to maintain the fiber network and provide the core electronics. In most scenarios the network owner has to continue to install fiber drops and/or customer electronics.

Not Many Quality ISPs. Every open-access network that has been tried in the US has had trouble finding and retaining ISPs. Some examples are discussed above. The ISPs willing to operating in this environment are generally small and undercapitalized. Open access forces these ISPs to compete against other small competitors, which holds down end-user rates, but which then also puts pressure on ISP earnings. Two of the largest open-access networks in Chelan County, WA and Provo, UT essentially lost most of the ISPs on their network over a decade of operations.

Leads to Cherry Picking. The open-access model, by definition, leads to cherry picking. If ISPs are charged a fee to use the network, then these fees will generally lead them to not want to sell to low-margin customers. All of the open access networks listed above report this as an issue. The only way to get broadband to everybody in an open access network is for the network owner to lower their fees – and that makes it impossible to pay for the network. CCG has never seen an open access network that has a customer penetration rate as high as would be expected if the same community had a municipal retail provider. Cherry picking means fewer customers on the network.

No Control over Sales Performance. The network owner in an open-access network has no control over the customer sales process. That means they only do as well as the ISPs on the network. In CCG's experience, having talked to many of the ISPs that operate on open access

network, the ISPs tend to not have the resources for major marketing efforts or else they only want to serve a niche market and don't try to mass market. A retail ISP that owned the same network would try to sell to everybody – but that never happens on an open access network.

Stranded Investments. One interesting phenomenon that especially affects open-access networks is stranded investments at customer premises. When a customer moves or stops service with a network operated by one entity there is usually a big push to reestablish service at that location. However, in an open-access network many ISPs don't make this same effort. Therefore, over time there grows to be an inventory of homes and businesses with a fiber drop and ONT that are no longer used and are not contribution to the cost of the business. CCG knows of one of the larger open-access networks with 25,000 active customers that has 5,000 locations where the fiber has been abandoned with no current service.

Public-Private Partnership (PPP)

In this scenario a municipality would partner with a single commercial ISP to operate the business. There are almost endless variations on this concept and the studies examined a few of the most common relationships:

- At one extreme, the municipality builds the whole network but hires an ISP to operate the network.
- The municipality builds the fiber network and fiber drops and the ISP partner provides customer electronics and everything inside the home.
- The municipality builds only the fiber and the ISP supplies everything from the street to connect to the customer.
- There are some claimed PPP arrangements that really aren't partnerships. For example, some cities have taken steps to help an ISP succeed. That might mean being an anchor tenant and giving all of your business to the ISP on a long-term contract. It might mean contributing land, building space or other hard assets. It might mean relaxing construction requirements such as permitting, locating, and inspections to lower the cost of building the network. But if a municipality doesn't put any assets or funding into a fiber network, then it's really not a partnership.

PPPs initially arose internationally as a way to finance infrastructure needs that local, regional, or national governments could no longer pay for up front or could only insufficiently finance from taxes, bonds, or other methods of raising government monies. Taken as a whole, governments in the US are today unable to fund all of the needed infrastructure and so more and more PPPs are being formed to finance infrastructure. There have been estimates that collectively there are several trillion dollars more of needed infrastructure projects in the country than could be financed by the combined borrowing power of all of the state and local governments added together.

There are three major ways that a fiber PPP can be structured depending upon who pays for the network. A fiber network could be mostly funded by the government, mostly funded by a commercial entity, or funded jointly by both.

PPP Funded Mostly by a Government. There are not many examples of this in the US. This scenario means that a government takes all of the financial risk of building a network and then hands the operations to somebody else. This is the arrangement that is in place in the Google

Fiber partnership with Huntsville, Alabama. Reports are that Google Fiber is responsible for the costs inside the customer premise and the city for the rest. There are similar partnerships between Ting and Charlottesville, VA and Westminster, MD. CenturyLink has reached a similar arrangement with Springfield, MO.

PPP Funded Mostly by the Commercial Provider. There are many examples where a commercial provider built a fiber network and doesn't consider the venture to be a PPP. Generally, any ISP that uses the normal avenue of obtaining rights-of-way and then adheres to the franchise and permitting processes in a city are free to build fiber.

It's also not a PPP if a government gives concessions to attract an ISP. The first few markets for Google Fiber are reported to have this arrangement. It's widely believed that Kansas City granted major concessions to Google Fiber to get them to build fiber there. This may have been things like free rights-of-way, expedited permitting, use of city land for placing facilities, etc.

For this kind of arrangement to be a traditional PPP, a municipal entity would have to get something in return for the concessions they make to an ISP. This could be almost anything that is perceived to be of value. It might be free or reduced telecom prices provided to government buildings or fibers connecting government locations together. It could also be the ISP agreeing to help the city meet some social goal, such as building out to poorer parts of the city that a normal commercial ISP might otherwise would not have considered.

PPP Funded Jointly. When a municipality and an ISP both contribute cash or hard assets to a venture then it's clearly a PPP. There are a number of examples of telecom PPPs working in the country today. Such partnerships are structured in many different ways and following are a few examples.

- Zayo partnered with Anoka County, MN. This is a suburban county just north of the twin cities. Each party contributed money to build a fiber network together. The county received access to a 10-gigabit network connecting all of its facilities and Zayo received connections to all of the major business districts. Zayo owns the network, but each party has affordable access to the whole network as needed. Each party is also allowed to build outward from any point on the jointly built network at their own cost.
- Nashville, TN partnered with a commercial fiber provider to build fiber to city locations as well as to commercial districts. Both parties made capital contributions. The city eventually sold its interest in the network but still retains fiber to most city buildings.
- There are dozens of small cities where the city built an initial fiber network to connect to schools, water systems, etc. and now allows commercial providers to build spurs from the city-owned ring. The financial arrangements for this vary widely. Sometimes the two parties just swap access to various locations on each other's network and in other cases they each pay to lease access on the other's network. However, both parties share the same network, portions of which each has funded.
- In Sibley and Renville Counties, MN, the counties, cities, and townships together contributed an economic development bond which is being used to fund 25% of the cost of a fiber-to-the-premise network.
- Several of the Public Utility Districts (PUDs) in Washington have built fiber into business and residential neighborhoods but then allow ISPs to build fiber loops and electronics and connect to the core network.

- Google Fiber recently reached an agreement with West De Moines, Iowa where the city will build empty conduit up to the side of each home and business, and Google Fiber will pull fiber and offer service to everybody in the city. The network is also open to other ISPs and is the first example we know of a dark conduit open access network.
- There are hundreds of examples of government entities that have built fiber routes jointly with some commercial enterprise. This is referred to in the industry as fiber sharing and generally each contributor to the fiber route will get some specific number of pairs of fiber for their contribution. For example, this is a common practice with school system that build fiber networks.

There are several kinds of contributions that a government can make to somebody else's fiber network. This could include cash, real estate, excused fees, or sweat equity. Governments can allow a commercial provider to use parcels of lands or give them an existing building. Excused fees might mean not charging for something that would normally be due such as permitting fees or property taxes. The government could excuse payments for poles, conduit, existing fiber, or towers. It could mean the commercial provider might not need to pay taxes or fees for some period of time, as is often done in many economic development projects. Sweat equity is assigning a value to the time contributed by the city. For example, we've seen a city assign extra employees for free for tasks like the permitting process during a major fiber construction project.

There are almost unlimited ways to model and form a public-private partnership. The underlying requirement is that the business must be profitable for the private commercial partner. Commercial providers expect a healthy rate of return on any investment they make in the business. Most commercial companies won't invest in a business that doesn't return at least a 20% to 30% return on their investment.

Advantages

Smaller Government Investments. The extent to which a private partner funds even a portion of the network reduces the needed investment from the public partner. A private equity partner can bring cash to the business that might be hard to raise elsewhere.

Disadvantages

Matching Goals and Expectations. One of the primary reasons why there are not a lot of telecom public-private partnerships is that it's often difficult to reconcile the differing goals of the two sides. The commercial partner is generally going to be very focused on the bottom line and returns while the community part of the business often has goals like community betterment and lower rates. One of the biggest sticking points in creating PPPs is that cities want fiber built past every home, which ISPs prefer to build to only selected neighborhoods. It's often very difficult to put together a structure that can satisfy all of the different goals.

Expensive Money. Commercial partners often have a goal to make at least a 20% return on equity, and that makes external equity an extremely expensive source of funding.

Tax Free Funding Issues. It's difficult to obtain tax-free bond funding to support a PPP. Tax free financing can't be used for a project that benefits a commercial entity.

Process Driven by Commercial Partner. Communities seeking equity partners for a public-private partnership fiber optics project will have fewer choices for the structure of the business since the external partner will probably demand a for-profit business structure as a likely pre-condition for investment.

Length of Partnership. Many commercial investors only make investments with a mind to eventually sell the business to realize the cash value. This may be difficult to reconcile with the long-term desires and goals of a community-based fiber optics project that might want to own the network forever.

Governance Issues. It's a challenge to develop a governance structure that can accommodate the government decision-making process. Governments generally have to go through a defined deliberative process including holding open meetings to make any significant decisions. This does not match well with the decision-making process and timeline for a commercial partner. A commercial partner might want to make a decision in days when the public process might not be any faster than several weeks.

Maintaining Local Control.

One of the biggest issues faced by any municipality that enters into a broadband partnership is maintaining control. If a community is going to spend millions to finance a fiber network, it's natural to want to be able to control things like setting broadband rates or determining products and policies intended to provide broadband to low income households.

However, entering into a partnership invariably is going to mean partnering with a commercial ISP. That's going to be an entity that has already successfully operated a broadband business before. Partner ISPs are going to automatically assume that they are going to get to call all of the shots related operating the business – and most ISPs are not going to be interested in entering into a partnership where that is not the case. ISPs have a natural mistrust of government entities because they assume that government will make decisions based on pleasing politicians or pleasing the public, and not based upon being profitable. And ISPs are generally right in that assumption. Municipal ISPs operate with different goals than commercial ISPs. There are numerous examples of municipal ISPs with super-low rates or with policies that provide big discounts to disadvantaged households – things that commercial ISPs are not easily willing to do.

There are only a handful of ways for a municipality to maintain operating control of a broadband business:

- Go it Alone. It's intimidating for a municipality to contemplate operating a competitive ISP business alone. But there are cities that have successfully done so. There are many keys to being a successful ISP, but the two most important ones for a new municipal ISP are to hire the expertise needed to operate the business, and to find a way to isolate the business from politics.

  Expertise is vital because there are dozens of mistakes that a new ISP can make, all which may lead to financial disaster. While new commercial ISPs also make some of these same mistakes, most commercial ISPs that have been successful have found a formula for success that works for them. An experienced ISP is far less likely to make any big or fatal mistakes.

The harder step is to isolate the business from politics. A municipal ISP has to have a structure that makes it hard for politicians to do things like cut rates to be popular during an election. The easiest way to do this is to structure the ISP to have a separate Board that makes operational decisions. Such a Board must be given the legal authority to take steps like setting rates – and that can provide a cushion against interference from elected officials.

- Operator for Hire. An operator for hire is just what it sounds like. A municipality could build a fiber network and hire an ISP to operate the business. An operator for hire would have no ownership and would be a vendor and not a partner. They would be paid to operate the business in a way directed by the municipal owner.

  The hard challenge of this is that there aren't many ISPs willing to accept this role. Most ISPs want a partnership relationship where they can share in upside profits. Unfortunately, if an ISP wants to share profits, they are not going to want a municipal partner making policies that cut profitability.
- Partner with Other Municipalities. The other way to maintain some control would be launch the business as part of a consortium of other municipalities. A municipality might not have total control in this situation, but they would likely be part of a governing Board comprised only of other municipalities. It's likely that such a business is going to have policies that the member municipalities will like.

It's hard to picture a true public-private partnership option where a municipality would retain control. It's unrealistic to want to benefit from the experience of a commercial ISP partner but then not respect their goals which are to be profitable. This is why it's so challenging to create partnerships for any purpose between municipalities and commercial entities. Eventually the differing goals of the two parties tend to cause major friction.

B. Services Considered

Following is a discussion of the products and services considered in the study.

Telephone Services (VoIP)

Voice over IP (VoIP) is a digital telephone service that transmits a telephone call to customers using their broadband connection rather than establishing a more traditional analog telephone connection. VoIP has been around the industry for a few decades. The first major seller of VoIP was Vonage, which still delivers VoIP over the open Internet. Most VoIP arrangements now use secure private broadband connections rather than the open Internet.

The study assumes that the retail provider of telephone service will purchase wholesale VoIP. This product is available from numerous vendors. These vendors own a digital telephone switch and they deliver calls to and from customers from that switch to the ISP. Our clients tell us that offering voice is still mandatory when selling to businesses since many businesses insist on having a vendor that delivers all of their communications needs.

The alternative to using VoIP is to buy a telephone voice switch and then establish connection between that switch and the public switched telephone network. These connections are referred to in the industry

as “interconnection.” We’ve found through a number of studies that it’s hard to justify buying a switch and paying for interconnection costs unless a service provider expects to serve at least 5,000 telephone lines.

High-Speed Bandwidth (in excess of symmetrical 100 megabits)

The network design for the studies can deliver a symmetrical gigabit bandwidth product to every customer in the service area. Additionally, the network can provide speeds up to 100 gigabits for the largest businesses, although there are probably none that want more than 10 gigabits. It’s anticipated that there would be residential and small business broadband products at speeds less than a gigabit. The study assumes the basic product is 100 Mbps, but that could easily be changed some other speed.

Internet Services (ISP, email, web hosting, etc.)/Security and Authentication Requirements for Business

It was traditional in the industry for an ISP to provide all services related to the Internet as part of their ISP service. This included such things as email, DNS routing, virus checking, spam filtering, etc. Most ISPs also offered services like helping customers create web sites and then hosting them at the ISP headend. A decade ago, there was also a booming ISP business line of providing off-site storage for customer data.

The majority of small ISPs now outsource these functions and product lines. None of these functions are profitable when considering the cost of labor to perform them. In addition, all of the basic ISP functions are now available as a cloud service or from a large centralized help desk company. Most small ISPs have decided that their primary function ought to be maintain a network designed to provide minimal downtime and leave these various ancillary services to somebody else.

A good example of this is virus checking and security. Virus checking today means not only trying to keep viruses away from customers, but today it means protecting against larger threats to the ISP such as denial of service attacks or the many other kinds of hacking. Most ISPs have found that they can buy better protection from a company that does this function for a hundred small ISPs rather than trying to do this themselves. They’ve found that there is no particular glory from doing these functions well, but there is a huge liability if they perform these functions poorly.

The feasibility studies assume these functions are outsourced. There is nothing to stop an ISP from tackling some or all of these tasks, but that would be contrary to where the rest of the industry is headed.

Managed WiFi

Many small ISPs now offer managed WiFi, which means that the ISP installs and controls the WiFi network at the customer premise. It’s become obvious over the past several years that a large percentage of the problems experienced by customers have been due to poor WiFi networks rather than to the broadband connection. ISPs began selling a product where they would install a high-quality WiFi modem. If a house is large, the ISP installs a meshed network with several networked WiFi routers. Since these routers are part of the ISP network, they can monitor the performance to make sure they are

operating properly. Many ISPs also offer related services like helping customers connect new devices to the WiFi system – something that can be done easily from the ISP end.

This is a profitable product. A quality WiFi router costs around $100 and ISPs are charging between $5 and $10 per month for the service. CCG know of ISPs that have already sold this product to more than 70% of their customers.

Other Future Products

Today many ISPs are expanding their product lines to add additional product lines that rely upon broadband. Perhaps the best example of this is Comcast. They now offer a wide range of new products. For example, they have sold home security monitoring to many millions of customers. They are now probably the largest single nationwide provider of smart home products and they have a line of products such as smart lighting, smart watering systems, smart door locks, smart thermostats, etc. Comcast has also been selling a cellular product to compete with the big wireless carriers. Comcast even recently tested bundling solar panels with their other products in a few markets.

CCG finds it likely that any ISP operating a fiber network will eventually offer some of these same kinds of products along with products that have yet to be developed. This could include things like medical monitoring to help the elderly live in their homes longer. It might involve intensive gaming connections, including virtual reality and holograms.

It's impossible to build a business case for products that have yet to be developed, but it's reasonable to believe that any sizable ISP will offer new products over the time frame of this study. Our business plans incorporate a generic small future revenue for "new products" which is undefined. The assumptions used will be described under the revenue assumptions below.

Wholesale Bandwidth Products

Wholesale bandwidth products are those sold to other carriers or to large business customers. Such products can be a major source of revenue for ISPs in larger cities. For example, CenturyLink is one of the biggest sellers of wholesale bandwidth products in the country after their merger with Level 3.

Following are the kinds of customers that buy wholesale connections:

- Cellular towers in most markets buy fiber connectivity and bandwidth to connect to the regional cellular hubs. However, there has been a big effort by both Verizon and AT&T to build fiber to cellular towers in many markets.
- Nationwide businesses like hotel chains, banks, manufacturers, etc. usually have an arrangement with a single ISP to serve all of their locations nationwide. These ISPs will consider buying from a new fiber network.
- Complex businesses like hospitals or the government labs in Falmouth. These entities generally have complex needs and look for ISPs that can provide more than just bandwidth. Most entities want to buy a second fiber connection from a different provider if it's available.
- Businesses with multiple locations in the same community like to have a locally interconnected network, much like what OpenCape has provided for the town government. This might include grocery stores, local banks or other businesses that might operate multiple locations.

- Giant bandwidth users. This could be things like data centers or large stock trading houses that want large bandwidth with low latency.

Products

Following are the typical wholesale products that are sold to the above kinds of businesses:

- Dark Fiber. This involves selling a fiber that is not connected to electronics. The ISP buying the dark fiber is responsible for providing and operating the electronics necessary use the fiber. Dark fiber might be sold by the mile of fiber, or else by a set fee per dark fiber connection.
- Transport. Some wholesale providers only sell connections between points A and B. This might mean the retail ISP might need to buy several transport paths to serve a customer – for example, there might be one transport connection between and end-user connection and the wholesale hub and a second transport connection between the wholesale hub and the ISP hub.
- Dedicated Bandwidth. Dedicated bandwidth means that the customer doesn't share it with anybody else. The typical products on an FTTP network share bandwidth at some point in the network, but some businesses are willing to pay to buy raw, unshared bandwidth. The network is capable of delivering speeds up to 100 Gbps.

We've included a small amount of wholesale revenues included in the studies. For now, many such entities, but not all are served by OpenCape, but even those entities would likely be interested in a redundant connection.

Offering Voice and Video

One of the questions asked by the RFP is if its reasonable for a new ISP to offer voice and video service. A new ISP can be intimidated by the complexities of these products.

Offering Voice. Until a decade ago, anybody that wanted to offer telephone service had to go through the process of becoming certified as a voice provider and buying and activating a telephone switch that would provide these services to customers. This option is still available to any ISP today and CCG still helps a few ISPs enter the voice business each year.

However, the more common approach today is to buy wholesale voice products, where some outside entity does all of the technical and backoffice work necessary to offer the voice product and the ISP then delivers the wholesale voice product to customers. There are a few different ways this can be done:

Wholesale Voice over IP (VoIP). There are a number of entities in the country that offer wholesale VoIP. The best vendors make this as easy as possible for the ISP, and the wholesale product usually includes all of the following:

- The VoIP provider will be a regulated CLEC (competitive local exchange carrier) and will take care of all needed regulations. In this case the ISP will not need to be certified by the state regulatory body (even though a few states would still encourage the ISP to do so).
- The VoIP provider supplies the voice switch. This is the device that makes and receives calls. For most VoIP providers today the voice switch is located in the cloud and the ISP communicates to and from the voice provider using a dedicated VPN through the normal connection to the Internet. It's also possible to a VoIP provider to place a small switch

box at the ISP that would allow local customers to talk each other inside the ISP network if the connection to the IP backbone is severed.

- The VoIP provider provides all interconnections to the world. This means that the VoIP provider will make the needed connections to 911. The VoIP provider will provide for ancillary services like operator services or calls to information. The VoIP provider will bundle in a long-distance service to place and complete long-distance calls. The VoIP provider will also make the needed connections to complete local calls within the ISP's market.
- VoIP products are generally simplified compared to traditional telephone service. For instance, a VoIP might only offer two residential products – one with no long-distance and one bundled with unlimited long distance. The VoIP provider will likely offer the most common types of telephone service used by businesses such as vanilla business lines, or trunk lines to support a key system or PBX. But VoIP providers do not usually support complex business phone systems such as the phone systems that might be used by a university or a big hospital.
- The VoIP provider will take care of functions like number portability that allow a customer to keep an existing phone number when changing to the ISP. The VoIP provider will tie into the national databases so that caller ID will identify the name of calling parties. They will also connect to databases that enable calls to 800 numbers and other similar industry routing databases.
- The VoIP provider will make sure that customers are listed in the white pages and are listed in caller ID databases.
- VoIP providers typically make it easy to integrate their product into the ISP. For example, they will provide software that can be tied into the ISPs billing system so that an order taken by a customer service rep is automatically schedule for the VoIP provider.

Resold Traditional Voice. ISPs sometimes buy traditional voice service from a nearby telephone company that is willing to sell their voice products wholesale. This might be a small regulated telco or another CLEC. These arrangements can be all-inclusive like the description above for VoIP service – but they usually are not. Each item on the above list would be negotiated and the ISP might take on some of the functions. It would be common in this case the ISP to become a regulated CLEC.

The drawbacks to the kind of arrangements is that the process is not likely automated and integrated since the seller of the voice provider probably doesn't sell enough of the service to justify spending the money to automate. This means that it will require more work from the ISP to install, change, or deactivate a telephone customer.

But there are upsides for connection to a more traditional voice switch. A traditional switch contains dozens of types of telephone lines and thousands of types of features that can be offered to business customers. VoIP providers often won't support things like Fax lines. A traditional voice switch product is often the preferred choice for ISPs that sell primarily to businesses since they can usually match any product that customers already have and want to keep.

Offering Video. There is no mature market for buying wholesale video. That makes it much more of a challenge for a new ISP to offer video. But there are still new ISPs that offer video, particular those who sell predominantly residential service to a customer base that expects video from their ISP.

Traditionally, cable TV is delivered to customers though a set of electronics the industry calls a cable TV headend. The headend performs several functions. First, it has satellite dishes that pull national programming from satellites. The headend also needs to find a way to connect to local network stations to be able to air the local channels. The headend then changes the format as needed of the signals to deliver to customers. Signals from satellites are generally compressed the signals must be decompressed and then formatted into whatever format the ISP's technology requires. The headend communicates with customers to deliver only the channels that a customer has subscribed to and wants to watch at a given time. The headend makes special connections with customers that want to buy one-time programming like wrestling matches. The headend generally communicates with a billing system to deliver the records needed to bill each customer.

We haven't heard of a new ISP that has purchased a new video headend in the last decade. The minimum cost of a headend is at least $2 million and can be a lot more depending upon the technology used to communicate with customers.

There are also other requirements that an ISP must meet to be considered as a cable company. The must register with the FCC and comply with some annual reporting requirements. They must obtain a franchise agreement in order to provide cable TV service in most towns. The process of buying programming is extremely complicated and most small ISPs join the National Cable Television Cooperative (NCTC) which buys programming for hundreds of small ISPs. It's not cheap to join the cooperative, and even if somebody joins the cooperative, they will sign a stack of programming contracts several feet tall that layers on numerous obligations due to programmers. It can take well over a year for a new ISP to negotiate contracts directly with programmers, and in doing so they generally pay the highest prices and get the most unfavorable terms. Finally, an ISP that wants to deliver video must sign a contract with each local network station that is within airwave reach of the market. This process is called the retransmission consent process.

If the ISP offers some form of traditional cable TV, the ISP will have to provide settop boxes to customers. Most ISPs charge at least $5 per month for each settop box, and since the boxes generally cost about $130, there is a decent margin if customers keep the boxes for a long enough time.

The worst thing is that after jumping through all these hoops, there is little or no margin in the cable TV product, and many small operators are losing money on video. This has convinced several small ISPs to drop the cable product.

But there are still a few ways for a new ISP to get into the video business:

> Buy Programming from a Nearby Headend. This is similar to ISPs that buy voice from a nearby telco. It's fairly common for ISPs to pay an existing headend to receive the signals from satellites for them. In the industry that function is referred to as transport.
>
> Under this arrangement, the ISP must go through all of the steps described above. They must join the cooperative or otherwise arrange to buy content. They must execute a franchise agreement in the local market and must negotiate a retransmission agreement with every local station in the region.

There is also a cost to this arrangement. An ISP must have at least a 10-gigabit data connection to the headend in order to transmit all of the programming. The ISP also might have to buy gear to remodulate the signal if they use a different customer technology than whatever is used by the headend provider.

In this arrangement and ISP is generally stuck with the same channel lineup that is carried by the headend owner. However, channel lineups don't vary a lot for small cable programmers because the programmers dictate a lot of the lineup, including channel placement.

Buy Wholesale Programming. There is a fledgling wholesale programming market developing and there are a few wholesale providers of programming. The vendors providing this service are trying to make it easier for ISPs, much like is done by the VoIP wholesalers. The cable wholesaler might obtain the need regulatory status and negotiate the cable franchise and the retransmission agreements. The obtains all of the programming and the ISP would not need to sign programming contracts or join the cooperative.

Under this arrangement the ISP will have the exact line-up offered by the wholesaler, since that vendor is the regulated cable provider. Generally, the ISP would be required to mention the wholesaler on customer bills, with something like, "Cable TV powered by X."

Offer OTT Service. This means offering an Over-the-Top video service like Sling TV or YouTube TV. There was a recent announcement that Windstream, a fairly large telco, is now offering Sling TV, Fubo TV, or YouTube TV to new customers instead of traditional TV. Customers must have a Roku stick or box to receive the service. This basically takes the ISP out of the cable business. There are no regulations to comply with. There are no programming contracts. There are no settop boxes.

The downside to this is that there is likely also little or no margins in the product. However, it does allow an ISP to offer a video product to those that want to buy everything from an ISP rather than subscribe individually.

For now, these products are not yet available to smaller ISPs and Windstream is the smallest company we've heard that offers this. However, we expect that to change and within the next year we're hopeful this could be an option for small ISPs that want to act more like large ISPs.

C. Financial Model Assumptions

Incremental Analysis

It's important to note that all of the projections were done on an incremental basis. This means that the studies only consider new revenues, new expenses, and new expected capital costs. This is the most common way that businesses of all sorts look at potential new ventures since the incremental analysis answers the question of whether any new business line will be able to generate enough revenue to cover the costs.

It's important to understand what an incremental analysis shows and does not show. An incremental analysis is basically a cash flow analysis. It looks at the money spent to launch and operate a new venture and compares those costs to the revenues that might be generated from the venture.

An incremental analysis is not the same as a prediction of what the accounting books of a new venture might look like. For example, if one of the existing ISPs in the area was to undertake one of these business plans, they would allocate some of their existing overhead costs to the new venture. The classic textbook example of this is that some of the existing cost of the general manager of the ISP would be allocated to the venture in the accounting books. However, the cost of the salary of the existing general manager is not considered in an incremental analysis since that salary is already being paid by the existing business. If these studies were to show an allocation of the general manager, then they would not be properly showing the net impact of entering the new market.

Timing

Timing is critical to any business plan. The faster that a business can start generating revenues the sooner it can cover costs. These studies are somewhat conservative in the predictions of the speed of the roll-out of the business venture. That means that if an ISP could get customers faster than predicted by the projections that they can have better results than we've shown.

All scenarios anticipate that the first customers will be added to the new networks in January of the second year after starting the project. It might be possible add some customers in the fall of the first year with careful planning and a smart construction plan.

Following are the major milestones as predicted by these forecasts:

- Financing: All of the forecasts assume that the financing is available in January 2021. This is illustrative only and could be changed to any other future date.
- Construction: Fiber construction is done during the summer and fall of the first year. Core construction of the network is done in the summer during the spring and summer after financing. In the fiber everywhere scenario construction carries through the second year.

Pricing Strategy

We assumed that the products would be as simple as possible. As the incumbent telephone company Verizon does not have simple pricing and offers hundreds of different variations of telephone products in the market. We assumed that a new business would offer only a few options. For example, for residential service we have assumed only two products - a basic telephone line and a telephone line with unlimited long distance.

There are a number of different pricing strategies used around the country by various ISPs for broadband. Following is a discussion of some of the more common models and a discussion of the pros and cons of the various approaches to pricing.

- Competition. When building broadband into a market that already has existing competition it's important to consider the prices of the competition as well as predicting how they might react to competition.

- Demographics. This asks the important question of what people are willing to pay for broadband. They residential survey showed that some portion of residents are price conscious, but that was not an overriding situation for the community as a whole. As somebody who works for a lot of ISPs, I observe that a lot of ISPs are not good at this. I regularly see ISPs that set prices too low based upon the assumption that nobody will buy – but I see other markets with higher prices and similar penetration rates.
- General Pricing Philosophy. ISPs often come to the market with predetermined notions of how prices ought to work. A pricing philosophy is often based upon the overall goals for the business and the way that an ISP thinks about business. For example, some ISPs have a goal of maximizing cash flow or of maximizing profits (not the same thing). Other ISPs are more community based and want to bring fast broadband to as many households as possible. These basic philosophies are often the driving force behind a pricing strategy.

  For examples, some ISPs believe in simplicity and only offer a few products. Other ISPs stress bundles and price accordingly. Some ISPs think that the way to sell a lot of services is by having low prices. Other ISPs think it's better to have higher prices and fewer customers. Some ISPs think it's important to the community to have a low-priced product for low-income households. Some ISPs charge the same prices to residents and businesses – others charge businesses a lot more.

Those various philosophies result in a couple of different pricing schemes that we see in the marketplace. A few key examples include:

- One Broadband Product. A few ISPs like Google Fiber, Ting, and a handful of smaller ISPs have one broadband product. They sell a gigabit of speed for a set price. Google Fiber had gone to a 2-product offering, but recently announced they are returning to the flat-rate $70 gigabit. Any ISP with this philosophy is likely not trying to capture a huge share of the market but is content to sell a high-margin product to a smaller number of homes.

- Low Basic Price. Some ISPs set the price for the basic product low. This is done more often by municipal ISPs, but there are small commercial ISPs with the same philosophy. As an example, in these markets somebody might set the price of the basic product on the fiber network as something like 50 Mbps for $40.

  CCG Consulting has access to the prices and the resulting customer counts from nearly 200 ISPs and what we have learned is that most customers will buy the basic broadband product as long as the speed is okay. A basic product set at 5 Mbps likely wouldn't sell, but in today's market a product with a decent speed like 50 Mbps will be perceived as acceptable to most households. Depending upon what we call the "steps" in pricing, a low-priced introductory product is likely to get 70% - 80% of all customers.

  The consequences to an ISP of low prices is that they likely get a higher penetration rate than an ISP with market rates, but they are also leaving a lot of money on the table. Consider the broadband rates in the market today.
  - The "basic" broadband product for a new Comcast customer that buys standalone broadband is $83. There are customers in the town that are likely grandfathered on older Comcast products with the most likely product being a 60 Mbps connection at $73. However, new customers can get a significantly lower rate through buying from the web.

As this report went to press Comcast was advertising a price of $49.99 for 200 Mbps for new customers. With the $14.00 WiFi Modem that product is priced at $63.99. Many customers repeatedly negotiate with Comcast over time for similar low rates.

- Verizon only product in Falmouth is DSL priced at $49.99 per month. Verizon typically also bills a $5 to $7 fee for use of a modem.

It's our opinion that a new ISP in the town would be competing against Comcast's "special" price, which is at $63.99. Comcast would likely widely offer that product in the town to compete against a new fiber overbuilder. We thus started our analysis with prices that start at $60, a modest discount from Comcast.

- Price Steps or Tiers. One of the key aspects of pricing other than the price of the lowest tier is the price steps between products. Consider a $60 starting broadband product and the following tiered price structures:

	Rate 1	Penetration	Rate 2	Penetration	Rate 3	Penetration
50 Mbps	$ 60.00	95%	$60.00	80%	$60.00	60%
200 Mbps	$ 90.00	4%	$75.00	15%	$70.00	30%
Gigabit	$120.00	1%	$90.00	5%	$80.00	10%
For 1,000 Customers:						
Revenue	$61,800		$64,000		$65,000	
Increase			4%		5%	

The difference in the steps or tiers is that "Rate 1" prices are set $30 between products, "Rate 2" is at $15, and "Rate 3" is at $10. The impact of smaller tiers is that it's easier to upsell customer to faster products. I derived the relative rate structure for the various tiers based upon what I've seen at various ISPs. Customers might voluntarily choose a fast product when the step between tiers is small, and they are more likely in the future to upgrade anytime they feel their speed is bogging down or inadequate. Conversely, when the steps are too large, customer buy and then stick with the lowest-priced tier rather than jump their bill too much.

It's an interesting phenomenon and to some degree is psychological. Consider in the examples above that more customers are likely to buy the gigabit product in Rate 3 for $80 than will buy the 200 Mbps product in Rate 1 for $80. Since both speeds are faster than what households likely need you might think there would be a small difference between the public reaction to the prices – but our experience is that penetration rates act much like the above tables. As a last note, the $60 base price in the above tables is still below market rate.

We have seen that multiple price tiers confuse customers. The above examples have tiers with three prices. We know of ISPs with seven to ten price tiers and in looking at their penetration rates we see that this confuses customers. We have seen the most effective rate structures having no more than four tiers, which can be explained to customers on a fiber network as fast, faster and fastest.

- Setting Business Rates. Philosophies vary widely on business rates. The incumbent telephone companies and cable companies generally charge a lot more to business than to residential customers. At one time the philosophy behind this is that businesses consume more resources

and cost more to serve than residential customers. That's still true for medium and large businesses, but most ISPs will tell you that the average home today uses considerably more bandwidth than the average small retail store. The exception might be a coffee shop supporting a public hotspot, or a business that deals in large files like photographers or engineers.

We know a few ISPs that charge the same rates to businesses and residences, although that is rare. Most ISPs follow the incumbent pricing practices but offer a decent discount from the incumbent prices.

One thing that a first-time ISP learns quickly is that incumbents don't have standard rates for businesses, but rather they negotiate them. It's not unusual to find two similar small businesses in the same neighborhood paying rates for the same products that are 50% apart. This creates a challenge for ISPs. Some ISPs set standard business rates that apply to all businesses and others set rates on a custom basis compared to what a business is currently paying.

The other thing that a new ISP learns quickly is that the large majority of businesses care more about reliability than price. They want their broadband and telephones to always work during business hours. They don't want to pay more than they can afford, but they are not afraid to pay for a quality connection. While a new fiber provider might see good appreciation for a fiber-based ISP saving them money, the chances are that they decided to change ISPs due to outages they have had in the past with their current provider – if they perceive fiber to be a more stable technology. One of CCG's clients recently did a survey of businesses in a new market and over half of them had experience a half-day or longer broadband outage during the last year. For most of them, this was the deciding factor they cited when they talked about the willingness to talk to a new network provider.

- Rate Bundles. The large cable companies are well-known for having bundles of products where they provide a discount to customers buying more than one product. Generally, customers have no idea which products the discount applies to. I would estimate that no more than 15% of the small ISPs that CCG works with provides a similar bundling discount. Most smaller ISPs set prices at rates they perceive to be competitive and don't discount them further. We know a few ISPs that built a business plan and forecasts upon straight rates and then found themselves in financial stress when a marketing person at the company decided they could sell more by offering discounts that weren't in the plan.

  Interestingly, Verizon recently announced that they are doing away with bundled rates for new customers. It will take a few years for customers with older plans to migrate to unbundled rates. Verizon describes the new rates structure as more open and honest and say that it is what customers want.

- Introductory Rates. The big telcos and cable companies are also well-known for advertising low introductory rates that increase dramatically after a term contract of one to three years. Most of the rates you'll see from these companies on the web or in advertising are the introductory rates, and the real rates of these companies are generally buried in the small print, if shown anywhere.

  Customers dislike the introductory rate process because they invariably get socked with a big unexpected rate increase when rates jump back to list prices. The time of big introductory

discounts might be starting to come to an end. AT&T decided last year to stop renegotiating customers to the low rates and when introductory offers end the company is sticking with the list rates. This has cost AT&T a few million customers on DirecTV, but the company says they'd rather have fewer customers that are profitable rather than maintain customers that don't contribute to the bottom line of the company. A few medium-sized cable companies have made this same change.

I don't know many small ISPs who have used this pricing philosophy. It requires having customers signing contracts and then ties up staff when those contracts end, and customers want to negotiate low rates again.

- Low-Income Pricing. This is covered in more detail Section I.D. of this report. Some ISPs, both giant ones and small ones offer products to low-income households. Most try to set rates to make it affordable, and most have some criteria for how customers qualify for the low rates, such as having students using the free lunch program. Most ISPs try to set the rates at a level that at least covers costs and perhaps returns a tiny margin.

Prices used in this Study

Telephone Rates

The studies used the following very simplified pricing for residential phone service:

Basic Local Line	$25.00
Line with Unlimited Long Distance	$35.00

We've assumed that both kinds of lines include a full package of features like voice mail, caller ID, etc. The above prices also include any extra fees that the incumbent telcos show separately on the bill, but which are part of the rate. These rates would not include true taxes on the service, such as the tax that supports 911.

Customers who buy the unlimited long-distance plans considered by these studies would be able to call anywhere in the country as part of their plan. Similar plans today often include Canada, Mexico, and even some other international locations.

The studies are less specific with business phone rates. The models have assumed an average monthly telephone revenue of $50 per business. There are a few larger businesses that would pay more than this, so the financial projections are conservative. It's worth noting that home businesses, including farms usually buy residential products for both broadband and telephone service.

Cable TV Products

Offering competitive cable TV in a new market is a challenge. If a small ISP offers cable at rates comparable to the incumbent, like Comcast, the product will lose a lot of money. Alternatively, an ISP in Falmouth could offer cable at a breakeven, which would likely mean rates $10 per

month, or more, higher than Comcast rates. I've elected to not put cable revenues in the financial projections for this reason.

This is not to say that an ISP might not decide to offer cable for competitive purposes in Falmouth. They might decide that it's needed to get customers. But if they offer cable at breakeven rates, doing so would not change the cash flows in the projections made for this study.

I would point out that most new ISPs do not offer cable. This goes from the largest overbuilders like Google and Ting down to new municipal broadband systems. Most smaller ISPs these days are instead helping customers find online streaming products that provide the programming that's important.

Broadband Products

The studies do not specify data speeds, but we assume that broadband over fiber will be far faster than any broadband available today in the rural areas. We have shown data speeds by 3 tiers. A typical mix of products in three tiers on fiber might be something like 100 Mbps, 250 Mbps, and 1 Gbps. The following rates match the 'Rate 2' pricing tiers discussed a few pages ago.

	Price	Percentage
Residential Fiber Broadband		
Tier 1	$ 60.00	80%
Tier 2	$ 75.00	17%
Tier 3	$ 90.00	3%
Business Fiber Broadband		
Tier 1	$ 75.00	75%
Tier 2	$ 90.00	15%
Tier 3	$105.00	10%

Most ISPs charge more to businesses for broadband, and the studies assume a $15 additive to business rates.

These would all be shared data products, meaning that the overall bandwidth to provide them is shared among multiple customers. This is not to say that the data path to a given customer is not secure, because the transmission to any specific customer is encrypted for privacy purposes. Still, there might be some business customers that will want a dedicated data product that is not shared with anyone else. The fiber network can accommodate this by providing such customers with an active ethernet connection. Prices for these services would cost a lot more than shared data services.

The financial models assume that the data products don't have data caps and provide unlimited broadband usage to customers. If there were data caps, then customers that exceeded those caps would be charged more than the basic prices. The only provider in the county today with a data

cap is CenturyLink DSL, but it's been widely reported that the company often doesn't bill for data overages.

Managed WiFi

This is a relatively new product that's been around for a few years. ISPs have found that one of the biggest problems with home broadband is due to obsolete or poorly placed WiFi routers in the home. A poor WiFi router translates to a poor broadband experience.

Many ISPs are now offering managed WiFi. This product places carrier-class WiFi routers in the home that are placed and operated by the ISP. High quality routers, and the placement of multiple routers for larger homes usually means better broadband coverage throughout a home. ISPs often assist customers when adding a new device to the wireless network. The managed WiFi routers provide a secondary benefit to an ISP because they provide a network monitoring location inside the home, meaning that the ISP is more easily able to pinpoint problems.

The studies assume a monthly rate for managed WiFi of $5.00 per customer per month for residences and $7.00 for businesses. It's further assumed that 70% of residents would buy this product and 80% of businesses.

Large Broadband Products

There are potential customers in the town that might buy larger bandwidth products. However, OpenCape is already serving many such customers. The studies are conservative and don't predict extra revenues from these kinds of opportunities. However, if fiber is built everywhere then it's likely over time that at least some such opportunities will arise.

One of the more interesting opportunities are small cell sites for wireless carriers. If there was fiber everywhere the carriers might elect to lease fiber from a new network – but there is an equal chance that they would instead build fiber instead to avoid long-term lease costs.

Network Capital Costs

The telecom industry uses the term capital costs to describe is the industry term for the cost of assets required to operate the business. The capital expenditures predicted in these models reflect the results of the engineering studies referenced in Section II.B of the report.

Below is a summary of the specific capital assets needed for each base scenario. The amount of capital investment required varies by the technology used as well as by the number of customers covered by a given scenario.

Capital for broadband networks include several broad categories of equipment including fiber cable, electronics for FTTP, huts and wireless towers, wireless electronics, and customer devices like cable settop boxes and WiFi modems. In addition to capital needed for the network, there are operational capital costs predicted in the projections for assets like furniture, buildings, computers, vehicles, tools, inventory, and capitalized software.

We have tried to be realistic, but a little conservative in our estimates, so that hopefully the actual cost of construction will be something lower than our projections. One way we were conservative was by adding a 5% construction contingency to the cost of the fiber.

However, it is important to remember that the engineering used to make these estimates is high level. The detailed engineering needed to be more precise is expensive and would involve having an engineer examine all places in the potential network to look at local construction conditions. That kind of engineering is generally not done until a project is ready for construction. Instead, the engineering was done using some field examination of the county, along with maps and other tools. We have made many such estimates over the years and we know that this level of engineering is generally good enough to assess if a project is worth further consideration.

The studies all assume that the provider of service will not build a new cable TV headend or buy a new voice switch for the provision of cable TV or telephone service. If the new provider is an ISP that already offers those products elsewhere, the assumption is that they would transport in the products over the fiber backbone. These services are widely available today on a wholesale basis.

Following is the capital required for the base case for each of the three primary scenarios. These represent the capital expended during the first 5 years, which for most projects are covered by borrowing before the business becomes cash positive.

The scenarios assumed different customer penetration rates. The base scenario assumes a 50% customer penetration rate. The capital costs would be higher or lower if there were greater or fewer customers than the penetration rates used to calculate these figures.

Fiber	$41,260,625
Fiber Drops	$ 3,722,685
Electronics	$ 7,735,306
Operational Assets	$ 1,877,055
Total	$54,595,670
Cost per Passing	$ 2,272

Customer Costs

Residential Fiber Electronics Costs: The model assumes that the hardware electronics for an ONT cost $441, including the cost of the labor for installation at the home. We've assumed the average electronics and installation for a business is $540, with the difference being higher labor costs. In the projections it was assumed that the installation would be done by external contractors. It might be less expensive to do installations using existing company personnel or local contractors who can install at a lower cost.

We've assumed that the service provider will supply a WiFi router for customers that want one. We've assumed these routers cost $110.

Fiber Drops: Fiber drops are the fiber that connects from the street to the customer premises. In this study the cost of fiber drops is significant. The assumption has been made that with the volume of drops

needed plus the anticipated speed of network deployment the drops during the first four years of the project would be installed by external contractors.

Drop costs vary according to the length of the drop. The fiber drops in the town are mostly relatively short with a significant number of homes close to the street. We sampled the average lengths of drops by sampling neighborhoods using Google Earth. The cost for an aerial drop for residences is estimated to cost $275 while buried drops are estimated to cost $378. The cost for an aerial drop for businesses is estimated to cost $380 while buried drops are estimated to cost $586. Most of the cost of providing drops is labor. These represent our best estimate of costs using external contractors for the labor.

The drops are the one portion of the fiber network where an ISP might be able to save some cost compared to our study. For example, an ISP might be able to assemble their own construction team to build drops for less our estimate. An ISP might also be able to find a local contractor that will build the drops for less.

Customer Penetration Rates

One of the most important variables in the study is the customer penetration rate, or the percentage of the homes and businesses in the community that will buy broadband service.

The analysis looks at customer penetration rates in several different ways. The base scenario begins with what we call expected rates. We started the analysis using a conservative customer penetration rate of 50%. The residential survey predicted that the long-term residential penetration rate might be as high as 61%, but we always want to start our analysis at something more conservative.

We also looked at higher and lower penetration rates to understand the impact of the penetration rate on cash flow. Finally, as will be discussed below, we calculated a “breakeven” penetration rate which represents the smallest number of the customers the business would have to win in order to maintain a business that would have a positive cash flow.

Expense Assumptions

As a reminder, unless otherwise noted, all scenarios are created from the perspective of a small ISP offering the services. There is one scenario that compares small ISPs to a municipal ISP. The assumptions listed below are for the small ISP scenarios.

The following assumptions also assume that the same ISP owns the network and operates the business – be that the town or a commercial ISP.

Expense Assumptions

Expenses are the recurring costs of operating the business once it’s built. We strive when building financial projections to be conservatively high with expense estimates. It’s often less costly for an existing service provider to add a new market than what is shown in these projections.

As mentioned earlier, expenses are estimated on an incremental basis, meaning that the models only consider new expenses that would be needed to open the new market for an ISP. In an incremental

analysis it's assumed, for example, that the existing ISP is already paying for positions like a general manager, an accountant, etc. and that the ISP only needs to hire employees needed to open a new market and add additional customers. The incremental expenses for a newly formed ISP would be higher than for an existing ISP coming to the new market.

The primary expense assumptions are as follows:

Employees: Labor is generally one of the largest expenses of operating a broadband network. The models assume that an ISP will need to hire additional staff to take care of the new customers. We have assumed salaries at market rates with an annual 2.5% inflation increase for all positions.

There is a difference in the cost of supporting employees depending upon if the employees are hired by the town or hired by a commercial ISP. Employees of a town generally incur higher costs for employee benefits since government employees typically are earning a pension. We express this in financial analysis by developing a loading factor that covers payroll taxes and other taxes like workers' compensation, as well as employee benefits.

Theoretically, government employees ought to be paid less to make up for the difference in salaries, but for broadband technical positions we don't generally see much salary difference between the two types of employers. We've assumed that the salary loading factor for a municipal employee is 60% while the loading factor for employees of a commercial ISP is 38%on top of the basic annual salary. Some ISPs pay union wages, and if we knew for certain that we were studying an ISP, then the salary loading is generally a little less than the municipal loading factor.

As stated earlier, these models are incremental and only consider the new employees that would need to be hired. An existing ISP that is already selling in other markets would likely add the following employees:

Customer Service Representative. Takes new orders, answers customer questions about billing, services, etc. Often serves as the first level technical support.

At a 50% customer penetration the business grows to a little over 12,000 customers. We've assumed that the business would need about 9 customer service representatives by the time the business reaches maturity.

Install/Repair Technician. These technicians maintain the network and respond to customer trouble calls. The technicians also maintain network electronics and facilities as well as customer electronics. We've assumed that by the time the business reaches maturity that the business would have 9 Install/Repair Technicians.

Inside Technician. This technician maintains the core network electronics, oversees the connection to the Internet, and monitors customer installations. In a new market of this size we're assuming that an ISP would add one new inside technicians.

Salesperson. A market of this size would require at least one full time salesperson. Selling to businesses can only be accomplished with door-to-door consultative sales. Some ISPs would put additional salespeople in the market initially to jumpstart sales.

If the town started an ISP or a new commercial or non-profit ISP was created to serve the town then other new positions would be created. An existing ISP would likely cover these functions using existing staff. The additional positions include:

General Manager. This would be the person in charge of executing the business plan. Most existing ISPs would not hire a new ISP just for a market the size of Falmouth, but a new ISP has no choice but to hire a GM.

Marketing Analyst. This person would be in charge of developing a local marketing strategy and overseeing residential sales.

Billing Specialist. This position oversees the billing and cash collection process.

There are additional positions that an ISP might staff. For example, somebody needs to keep the books. If the local government was to become an ISP, then it would likely handle accounting, payroll, human resources and other similar backoffice functions.

The studies assume that construction contractors will build the fiber network. We've also assumed that customer installations will be outsourced during the construction process and for the first few years thereafter. Once the bulk of customers has been added the forecasts assume that future installations will be done by company technicians.

Start-Up Costs: To be conservative, the analysis includes start-up costs. There are expenses associated with launching a new business or new market and rather than list them all specifically we have included them as start-up costs. There are start-up costs even for an existing ISP when entering a new market. We've assumed the start-up costs are $210,000.

Sales and Marketing Expenses: Every scenario requires a significantly high customer penetration rate to be successful. We used the assumption that there would be a marketing effort to sign customers (instead of the word-of-mouth that often happens in rural markets). It would be too risky to spend the money to build a network without knowing for sure that there are enough interested customers to allow the business to pay for itself. We've assumed over $700,000 in marketing expenses during the first four years. It's possible that marketing money could be spent earlier than what we're showing in the forecasts.

Delivery of Products: The projections assume that the new business will not construct a headend to provide the services. It's likely that any ISP tackling the town is likely already buying and providing these products to customers.

The studies assume that a wholesale basic telephone line can be purchased wholesale at $6.00 per month. A line with unlimited long distance is assumed to be $9.00. These are conservatively high costs and lower-cost alternatives are available.

Maintenance Expenses: There are a number of routine maintenance expenses that the new business would incur on an incremental basis. These include:

- Vehicle expenses to maintain the vehicles required for the field technicians.
- Computer expenses to support the computers used by employees.
- Tools and equipment expenses.
- Power expenses to provide power to the network.
- General maintenance and repair of the outside plant network and the electronics to repair damaged or nonfunctional electronics.
- Internet Backbone. This is the cost to communicate with the Internet. The expense consists of transport (leasing fiber to connect the town to an Internet POP), and bandwidth.
- ISP Function / Help Desk. We've assumed that the ISP will outsource these functions – most small ISPs do. This fee covers a wide array of services. The fee covers network monitoring where technicians are ready 24/7 to respond to troubles or network outages. The fee includes security features such as protecting the network against spam and denial-of-service attacks. The fee covers basic ISP functions such as routing data traffic to and from the Internet (called the DNS function). The fee includes the help desk function, which is the function of assisting customers with broadband and network issues. The models assume a monthly cost of $4 per customer. This function could be provided by ISP employees, in which case this cost would cover new employees, or this function could be outsourced. This fee does not provide company voice mail, and most small ISPs do not offer white labeled voice mail.

Software Maintenance: Triple-play providers maintain a complex software system called BSS/OSS (billing and operational support systems). This software provides a wide range of functions: order taking, provisioning new customers, tracking of customer equipment, tracking of inventory, creation of customer bills, tracking of customer payments (or nonpayment). Since most such software is billed to providers on a per-customer basis we have assumed an expense for this maintenance.

Billing: Billing costs are shown as the incremental cost used to bill customers. We assumed that there would be some mix of mailing paper bills, of charging bills to credit cards, and of charging bills directly as debits to bank accounts.

Taxes: The model assumes that a commercial ISP that operates the business will pay state and federal income taxes. These taxes would not apply if this was operated as a municipal business or as a nonprofit.

We have assumed no property taxes on assets, but it's possible that some amount of this might apply. There are a few places in the country that charge property taxes on fiber networks, but most of the country doesn't. The issue of charging or not charging is usually county specific.

The forecasts do not include any taxes that are assessed to customers. For example, this business would be expected to charge and collect various telephone taxes. These kinds of fees are normally added to the customer bill, and thus customers directly pay these taxes. The models don't show these taxes and the assumption is that the taxes would be collected and sent to the tax

authorities on the customers' behalf. They are not shown as revenue or expense to the forecasts, but rather are just a pass-through.

Overhead Expenses: The forecasts include various overhead expenses. These include new expenses like legal, accounting audit expenses, consulting expenses, business insurance, and other similar expenses that are directly related to entering a new market. Since we are looking at incremental expenses, we have not shown an allocation of expenses from existing corporate or overhead employees.

Depreciation and Amortization Expense: The forecasts include both depreciation and amortization expense. These are the expenses recognized by writing off assets over their expected accounting lives. For example, the depreciation rate for a vehicle is 20% per year (is written off over 5 years). The cost of a new vehicle is then depreciated monthly to write off the asset over the 5 years, or 60 months. All hard assets are depreciated except land. Depreciation rates are set according to the expected life of the assets—something that is usually determined to comply with IRS rules and also accounting standard practices. Soft assets like software are instead amortized, using the same process as depreciation.

D. Financial Model Results

It is never easy to summarize the results of complicated business plans to make them understandable to the non-financial layperson. In the following summary are some key results of each study scenario that we think best allows a comparison of the numbers between scenarios. These summaries look at the amount of cash generated over the life of the plan.

The way to measure profitability in a new business is going to differ according to the structure of the business. A municipal business, for example, generally measures success by the ability of the business to generate enough cash to operate without any external subsidy. While for-profit business would generally use something like net income to measure profits.

It is important that a business always has cash in the bank to meet its obligations. In this particular business plan the ideal situation would be to always have at least $300,000 in the bank to have a cushion against nonlinear monthly expenditures. Not all expenditures are spent evenly throughout the year and a business must maintain a cash cushion to allow for those times of the year when the expenses are higher than normal or when the revenues are lower than normal.

Following are the results of the various scenarios. Note that a table of all of the financial results is included in Exhibit II. That Exhibit makes it easier to compare different scenarios.

Why the Projections Are Conservative

We always try to make our business plans conservative. By conservative, we mean that an actual business plan ought to perform a little better than we are projecting. Following are some of the conservative assumptions used in the business plan:

- The models contain no "home run" revenues. These would be sales of larger broadband products such as selling bandwidth to the local schools. We know that every fiber business gets some of

this kind of revenue, but we took the conservative approach of not showing it because we can't guess how much and when such opportunities might occur. We try to avoid predicting such revenues since it's possible they will never materialize.

- The engineering estimates include an 8% contingency on the fiber everywhere scenario and 5% contingency on the other two scenarios. We think the estimates of construction costs are solid and this contingency might not be needed.
- If the network is constructed by "edging out" from existing telcos, there could be some savings for ISPs in the cost of building fiber.
- In the model, we show an increase in the cost of wholesale bandwidth over time. However, industry costs for raw data might be less than we are projecting and might even drop over time.
- Our model assumes a regular replacement of electronics. However, it is possible that upgrades will be needed less often than we have shown. Further, our assumption is that the cost of electronics at the time of each upgrade would cost as much as the equipment that is being retired. The experience of the electronics industry is that electronics get cheaper and more efficient over time, so the cost of upgrades is probably going to be less than is shown in the model. The vendors in the industry have also gotten better at having phased upgrades that allow for keeping older equipment in place and not having to replace everything at once, making upgrades less expensive than we have projected.
- There are steps that the new business could take to improve upon these projections.
    - Preselling: We've seen service providers that are able to get earlier revenues when they presell to customers. This gives them the opportunity to begin connecting the network to the homes of presold customers while the network is being built. This would allow customers to be turned on in "nodes" or neighborhood-by-neighborhood as construction to specific parts of the county was completed.
    - More Concentrated Build Schedule: It's always possible to build faster than shown in these forecasts if the ISP is able to execute on a faster construction schedule. The amount of network that can be built in a given time period increases by adding more construction crews.
    - Get Temporary Help: There are often other bottlenecks at small companies that can slow down customer installations. This could mean the need for more sales and marketing staff, additional customer service reps, or inside technicians needed to provision new customers. Service providers should strongly consider using temporary employees during the roll-out of a major new market.

One Retail Operator

As a reminder from above, here are the basic assumptions included in the following scenarios:

- All of the above assumptions for revenues and costs are used in the models.
- Fiber is built to pass every home and business in the town.

A summary of all financial results is included in Exhibit II. The following is a summary of financial results for the four primary options studied. The first two columns look at the town (or some other local entity like the EDIC) being the ISP and consider general obligation (GO) bonds and revenue bonds. The final two column looks instead at a commercial ISP serving the community – the third column is a new ISP formed to serve in Falmouth and the last column shows an existing ISP adding Falmouth as a new market.

	Town as the ISP			
	GO Bond	Revenue Bond	New ISP	Existing ISP
Asset Costs	$54.64 M	$54.64 M	$54.64 M	$54.60 M
Equity	$ 0.00 M	$ 0.00 M	$ 7.85 M	$ 7.59 M
Debt	$62.90 M	$69.40 M	$52.35 M	$50.63 M
Total Financing	$62.90 M	$69.40 M	$60.20 M	$58.22 M
Cash after 20 Years	$13.20 M	$ 5.91 M	$10.65 M	$16.31 M

The above results show how different ISP models and different types of financing affect the financial performance. Here are important things to understand about each financing option.

- Bond financing borrows all of the money at the start of a project. That means the project starts accruing significant interest expense from the first day of borrowing. Since fiber project projects are not likely to reach a cash breakeven position for 3 to 5 years, using bond funding for a fiber project requires pre-borrowing the interest payments for at least the first three years. This is the primary reason why the amount of borrowing for bonds is greater than for a bank loan for the identical project.
- Revenue bonds generally have additional fees referred to generically as surety. In the studies we have included a Debt Service Reserve Fund (DSRF) in the revenue bond scenario that borrows an extra amount equal to a year of debt payment that serves as a safety net for the bondholders in case the project is ever unable to meet debt obligations.
- In today's market, bond interest rates are generally less expensive than bank interest rates, but that historically has not always been the case. In the studies we've assumed that general obligation bonds would be for 25 years with an interest rate of 3.5%. General obligation bonds have been assumed for 25 years at 3.25%. Bank loans are assumed at 20 years at a 4.5% interest rate. All these rates can vary widely depending upon who is doing the borrowing, and the assumed rates are current market rates for borrowers with a good credit rating.
- The last two columns above show the same project funded by bank loans. One of the biggest issues with using ban loans is that banks are not as likely to give a long repayment term like 25 years. Many banks are leery about lending for more than 12 to 15 years – which doesn't align well with fiber projects.
- Bank financing also almost always requires cash equity – meaning the borrower must bring some cash to a project. The above examples assume that the bank requires that 15% of the cost of the project is funded with borrower cash. In the examples above, a borrower would need more than $7 million in equity, and there are not many small or regional ISPs that could provide that much cash. The requirement for equity is the number one issue that makes it hard for commercial ISPs to grow quickly or to tackle projects the size of Falmouth.

Here is what can be learned by the number table above:

- It looks feasible for a fiber business to be financially successful in Falmouth – assuming it can achieve the 50% market penetration assumed in the above numbers.
- The extra borrowing required for revenue bonds make for a bigger challenge, from a financial basis, than general obligation bonds. There are often political challenges using general obligation bonds – but from a dollar perspective GO bonds make it easier for a fiber project to succeed.
- As mentioned above, the biggest drawback for bank financing is bringing the needed equity to the project. Note that grant money can act as equity, but it seems highly unlikely that a project in Falmouth could attract over $7 million in grants in the current environment.

- While commercial bank financing means smaller loans, the loans are likely to incur higher interest rates and shorter loan terms, which together can equalize the impact of bank versus bond financing.

Sensitivity Analysis with Revenue Bond Financing

The study then considered what we call a sensitivity analysis. We looked at the impact of changing the key variables and assumptions that have the biggest impact on the bottom line of a fiber project. The following describes the impact of changing key variables for the scenario of financing with revenue bonds (the second column in the table above). We could create a similar description of the impact of changing the variables for each of the options in the table above – but the impact of most of these changes is similar regardless of the specific business model. For example, the impact of changing prices is the same regardless of the way a project is funded.

Changing Customer Penetration Rate

The base analysis considered a penetration rate of 50%. We also looked at increasing the penetration to 55% and 60%. The impact of changing penetration rates high or lower by 5% was a change in cash over 20 years of $13.45 million. This means that the impact to the business of a 1% change in penetration rate (from 50% to 51%) is almost $2.7 million. We would describe the fiber business plan in Falmouth as being extremely sensitive to the customer penetration rate. This means that it will be vital to understand customer demand before launching the business. This also means that it would be prudent to pre-sell to as many customers as possible before launching the business.

Changing Broadband Prices

We looked at a scenario that changed broadband prices. Increasing broadband prices by $5 per month (changing a rate from $60 to $65) changed cash flow over 20 years by $11.2 million. Decreasing rates by $5 lowered cash over 20 years by $10.9 million. This means that a $1 change in broadband prices changes 20-year cash flow by approximately $2.2 million. This is also a high sensitivity. The cautionary tale about this finding is that an ISP must be careful after launch to stick to target prices. If a future decision is made to cut rates to be more competitive, the impact on the bottom line could be huge.

We also looked at the impact of increasing rates over time. The base study assumes there is never an increase in broadband rates. That is a conservative assumption, and we know markets where there are multiple providers where the rates have never been increased – no competitor wants to be the first to raise rates. However, the big cable companies like Comcast are under a lot of pressure from Wall Street to keep raising rates. Comcast has gotten guidance from analysts that they ought to have a target base broadband rate of $90. That doesn't mean the company will raise rates that much, but we've now seen rate increases for several years in a row and having annual broadband rate increases might become the norm

We assumed a very conservative rate increase. We raised rates by 5% every fifth year. This means the effective rate increase is less than 1% per year – far below the likely rate of inflation. This rate increase means that the starting broadband price of $60 today would still be less than $70 in twenty years.

The impact of raising the rates is large and increases cash flow over 20 years by $12.9 million. While it might seem like a no-brainer to assume the rate increase in a business model, there is no way to know today that competition might lead to a long period in the market where rates might not increase. Alternatively, Comcast could decide to raise the rates in the market the same as everywhere else, and a local ISP might be able to mimic rate increases and generate a lot more than the extra $12.9 million.

Changing Financing Terms

We looked at the impact of changing the various financing parameters.

Interest Rate. We looked at a scenario that changed the interest rate by 50 basis points, or 0.5 % (such as changing the interest rate from 3.5% to 4.0%). This changed cash flow by $6.1 million over 20 years.

This equates to a warning that anybody planning a new fiber network during a time of financial uncertainty must keep a close eye on interest rates and be ready to not proceed with financing if interest rates move too high. We've been lucky for the last decade that interest rates have held steady for years at a time, but over history it's more normal for interest rates to fluctuate.

Loan Term. We looked at the impact of increasing the loan term from 25 years to 30 years. This had a dramatic impact and increased cash over 20 years by almost $14.7 million. This provides a great incentive to consider the longest loan maturity that can be achieved. Longer loans mean lower annual debt payments (just like with a home mortgage). Bonds can always be repaid earlier if that becomes a goal, but the longer the loan term, the smaller the annual required debt payments.

We looked at the feasibility of shortening the loan to 20 years and we couldn't find a way to make this work. The payments on a 20-year revenue bond are higher than can be supported by the cash flow of the business.

Adding 5% to the Construction Contingency

We examined the impact of changing the cost of the network. In this case, we chose to change the cost of fiber by 5%, or more than $1.6 million This changed cash over 20 years by $2.4 million. To put that into perspective, changing the cost of the network by $1 million changes cash flow over 20 years by over $1.4 million.

The Additive Nature of the Variables

The impacts citied for the various variables are somewhat additive. For example, the above discussion describes an improvement to cash generated by the business from finding a lower interest rate on debt than shown in the models and for spending less on the network. These improvements are roughly additive, meaning that you can add the results above together and will come close to the impact of making both changes to the models.

It's impossible at this early stage of considering the feasibility of building fiber to know the exact market conditions that might be in place should the town move forward and build this network. Interest rates a few years from now might be higher or lower than we've assumed. The town might decide that you can charge a higher rate than is assumed in the models. You might go out for construction bids and find that you can build the network for less than assumed in these models. If all of those positive changes occur, then the business could do significantly better than any of the scenarios shown in the summary in Exhibit II. But these changes might just as easily go the other way. The biggest unknown is probably interest rates, and there have been a number of times during my career when interest rates were far higher than what we see today and what are in these models.

Public-Private Partnership (PPP)

There are numerous ways to structure a public-private partnership where the town and a commercial ISP work together to fund and bring broadband to the market.

A town that wants a fiber network only has a few choices:

- The town can fund the network and become the ISP. We've shown above how these scenarios work.
- The town can try to attract an ISP to invest in and operate a fiber network. We've also shown this scenario above. There are only a handful of examples of ISPs coming to larger cities using their own funding. Google Fiber invested in fiber in Kansas City, Austin, Texas, and parts of the research triangle in North Carolina. However, it appears that Google Fiber has abandoned this model as too expensive and is no longer funding the construction of networks in cities. This study shows that the cost of the network needed to bring fiber to Falmouth costs over $54 million. There are few, and perhaps no ISPs who are willing and able to make an investment of that magnitude to build fiber in the town. Nationwide, we don't see few ISPs making that level of investment in a single community.
- The third option is for a town to invest in a fiber network and invite a quality ISP to operate the network. In this sort of PPP, a municipality has to make a major investment in fiber. Most municipalities don't want to be an ISP, and so they often look for an operating partner. There are a handful of partnerships that have been formed where the municipal partner brought most of the financing. Google Fiber has entered into this type of partnership in West Des Moines, Iowa and Huntsville, Alabama. Ting has entered this type of arrangement in Charlottesville, Virginia, and other markets.

Following is an example of this kind of partnership in Falmouth. There are numerous other ways that the partnerships could be structured, but all other scenarios would be a different version of the numbers below. The partnership below assumes a penetration rate of 55%. That illustrates one of the biggest downsides of partnerships – the fiber business must perform well enough to be financially attractive to both partners (and good enough to feel safe to the municipal partner).

	ISP Partner	Falmouth
Customer Revenues	192,738,492	
Cost of Goods Sold	(7,461,975)	
Operating Expenses	(66,135,267)	
Interest Expense	(3,827,740)	(24,547,664)

Income Taxes	(8,214,770)	0
Margin	107,098,741	(24,547,664)
Equity	1,305,000	
Assets	(22,362,989)	(46,647,794)
Loans	8,700,000	52,000,000
Loan Repayment	(8,700,000)	(37,243,935)
Net Change in A/R & A/P	(304,843)	(250,802)
Cash Generated	85,735,905	(56,690,195)
Lease of the Network	(61,352,598)	61,352,598
Cash Return	24,383,310	4,662,403

Here are the specific assumptions behind the above partnership:

- This partnership builds the same fiber network as other scenarios we studied and brings fiber to every home and business.
- These numbers represent the cumulate cost for each line item over 20 years.
- The town would finance, build, and own the fiber network and the fiber drops and would finance the project with general obligation bonds.
- The ISP partner pays for all electronics and installation costs.
- The ISP partner operates the business including maintaining the fiber network. All employees work for the ISP and the town has no fiber employees.
- All revenues go to the ISP.
- The ISP covers all operating expenses.
- The ISP needs a loan to cover the cost of assets.
- The ISP pays a sizable lease to the town. This lease covers all financing costs for the town needed to cover debt payments and in the above example the lease also returns a small profit to the town over time.

There are numerous variations on this partnership, but none are drastically different than the table above. Changing the partnership assumptions would move dollars between the two columns above. Following are some of the ways that the partnership could differ:

- The town might pay for the core electronics, which would increase the investment for the town and decrease the borrowing for the ISP partner.
- The town could hire a few technicians and maintain the fiber network instead of letting the ISP maintain the network.
- The town could pay for all of the assets.
- The ISP could finance the fiber drops.
- There could be more or less profit sharing with the town.

None of these changes would make a drastic change to the table above. In all likely partnership scenarios, the town is likely going to have to fund the fiber network, which is the big dollar item. All scenarios would still require a large lease payment between the two parties to cover the cost of the network.

There are a few issues to consider in creating this kind of partnership:

- Negotiating the lease between the two parties is the hardest part of the arrangement. No town wants to get lease payments lower than their annual debt payments. No ISP wants to have an arrangement that would make them pay a lease payment that is higher than the cash generated by the business. One of the two parties generally has to compromise to make a PPP work, because the business generally doesn't generate enough cash in the first five years to make both parties whole. There is also always that chance that the business will underperform – and in that case cash shortages could be permanent for both partners.
- To get a bank loan a partner is likely still going to need to provide equity. In this expel we assumed equity of $1.3 million.
- One of the biggest hurdles in finding a partner is finding one that want to remain in the partnership for the length of the financing – in this case 25 year. A lot of ISPs today have a goal to sell and realize the accumulated value of their businesses, and so the challenge of finding a commercial partner is increased if you only want partners that are likely to still be operating the business decades from the start. It's not hard to envision a partnership where an ISP sells, and the purchasing partner doesn't want to maintain the partnership relationship. If a town owns that network and not the customers, this could be a problem. It's also not hard envisioning a partner selling to an ISP the town doesn't like.

Open Access

The open access operating model is discussed in Section III.A. of the report. In this model, the town would build, own, and operate a fiber network and would sell wholesale connections to multiple ISPs which would sell retail services to customers.

There are a lot of difference in the open access model versus the partnership model above. Following are the primary assumptions for the open access network:

- The town would finance, build, own, and operate the fiber network and the fiber drops and would finance the project with general obligation bonds. This means the town would need to have several technicians to take care of the fiber network.
- The town would pay for core electronics. In the scenario shown below, the ISPs would pay for the customer electronics, although in some open access networks that is also the responsibility of the network owner.
- The various ISPs compete against each other for sales to customers. The ISPs each cover their own cost of sales and operations.
- All retail revenues go to the ISPs.
- The ISP buy "fiber loops." In the example below, this rate is set at $30 per month, meaning an ISP would pay that rate for each customer they connect to the fiber network. The example below also assumes that connections to apartment buildings would be set at a lower rate. This differs significantly from a lease in that ISPs only pay for customers that are connected to the network. This means revenues to the town are low for the first few years until a customer base is built up.
- There are a few dozen open access networks around the country, and each of these shares a few common characteristics:

- The retail prices charged by the ISPs are higher than what would likely be charged if the town owned and operated the business. In the example below, broadband rates are set $65 for the lowest-price option. Rates might be even higher than this.
- Open access networks almost never get as many customers as a single ISP would get which owned and operated the network. In the example below, we assumed the overall penetration rate for all of the ISPs is 45%. Penetration rates are lower for several reasons.
  - The ISPs are not liable for the debt on the network and are not driven to push for enough customers to make the business work. ISPs really aren't bothered in the town that owns the network loses money.
  - The small ISPs that get onto open access network generally are not well funded and tend to not be able to afford a robust marketing program.
  - To some degree, every customer on an open access network returns a positive margin to the ISPs, and so a given ISP might be happy with some lower number of customers.
  - ISPs on an open access network always "cherry-pick." They rarely will sell to customers that buy only the lowest-price fiber product and nothing else. That alone might eliminate 5% to 10% of the market as potential customers.

Following is an example of an open access network. For convenience, all of the ISPs are lumped together.

	ISPs	Falmouth
Customer Revenues	168,055,264	
Cost of Goods Sold	(6,132,567)	
Operating Expenses	(52,377,217)	(11,325,610)
Interest Expense	(2,429,829)	(24,736,492)
Income Taxes	(7,367,927)	0
Margin	99,747,723	(36,062,102)
Equity	828,750	
Assets	(18,332,647)	(49,293,226)
Loans	5,525,000	52,400,000
Loan Repayment	(5,525,000)	(37,530,427)
Net Change in A/R & A/P	(249,044)	(193,406)
Cash Generated	81,994,782	(70,679,161)
ISP Loop Fees	(61,396,088)	61,396,088
Cash Return	20,598,693	(9,283,072)

This scenario shows the ISPs collectively making money and the town / owner losing money. This example is pretty typical for the open access networks in place around the country today. Many of these businesses generate enough cash to cover operating expenses, as does the example above. But the open access model still loses money every year, and a town that builds an open access network will likely have to somehow subsidize the debt payments each year. We don't know of any open access network that covers the full cost of the business including covering debt. A number of the open access networks

in the country have been built by municipalities that also operate municipal electric companies. Some of these cities knew the business would need to be subsidized but decided that broadband was needed badly enough to build the network anyway. Many such networks are located in rural counties.

There is no way that I know of to turn the above analysis positive. If the town raises the ISP loop fee, the ISP passes this on in the form of higher rates to customers – and that generally results in fewer customers on the network. If the town lowers the loop rate to get more customers, there is not enough revenues generated due to the lower loop rate. This is a market model that doesn't seem solvable.

What Conclusions Can We Draw from the Financial Results?

There are a number of conclusions we can draw from the results of the business plan analysis:

It is Feasible to Operate a Profitable ISP in the Town. We undertook our analysis starting at a 50% market penetration to be conservative. The residential survey suggest that the long-term penetration rate might be as high as 61%, and at the number of customers the business looks to be profitable. There are profitable scenarios even at a 50% penetration rate, although you might hesitate to get into the business if that is the expectation of long-term performance.

It is possible for a business with a 50% penetration rate to lose money if the some of the key parameters work against you. For example, if interest rates are higher at the time of financing the project the cash flows would be a lot tighter. It might feel necessary to cut rates if the ISP business encountered a competitor that wanted to compete with lower rates. The best news there is that the big ISPs don't seem to do that anywhere, so it's not likely, for example, that Comcast would undercut your rates. They are more likely to match your rates.

Perhaps the key finding associated with profitability is the breakeven penetration rate. This represents the number of customers needed to create a business that should always remain cash positive. With bond funding the breakeven was calculated at a 48% penetration rate. With bank financing the breakeven drops to a 42% penetration rate.

The Method of Financing Matters. It's easier to make the fiber work if a new network is financed with general obligation bonds instead of revenue bonds – but very few towns want to take on new debt that is backed by taxes.

Hard for a Private ISP to Fund. There are few private ISPs that would be able to raise the cash needed to build a fiber network in the town. The cost of the needed assets is over $54 million and there are almost no fiber overbuilders in the country that are making this kind of investment anywhere in a single market. If an ISP had that kind of funding, there are other cities that would have a lower cost of network than Falmouth. Falmouth covers a large geographic footprint, and while there are parts of the town with sufficient housing density, there are plenty of places within the town with lower densities.

The biggest problem for most commercial ISPs is that they'd have to bring significant equity to get this project financed. If an ISP had to bring the somewhat standard 15% equity to raise funding, that means an ISP would need to have over $7 million in free cash – there are few ISPs that carry free cash since most constantly reinvest in existing networks.

The Business is Sensitive to a Few Key Variables. All of the scenarios are sensitive to changes in a few key variables:

- Penetration Rate. The most important variable is customer penetration rate. Our starting analysis was at a 50% penetration rate to be conservative. Our analysis shows that changing the penetration rate by 1% will change cash flow over 20 years by $1.8 million. While this demonstrates improved cash flow from doing better than expected, this means a significant risk from underperforming on the planned customer penetration rate. Not getting enough customers is probably the number one problem for new ISPs.
- Broadband Prices, The financial results are also highly sensitive to broadband prices. The studies all used an assumed starting price of $60 for the basic broadband product. Changing broadband prices higher or lower by $1 changes long-term cash flow over 20 years by 1.5 million.
- Rate Increases. The base models assume no rate increases to be conservative. It's possible in a competitive market that rate increases could be slim or even not happen. However, if competitors like Comcast continue to raise rates, then there is a huge upside in cash flow if this fiber business can raise rates. Raising rates by less than 1% per year increases cash flow over 20 years by $8.9 million. Unfortunately, there is no way to safely build those increases into projections.
- Interest Rate. The business plan scenarios are sensitive to changes in interest rates. A change of 50 basis points (changing interest rate from 3.5% to 4%) will change the cash flow in a bond-financed project by $6.1 million over 20 years. The impact on a bank-financed project is smaller, but still significant at $2.26 million over 20 years. While we've had a long period of over a decade where interest rates have remained steady, in a time of economic uncertainty it will be vital to keep an eye on interest rates.
- Loan Term. Increasing the length of loans by five years would provide a major benefit to financing fiber. With bond financing, changing from 25-year bonds to 30-year bonds would improve cash flow over 20 years by $10.9 million. With bank financing, changing from 20 years to 25 years improves cash flow by $10.4 million over 20 years.
- Changing Capital Costs. The impact of changing the amount of capital needed for a project has a much smaller impact than other variables. With bond financing, changing capital costs by $1 million changes cash flow over 20 years by $1.4 billion. With bank financing the impact of changing capital costs by $1 million is a little less than $1 million.

It is essential before deciding to get into the business to pin down these key variables. Changes in any of these variables will affect the long-term earnings potential for a given scenario. The impacts of changes of the variables are also largely additive. For example, the improvements that might be achieved through raising the rates or lowering the interest rate on debt can be added together if both variables change in a real business plan.

Public Private Partnerships Can Work. Since there are scenarios that would be profitable for a single service provider, then there are scenarios that will support public-private partnerships. The most likely partnerships are still going to require the town to make a significant investment in a fiber network.

Open Access Does Not Look Feasible. We could not find an open access scenario that was profitable for the town. This scenario does look to be profitable for ISPs that would operate on the network.

IV. Other Issues

A. Funding for Broadband Networks

For a large percentage of broadband projects, the biggest challenge is finding the funding. This section of the report looks at the various ways that other communities have been able to fund broadband networks. If a community wants fiber badly enough, there probably is a way to pay for it.

There are a number of different financing option to consider. Below we look at the following:

- Private Financing (loans)
- Private Funders of Fiber Networks
- Federal Loans
- Public Financing
- Grants
  - Federal Programs
  - State Programs
- Loan Guarantees
- Opportunity Zones and New Market Tax Credits
- Customer Financed
- Public Private Partnerships
- Other Sources of Financing

Private Financing Options

When commercial ISPS build networks, they have to rely on traditional private financing, meaning loans. Following are the key elements that determine the cost of bank financing:

> **Equity**: Most forms of private financing require some equity. Equity means that the borrower brings some sort of cash or cash equivalent to the business as part of the financing package. The amount of equity required will vary according to the perceived risk of the venture by the lender. The higher the risk, the more equity required.
>
> Equity can take a number of different forms:
>
> - Cash: Cash is the preferred kind of equity and lenders like to see cash infused into a new business that can't be taken back out or that doesn't earn interest.
> - Preferred Equity: For a stock organization (like an LLC or other type of corporation) the business can issue some form of preferred stock that then acts as equity. Preferred equity usually gets some sort of interest rate return, but the payments are not usually guaranteed like they are for bank loans. If the business gets into a cash crunch, they must pay bank loans and other forms of debt before they pay preferred equity interest.
> - Assets: It's possible to contribute assets as equity. For example, a new fiber venture might be seeded by having one of the partners contribute an existing fiber route or other valuable asset to the business. In such a case the contributed asset often has to be assigned a market value by an independent appraiser.

- Non-recourse Cash: Non-recourse cash means accepting a contribution to the business that is not guaranteed to be paid back. To give an example, in Sibley and Renville counties, a fiber business was launched in the form of a cooperative. The local government provided an economic development bond to the business as a non-recourse loan. This means that the new fiber business will make their best effort to make the bond payments, but if they are short of cash then the government entities that issued the bonds would have to make the bond payments. The banks involved in that project looked at the contributions from the bonds to be the same as equity.

Bank Loans: The banking industry as a whole does not like to finance long-term infrastructure projects. This is the primary reason why the country has such an infrastructure deficit. Fifty or more years ago, banks would fund things like power plants, electric and water systems, telephone networks, and other long-term revenue-generating assets. But various changes in banking laws have required banks to maintain larger cash reserves which makes them less willing to make long-term loans. Banks have also increased their expectations over time to want to earn higher interest rates. Many attribute this to the fact that giant publicly traded banks have captured most of the banking market. Banks don't like long-term loans since the interest rates get locked in for many years, possibly depriving the banks from earning more on their own equity.

Most banks prefer not to make loans with a term much longer than 12–15 years, and many telecom projects can't generate enough cash in that time period to repay the loans.

There are exceptions. A few of the large banks like Key Bank and Bank of America have divisions that will make bank loans to municipal ventures that look a lot like bonds. These loans will have long payment terms of 20 years or more and reasonable interest rates. However, most of these loans go for things like power generation plants and other projects that have a strong guaranteed revenue stream. These banks have done a tiny handful of telecom projects, but they view most broadband projects to be too risky.

Banks are also averse to start-ups and prefer to make loans to existing businesses that already have a proven revenue stream. It's extremely hard for a first-time borrower to be able to borrow the kind of money needed to build a telecom project.

There is one unique banking resource available to companies who want to build fiber projects. This is CoBank, a boutique bank and a cooperative. This bank has financed hundreds of telecom projects, mostly for independent telephone companies and for electric cooperatives. CoBank is a relatively small bank and has strict requirements for financing a project. They are leery of start-ups and we can't think of a start-up they have financed recently. They also expect significant equity to be infused into a new venture. They tend to have somewhat high interest rates and somewhat short loan terms of 10–12 years.

Cooperatives also have another bank that lends only to cooperatives. This is RTFC (Rural Telephone Financing Cooperative) that is owned by cooperatives.

One interesting source of bank financing is local banks. Historically local banks were the source in many communities for car and home loans. But over the last few decades those loan portfolios have migrated to other lenders and local banks have been struggling for a decade to find

worthwhile projects in their regions. We know of many commercial projects for small telcos that have been financed by local banks.

The biggest challenge of borrowing from a local bank is that they typically have a relatively small lending limit. Most local banks won't make an individual loan for more than a few million dollars. That obviously doesn't go far in a fiber project. However, local banks have become adept at working in consortiums of multiple banks to make larger loans. This spreads the risk of any one loan across many banks. A banking consortium usually begins with a local bank in the area of the project, with the local bank taking the role of finding other banking partners and of servicing the loan. This approach requires a lot of extra effort from a local bank, but the approach has been used to finance good telecom projects.

Collateral. The biggest issue that banks have in lending to broadband projects is the lack of collateral, which is the assets they inherit if the project should fail. Banks like hard collateral like buildings, vehicles, shared of stock, and things they know they can readily sell for a reasonable price. Banks don't like broadband networks as collateral, because even a little bit of web searching shows them that networks are sometimes sold for pennies on the dollar.

It is important understand the importance of collateral. Communities often ask an ISP operating nearby to come build fiber in their town. What they generally fail to realize is that the ISP likely had to pledge their entire business as collateral in order to secure the loan to finance a new market – meaning that if the new venture fails they can lose the whole business.

Return on Bank Equity. Banks don't only consider the interest rate when making loans. A bank concentrates on its return on equity and will consider a combination of factors like interest rates, up front and monthly loan fees, the likelihood that a borrower will pay a loan off early or default on a loan, etc. A bank will look at a dozen financial parameters before making an offer of interest rate and term – all based up their analysis of return on bank equity. There is a misperception that interest rates are negotiable, but the same project offered to multiple banks is likely to get a nearly identical financing package offered by all of the banks.

Private Funders of Fiber Networks

There are a few fiber projects around the country that have been funded by private equity. This is still a relatively new phenomenon. Here are a few examples:

SiFi Networks.[19] This venture is headquartered in Morristown, NJ. SiFi has financed and built a fiber optic network in Fullerton, CA. This is a city with 54,000 passings. This is an open access network, meaning there will be multiple ISPs. For now, the two ISPs are Ting (an ISP headquartered in Canada) and GigabitNow (an ISP from Seattle). SiFi networks is currently working on funding projects in Salem MA, East Harford CT, and Saratoga Springs NY.

[19] https://sifinetworks.com/corporate/fibercity/

Netly.[20] Netly is located in Solano Beach, CA, and has built a fiber network in that city. The company is now considering additional cities. They want to fund, build, and operate open access networks, allowing multiple ISPs to use the network.

Federal Loans

The only federal loan program for broadband is operated by the Rural Utility Service (RUS), which is part of the Department of Agriculture. Unfortunately, this agency only makes loans, grants or loan guarantees for communities smaller than 20,000 people. Even was that limitation changed, there are numerous restrictions on RUS loans and we've never seen a loan given to a municipality.

Public Financing Options

The two primary mechanisms used for public financing are revenue bonds and general obligation bonds. There are some major benefits of using bond financing. First, the term of the bond can match the expected life of the assets and it is not unusual to find bonds for fiber projects that stretch out for 25 or 30 years. It's also possible to finance a project completely with bonds, meaning that no cash or equity is needed. The primary historic source of public money used to finance telecom projects is through the issuance of municipal tax-exempt bonds, meaning the buyers of the bonds don't have to pay federal and/or state income taxes on the revenue from the bonds.

Revenue Bonds: Most of the municipal fiber networks that have been built have been financed through revenue bonds. Revenue bonds are backed by the revenues and the assets of the fiber network and the associated business. With a pure revenue bond, a local government would not have to repay the bonds if the project fails. With that said, having a bond default is a financial black eye that might make it hard for a community to finance future projects. So, to some degree, most governments feel obligated to pay back revenue bonds, since there is a big cost for not doing so.

It has gotten harder to finance broadband projects with pure revenue bonds due to some failures on the part of other municipal networks. Among these are Monticello, MN; Crawfordsville, IN; and Alameda, CA. These kinds of failures have made investors leery about buying bonds that are only backed by the business. This reluctance has made financing with revenue bonds more expensive.

The cost of a bond issue cannot be judged only by the interest paid. In fact, the other financing costs of bonds can outweigh the interest rate in the effect on the bottom-line cost of repaying a bond issue. Because of market reluctance to buy revenue bonds, they often have higher interest rates than general obligation bonds, but they also can incur the following costs:

Debt Service Reserve Fund (DSRF): Many revenue bonds require borrowing additional funds to be kept in escrow as a hedge against missing future payments. The DSRF is often set to equal a year's worth of principle and interest payments. This money is put into escrow and is not available to operate the business.

[20] https://www.netlyfiber.com/

Capitalized Interest: Bonds begin accruing interest from the day the money is borrowed. Since fiber businesses take a number of years to generate enough cash to make bond payments, the bondholders require capitalized interest that is used to make the interest payments for up to the first five years of the project. Basically, the project must borrow the amounts needed to make debt payments which can add a significant amount to the size of the bond issue.

Bond Insurance: Bond insurance is an up-front fee paid to an insurance company that will then pay one year of bond payments to bond holders in case of a default. We've seen bonds issued that have required both a debt service reserve fund and bond insurance.

For a number of years now the interest rates charged to bonds have been lower than the interest rate on commercial loans. But that has not always historically been the case. The difference between bond interest rates and commercial interest rates both change over time; that difference is referred to in the industry as the "spread." Sometimes the spread favors bonds and at other times it favors commercial borrowing. In our financial analysis we assumed that the interest rates are lower on bonds. Interest rates are also not the same for all kinds of bonds. For instance, the interest rate for revenue bonds can be considerably higher than general obligation bonds due to the perceived higher risk.

General Obligation Bonds (GO Bonds): If revenue bonds aren't an option, then the next typical alternative is general obligation bonds. General obligation bonds are backed by the tax revenues of the entity issuing the bonds. This backing can be in the form of various government revenues such as sales taxes, property taxes, or the general coffers of a government doing the borrowing.

What these pledges mean is that if the broadband project fails and can't make the bond payments, then the backing, the pledge revenue source such as property or sales tax, would have to be used to make the bond payments.

Many states require a referendum to approve general obligation bonds. Most states have a few exceptions for things like economic development bonds that don't require a referendum, but local government sometimes hold a referendum anyway just to make sure the public supports the initiative being financed.

There are other financing mechanisms that have been used by other municipalities to fund revenue-generating projects. These include:

Variable Rate Demand Obligations (VRDOs): VRDOs are a bond where the principal is paid in a lump sum at maturity. However, the borrower has the right to repay the bonds in whole or in part at any time (upon an agreed-upon notice). VRDOs are effective in circumstances when the borrower wants to match the repayment of the bonds to a revenue stream that varies year to year or a revenue stream that can vary from initial estimates and changes over time. In the case of the new telecommunications system, this type of financing provides the flexibility to make bond payments that match the actual revenues received. If revenues are slower than anticipated, principal payments do not need to be made. If revenues come in faster than anticipated, repayment of the bonds can be accelerated without penalty. We can recall having only ever seen

this used once for a municipal telecom system by the city of Alameda, California. This kind of financing is used fairly routinely for other kinds of municipal needs.

VRDOs are most commonly structured as 7-day floating rate bonds. Interest rates are reset each week, and this adds a lot of risk to this type of financing. Unlike fixed-rate bonds, the borrower doesn't know what the interest rate will be on the VRDOs over the life of the issue. Interest rates on VRDOs are on the short end of the yield curve and have therefore historically been lower than interest rates on fixed-rate bonds even with the additional ongoing costs for a liquidity provider and a remarketing agent. There is typically a maximum rate stated which the VRDOs cannot exceed. But in a market where there is a significant increase in overall interest rates this kind of financing could end up being significantly more expensive.

Capital Appreciation (Zero Coupon) Bonds (CABs): CABs are bonds that are issued at a deep discount and which do not bear any stated interest rate. Like a Series E savings bond, CABs are bought at a price that implies a stated return calculated on a basis of the bond being payable at par at maturity. With no stated interest rate there is no interest paid until maturity, at which time all of the compounded accreted interest is paid. With no interest payments required in the beginning years of the bonds, this would enhance the cash flow in the beginning years of the business.

CABs do, however, have several drawbacks over other types of available financing. First, the interest rates on CABs are typically higher than both the fixed-rate and VRDOs. Second, investors prefer not to have a prepayment option on CABs, which limits the flexibility of the government to call the bonds early if revenue collections are better than anticipated or if a restructuring of the debt is needed. This structure is used frequently for various government borrowings, but we've not ever heard of this being used for telecom—although there is no reason why it could not be used.

Grants

It's hard imagining the construction of fiber networks in rural areas without some grant support. This is particular true in these counties, which have rougher terrain and other issues that add to the cost of building fiber compared to many other parts of the country.

Federal Broadband Grants: The current federal broadband grant initiatives all fund fiber in places with little or no broadband connectivity. Unfortunately, we don't see any of the current round of grants applying to Falmouth (or to any other cities that are already served by a large cable company). The current grants include:

Rural Digital Opportunity Fund Grant (RDOF). The FCC has created a massive $20 billion grant program that will be awarded in 2020 and 2021 for rural locations with little or no existing broadband.

ReConnect Grants.[21] In the 2017 Farm Bill, Congress created a grant program called ReConnect. The program awarded $200 million in grants, $200 million in loans, and $200 million in a

[21] https://www.usda.gov/reconnect

combination of grants and loans in 2019. Congress reauthorized an additional $600 million to be awarded in 2020. These grants are administered and awarded by the US Department of Agriculture.

Community Connect Grants.[22] This program specifically targets the poorest parts of the country and ones with little or no existing broadband. This program awarded $34 million in 2018 and $30 million in 2019. Grant awards for the program are generally between $100,000 and $3 million and require at least a 15% matching from the grant recipient.

BroadbandUSA Program.[23] This program is part of the Department of Commerce's National Telecommunications and Information Administration (NTIA). The agency provides an annual database of grants that can sometimes be used for broadband (and are often used for other purposes). Examples include the Appalachian Regional Commission and the Community Development Block Grant (CDBG) Program. We've seen communities be creative in using such grants to fund at least some small portion of a broadband initiative. Every mile of fiber funded through one of these alternative initiatives is one less mile of fiber needed for a whole-city build. For example, we've seen grants provided for things like:

- Building fiber to schools and libraries to replaced expensive leased fiber.
- We've seen a fiber component in smart energy initiatives like smart-grid and smart lighting.
- We've seen public safety grants used to fund fiber to critical public safety locations like sheriff stations, 911 centers, public safety radio towers, firehouses and other first responders, etc.
- We've seen grants awarded for extending broadband to public housing.
- We're starting to see the placement of conduit for fiber included in state and federal grant funding for federal and state highways.

State Grant Programs

The State of Massachusetts has a broadband program operated by the Massachusetts Broadband Institute. (MBI)[24] The Commonwealth created MBI in 2008 as a division within the Massachusetts Technology Collaborative to coordinate state efforts to expand broadband in unserved and underserved parts of the state. MBI works closely with the Executive Office of Housing and Economic Development (EOHED)[25] to coordinate funding ventures, and the Public Safety Broadband Office[26] to coordinate public safety efforts. MBI maintains a document, the Last Mile Program Policy, which acts as the State's broadband policy.

MBI administers two grant programs.

[22] https://www.rd.usda.gov/programs-services/community-connect-grants
[23] https://www.broadbandusa.ntia.doc.gov/new-fund-search
[24] https://broadband.masstech.org/
[25] https://www.mass.gov/orgs/executive-office-of-housing-and-economic-development
[26] https://www.mass.gov/orgs/massachusetts-public-safety-broadband-office

Last Mile Grants[27] This grant program is aimed at 44 specific communities in Western Massachusetts to build broadband infrastructure. These grants can also find additional grant money for engineering and related services through the Last Mile Infrastructure Grant program administered by the EOHED.

Broadband Extension Grant Program.[28] For now this program is only available to communities in Western and North Central Massachusetts. It provides grants to municipalities to expand broadband networks when the coverage of a cable provider is less than 96% of the community.

For now, these grant programs do not provide benefits to Cape Cod. However, it's still worth investigating these efforts and lobbying local politicians to extend the programs to your area.

Loan Guarantees.

Another way to help finance broadband projects is through federal loan guarantees. A loan guarantee is just what it sounds like. Some state or federal agency will provide a loan guarantee, which is very much like getting a co-signer on a personal loan. These programs guarantee to make the payments in the case of a default and thus greatly lower the risk for a lending bank. In return for the lower risk, a bank is required to offer a significantly lower interest rate.

These guarantees are not free. There is an application process to get a loan guarantee in much the same manner as applying for a bank loan or a grant, meaning lots of paperwork. And then the agency making the guarantee will generally want a fee equal to several interest "points" up front. To some extent, this process works like insurance and the agency keeps these fees to cover some of the cost of defaults. If they issue enough loan guarantees, then the up-front fees can cover eventual losses if the default rates are low. These points are a payment to the agency for issuing the guarantee and are not refundable.

There are several federal agencies that might be willing to make loan guarantees for telecom projects. The following agencies are worth considering:

HUD 108 Program: The Department of Housing and Urban Development has a loan and loan guarantee program that is allotted for economic development. There is both federal money under this program as well as money from this program given to the state to administer. While these loans and loan guarantees generally are housing related, the agency has made loan guarantees for other economic development projects that can be shown to benefit low- or moderate-income households. If enough of a fiber project can be said to benefit low-income residents, then these loans can theoretically be used for some portion of a fiber project.

Small Business Administration 504 Loan Program: This program by the SBA provides loans or loan guarantees to small start-up businesses. These loans or loan guarantees must be made in conjunction with a bank, with the bank providing some loan funds directly and with the SBA loaning or guaranteeing up to 50% of the total loan. This program would only be possibly

[27] https://broadband.masstech.org/last-mile-programs/program-unserved-towns

[28] https://broadband.masstech.org/last-mile-programs/program-partially-served-cable-towns

available if a small business (an ISP) ended up funding the network. There are dollar limits on the size of these loans and this funding would not be nearly enough to fund a fiber network – but it could be one source of funding for a start-up community-based ISP that could be used to fund during the start-up phase of launching a fiber business.

There are other federal loan guarantees that benefit only rural areas or only a specific region of the country like Appalachia, and such programs would not be available in Falmouth.

Opportunity Zones

Congress created a new tax opportunity as part of the 2017 Tax Cuts and Jobs Act. The Act created Opportunity Zones in which investors can get special capital gains treatment and other tax breaks for investing in qualified infrastructure within an opportunity zone. Each state governor then designated specific opportunity zones.

Qualified investments made inside that area can get special tax treatment. The first benefit is that taxes can be deferred from past investments if the gains are invested inside of an opportunity zone. For example, if an investor had a capital gain from the sale of a property, they could invest those gains and not pay taxes on the gains now, but have those gains deferred until as long as 2047. Investors have until 2026 to make such investments.

An investor also gets tax forgiveness on new investments made inside the opportunity zones if that investment is held for at least 10 years. Most of the opportunity zones include sizable areas of low-income residents and a qualified investment must meet a test of benefitting that community in some significant way. A fiber optic network that will bring broadband to all of the homes in an opportunity zone should meet that test – there are lot of demonstrable benefits of fiber.

Most opportunity zone investments are being made from special funds created for that purpose, although a high-wealth individual could also make an investment.

Opportunity zone financing is most attractive when combined across multiple projects. For example, somebody might be interested in making an opportunity zone investment in a fiber network is that was coupled with some other opportunity investment in the same neighborhoods. This might be low-income housing, green energy production, or some other project that has a clear benefit to the local community.

The town has an opportunity zone in the east end of town, defined by Census tract 25001014500.[29] This Census tract covers a population of about 5,650. There is a fuller description of how an opportunity zone investment might be used in a fiber project at the end of this section of the report.

New Market Tax Credits

The New Markets Tax Credit (NMTC) Program was established in 2000 as part of the Community Tax Relief Act of 2000. The goal of the program is to spur revitalization efforts of low-income and impoverished communities across the United States and Territories. New market tax credits are normally used to fund only a small portion of a project.

[29] Map at: https://esrimedia.maps.arcgis.com/apps/View/index.html?appid=77f3cad12b6c4bffb816332544f04542

Eligibility of the town to use these funds would depend upon meeting an earnings test, and it's likely that the town would not be eligible for these investments. However, this would be worth checking with a specialist working with NMTC.

The NMTC Program works by giving big tax credits to investors that are willing to invest in infrastructure projects in qualifying communities. The tax credits are so lucrative that often the other terms for accepting the funding are modest. The tax credit equals 39% of the investment paid out—5% in each of the first 3 years, then 6% in the final 4 years, for a total of 39%.

The Community Development Financial Institutions (CDFI) Fund and the Department of the Treasury administer the program. The process of how the Treasury allots credits is a complicated one and we won't cover it, but in essence, there are entities around the country each year that are awarded tax credits and these entities work as brokers to allot the credits to specific project. The credits are often purchased by the large national banks or other firms that invest in infrastructure.

Generally, in practice, these funds act like a mix of loans and credits to the recipient. For instance, a community that received these funds might have to pay some modest amount of interest during the 7 years of the tax credit, and at the end would have a balloon payment for the principal. However, in some cases even some or all of the principal will be excused, making this look almost like a grant.

Because the entities that get the tax credits change each year, and because applications are made to the entities that hold the credits, the process for applying for this money is somewhat fluid and changes from year to year. However, there are entities and consultants who help find New Market Tax Credits and who can help you through the maze of requirements.

Customer Financing

When neither an ISP nor municipality can finance a project, we've seen citizens to step up and agree to somehow fund directly some or all of a broadband project. There are several examples of places where this has been done in the country:

Property (or Other Kind of Tax) Revenues. It is possible to obtain some or all of the cost of a broadband network through a pledge of future tax revenues. That pledge can then support a bond. This is different than most bonds for a broadband network where the network would be secured by revenues of the broadband venture. But a pledge of some other kind of tax revenue is one of the easiest ways to get a bond. There are some real examples of this kind of financing:

- Lyndon Township, Michigan: This is a township of about 1,000 homes that voted to raise property taxes to fund to build a fiber network. The township then partnered with a local broadband cooperative to provide services. The project is a win/win for citizens. Property taxes increased about $25 per month per household. The township provides free access to the network to the cooperative which is charging about $25 for broadband – making the total cost of getting broadband about $50 per month. This is an area that had no broadband before the project.
- UTOPIA, Utah: UTOPIA is a consortium of a number of small towns in Utah that banded together to get fiber. Each town has pledged property tax revenues to fund part of the cost of the network.

- Cook County, Minnesota: Cook County funded about half of their fiber network using a federal grant awarded from the Stimulus funding program in 2008. The county held a referendum and used a sales tax increase to pay for the matching funds needed to build the project.

Direct Customer Contributions: It's also possible to pay for some of a broadband project through direct contribution of possible customers. This has never been done on a large scale because it would be exceedingly difficult to get a lot of residents to agree to write a check to fund a network. But there are some examples to consider:

- Contribution to Aid in Construction: Most utilities have a program where they will agree to extend their network to customers if those customers agree to pay the cost of the connection. We are aware in the broadband area of numerous cases where small pockets of rural home raised the needed money to get connected to a nearby broadband network.
- Ammon, Idaho: This is the only municipal attempt at funding a network in this way. The City of Ammon will connect customers to a fiber network if they will contribute $3,500 up-front to cover the cost of construction.

Public Private Partnerships

A public private partnership (PPP) is formed when a government entity and commercial entity fund a project together. There is no one model for a PPP and such an arrangement can be structured in many different ways. The main benefit of a PPP is that the commercial operator of a project benefits by getting some bond financing from the municipal partner. This allows the business to blend the benefits of bond and commercial financing and is one of the ways that makes it easier to get through the first few years of the project.

The general benefits of bond financing are what makes public money attractive to a commercial partner—low interest rates, long repayment term, and small or no payments for the first few years. But the downside is that there are more overall financing costs and in the long run a bond makes a project cost more in terms of cash. The safety of a bond in the first few years, though, can be very attractive.

Combining Public and Private Financing. There are benefits to combining the two kinds of financing:

- Banks will often consider the financing that comes with bonds as the equivalent of equity, meaning that the commercial partner will not require as much, or even no, cash equity.
- In terms of the amount borrowed, the two methods work well together if construction loans are used to cover the construction and bond financing is used for the longer-term financing costs.
- Combining the two methods works to produce a payment term that is longer than a traditional commercial loan.
- Combining the two methods also usually means lower debt payment during the first few critical years while the network is being built.
- One banking issue must be resolved when combining public and private financing. When there are multiple lenders to a project, one of the lenders must be given the "first lien position," meaning that payments to them take priority over other loans. It would not be unusual for a bank loan and a bond issue to both want the first lien position. In our experience this dilemma is most often solved by having the municipal bonds take a second lien position, meaning that the municipal bond payments must be secured by something other than the revenues of the project.

- There is also likely to be wrangling between the parties for collateral. As mentioned elsewhere, a physical fiber network makes for poor collateral, but each lender is still going to want to latch on to whatever collateral they can grab. The most covered collateral is customer revenues, which almost always would go to the lender with the first lien position.

Following are two examples of this type of PPP, both from Minnesota:

- RS Fiber: RS Fiber is a new broadband cooperative that was formed in Renville and Sibley counties. The project was funded from various sources including a loan for 25% of the project supplied by a bond backed by the cities and counties involved in the project. The Cooperative raised the other money with a combination of bank loans and grants.
- Swift County: The county government there contributed a significant percentage of the cost needed to construct a broadband network in the county. The bond proceeds were loaned to Federated Telephone Cooperative and are expected to be paid back over time. However, the county loans took second lien position behind commercial loans.

Other Sources of Financing

Vendor Financing. Vendor financing for electronics was huge during the telecom boom in the late 1990s. Several vendors would finance the purchase and installation costs for electronics for fiber networks. The primary benefit of vendor financing is no payments for a few years while the network is being constructed and customers are being added. Such financing worked best when combined with other kinds of commercial financing. We've heard of several cases of vendor financing in the past year, mostly from some of the lesser-known vendors in the industry.

Loans from Individuals: We've seen broadband projects where 5% - 10% of a project has been funded through loans from individuals in the community. This is a well-known method when constructing fiber networks in a farming community where farmers kick-in a part of the cost of building the network. Such loans usually take last place in payment priority behind any commercial lenders. Banks love such loans because they are direct evidence of community buy-in of the network. Such loans would generally have a simplified loan contract with simple loan covenants. Money borrowed in this manner generally avoids the fees associated with commercial or municipal financing.

Loans / Grants from Non-Profits. We know of several communities that have gotten substantial loans and grants from major non-profits or trusts. These have typically been non-profits located in the communities that see the public benefits of broadband.

Comparing Financing Options

Comparing Bond and Bank Financing

Benefits of Bond Financing: There are several major benefits for using bond financing:

- The term of the bond can match the expected life of the assets and it is not unusual to find bonds for fiber projects that stretch out for 25 to 30 years. It's difficult to finance a commercial loan longer than 15 years and most loans are shorter. The longer the length of the loan, the lower the annual bond payments.

- Bonds can be used to 100% finance a project, meaning there is no need for cash or equity to fund the new business. Lack of cash equity is generally the requirement that creates a challenge for traditional commercial financing.
- Bonds often, but not always, have lower interest rates than commercial debt. The interest rate is dependent upon several factors including the credit worthiness (bond rating) of the borrower as well as the perceived risk of the project.
- It's generally easier to sell bonds than to raise commercial money from banks. Sometimes bonds require a referendum, but once bonds are approved there is generally a ready market for buying the bonds and raising the needed funds.

Benefits of Commercial Financing: There are also a few benefits for commercial financing.

- Generally, the amount that must be borrowed from commercial financing is lower, sometimes significantly lower. This is due to several issues associated with bond financing. Bond financing often contains the following extra costs that are not included with commercial loans:
  - Surety: Bonds often require a pledge of surety to protect against default of the bonds. The two most common kinds of surety are the use of a debt service reserve fund and bond insurance. A debt service reserve fund (DSRF) borrows some amount of money, perhaps the equivalent of one year of bond payments and puts it into escrow for the term of the bond. They money just sits there to be used to help make bond payments should the project have trouble making the payments. Bond insurance works the same way, and a borrower will pre-pay and insurance policy at the beginning of the bond that will cover some defined amount of payments in case of a default.
  - Capitalized Interest: Bonds typically borrow the interest payments to cover bond payments for some period of time, up to five years.
- Construction Loans: Another reason that commercial financing results in smaller debt is through the use of construction financing. A commercial loan will forward the cash needed each month as construction is done, and interest is not paid on funds until those funds have been used. However, bonds borrow all of the money on day one and begin accruing interest expense on the full amount borrowed on day one. Construction loans also means that a borrower will only draw loans they need while bond financing is often padded with a construction contingency in case the project costs more than expected.
- Deferred Payment: Commercial financing can be structured so that there are no debt payments due for the first year or two. This contrasts with bonds that generally expect interest payments to be paid immediately after borrowing. Since fiber projects can take several years to reach a cash breakeven, it's typical for a bond to pre-borrow the interest payments for the first few years (known as capitalized interest).
- Retirement of Debt: It's generally easy to retire commercial debt, which might be done in order to pay a project off early or to refinance the debt. This contrasts to bonds that often require that the original borrowing be held for a fixed number of years before it can be retired or refinanced.

Funding Strategy for This Project

The RFP asks us to discuss a funding strategy based upon the following questions:

- Stakeholder or potential third-party contributors.

- Grant funding options.
- Millage funding options (municipal bonds).
- Establishing a public-private partnership if viable.
- Capital, revenue bond, and municipal self-funding options.
- Provide suggestions on funding sources for the infrastructure buildout.
- Based on estimated user fees, describe a sustainable debt repayment method.

The town has three possible options for funding a broadband solution:

- Attracting an ISP to Invest in the town.
- Public-private partnerships
- Locally financed network.

Attracting an ISP. This study quantified the cost of building a fiber network everywhere in Falmouth. There are not many ISPs in the country that are able to make an investment of the size needed to build fiber everywhere. Most of the ISPs in the region do not have the financial wherewithal to make an investment of that size. This is not to say that it is impossible to attract and ISP and there are other cities that have attracted ISPs to make the needed investments.

The best way we know of to find a potential ISP partner is by issuing an RFI looking for a partner. That RFI could contain a summary of the key findings of this study including the cost of building fiber in the cities and a discussion of the potential returns for an ISP. We have seen well over one hundred such RFPs in recent years and most RFIs have gotten no serious responses from ISPs – but some do, and some cities have found ISP partners in this manner. The more typical response you'll get will be from ISPs offering to operate the network if the town builds the network.

Public-Private Partnerships (PPP). A public-private partnership is going to require a significant local financial commitment since you'll still have to pay for most of the cost of building a network. The three most common forms of PPP are:

- The town builds everything and you find a partner to operate the ISP business.
- The town builds the fiber network to the point of reaching customers and an ISP partner covers costs inside the home. The ISP partner in this situation would typically operate the business.
- The town builds the fiber network and an ISP partner builds the drops and provides the electronics needed to provide service.

Each of these options still requires a significant local investment since building the fiber network is the biggest cost for bringing fiber to the communities. The options for funding a fiber network are the same as described in the next option below.

Municipality Builds and Operates the Network. In this option the municipality has to cover all of the costs of the business. That includes the cost of building the network, the operating costs for launching and running the ISP, and the debt costs incurred to finance the network.

Cities which have built fiber networks have mostly funded the networks with municipal bonds – and there are good reasons for doing so:

- Municipal bonds are the only form of financing that allows for borrowing 100% of the costs of building a network, including borrowing to make the interest payments, at the beginning of a project.
- While cities are allowed to borrow from banks, most cities are not willing or able to meet the terms required by banks. Banks also have little experience in lending to cities since most such lending is done through municipal bonds.
- Banks are somewhat put off by the public nature of everything to do with financing a municipal project. Banks require non-disclosures from most borrowers and are not comfortable with public disclosure laws.
- Perhaps the biggest reason is that banks rarely make loans for the long payment terms needed to support a broadband business. Most banks loans are under ten years in duration. We've seen bank infrastructure loans with terms as long as twenty years, but that's relatively rare.

This is not to say that bank loans are impossible, but it would be a highly challenging process to tackle for the size of the borrowing needed to this project. This makes the most likely path for financing a fiber project to be municipal bonds.

The biggest decision to make when using bond is the surety. This means the revenue stream that is used to guarantee the bonds. There are a number of ways that other communities have guaranteed bond payments:

- General Tax Revenues. The most common kind of surety for bonds is general tax revenues. Should a bond backed by tax revenues ever get into trouble, a town would be obligated to raise taxes to cover the shortfall. This would normally be negotiated up-front with the sale of the bonds and the pledge revenues could be property taxes, sales taxes, or any other kind of tax revenue that is under the town's control and that could be increased to cover bond payments.
- Revenue Bonds. A revenue bond would pledge the revenues from the fiber project to cover bond payments. Should the business underperform, the bondholders have to accept the lower payments. Many such bonds would let the bondholders seize the property in the case of a default, which would mean they would take over the fiber network and business. However, since most bonds are sold to "coupon-pinchers," meaning small private investors, it's exceedingly hard for a group of bondholders to agree on that sort of takeover. Every town funding fiber hopes to get revenue bonds, but there we don't think that a pure revenue bond is an option for cities any longer, due to several defaults on revenue bonds for broadband networks. Some of the failures include Alameda, California, Crawfordsville, Indiana, and Monticello, Minnesota.
- Quasi-Revenue Bonds. Most municipal fiber networks have been funding with bonds that straddle both revenue and general obligation bonds. Such projects first pledge all of the revenues from the fiber business to the bondholders. But bondholders don't feel safe with just the fiber business revenue pledge and ask for more surety. This primary form of extra surety used is the creation of a debt service reserve fund (DSRF). This generally means that the municipality borrows (or puts into escrow from general funds) a deposit equal to one-year of debt payments. Should the project ever get into trouble, the bondholders can take bond payments from the DSRF. The municipal borrower is then required to replenish the DSRF.

  Municipalities like this process a lot more than a pure revenue bond. For example, if a revenue bond pledges property tax revenues, then the town is obligated to raise property taxes, with zero recourse. However, a town generally has total flexibility in deciding how to replenish the DSRF. They could do so from cash reserves, or they could find the needed revenue from any other

source including raising taxes. Just as a footnote to keep in mind, it would be an extraordinary circumstance if the fiber business can't cover most of the debt payments in a year, so normally a call on a DSRF fund would be some amount smaller than the whole balance of the DSRF.

There are other ways that cities have raised the funds needed to build fiber:

- Homeowner Pledge of Property Taxes. There have been some small communities where homeowners agreed to an increase in property taxes directly used to pay for a fiber network. One example is Lyndon Township in Michigan where homeowners voted to raise property taxes for twenty years to finance the network. The benefit to citizens is that the township was then able to drastically lower the cost of broadband, which is sold for $25 per month. The township still had to issue a municipal bond, but those payments are made from the increased property taxes and none of the revenues from the fiber business are used to pay for debt. There have been a number of communities that have tried to duplicate this concept but that have failed to pass a referendum approving the increased property taxes.
- Pledges of Sales Tax. Cook County, Minnesota paid for about one-fourth of their fiber network through an increase in sales taxes. The sales taxes were increased by a penny, and that revenue goes directly towards covering a portion of the bond payments.
- Homeowner House Equity. Utopia is a network in Utah that covers more than a dozen smaller communities. The business got started by asking homeowners in a community to allow for a lien against each home in the community. These liens provided the surety for the municipal bonds. The fiber business revenues were still expected to cover debt payments. But if the project were ever unable to cover debt payments then the bondholders could have called the homeowner liens and gotten payments from each homeowner in the community. This was a cumbersome process and took a long time to organize. In more recent years as the business has grown, Utopia has refinanced to a more normal debt structure.
- Homeowner Contributions. The City of Ammon, Idaho requires any homeowner that wants to be connected to the network to pay $3,500. The city is willing to accept the payments over time. These payments significantly reduce the amount of network that needs to be financed in some more traditional manner.

  There are some drawbacks to the financing method. Neighborhoods only get fiber when enough homeowners have made the contribution. Some neighborhoods are not meeting the needed funding threshold. Of more significance, homes that can't afford the payment are locked out from buying fiber. It seems somewhat odd for a municipality to be supporting a financing mechanism that discriminates against the poorest people in the community – most cities have the opposite goal, which is to make fiber available to everybody.
- Municipal Self-Funding. The only municipal network we can think of that was totally self-funded is North Kansas City, Kansas. This small town, surrounded by Kansas City, was able to fund a fiber network by using revenues from two riverboat casinos moored in the city. Those revenues, by law, could only be used by the city for making infrastructure investments.

  However, many cities that build fiber networks contribute some cash towards the project. This is particularly common for cities that operate an electric utility that might be sitting on cash reserves. Cities generally 'lend' the cash internally to the fiber project and expect the money to eventually be paid back to reserves. Such loans can be set at a low interest rate to match whatever the funds might have been earnings from investments. Any cash that can reduce bond

payments is generally a major benefit to a fiber project since it lowers annual debt payments and reduces the risk of failure.

Thinking Outside the Box. We're seeing today that some of the communities getting fiber networks are only doing so by thinking outside the box. Following are a few ideas that are worth considering as non-standard ways to finance a fiber network.

- Direct Tax Funding. One of the more interesting ways to pay for a fiber network is by directly paying for some of all of the network directly with taxes. There are a few examples of this for existing municipal fiber initiatives. Cook County Minnesota funded about 25% of a countywide fiber project through an increase in sales taxes.

  Another example is with Lyndon Township in Michigan. The township passed a referendum to pay for the entire fiber network through an increase in property taxes. This means that the fiber business does not have to contribute to debt.

  The concept behind this kind of financing is that everybody in the community contributes to a fiber network, which is a benefit to the community even for households that don't buy broadband. There are a number of benefits from the fiber network not having to cover all debt costs:
  - Broadband prices could be reduced, which makes broadband affordable to more homes. In the extreme case, if tax revenues fund the whole network then broadband prices could be set far below market rates – it might be possible to have something like a $30 gigabit product.
  - Broadband prices could be set at market, and a fiber business could turn into a new source of revenue for the community from the profits derived from selling broadband.
  - In a town like Falmouth, having a fiber network might distinguish you from other tourist towns. This could drive up property values (and property tax revenues) that would help to pay for a network. A new fiber network could also draw more people to visit Falmouth.
  - Fiber broadband might entice more people to live permanently in Falmouth. It seems likely that a lot more professionals will be working from home even after the end of the pandemic.

  This kind of funding can be made to work if voters can see a broadband benefit that equals or exceeds the increased tax burden.

- Raising Local Start-up Funding. Mansfield Community Fiber is a new fiber initiative that is currently in the process of building networks in over 20 rural towns in Vermont. The company got initial funding by soliciting funds from the community. They sold membership "shares" in increments of $2,500. Some wealthy people purchased multiple shares and some households went in together to buy shares. The company eventually sold over $7 million in shares which provided enough seed money to begin borrowing the rest of the money to build the network.

  The shares are not equity but are notes that carry a reasonable interest rate. The advantage for the startup business is that they can accrue interest for many years on the shares, giving them time to build the business to be a cash success.

This kind of start-up capital could be used along with any other kind of financing. For example, if a similar amount of $7 million could be raised in Falmouth, it would significantly lower the size of the bond needed to fund the rest of the project.

Falmouth might be the ideal kind of community to consider this kind of financing. We got the sense in doing this study that there are a lot of people in the community who care about the success of the town and might be open to investing in a fiber business. Raising some of any needed funding locally makes a strong statement that the community is behind a broadband effort.

- Partnering with an Incumbent. Chesterfield and other villages in New Hampshire that have partnered with Consolidated Communications, the incumbent telephone company. Consolidated is a large telco operating in almost thirty states. The village raised bond money to help pay for a fiber network to reach every home and business. Consolidated agreed to serve the business and is going to charge a small premium on broadband for twenty years to recover its costs for entering the partnership.

  It's not inconceivable that Verizon would consider such a partnership if the town were bringing significant funding to a partnership. Verizon has never done a partnership with a community, but you can't write off this idea without giving it consideration. Verizon would benefit by gaining major market share in a town the size of Falmouth and the town would benefit by having gigabit broadband.

- Consider Opportunity Zone Financing. Congress created a new tax opportunity as part of the 2017 Tax Cuts and Jobs Act. The Act created Opportunity Zones in which investors can get special capital gains treatment and other tax breaks for investing in qualified infrastructure within an opportunity zone. Each state governor then designated specific opportunity zones. The town has an opportunity zone in the east end of town that covers a population of about 5,650. Here's how an opportunity zone investment might be part of a larger financial funding effort:
  - An investor looking to take advantage of opportunity zone benefits would invest equity to help finance a broadband network in the town. The benefits would be limited to the portion of the network built within the opportunity zone.
  - Opportunity zone investors are looking for tax-free capital gains. A typical structure might be that the town (or whoever is building the network) would gain a low-interest or even no-interest loan from the investor. At some pre-determined future date (at least 10 years in the future) the town would "buy-out" the investor at some multiple, say twice as much as way invested. That multiple would equal the interest that might have been earned over the 10-years but would be expressed as capital gains for the investor.
  - Such an investment would have a great benefit for a broadband project. One of the biggest hurdles in financing a fiber network is covering the interest and principal payments on debt. Getting even a portion of the funding with an opportunity zone investment would reduce principal and interest payments for 10 years. The remaining loan would likely have to be refinanced at the time of the repayment, but by then the business might have accumulated enough cash to pay to loan balance outright, or likely is in a good position to take on a new debt.
  - An opportunity zone loan is still a loan and all of the normal issues like collateral and priority of payments would still need to be established. We are not aware of anywhere

that opportunity zone financing has been paired with municipal bond funding, so these issues would have to be resolved.

B. Choosing an Operating Model / Partnering Potential

How does the EDIC and the town take this report and decide what operating model to choose? This involves a decision-making process that commercial ISPs are used to but that might be alien to a government entity. Choosing an operating model means undergoing a three-step process:

- The first is to look internally. Specify your goals. Know your existing strengths and weaknesses in terms of what you might bring as an ISP or as a partner. Understand your willingness to accept risk and the willingness for the community to accept losses.
- The second step is to then take your attributes and compare them to the pros and cons of the various operating models.
- Finally requires looking externally to see if the option you chose is reasonably feasible. If a municipality want to become the ISP, can it borrow the needed funds to build the network. If a municipality wants to join a partnership, are there partners available?

Internal Assessment

Choosing an operating model means undertaking an honest assessment of the local government's ability to participate in one of more of the operating models. Sometimes this assessment is easy. For instance, if the government is not willing to borrow money, then any options that require the government to help fund the network are off the table. But for a government that is open to the range of possibilities, the internal assessment is a needed part of the process of choosing an operating model.

Goals. This process should always start off with a set of goals of what you want to achieve with better broadband. The goals are important, because the goals alone sometimes dictate the operating models that you must consider. For example, if a goal is to make sure that broadband is affordable for even the lowest-income homes, then inviting in a commercial ISP might be off the table – most commercial ISPs are unwilling to serve everybody in a community or to subsidize service for low-income homes. If the goal is to promote competition over everything else, then the only good choice might be to pursue open access.

Strengths and Weaknesses. One of the hardest things any organization to do is to make a fair assessment of your own strengths and weaknesses. Government entities, almost by definition, don't share the same attributes as a competitive corporation. Before any community contemplates being an ISP, we always recommend that a government entity rate themselves in terms of the attributes that would be desired by a competitive ISP. These include things like:

- Competitive nature
- Quick decision-making
- Comfortable in selling to the public
- Technology savvy and willingness to remain cutting edge
- Willingness to accept the risk of losses and poor performance
- Willingness to hire and fire staff based upon performance
- Willingness to empower employees at all levels to make needed decisions

There are a number of ways to assess strengths and weaknesses. Perhaps the most common is to undertake a SWOT analysis that provides a framework for assessing the strengths, weaknesses, opportunities, and threats posed by a new challenge. If you've never done this there are consultants that can help you through this process. What's most important in this analysis is the willingness to be brutally honest in the assessment.

That is not easy for a local government to honestly assess its weaknesses because that invites criticism of the local government. However, for a town that doesn't already operate an electric utility, it would be vital to fully assess the ability of the town successfully operate or partner in a broadband business before undertaking such a major project.

Is a Municipal Electric Utility Necessary to Succeed with Fiber?

There is an extra step of consideration for any government entity that is not already operating an electric utility. Most of the municipalities that have decided to build and operate their own broadband utility already had an existing electric utility. There are some significant advantages to already being an electric utility:

- The biggest advantage that an existing electric utility has is a billing relationship with every customer in the community. Assuming that the public likes the municipal utility (not always the case, but usually so) then the utility has instant name recognition and public trust when they open an ISP. This gives them a leg up on a new ISP entering the same market.
- The municipality likely owns most or all of the utility poles, making it a lot easier to build fiber. A pole-owner has a lot more options on how to string fiber on poles. For example, they can place some or all of the fiber in the power space (near to the electric lines) which is something that is rarely available to fiber overbuilders.
- An electric utility already engages in many of the activities needed to operate a fiber network. The company will have technical staff who can easily learn fiber technology. The utility will already have cherry-pickers and technicians used to working on aerial wires.
- An electric utility will already have management staff that doesn't necessarily need to be duplicated. For instance, the general manager of the utility can also be the general manager of the broadband business, which reduces the need to hire a whole new staff to operate as an ISP. This sharing or resources can happen across a lot of middle management.
- An electric utility will already have the needed backoffice functions like accounting, human resources, billing systems, cash collection processes, a public business office, etc. that all must be established for a new ISP.
- An electric utility will already have a customer service group that interfaces with customers. Depending on the size of the community, a lot of residents will be on a first-name basis with long-term customer care employees.
- An electric utility should already have outage plans in place to allow it to quickly respond to electric outages. This is one of the hardest things for a new ISP to develop. Electric utilities also often have emergency plans in place that will bring technicians from out of market in the case of major storm damage.
- A municipality with an electric utility often has an easier time raising bond funding. If the electric utility is successful enough, bonds can be issued that are backed by electric rates rather than backed by tax revenues. We've seen cases where this meant that bonds could be issued without needing a referendum.

- One of the less obvious benefits of adding a broadband utility to an existing electric utility is that the electric utility can pick up a significant piece of the cost of building the network. This can be done by having the electric utility pay for a portion of the fiber build for fibers to connect to substations, or this can be done by having the electric utility lease this capacity over time, making them a large customer of the fiber utility. Cities that tackle smart grid have even more opportunities to generate revenues for a fiber utility.
- Another hidden benefit for an electric utility that opens a fiber business is that the operating costs for the electric utility drop. As costs for things like a portion of the general manager, for a business office, and all of the other shared functions are allocated to broadband, the allocations to electric are reduced. This can take pressure off of electric rates, or even reduce rates over the long haul.
- It's been the experience at CCG that an electric utility can launch a broadband business faster than a new ISP can be established in a market.

These advantages all result in a significant cost advantage for a municipality with an electric utility. Most municipalities that don't have any existing electric utility are intimidated by launching a new broadband ISP. These municipalities look at all of the aspects of creating a new ISP and generally realize quickly that they are not prepared to tackle the huge number of steps it takes to create an ISP from scratch.

Partner Instead? An ISP partner can bring many of the same advantages that come with an electric utility. They are already in the business and have the staff that understand the business. An ISP already has the upper and middle management that likely wouldn't have to be duplicated to open a new market. An ISP will have all of the backoffice functions such as billing systems already covered.

An ISP partner brings some things that an electric utility does not. They are already experts in the broadband business. They already sell bandwidth and likely other triple-play products to customers. They already understand all of the nuances of the industry such as regulations, taxation, the construction process, the industry vendors, etc.

ISPs also bring one big advantage that doesn't come from an electric utility. An ISP knows how to sell in a competitive environment – the one aspect of being an ISP that often intimidates a monopoly electric utility.

One of the other big advantages of working with an existing ISP is that they can significantly shorten the time to market. It wouldn't be a surprise for a commercial ISP to get the first paying customer 6 – 9 months earlier than the same ISP business launched by the electric utility.

However, partnering is not without a cost. An ISP partner is going to want to make a profit, and that adds cost back onto the process that likely wipes out the cost advantages just mentioned above. Being in a partnership can cost more than launching a standalone ISP.

The many reasons discussed above are why almost every municipality that doesn't have its own electric utility generally has chosen to have an ISP partner or partners. Starting from scratch to build an ISP is extremely challenging. It means having to simultaneously master the following types of tasks. This is an abbreviated list and in a new market launch we've seen Gantt charts that list several thousand steps needed to open a new ISP market. That list is even longer if it's being done by a newly created ISP.

- The Technology. This includes the technology of building, maintaining, repairing, and installing fiber. It involves choosing a last mile electronics technology. It means choosing for a variety of different network designs for the network topology including issues like using huts versus centralizing electronics. It involves mastering the process of installing fiber at a wide variety of different homes and businesses. It means deciding how to tackle apartments and other more complex deployment situations. It means deciding how to deploy alarms to notify of network problems, how to monitor the network, how to respond to network problems. It means deciding the ancillary issues such as how to best map the network to most useful in the future or the best way to establish a spares inventory.
- The Construction Process. This involves selecting an engineering firm to design the network. It means selecting a construction company to build the network. It means finding a vendor and buying the electronics. It means directly buying many of the components of the network. Even if the construction company or engineer purchases the major components of the network there will be long list of things that have to bought directly – and this often overtaxes the government purchasing process. Somebody has to then monitor the construction process to make sure they stay on specification. A municipality often gets involved in the process by issuing construction permits, locating existing underground utilities, inspecting construction work sites, etc.
- Creating the ISP Organization. An organization chart has to be created including detailed job descriptions that often must be integrated into the civil service job structure. Employees must be interviewed and hired. With a new company there has to be a plan for training and integrating employees into a team. This also means defining how the new ISP fits in with the rest of the existing organization. It means defining who in the organization gets to make specific types of decisions.
- Creating the Products. Products and prices need to be selected, down to the smallest detail. For each product, the ISP must decide how it will function – done internally or outsourced, and then the appropriate purchasing processes must be used to acquire and activate all the components of the products. Processes must be established to implementing products for customers. As a small example, if telephone service will be offered, customers will want to keep existing phone numbers and will expect the ISP to "port" the number from the old ISP to the new one.
- Developing Backoffice Practices. This starts with implementing the accounting process and deciding how to account for the cost of the network and the operating expenses of the business. That means developing a chart of accounts. It might mean creating work orders in order to capitalize labor, interest expense and other overheads into the cost of the network. It means defining how cash will work from the business from financing the network through the final process of collecting cash from customers. Bond financing generally layers on a lot of specific processes. The biggest decision to make for the backoffice is the software to use to operate the ISP. This is called BSS/OSS software in the industry, which means a billing and operating software system. It can take 6 – 9 months to implement a new BSS/OSS, so the process of selecting software should start early.
- Develop Provisioning Process. Provisioning in the industry means all of the processes that must be put into place from the time that a salesperson closes a sale until the customer has received their first bill for service. For an ISP to work smoothly processes must be well-defined so that paperwork (hopefully all computerized with BSS/OSS software). It means deciding the steps that must be taken during the process and defining exactly who does each step. Creating an efficient provisioning processes is often one of the most challenging steps for a new ISP. There are a few dozen steps at minimum in the provisioning process such as taking and verifying orders, making sure each customers gets the right products at the time of installation, qualifying customers and

doing credit checks or taking deposits as needed, getting each customer properly entered into the billing system so that all products are billed, coordinating with customers during the process up through scheduling the installation visit, etc.

- Develop Operational Processes. This means defining daily workflow. For example, what exactly does an installer do from the beginning to the end of the day. What software systems do they need to do their job right. What records do they need to keep during the day in terms of a time sheet, a vehicle log, a list of materials used, etc. How does the business decide which field technicians goes to which field task? This means keeping track of a time calendar and trying to meet pre-scheduled meetings with customers (something the competition does poorly). How does the business cope with holidays, vacation days, sick days, training days?
- Developing a Sales and Marketing Plan. This starts with developing a brand for the business which includes a logo, web page, social media presence, etc. It means deciding how to communicate with the public during the construction process and then deciding when it's time to take orders. The sales process must be specifically designed. If you're going to advertise it means developing advertising content and figuring out how to get it in front of the public. If you're going to deploy a sales staff it means defining sales quotas, sales compensation. This also means being ready to modify the sales and marketing process quickly as you find out what works and doesn't work in the market.
- Implementing Business Process. This might mean setting up a business office for customers to visit and pay bills. It might mean establishing the processes of getting bills out the door. It means establishing the process of notifying and disconnecting customers that don't pay. It means buying trucks, furniture, computers, etc. for employees. It means getting the needed training for new employees. It means deciding how to take trouble calls and how to react to them. It means developing an escalation process where issues go up the chain as needed to be resolved.
- Deciding on Policies. An ISP will have dozens of policies. Are deposits or credit checks required? What are the options for paying for service (credit cards, bank debits, paper bills, email bills? It means deciding when customers get notified about non-payment and when they get disconnected and then reconnected. It means determining how and if you're willing to give discounts to customers. It means deciding which employees have the authority to make decisions that directly affect customers.
- Develop Customer Installation Processes. These are the processes at the home or business. Will you use contractors or employees for various tasks? What paperwork does a customer need to sign (contract, terms of service, rights-of-way to cross a yard)? What exactly is included in an installation for free and what incurs extra charges. What are the policies for where you're willing to bring a wire inside a home or business? Can and should an installer upsell customers during the sale process, and how does the rest of the business change an order quickly?
- Meeting Legal / Regulatory Obligations. What federal, state, and local regulations affect the business and how do you make sure you are following regulations? What taxes must be collected from customers and how do you remit taxes to taxing authorities. What contract must be in place with the many vendors for construction and buying the products? Is there insurance you want to buy, or will the municipality self-insure?

While this is an intimidating list, it can be done. Tackling becoming an ISP means hiring a few people who have done this successfully before and can help to navigate the many tasks described above. It means finding engineers and consultants to help through the launch process to step the business from making big costly mistakes and from having unnecessary delays in the business launch.

Some of the cities that have decided to be an ISP start with what they call a pilot project. For a pilot project to be useful, most of the above steps must be implemented, and the concept of a pilot project is to observe and modify the processes to meet your company's skill set. The downside of a pilot project is that it drives only a tiny amount of revenue to cover a business with at last a decent core of staff on board.

Understanding the Risks of Operating an ISP

Regardless of operating choice you make (partner or going it alone), a municipality should take some time to consider the market risks of forming a competitive broadband business. It's far too easy to have a profitable looking financial business plan and assume that you end up with a profitable ISP that spins off cash to the municipality. The reality of the marketplace is that there are a number of risks that experienced ISPs recognize when entering a new market. Following is a list of some of the more likely market risks:

Competitive Risks. There is always the risk of a significant response from existing service providers. For example, it hasn't happened many times, but there are a few examples where incumbent service providers engaged in a serious price war with a new ISP. In a price war, prices can go so low that all service providers in the market lose money. Large incumbents can ride out the operating losses in a price war, while a new operator can't.

There is also the risk that a competitor could overbuild a new fiber network. It doesn't happen often, but it has happened. For example, in Monticello Minnesota, the incumbent telephone company TDS reacted to a municipal fiber network by building a second fiber network. In parts of the North Carolina research triangle and in Austin, Texas, both the incumbent telephone company and the cable company built some fiber-to-the-home as a reaction to fiber built by Google Fiber. That means a few lucky households are served by three gigabit fiber networks.

Existing cable companies often pull out all of the stops to make it hard for a new competitor to thrive. For example, they might offer low rates in a special and lock up customer in 2- to 3-year contracts before a new ISP is open for business. They often saturate the market with advertising and have been known to use negative advertising against new market entrants.

Financial Risks. The need to pass referendums to get public funding of broadband money can be a major barrier to entry, particularly for projects that use property or sales taxes to guarantee a broadband project.

Finding satisfactory collateral for loans is always a challenge when financing broadband projects.

No business plan is foolproof and there is always a risk of a project failing. Fear of failure often stops municipalities or commercial ISPs from taking the chance and making the needed investment.

Operational Market Risks. Above is a description of the many steps required to successfully launch a new ISP or a new market. The operational risks come from doing any of the tasks on that list poorly. For example, a new ISP might build a world class network but then stumble badly in the sales and marketing process.

The danger of botching the launch is in tarnishing the reputation of the new ISP business before it really gets going. An example of this was the FTTH network in Lafayette, Louisiana which suffered from huge problems with their video product. This was due to their vendor Alcatel not delivering the product that was promised in their response to the original RFP. The TV was so bad that many customers dropped the city ISP and word-of-mouth stopped a lot more customers from trying the new network. It took over a year to fix the video problems and during that time period the business fell significantly short of their business plan projections. Over time the city regained a reputation as a quality service provider and today is financially successful and is expanding into the surround suburbs. But that one mistake really hurt the business.

Risks of Operating Losses. One issue that new ISPs don't like to think about is what happens if the new ISP loses more money than anticipated. A new ISP needs to have a contingency financing plan to cover unexpected losses. A municipal ISP needs to be prepared to dip into municipal funds to cover shortfalls. Cities with electric utilities sometimes cover these losses by using electric cash reserves or even by raising electric rates. Commercial ventures that are part of a larger company can be covered for a while by the parent company.

However, standalone fiber ventures, either municipal or commercial, run a much greater risk. A standalone commercial venture that runs out of cash generally folds. In a municipal venture the only recourse might be to somehow cover losses from tax revenues or municipal cash reserves.

The Cost of Success. In the telecom world there is a phenomenon I call the cost of success. It's costly to add a new customer to a fiber network and if a new venture does better than expected, then a new ISP can find themselves without the capital funds needed to add new customers. The alternatives are to somehow borrow more money to fund the growth, or else make customers wait until the project generates enough cash to cover customers in a queue. It's often not practical for a municipality to borrow more money.

Local Rules and Regulations. It's important to realize that there are different rules governing fiber construction along county, state, and federal roads that might differ significantly from rules for city streets. We know of one that ran into a huge problem when the discovered after they had been funded with a bond that the county government wouldn't let them bury fiber in the ditches along the side of the road as had been planned. It turns out that the original public rights-of-way for these roads was a dozen feet off the edge of the road and over the last fifty years almost the entire service area had been overgrown with trees and woods along the roads. The municipal ISP had to bury fiber through the trees at significant extra cost when the county government refused to relax the rules.

In another case we know of an ISP that encountered a process along a county road where permits were required for each pole rather than filing a permit for a batch of poles. The extra paperwork slowed the permitting process to a grinding halt and delayed the construction process. The moral

of these stories is to do the needed homework with all jurisdictions early before raising money and committing resources.

Municipal Purchasing Rules. We've seen that municipal purchasing rules can add to the cost of building a government network. While these rules have the goal of making sure that a municipality doesn't overpay for good and services, the rules can add significant time and costs when buying all of the needed components and service vendors involved in a broadband network launch.

We've also seen the municipal purchasing process add cost to purchased goods and materials. Most of the vendors in the telecom world are not used to dealing with the municipal purchasing process, so many of them pad their prices when bidding – fully expecting to negotiate the prices lower later, only to sometimes find that their bid price was accepted without negotiation. We also find that there are quality vendors that refuse to participate in the municipal purchasing process.

A Few Municipal ISPs Have Failed. It's worth noting that there is a much longer list of commercial ISPs that have failed. There is no guarantee of being a success in a business where a lot of money is needed to fund a network and a business must win a lot of customers to break even. Following is a short description of a few of the municipal failures that the town will likely hear about if you decide to move forward:

- Monticello, Minnesota. The city was sued by the incumbent telephone company, TDS, within a few days after closing on bond funding. In hindsight the city should have returned the bond money to investors until the lawsuit was solved – but it didn't and the accumulated interest costs put the company far behind the business plan after it won the lawsuit. Additionally, the telco built fiber to some parts of the city to complete against the municipal fiber network.
- Crawfordsville, IN. The city built a fiber network, and for some inexplicable reason did almost no marketing. This might be the ultimate example of the 'build it and they will come' philosophy – and without marketing customers do not automatically show up.
- Alameda, California. The utility operated an ISP that never made money mostly due to the extremely high salaries in California (Alameda is an island across the bay from San Francisco). The city ultimately sold the business to Comcast.
- Bristol, Virginia. The city was one of the first to build a fiber network to reach everybody and from a financial perspective was a success. Years after the network was built some employees defrauded the company of money as part of a grant-funded project. Ultimately, several employees went to prison, but the city was able to sell the network and recovered the money that had been invested in the network. This is a warning that failure doesn't always have to be financial.
- Burlington, Vermont. The business lost money annually after the city decided to raid bond proceeds from the fiber project when the city had an economic downturn. The city eventually sold the business to a commercial ISP.

Looking Externally

Before finally deciding on an operating model we recommend that a potential ISP look externally to validate that what they have in mind is possible.

If everything above was considered in the first two steps, then there are usually only a few external issues to consider. Every situation is different, but the biggest external issues are things like the following:

Finding Qualified Staff. This isn't generally an issue in urban areas, but it can be a major issue in smaller markets. We've seen small-market ISPs struggle and sometimes fail to find needed experienced staff. For example, I helped a client find a CFO for a sizable rural ISP and it took nearly two years to finally attract a qualified person. Any new ISP needs at least a few seasoned veterans and finding them and attracting them can be a challenge. There is also often a significant wage differential between public and private jobs that has to be considered.

Verify the Availability of Funding. If you're going to use municipal bonds this would be the point in the process to have a detailed discussion with your bond advisors. Interest rates have been somewhat steady for many years in the United States, but there is a chance due to the unsettled nature of the economy that this could change. Any government that raised bond money back in times when interest rate fluctuated recalls delaying bond issue to try to find that "perfect" day to sell the bonds in order to get an acceptable interest rate.

If a project is going to require commercial funding, this is the time to get bankers talking to bond advisors to identify any issues that might become impediments.

Finding a Partner. We find that most municipalities tend towards liking partnerships. This means they can bring in somebody that already knows how to operate an ISP. It also might mean mitigating the risk by bringing in commercial funding to help offset some municipal funding. Finding a partner is such an integral step for many municipalities that we're going to discuss the partnership process in detail and answer the question of how to identify a good partner. Following are the best characteristics of an ISP operating partner:

> Experience. We know of several investor-driven ISPs looking to invest and operate broadband networks, but that have never built or operated a network. This isn't to say that such a group can't be a good partner, but it's a higher risk to work with an ISP that doesn't already have customers and that hasn't worked in a partnership before.
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> There are a few horror stories in the industry of public/private partnerships that went awry because of lack of experience by the ISP partner. In the following two examples the ISP management team was made up of folks with industry experience but who had never worked together as a team before.
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> - The first example is Utopia in Utah. This is a collaboration of small towns that are working together through the Utopia organization to create economy of scale for the business. State law in Utah doesn't allow municipalities to be an ISP, so Utopia works as an open access network where the consortium of cities built the network and various ISPs compete for customers.
>
>   Utopia started by hiring an external management team that had not worked in the open access environment before. A number of things went wrong – the networks were late in getting constructed and came in over budget. The ISPs did not sell as aggressively as the business plan had supposed. Utopia ran out of cash before construction was complete and

almost folded, but the business was eventually saved through several rounds of refinancing and is now large enough to be financially stable. It took almost a decade of the business being in financial duress to get to that point.

- Another example is Lake County, Minnesota. The county decided to borrow money to build a county-wide fiber network. This is one of the northernmost counties in the state and quite remote. There are 11,000 residents in 2,100 square miles. They hired an outside firm to construct the network and run the ISP. The project went way over budget and the project ran out of money with a backlog of almost 1,000 customers they couldn't connect to the network.

  The project was funded through a combination of a $10 million federal grant and a low interest government loan for $56 million. The county also bonded over $7 million locally for the project plus floated loans to keep the project afloat. The project went completely underwater financially and didn't make enough money to cover debt payments. In 2019 the county sold the network to an ISP for $8.4 million. The federal government had to write off about $40 million in debt and the county still must cover the original bonds plus the internal loans made to the project.

Experience Working with Municipalities. It's somewhat important to work with an ISP that has worked with local governments before. CCG has witnessed a number of public private partnerships with the recurring theme that the two parties get frustrated with each other over time. This is due to two factors – frustration with the decision-making process and a difference in goals and expectations.

Commercial ISPs become quickly frustrated with the municipal decision-making process. Most local governments have a specified legal process that must be followed to make certain kinds of decisions. This might mean listing the topic for a public meeting, waiting for a period of time, and allowing public comment on the issue. Commercial ISPs are used to making decisions quickly and they don't like the drawn-out processes that government requires. Government entities get frustrated as well since their commercial partners push them to make decisions quickly when they can't.

A more fundamental issue in public private partnerships is a fundamental difference in goals. The issue commonly arises when the two parties didn't thoroughly discuss their long-term goals for broadband before a partnership began. Commercial ISPs are often most worried about cash flow and profit margins. If they've invested equity in a broadband network, they become unhappy if the business doesn't meet their earnings goals. Governments often have a different set of goals – serving every household, offering low-priced broadband to low-income houses, providing subsidized broadband to non-profits and anchor institutions. In many cases, these kinds of fundamental differences can't be overcome and eventually result in a dissolution of the partnership.

The differences between the two kinds of entities often surface when there is a discussion of rates. Local governments often push back against rate increases – particularly in election years. Cities push partners for low rates in general, and often want an ISP to give low rates for low-income households and even free rates to groups like non-profits.

These kinds of issues are less likely to be a huge problem if the ISP has worked successfully with other municipalities before. A government entity that is working with an ISP that has not partnered in this manner before should have an in-depth discussion up front about expectations. It's a lot easier if the two parties decide up front that they aren't compatible instead of getting a divorce after the partnership has been launched.

Financial Strength. Municipal entities often have a hard time judging the financial strength of partners. Unfortunately, most public/private partnerships are not with big well-financed ISPs. The more typical partnerships are with telephone companies, electric cooperatives, or fiber overbuilders. It's typical for commercial ISPs of this type to overstate their financial security – and they may even believe what they say in doing so. But there are a few fundamental things about ISPs that a municipality should understand:

- Every ISP has a natural borrowing limit. There is only so much debt that bankers and other lenders will allow them to carry. By definition, when an ISP nears that lending limit it means that bankers think the company is pushing its financial limitations. Any ISP that has borrowed to its limit can't afford to make financial mistakes, and that means the partnership and all their other ventures need to perform as expected. It's not unusual to see budding partnership be dependent upon obtaining financing, and it's not uncommon for the ISP to not get the hoped-for funding.
- The biggest issue with ISPs and borrowing is collateral. Banks don't look at fiber networks as good collateral for loans because there is very little value from repossessing a fiber network. This means the only good collateral that most ISPs have is the value of their existing company. Even surprisingly large ISPs might have to pledge their entire company in order to borrow a sizable amount of money to build an expensive network. It's often necessary for owners of ISPs to make personal guarantees on loans, meaning that both their business and their personal assets are on the line with a new fiber project. ISPs are highly unlikely to disclose to a government partner the details of how they raise money – among other reasons they are scared of public disclosure laws and don't want their personal financial position discoverable as a public record.

Capacity to Grow. One of the hardest things to judge is the ability of an ISP to grow quickly. A traditional ISP like a telephone company may have a lot of customers – but they acquired them slowly over decades. ISPs (and all other types of businesses) often get stressed to the breaking point when they try to grow too fast. It's not unusual for an ISP to somehow assume that existing middle and upper management can handle a growth scenario while still somehow handling the existing responsibilities they've always had.

Just because a company is a great ISP doesn't mean that the company is capable of growing quickly. Unfortunately, there is no way to judge this unless the ISP has already been growing prior to the creation of the partnership.

Fair Recognition of Value. One of the important attributes of a good partnership is the full and fair recognition of the value that each party brings to the partnership. Municipalities should be wary of a partner that overvalues what they bring to and undervalues what you bring. A government can create value for a public/private partnership in a number of ways:

- Funding. Any amounts paid towards funding a broadband network are valuable. Governments often don't know how to set a value for cash contributions – something that

commercial partners routinely figure out. It's been my experience that ISPs don't value government funding as much as they do other funding sources. I think this is because government funding doesn't come with the same stringent strings and responsibilities. A local government is not likely (or even able) to require things that a bank might require such as collateral or a lien on a partner's assets. If an ISP gets into financial trouble, the first entity they will try not to pay is a government partner. This can be dealt with in creating a partnership agreement, but to some degree that requires a government to think like a bank.

- Anchor Tenant. Government entities often make good anchor tenants – which is pledging to be an early customer of a network and guaranteeing to buy services with a long-term contract. It's not untypical for a government to be one of the largest broadband and telecom customers on a network. This might be a challenge in Falmouth since local government already largely uses OpenCape.
- Other Assets. Governments often have other assets that can benefit a partnership. This could be land for placing equipment; It could be a building to create a central office or a storefront. It might mean towers, empty conduit, or spare existing fiber that can be used to defray the cost of constructing a broadband solution. The value of such assets should be set according to what the partnership would pay to get the same thing from a third party.
- Easier Construction Processes. Local governments often take a significant role during the construction process. They might have to approve permits for rights-of-way. They might be the entity that locates existing utilities. They might require inspection of construction work sites, during and after construction. They might require things life traffic management during construction. Before tackling a major fiber construction project with a partner, a government might review these various requirements to see if they can be streamlined to make it easier to build fiber. Note in doing so that this likely means making any relaxed rules available to any other entity that wants to build fiber.
- Contributed Labor. A government can contribute labor. Using the last example above, a government could agree to conduct permits, locating, or some other service for free as a way to contribute to launching a partnership project.
- Tax Abatements. Tax abatements have always been a tool for economic development. Governments often have it within their power to excuse certain taxes to entities that bring something of economic value to the community. For example, it's common to not charge a large new business any property taxes for some period of time as a way to lure them to locate in the community. There are numerous taxes and fees that might impact a new broadband network such as property taxes, sales taxes, right-of-way fees, etc. that a government might be willing to waive to help a new network get established.

The bottom line to this discussion is that a government can bring significant value to a partnership, and that contribution should be fairly valued. Even when a government brings tangible value, such as contributing funding, it's not unusual for an ISP to undervalue that contribution. It's even more prevalent for an ISP to not assign a realistic value to the more intangible contributions.

How do You Find a Potential Partner? We've seen almost every partnership we know of come through three different processes:

Request for Information (RFI). It's fairly typical for communities that want broadband to issue an RFI aimed specifically at soliciting potential ISP partners. These RFIs typically describe the situation in the community, typically describe whatever work has already been accomplished (such as this feasibility study) and describe the role the municipality wants to take in a partnership.

The RFI then asks ISPs to describe themselves and their capabilities. The RFI generally doesn't go so far as to request a specific solution, but rather asks the ISPs to discuss how they might tackle broadband issues in the community.

An RFI is generally a first step to determine which ISPs might be interested in partnering. After the RFI the process typically moves to one of the two processes described below.

Request for Proposal (RFP). An RFP is typically a lot more in depth. In addition to asking ISPs to introduce themselves, an RFP might ask for specific proposed solutions. It might go further in detail asking about the financial strength of the ISP business and details of how they operate in other market.

Direct Negotiation. In some states, governments can interact directly with potential ISP partners rather than go through an RFI or RFP – all depending on state purchasing and contract rules for government entities.

Comparing the Three Options. It's first worth considering the issue from the perspective of an ISP. ISPs are leery of public records laws. ISPs are often highly reluctant to provide financial information, customer lists, or other information that they feel is confidential. They don't trust that local governments will fight to keep such information confidential. ISPs are even more leery of spelling out specific details of their business plan and how they approach a broadband market – they don't want that information to be available to their competitors.

Many ISPs are not willing or able to respond to an RFI or an RFP that asks for lengthy written responses to a long list of questions. Businesses that sell equipment and services are used to the idea of making proposals and usually have a pile of pre-prepared canned responses to the typical questions they are asked by a prospective customer. However, an ISP may never have been asked to make a proposal in writing in the specific and detailed way that might be needed to respond to an RFI or an RFP. There are ISPs that refuse to participate in an RFI or RFP for this and related issues. We know there are ISPs that eliminate cities from consideration if they insist on going through the formal RFP process.

ISPs prefer direct discussions where nothing is put into writing during the negotiation stage. That's the same process that ISPs typically use when they partner with other ISPs – they sit and talk out the pros and cons and mutually decide if there is a potential for a partnership. As often as not, such discussions end up with the realization that a partnership is not a good idea, and the parties amicably go their separate ways and nothing they discussed is in writing.

Here is the process that I like best, having been through a lot of discussions between governments and ISPs:

For most local governments, the best first step is to invite known ISPs for a high-level discussion about whether a partnership makes sense. This process might involve several meetings where an ISP might come back with ideas, and where the local government reacts.

A lot of cities like the RFI process when it makes sense. For example, CCG was working with a geographically isolated community where there was no local ISP candidate within fifty miles. An RFI made sense since the community didn't have a wish list of local ISPs to consider. An RFI also might make sense for larger communities. In this case I define larger to mean that the cost of the project is large – perhaps more than $25 million. I've known communities that found an ISP partner through an RFI that they would never have otherwise found.

If a community issues an RFI it should ask for basic information only. That might include asking an ISP to provide their history, telling about the products they normally sell, and talking about the management team. While cities might have a hundred questions for a prospective partner, the ISP is going to be a lot happier if the details of their business are not put into writing at the early stage of meeting and negotiating.

RFPs only make sense for larger cities – probably those with network costs over $100 million. It's not likely that a small ISP will respond to such an RFP. Even in an RFP, I recommend not asking for sensitive financial information about the ISP – that can always be provided if the likelihood of a partnership develops.

Establishing Compatible Goals. At some point during the early stages of the process it's vital for both sides to thoroughly discuss their goals for the project. Misalignment of goals is the number one issue that plagues any partnership eventually. Both parties need to fully hear and understand, and be completely comfortable with the goals of the other partner.

Goals generally can be stated simply and don't have to be complicated. Goals for a municipality might be things like serving the entire community, not needing to subsidize the project, keeping rates low, etc. Goals for an ISP might be to generate s specific target of cash flows / profits. It wouldn't be unusual for an ISP partner to eventually want the option to buy the business. An ISP also might want just the opposite and might want to capitalize on the success of the business by selling out after some period of time.

It's important to not only see each other's goals, but it's vital for a municipality to understand the ISP's goals. This is one situation where a municipality might want to discuss these goals with a consultant or somebody with broad industry experience. It's not unusual for two partners to be talking a different language when discussing financial issues and it's vital to fully comprehend what a partner is telling you about their goals.

Alignment of goals is a make-or-break point in a potential partnership. Many of the differences that a municipality and an ISP might have can be negotiated, but you can't negotiate a difference in philosophy. If an ISP has a goal that a municipality can't live with, such as selling out in ten years, then our advice is to not pursue the partnership. When an ISP tells you a goal of that nature, they mean it.

How to Rank Potential Partners? There are hundreds of questions that a local government might ask an ISP that might range from big important questions like, "Can you bring funding to this project?" to questions that are important but have lesser impact on creating a partnership such as, "What's your process of disconnecting customers who don't pay?"

I advise prospective partners (government or otherwise) to place their questions into three categories, 1) make or break questions, 2) questions that might disqualify a potential partner, and 3) all other questions.

Every community will have its own list of make or break questions based upon their own priorities for what a partner should bring to the table. Make or break questions might be things like 1) "How much funding can you bring to the project?" or 2) "Are you willing to serve everybody in the community?"

Questions that might disqualify a potential partner might be similar questions, again based on the specific priority and goals of a given community. Keep in mind that some of the items in this category might be subject to negotiation – something that should be asked.

The first two categories of questions are the important ones that should be used to qualify and rank potential partners. Other less critical questions are important, but probably don't get considered unless it's close between two candidates. You choose a partner based upon the most important aspects of the relationship.

There are several techniques that are used to compile rankings. Most rankings of this sort are done by compiling the rankings by a team of reviewers. The most important questions might get weighted somehow to have the biggest impact on the composite answer. At the end of this process is a numerical answer that reflects the composite opinion of those doing the ranking. It's likely that such rankings are not even the final answer and often the ranking process will send a government back to ask more questions. Since this is not a purchase of service, but a partnership, it's also highly unlikely that it would be mandatory to take the ISP that ranked the best.

Defining the Role of Each Partner. It's vital to define the specific roles and responsibilities of each partner. Ideally, this should be done before formalizing the partnership arrangement. CCG has often used a technique that seems to work ideally in defining a partnership. It starts with a list of all of the tasks needed for launching and operating the upcoming broadband business. The level of detail usually become readily apparent. For example, if it's clear that the ISP is going to have 100% of the interactions with customers, then having a task called "Interface with customers" would be sufficient rather than listing all of the various ways that somebody might interface with customers.

The items on the list would include financial and other contributions as discussed earlier, issues having to do with construction the new network, issues having to do with governance, issues having to do with operating the business.

A responsibility must be assigned for each task on the list. The choices for each task are 1) the task is the responsibility of the government, 2) the task is the responsibility of the ISP, 3) the task

is a joint responsibility of both parties (in which case that needs to be fully described), or 4) the task is the responsibility of some third party (like an outsourced arrangement). This kind of process quickly shows if the two parties are aligned and agree on all of the responsibilities and if there are tasks where the two sides have a different view. The example used earlier involved setting of rates – this is a good way to get it in writing from both parties about the roles in setting rates.

Making this list serves two purposes. It's a great tool for getting both parties to acknowledge the specific roles of each partner. It also then serves as a great template for developing a contract between the partners.

Maintaining Local Control. One of the hardest things to approach is having a partnership yet retaining local control. The following issues all have bearing on the level of control a municipality might have for an ongoing broadband business.

Before answering the question, I would challenge a municipality to make a list of items they would like to have some control over. It's likely that a list will include major aspects of operating the business such as rates, installation intervals, business hours, priorities of repairing customers after an outage, etc. I then ask the municipality to change hats and look at these same issues from the perspective of the ISP, who is trying to run a profitable business. This exercise often highlights requests for control that are unreasonable.

One of the stories I tell about politics and the broadband business concerns Bristol Virginia Utilities, which was one of the first cities to enter the broadband business. The business was operated by the electric utility, which was a branch of the local government, but which had a full standalone operating authority. The bonds were fully backed by the electric utility, but since the city had to approve any bond issue, the city reserved the right to set and approve rates. A few years after launching the business, and during an election year, the city council voted to slash all of the rates by 15%. The utility warned them this would put the business underwater, and sure enough they were unable to meet a bond payment due six months later. The city got the message and ended up raising the rates to a higher level than the original rates to correct the shortfall, and the city also changed their ordinances so that no future city council could change rates.

There are numerous other examples of negative ways that local governments have meddled in a broadband business. Politicians might make promises to constituents on behalf of the ISP. Politicians often press to give special rates to friends or to forgive bad debts for a constituent. It's not unusual for politicians to go further and interfere in things like personnel decisions. It's incredibly important to have clearly defined boundaries and lines so that an ISP is able to say no to meddling.

ISPs are highly wary of ceding any control to a government entity. ISPs fully comprehend that a partnership with a municipality is always tentative and can change drastically after an election. There are plenty of examples of a council or board that changed from pro-broadband utility to anti after an election. Political changes can put a huge strain on the business relationship even if there are no control issues. ISPs know that the municipality they partner with today may not be the same in the future.

This is not to say that a municipality shouldn't have any control over the business. One of the more obvious aspects to maintaining control depends upon who funds the network. A municipality is going to get little or no say in how to operate a network that includes significant funding from a commercial ISP. If an ISP brings money to a project, they generally will not take the risk of letting a municipality tell them how to operate the business – since the ISP's primary goal will be in getting a good return on their investment.

But even funding doesn't always determine control. Many ISPs will only partner if they get to make all of the business decisions – even if the government funded the network. This is why potential partners need to ask all of these questions before they create the partnership.

The only sure-fire way for a municipality to have control is to fund and operate the network. It's going to be difficult to find an ISP partner that will want a local government to influence business decisions once the business is operating. This is a case where a little authority is a bad thing. If a municipality has any authority to control the business, then eventually somebody at municipality will go too far, either today or in the future as the government changes.

The conclusion of this long discussion is that some parts of everything discussed in here should be on the table for a government that doesn't know the operating model they want to use. If there is interest in either going it alone as a standalone ISP or else partnering with an ISP, then most of the things discussed above should be considered. The decision to get into the broadband business is a consequential one for a government entity. You don't want to rush the decision and you want to kick the tires on all aspects of the different operating models.

C. Getting Local Buy-In

This section of the report will discuss a community engagement strategy – how to bring the public into the decision-making and implementation of broadband. Government entities have always known how difficult it is to activate the public to get engaged on any issue. It takes an enormous amount of effort to do this right. This section will describe techniques used successfully by other communities.

A community engagement strategy generally has two phases:

- The first phase is exploratory and has the goal of understanding the level of community interest in broadband.
- A second phase would be activated at the point that the community decides to move forward with a broadband solution. The goal of a second phase is to identify residents and businesses who will support a broadband network when built.

Staffing for Community Engagement

Both phases of community engagement require some level of staffing to be successful. Both phases require a focused and persistent effort, so it's important to identify staffing needed to be successful. We've seen many efforts to get community buy-in fizzle when nobody was dedicated to the community engagement tasks. We've seen the following ways that communities have staffed the effort.

- Dedicated Government Staff. The most expensive option, but one of the most effective, is to dedicate government staff to concentrate on community engagement. That requires a

commitment by elected officials to fund the effort. This would typically not be a permanent position, but rather somebody dedicated to the effort for some fixed period of time. This is also not a 9 to 5 job since interfacing with residents often means evening meetings.

A county in Minnesota found a broadband solution because the mayor of one of the smallest towns in the county told his economic development director that getting broadband was his top priority. This economic development leader spearheaded the first phase of the process – educating the public on the issue of broadband. This particular area had towns with okay broadband from a cable company and rural areas with little or no broadband. The economic development director met with everybody imaginable in the area including other city governments, county governments, state representatives, and every civic and social group imaginable. After two years of tireless work by this one staff person the communities in parts of two counties agreed on a broadband solution. This would never have happened without this one dedicated staff position.

- Volunteers. Volunteers are also an important part of this effort. Every community seems to have some people who really hate the state of the existing broadband and who are willing to volunteer time to hunting for a solution. In the example given above, the economic development director assembled a group of active volunteers to help with the effort to engage with and educate the public. These folks created email lists, went canvassing door-to-door talking about the need for broadband, and showed up at every government meeting to stress that they wanted a broadband solution. It's important that any volunteer effort have some structure and working with a staff person can make sure such a group stays focused. If a community decides to engage volunteers there should still be a commitment to providing some funding. In the case of the Minnesota effort, local governments funded the effort required to engage in a canvass of the communities to understand the interest in broadband. This included several rounds of mailing postcards asking homeowners to pledge support for broadband.

- Broadband Task Force. Another approach is to create a formal committee of citizens who are willing to work together to explore the issues around community broadband. Such a Broadband Task Force generally is composed of citizen volunteers and perhaps a few elected officials. The group would meet regularly and work towards exploring the need for a broadband solution. It's normal that such a group would report back regularly to the government about their progress. Such a group can collectively take on some of the needed community engagement tasks, and we've seen effective committees do this well. It's not unusual for a Broadband Task Force to solicit help from additional volunteers.

  Such groups are usually given a budget, but also restrained by needing to have expenditures pre-approved. We could write pages on the dos and don'ts of operating a successful citizen's advisory group. It's likely the town has done this before for other issues. The main key for success is to make sure that the group has a specific agenda, a specified budget, and the specified authority to meet their goals. Citizen groups can accomplish great things if they are properly directed to do so – but can stray if not given good direction.

Consumer Education

One important aspect during both phases of community engagement is to provide useful information to help the public better understand broadband issues. We've seen communities tackle public education in some of the following ways.

- Publish This Feasibility Report. While not many people will wade the whole way through a report of this size, it's been written for anyone in the community to read.
- Hold Public Meetings. Public meetings can be held to explain the results of this study, or meetings could be more generic and be aimed at explaining the broadband issues. It's worthwhile to have elected officials at public meeting so they can directly hear the kinds of issues that households and businesses have with existing broadband. It's vital to advertise heavily to drive attendance at meetings. CCG has been to a community meeting where only one resident showed up, and to others that were standing room only in a large room.
- Broadband Web Site / Social Media. Many communities create a broadband web page or accomplish the same thing using social media. Such a page can be used to educate as well as inform. For example, a common educational feature is to have a lengthy section with responses to "Frequently Asked Questions." Such a website can also inform the public about upcoming events or other things the government wants to advertise.
- Gather List of Broadband Proponents. One important resource is to create a database of local broadband proponents – citizens who say they support broadband. Having list of emails, home addresses, and phone numbers will be useful when it's time to gather support for public actions.
- Broadband Newsletter. Communities often create a newsletter dedicated to broadband. These newsletters are aimed at educating the public on topics related to broadband and also to keep the public informed on the progress of the effort to get better broadband.
- Outreach Meetings. One of the most successful ways to reach the public is what CCG calls outreach. This means sending a spokesperson to meetings of the local organizations to talk about broadband issues and to answer questions. This can be any sorts of groups – PTAs, church groups, service organizations, youth groups, etc. Most organizations will allow time for a short presentation. It's vital to have a prepared presentation to get across whatever message you want the public to know. These outreach meetings are best done by those who are strong broadband proponents or who have specific knowledge about broadband.

Pre-marketing Efforts

If the broadband effort reaches the second phase, one of the most important steps is to identify potential customers for a broadband network. The biggest concern that every ISP has about a new market is knowing if they can get enough customers to be successful. We already have an inkling of the support in Falmouth from the residential survey. The pre-marketing efforts go a layer deeper and ask residents and business to pledge support for a new network. There are several techniques that communities have used to understand market demand.

Statistically Valid Surveys. Falmouth has already undertaken a residential survey. The goal for doing a residential survey is to be able to predict the most likely range of customer broadband penetration should somebody build a broadband network. We've found over the years that if a survey is conducted in a way to be statistically valid that the results provide a good prediction of the likely customer penetration rates.

Canvass. A canvass is similar to a survey but has the goal of reaching out to everybody in the

community. Communities often undertake a canvass at the point where there is a decision to move forward to implement a broadband solution. A canvass can have several goals. The simplest goal would be to create a list of broadband supporters. A canvass could also be used to get homes and businesses to pledge to buy broadband if a network is built. Such pledges are typically non-binding but can provide good support when the community is looking for funding

Canvasses can be done in several ways. A canvass often starts with an online invitation to support a broadband initiative. Canvassing can also be done by mail. We've seen communities engage groups like the PTA or service organization to get people to participate in the canvass. We've seen communities that send volunteers door-to-door to ask citizens to participate in a canvass.

Other Areas of Broadband Concern

Often when communities are looking at attracting a broadband solution, this raises a few issues related to but separate from getting a broadband network. Communities often embark in research and community outreach on these issues in addition to the broadband issue.

Better Broadband for Schools. Communities that don't already have gigabit connections in schools usually make it a priority to beef up school broadband as one of the first priorities of getting a broadband network.

Computers for Students. One of the reasons that communities often build broadband networks is to solve the homework gap, where students don't have computers or broadband at home to do homework. Even if a community solves the broadband issue, they still need to find a solution for the computer issue. Sometimes this is accomplished by having the schools give a computer or tablet to every student. Other communities have undertaken a program to get a computer into each household that needs one.

Focus on the Digital Divide. Communities also often undertake programs to make sure that everybody can take advantage of the new broadband network. This can manifest in numerous ways. That might mean getting computers and WiFi into public housing. It might mean beefing up computers and broadband in libraries. It might mean establishing numerous outdoor WiFi hotspots around the community. It might mean starting basic computer literacy classes. It might mean looking for a solution to bring affordable products to qualifying low-income homes.

D. Other Issues

Falmouth Community Television

One of the questions asked by the RFP is how having a community network could impact Falmouth Community Television which is funded largely from cable franchise fees. Since franchise fees are collected based upon traditional cable TV revenues in a community, it's worth looking at the regulatory and market trends that are already affecting cable revenues and franchise taxes.

The Downward Trajectory of the Cable Industry. The traditional cable TV industry had a miserable 2019. Collectively the biggest cable TV providers lost over 5.9 million subscribers during the year,

almost 7% of the total customer base. The impacts of the coronavirus, along with the already existing trends in the industry spell bad news for the industry in 2020.

The coronavirus pandemic has had a big impact on the cable industry in 2020. The largest traditional cable providers collectively lost over 1.5 million customers in the second quarter of 2020 – an overall loss of 2.0% of customers. This is the smaller than the loss in the first quarter of 1.7 million net customers. To put the quarter's loss into perspective, the big cable providers lost 16,700 cable customers per day throughout the quarter.

The majority of subscribers leaving traditional cable cite cost as the primary reason, and as millions of people have lost jobs due to the pandemic, one of the first things they are going to do is to ditch traditional cable for something less expensive. For years, nationwide surveys of subscriber sentiment have shown that as many as 20% of households each year contemplate dropping traditional cable TV, but for a variety of reasons they don't get around to doing so. This year a lot of these homes are finally going to make the change.

A Recent Roku Survey. Roku undertook a survey in March 2020 that took a deep dive into cord cutting and interviewed over 7,000 homes. The overall conclusion of the survey is that cord cutting is accelerating in 2020. The survey was done at the beginning of the pandemic, and overall industry statistics for the second quarter make it sound like cord cutting exploded in the second quarter of this year.

The Roku survey segregates the television market as follows: 43% of homes still have traditional cable TV. Another 25% still have traditional cable TV but have reduced to a lower-cost video package, making them cord shavers. 25% of the market are now cord cutters and 7% of the market never have had traditional cable TV.

Probably the most interesting statistic is that one-fourth of the market consists of cord-shavers who have reduced their traditional programming packages. It's been clear that cord-shaving has been happening, but I've never seen it quantified before. The big cable companies never mention cord shaving when reporting cable TV subscribers. The magnitude of the households that have trimmed back to lower-cost programming packages explains why the paid subscriptions to cable networks is dropping far faster than the drop in cable customers.

Lack of sports is driving some cord cutting during the pandemic, and 28% of cord cutters said that lack of sports was their number one reason for cutting the cord. 17% of cord cutters (or 4% of the whole video market) say they will consider returning to traditional TV when sports returns to the air fulltime. 31% of cord cutters say they will pursue a sports streaming service when sports returns.

The number one reason cited for cutting the cord was cost savings, and many of those surveyed said they were driven to this decision due to change in household income due to the pandemic. The average Roku user said that they are saving $75 per month with cord cutting. Cord cutters are watching more free ad-supported content as a way to cut costs. 42% of cord-cutting households said that free content or extended free subscriptions to streaming services helped to convince them to cut the cord.

45% of the households in the cord shaver category say they are likely to cancel traditional TV in the next six months. Almost every survey about cable TV I've seen for the last five years has included

substantial numbers of homes that say they are going to drop cable TV – but then don't. But this statistic does indicate that there are a lot of households thinking about cutting the cord. It's often a complicated decision for a home with multiple family members to finally cut the cord.

The pandemic makes it harder to discern long-term trends in the cable industry. This survey supports what we're seeing in the market, that a lot of homes continue to drop traditional TV packages. But the pandemic provides several good reasons to drop a cable subscription that won't be permanent. Sports will eventually come back to TV and sports fans are going to find a way to watch sports. As the economy rebounds, people will get back to work – it's an easier decision to cut a $100 per month cable subscription when one or more people in a home are unemployed. The pandemic has also ended the creation of new content, and many cable subscribers are willing to pay for an expensive cable TV subscription in order to see the latest versions of their favorite shows. I've read that it might take more than a year after the pandemic ends to see a fresh supply of new content again.

It will take time to see if an improved economy reverses any of the cord cutting trends. For now, any company offering cable TV is in for a rough ride. It's hard to see any positive news from the results of this survey for programmers other than ESPN.

Franchise fees are plummeting in the same trajectory as cable TV revenues. The franchise fees collected are lowered when somebody drops cable in favor of online programming or downsizes to a less expensive cable package.

Regulations and Franchise Fees. In September 2018, the FCC issued a Report and Further Notice of Proposed Rulemaking (NPRM) concerning cable franchise fees and related issues. This docket was prompted by a court decision in July 2017 by the US Court of Appeals for the Sixth Circuit concerning earlier efforts by the FCC to clarify and restrict franchise fees. In that case, Montgomery County Maryland v. FCC the courts had remanded several FCC rulings as being unclear.

The original FCC order that was challenged in court clarified a few rules concerning franchise fees. First, the agency clarified that the maximum franchise fee that can be levied against a cable provider is 5%, and that the 5% fee had to include any in-kind payments expected from a cable company under a franchise agreement. Further, the FCC clarified that franchise fees are only supposed to be levied against cable TV revenues and not against other products and services offered by a cable company.

Cities have expanded franchise agreements over the years to include other kinds of compensation. For instance, many cities require cable companies to provide free cable TV service to government offices and schools. Some franchise agreements require cable companies to provide free or reduced bandwidth to schools or low-income housing. The FCC even citied franchise agreements that required unusual activities such as cable companies having to plant flowers in parks.

The 2017 lawsuit was aimed at clarifying the original FCC order, particularly the requirement that cities are allowed to extract payments in-kind, but that any such costs to cable companies count against the 5% cap on total franchise fees. The court decided that the FCC had not been clear on the definition of in-kind payments. For example, the court said the FCC wasn't clear if the costs of providing PEG channels was considered as an in-kind payment. If the act of providing the channels is considered as an in-kind cost, then the amount of franchise fees paid to Falmouth and to Falmouth Community Television would be reduced.

The 2018 order is an attempt by the FCC to clarify the questions raised by the court. Specifically, the FCC NPRM asks comments on the following issues:

- The FCC proposes to treat incumbent and new competitive cable operators identically in order to not impose any restrictions that might hurt the expansion of broadband deployment.
- The FCC seeks to clarify the definition of in-kind payments and reiterates that any such payments are to be included in the 5% cap on franchise fees.
- The FCC is reaffirming that there should be no franchise fees imposed on other services like broadband, telephone, or smart-home services.
- The further clarify that there can be no other provisions included in a franchise agreement that would act to regulate any service other than cable TV. For example, some LFAs have been trying to use franchise agreements to dictate things like the coverage, speeds, or prices of broadband services.
- The FCC also asks if these same rules should apply to statewide franchise rules that have been created by state legislators as an alternative to local franchise authority.

The FCC still has not reacted to the comments it gathered on this docket in 2018 and 2019. The FCC has no mandatory timetable for such decisions and the agency has given no clue about when it might react. Until the FCC reacts, some of the rules in its first order are on hold until the FCC clarifies. The risk to Falmouth Community Television is that the FCC will affirm that in-kind contributions can reduce franchise payments. Comcast could claim a significant cost for providing the PEG channels used by Falmouth Community Television and could reduce franchise fee payments accordingly.

Regulations on Traditional versus Online Programming. Traditional cable TV is heavily regulated at the federal, state, and local levels. The FCC website has a nice summary of the history of cable regulation.[30] The industry is less heavily regulated today than it was forty years ago, but there are still a lot of federal regulations that apply to cable TV.

The FCC website includes a definition of cable television as follows: "***Cable television*** *is a video delivery service provided by a cable operator to subscribers via a coaxial cable or fiber optics. Programming delivered without a wire via satellite or other facilities is not "cable television" under the Commission's definitions."*

All of the federal cable regulations are aimed at cable TV that enters the home via a coaxial or fiber wire. Satellite or wireless delivery of television signal is not considered to be traditional cable TV, although the FCC regulates satellite TV under a different set of rules.

Today there are surrogates to cable TV that are not regulated. There are online cable alternatives like Sling TV and YouTube TV that have grown over time to look a lot like traditional cable TV. The service included a channel guide. From a functional perspective it's hard to see the difference between the online programming and traditional cable. Online video enters most homes using coaxial or fiber cables. Both offer a line-up of local channels and a similar mix of national programming. Both kinds of services offer options like DVR service to record programming to watch later. If you were to show both services to somebody who never watched TV before, they'd probably not see any difference in the two services.

[30] https://www.fcc.gov/media/engineering/cable-television

The huge difference at the local level is that there are no franchise fees levied against Sling TV or YouTube TV. Cable companies are arguing that this difference alone gives online programming a competitive edge – and it's hard to disagree with them. From a regulatory perspective, this is closely analogous to the difference between traditional telephone service and voice over IP (VoIP). ISPs successful fought to define VoIP as a non-regulated service, although there is no functional difference between the two products at the customer level. It's likely just a matter of time until we see a legal challenge by a large cable company trying to avoid collecting franchise fees. They'll argue that they are not different than Sling TV, and the courts might side with them.

The City of Creve Coeur, Missouri, filed a lawsuit in 2019 against Netflix and Hulu claiming that the companies should be paying the same local franchise fees as Charter Communication, which is the incumbent video provider in the community. The city claims that it is losing franchise tax revenues as people cut the cord and go from Charter to the online content. The city wants to tax the companies that are taking that business away from Charter. They argue that Netflix and Charter ride the same wires and rights-of-way to deliver content and both should be taxed the same.

Just before this report went to print a similar lawsuit was filed by four cities in Indiana - Indianapolis, Evansville, Valparaiso, and Fishers. They sued Netflix, Hulu, DirecTV, and Dish Networks on almost identical grounds as Creve Coeur.

If the court sees this as a regulatory battle the case will likely get remanded to the FCC. But there's no way to predict what might happen if a court looks at this as a tax dispute. There is at least some tiny chance that a court could rule that Netflix can be taxed.

It's not clear if Creve Coeur wants Netflix and Hulu to sign a franchise agreement, but if they do the city might not like the result. Current FCC regulations require that a municipality can't demand concessions from one franchise holder that doesn't apply to all franchise holders. I can picture a stripped-down franchise agreement for Netflix that Charter would leverage to get out of obligations such as having to provide a PEG channel.

The FCC does not want this issue handed to them because it opens the door to defining who is a cable company. The agency opened an investigation into this issue a few years ago and quietly let it drop, because it's not a decision they want to make. The FCC is constrained on many issues related to cable by laws passed by Congress. I think the FCC decided early in the investigation that they did not want to tackle the sticky issues of declaring online programmers to be cable companies. Had the FCC done so this suit might have good traction.

What's the Future for Falmouth Community Television? There are a few impacts that are definite and a few impacts that hang as possible threats. Franchise revenues that fund Falmouth Community Television are going to continue to plummet. In the past we saw landline telephones drop from a nationwide penetration rate of 98% down to under 40% today, and still dropping. Cable subscriptions are being dropped at a much faster rate than were landline, and the peak penetration of traditional cable in the country was around 82%. It's impossible to predict where the bottom of the industry will land, but it's going to be a lot lower than just a few years ago. Franchise revenues are also going to continue to drop from cord shaving, where homes downgrade to a less expensive cable package.

The FCC will eventually react to the NPRM involving franchise fees. If the FCC affirms its original order, then Comcast is going to lower the amount of franchise fees paid in Falmouth to account for any in-kind value provided that is not cash.

The RFP asked for our opinion of what happens if somebody builds a competitive fiber network in the community. CCG Consulting has worked with both commercial and government builders of fiber networks and we foresee the following as the likely outcome of having a new fiber provider:

We've seen with dozens of clients that over half of customers who move to a new network use that change as the opportunity to cut the cord and drop traditional cable TV. This happens even if the new network provider offers a cable TV alternative. The Roku survey citied above showed that over 40% of homes are at least think about cutting the cord, and going through the process of changing providers is an easy way to do so without that long call from the cable company trying to talk them into staying.

A lot of new fiber providers aren't offering traditional cable. It's nearly impossible for a small ISP to even break even with a cable product, and most ISPs are not willing to go through the hard work of offering cable that loses money.

The bottom line is that a new fiber network in the community is going to push down cable subscription rates faster than they would otherwise drop. In the long run, the people who drop cable when moving to fiber would likely have eventually dropped cable anyway – but the new network will accelerate the drop.

Falmouth Community Television has the same future options as many other community cable TV organizations:

- As revenues plummet, they can cut expenses accordingly and reduce the programming and functions they provide in the community.
- They can look for alternate sources of revenue to offset some of the losses. This might include selling local advertising, getting local sponsors, creating content for other community systems for pay.
- A harder path is to replace funding with some other source of tax revenues. We haven't heard anybody doing this yet, but we know communities that are considering providing some funding for community television from other revenue sources like sales tax or property taxes.
- We know of small cities and rural counties that have abandoned PEG channels and put the same content directly on the web. That has the downside of making the content unavailable to homes without broadband.
- Another option being discussed around the country is consolidation of community television operations. There can be a significant economy of scale for neighboring communities to share technicians, administration, studio space, electronics, and all of the costs of operating a community television station. The upside to consolidation is a reduction in costs; the downside is losing at least some local control.

Working with Other Utilities

The RFP asks us to discuss the possibility of working with the local electric utility (Eversource) and gas utility (National Grid) if you built a fiber network. There is the additional benefit to also incorporate fiber more into the town's water utility.

There are several distinct ways that utilities can benefit from a communications network like fiber. The first is in monitoring existing networks. The second is in interfacing directly with customers.

Utility Network Monitoring. Network monitoring generally involves connecting a communications network to sensors that are used to provide feedback on the operations of various parts of the network, often back to a centralized monitoring center. The various utilities have had used sensors of various types for decades. Before that, staff had to periodically visit the various parts of the network to physically make sure things were operating properly.

Electric Utility Monitoring. Electric utilities refer to their monitoring network as SCADA (supervisory control architecture and data acquisition). A SCADA system connects to sensors or electronics at various points in the network that report back on power usage and other information that tells the utility how a remote electrical component is working. For example, the utility can gather data from a remote electric substation so that an operator at the hub can see how that unit is performing. A modern SCADA system also provides the capability to provide feedback to the substation to correct any settings that can be directed from the core.

SCADA monitoring has been around for many years and the connections were originally made using telephone copper connections and small bandwidth applications like ISDN. The low bandwidth connections were more conducive to monitoring than in remotely controlling a location. Over time, electric utilities required more bandwidth to allow for greater interaction and control between the hub monitoring location and remote devices. Electric companies have also greatly expanded the reach of SCADA systems. Originally this was used only for remote electric substations, but today an electric company might monitor a number of other devices such as backup generators, power interfaces at key industrial customers, and even transformers in key locations that have had repeated problems.

There is an entirely different set of monitoring and controls used to interface with power generation. Electric companies that generate power within their own grid need to closely monitor the quantify and quality of electricity being generated in order to incorporate local power with purchased power. The scope of electric generation has expanded significantly in the last decade. Originally power generation mean coal-fired power plants, hydroelectric power generation, or nuclear power plants. But today that also means solar power generation, like the new generation plan built in Falmouth. At the extreme, electric companies want to monitor home and business solar generation if those power sources are fed into the grid. Power generation today might also include wind power generation locations.

Electric companies have expanded SCADA capabilities in two ways. Many electric companies have built private fiber networks to connect to their large installations like substations. However, even utilities with their own fiber networks still often lease commercial broadband connections to reach to locations where it's not cost justified to build a new fiber route. There are many electric utilities that rely entirely upon purchased broadband connections. Some electric utilities are making the internal connection using microwave radios rather than fibers.

Water Company Monitoring. Water utilities have the same needs to monitor key locations in their network. They want to be able to communicate with pumps, water towers, waste treatment

plants, and any other key locations where the utility wants to track water flow, wants to monitor the performance of facilities, or want to control devices like pumps.

Many water utilities are greatly expanding their monitoring capabilities in recent years. It has become apparent that underground water leaks can cost a utility huge amounts of money, and so water companies have been expanding the use of flow meters to be able to pinpoint the location of new water leaks.

Gas Company Monitoring. Gas company monitoring is similar to what's done with water systems, except that there is a host of additional sensors in the system checking to identify gas leaks. Gas utilities not only measure gas pressure and flows, but they generally have sensors that can 'sniff' leaked gas at key locations.

For all of these utilities, the amount of broadband needed to monitor a single location is relatively small. This means that the extra broadband that is available with fiber is not needed. The primary reason that utilities consider building their own fiber networks is because of private control of the network. No utility wants to have major problems that occur during times when the telephone company or cable company connection are out of service – something is somewhat routine in most local broadband networks. Electric utilities want to quickly respond to issues that issues that might cause power outages. They want to take remedial action to stop power outages.

Electric companies learned a valuable lesson twenty years ago when the country suffered several significant and widespread power outages – some that affected as much as half of the country. They learned that outages were made worse because the utilities were not closely monitoring grid locations and didn't have in place any systems that could react quickly enough to pinch off rolling blackouts and brownouts. In many cases the remedial actions needed must happen within seconds or minutes – and electric utilities realized that meant having their own networks so they didn't have to trust in communications from somebody else.

Smart Grid – Interfacing with Customers. A smart grid is an electrical grid which communicates with a wide variety of devices like smart meters and smart appliances. Smart grid technology started over 25 years ago when utilities asked customers for the ability to turn off power-consuming devices like air conditioners during days when the electric grid was under stress. The first-generation technology was basically not much more than an on/off switch for the air conditioners or heat pumps that could be activated remotely by the electric company. This was one of the innovations that was put into place to control the big rolling brownouts.

Over time smart grid has grown to be a lot more sophisticated. For example, electric companies now offer smart thermostats where the electric company will help customers save money while also providing for the original function of acting as a safety valve for turning off devices during network stress. The smart thermostat is not really smart and the brains that control the device are in the cloud and controlled by the electric utility. A smart meter can perform a range of cost-saving activities. For instance, the technology can automatically turn the temperature down when residents go to work or are sleeping and turning it back up when people are active in the home.

The newest technology deployed by electric companies is being called smart grid. Electric grids most typically differ significantly during the day in the cost of producing electricity. When electric usage for

the whole grid is low the utility might be generating all of the power itself. When power usage for the whole grid gets higher the utility might have to buy power from a neighboring utility at a higher cost than internally generated electricity. It can also work the other way. For example, a utility might have access to low cost solar power on sunny days but have to rely on other power sources at night and on cloudy days. Utility costs also vary in towns where there are large industrial users of electricity, like large manufacturing plants, that use a lot of electricity at only certain times of the day or night.

A smart utility has technology in place that tries to minimize the use of the most expensive power. One of the tools used to do this is smart meters. This can help consumers use electricity at the times when power is the cheapest. For example, charging electric cars uses a lot of electricity at a home. A consumer can save a lot of money if they are willing to let the electric utility only charge the vehicle at the times when the grid is using the lowest-cost electricity. The utility can pass that savings on to the consumer. Smart meters allow for time-of-day billing where power is charged at different rates throughout the day. Customers and the utility together can use the smart meter to minimize the use of home electricity when usage on the grid is getting too high. Rather than just turn off an air conditioner, the technology can be connected to other appliances and systems like basement freezers, sump pumps, dehumidifiers, and any device that uses a substantial amount of power. When the utility can apply the technology to large number of homes, they can influence the amount of power used by the grid and save them (and consumers) money.

Electric utilities are introducing new technologies to control their costs even further. Some are selling battery storage for homes and businesses that can store power from solar panels or even from the grid. The utility can dip into the stored power when needed rather than buy power externally and can save a lot of money. The utility can also use excess power at times when power costs are at the lowest to charge the storage devices.

Fiber and Smart Grid. Just like with SCADA connections, the amount of bandwidth needed for a single smart grid customer is relatively small. The smart grid system passes data between a customer and the utility about electric usage, but this is a relatively small amount of data.

When the smart grid technology was new there were those who thought that fiber networks would be the ultimate tool for controlling a smart grid. However, since there were so few fiber networks in the country, and only a tiny few owned by electric utilities, the industry took a different path. Today most electric utilities communicated with smart grid customers using wireless technology. The utilities build wireless transmitters around the community that communicate with external smart electric meters or with devices that are mounted on the side of the home to connect to indoor meters.

The electric companies generally own the wireless system, and this provides the 100% control feature they are seeking when it comes to controlling devices that affect the overall grid performance. Many electric utilities have eliminated meter readers because they can read the meters through the radio systems. But these same connections can also be used to communicate with a smart meter and the other smart devices that customer might choose to use.

Water Companies and Fiber. Water companies can also benefit by having a fully connected monitoring system. Placing monitors throughout the system can solve a few problems that water systems typically have:

- Some percentage of water meters on most systems are inaccurate and are underbilling for water. Monitoring and comparing the amount of water billed versus what is delivered to various parts of town can help to identify where meters might be faulty.
- All water systems lose water through leaks into the ground. A monitoring system can be used to more quickly identify fast water leaks. Cities tend to find leaks that result in above-ground flows, but often don't know about underground leaks. More insidious or slow steady leaks, and it's not unusual for older water systems to lose 20% or more of water per year to slow leaks. A well-designed monitoring system that compares flows per route can identify routes with these problems.
- Most water systems already have some sort of communication to connect to pumps and other water infrastructure throughout a system.

There are few water companies that have upgraded to the latest monitoring technologies. Instead, most water companies communicate with field units like pumps through wireless connections or low-price broadband connections like DSL. The bandwidth needed for communicating and for monitors do not require the big broadband provided by fiber. However, if a city had a fiber network, it could eliminate any external communications costs by making all such connections on fiber.

Summary. What does all of this mean in terms of the opportunity for a fiber network owner and these other utilities to work together? There are some opportunities, but it's not nearly as large as might be suspected:

- All of the utilities have connections that are used for monitoring. To the extent that those connections are not on radio systems owned by the utility, then there is a possibility for a fiber network provider to sell broadband connections to the utility. However, utilities are often looking for the lowest-cost broadband available. They might want to stick with DSL connections, for example, of those cost less than fiber connections.
- Almost all electric companies are using wireless technology to make smart grid connections to customers. There is an opportunity to sell fiber connectivity to reach utility radio towers, but most utilities prefer to own these fiber connections themselves – it goes back to the idea of not wanting to rely on anybody else's network. Even many municipalities that own fiber networks and electric utilities still provide these connections using wireless technology – because the industry has not developed affordable interfaces between smart meters and fiber connections. The mass-produced wireless devices are much cheaper.
- The final consideration is that larger utilities that serve multiple communities generally want to have the identical solution everywhere in the network. For example, if Eversource uses Verizon throughout its network to make connections, it is likely unwilling to do something different in one town like Falmouth, even if you have a fiber connection. A utility does not want to have to work with multiple ISPs or have to troubleshoot if there is a problem to find out which ISP is causing problems. We know of many sizable municipal fiber networks that have not sold any connections to the local utilities due to this concern. However, the town should definitely talk to Eversource about being a partner – it's possible they would be interested.

Collaborating with Neighboring Communities

One thing we learned in doing this study is that the entire Cape has nearly the identical broadband situation. Verizon has not built any FiOS on the Cape and all of the communities are served by a combination of Comcast along with Verizon DSL.

It also seems that Falmouth is the first community on the Cape to undertake a formal broadband study like this one. Other communities have considered this, but not have gone so far as quantifying the cost of building a fiber network or examined the opportunity for a fiber ISP to succeed in a community.

The idea of regional collaboration is relatively common in the broadband and utility world. There are numerous examples of collaborations that have been created to save on costs and to achieve economy of scale. For example, there are dozens of regional collaborations that have been created for rural electric companies. These businesses benefit tremendously by having one administrative staff operate multiple small utilities. There is a smaller set of similar collaborations in the broadband world, but there are around a dozen collaborations that we know of that have combined the backoffice functions for multiple small telephone companies and cooperatives. There are another dozen collaborations where telephone companies in a state have joined forces to fund and build a middle-mile fiber network to provide connectivity into rural areas.

All of these collaborations are based upon taking advantage of economy of scale. That is an economics term that describes how companies can be more efficient with size. It's easy to understand economy of scale when contemplating multiple cities building fiber broadband networks in the Cape. The analysis that we did for this study of the cost of bringing fiber broadband to Falmouth. In that study we supposed that a new ISP created to serve the town would need to hire backoffice staff like a general manger and accountants. The business would need to buy software systems and develop processes for communicating with customers.

All of these functions would be far more cost effective when spread across a greater number of customers. A general manager that was hired to operate an ISP in Falmouth could equally manage the same function in nearby towns. The same is true for most of the administrative and backoffice costs of operating a broadband business – big is better in terms of the cost required to serve a single customer.

Creating Collaborations. Almost all of the existing collaborations that we know of are the result of existing ISPs coming together to save money. For example, there is a collaboration of telephone cooperatives in Tennessee that provides the backoffice functions and management for a business that served hundreds of thousands of customers. The joint holding company created to provide those functions is far more cost effective than the costs that were experienced before the collaboration collectively of each of the member cooperatives.

From what we've seen, collaborations often grow around one existing hub ISP. For example, the City of Windom in Minnesota has operated a municipal cable network since the 1970s. The city upgraded the network to provide broadband over a decade ago, and eventually decided to upgrade to fiber and changed the business name to Windom.net. A half dozen small communities around Windom decided to finance fiber and allow Windom to operate the ISP. These small towns would not have been able to afford to create an ISP on their own saw the economic sense in the collaboration. There are similar stories associated with most existing collaborations.

There are very few examples of collaborations that were created for the purpose of building broadband that did not start with an existing ISP at the core of the collaboration. We can only think of two such collaborations, and both happen to be in Minnesota.

Southwest Minnesota Broadband Systems (SMBS) is a collaboration among ten small communities that built a new broadband network and business together. These are tiny communities which combined only had 3,600 residents. The communities all had no broadband alternatives and started meeting in 2007 to see if they could attract an ISP to serve the communities. The consortium was not formally created until the opportunity arose to win a large grant. The newly formed consortium was awarded a big grant in 2009 from the American Recovery and Reinvestment Act (ARRA). This was a one-time grant program that was created as part of the stimulus funding bills created to pull the country out of the 2008 economic recession.

The grant funding still required the communities to raise additional matching funds, but the grants provided enough cash to enable the cities to borrow the remaining funds and to create a business that could succeed. The newly created consortium hired a management team that built the fiber network and launched the ISP. The network brought gigabit broadband to an area that had no broadband faster than rural DSL before the fiber network.

RS Fiber Cooperative is a consortium ISP that was created to serve a number of small cities and the surrounding rural areas in two rural counties in Minnesota. The consortium was formed when the mayor of one of the small towns decided that his town needed fiber and sent his economic development manager off to find a solution. It took years, but eventually all of the small towns in the region decided that broadband was something the area needed, and they formally banded together to create a Joint Board, which is a formal government organization in Minnesota that can be created by multiple government entities to solve a common problem.

The Joint Board tried to raise the money to fully finance a fiber-based ISP. However, after almost two years of trying it became evident that this wasn't going to work as a municipal venture. A few of the cities were unable to make the needed financial pledge to support a municipal bond issue. Even more aggravating, the city and county attorneys from the various cities, townships, and counties were unable to agree on much of anything. The whole effort fell apart.

But the Joint Board didn't give up and CCG suggested a few alternative business ideas, which included creating a new broadband cooperative. RS Fiber Cooperative was formed by some of the remaining cities (a few dropped out from the original consortium). The plan was to raise 25% of the financing from the cities and the rest from banks. This passed muster with the remaining cities because their pledge for the bonds was much smaller, and the type of bonds changed from general obligation bonds to an economic development bond. The legal squabbling was also greatly reduced due to the change in the form of the bonds.

The RS Fiber story is perhaps the best demonstration of the huge amount of work required to create a broadband consortium from scratch, without an existing ISP involved. There were hundreds of meetings and hearings on the issue at the various cities and the process took years and a huge amount of perseverance. There are not many groups of cities or towns that would have made it through the challenge.

A collaboration of communities on the Cape is always a possibility – but creating a collaboration where there is no existing ISP presents the following challenges:

- As this study shows, the amount of money needed to build fiber on the Cape is going to be enormous. The different towns on the Cape are going to differ in their ability to raise the needed money to build fiber.
- It's extremely challenging to combine forces to coordinate to raise large amounts of municipal financing on the same schedule. The coordination required for each community to raise money at the same time is an extremely daunting challenge. It would likely require one or more full time people to coordinate the effort – and the chances of communities dropping out of the process are high. In the RS Fiber example, a number of cities dropped from the consortium when they were unable to meet the expectations and timetable to make the effort happen.
- Perhaps the hardest challenge of this kind of consortium is governance. When there is no existing ISP, every town is going to have differing ideas on how the new broadband business ought to work. Getting everybody on the same page for the dozens of important decisions that have to be made is hard. The RS Fiber effort spent over a year of wrestling in choosing which of the cities would house the newly formed business and staff – everybody wanted the new jobs in their community. Other issues like broadband prices or the obligation of the newly formed ISP to serve low income homes can also be contentious.

This is not to say that a collaboration isn't possible, just that it's extremely challenging. There is a risk of pursuing a collaboration and the process bogging down and nobody ever getting to the point of building a fiber network. We're aware of numerous collaborations that have never gotten past the discussion and planning stage.

However, if Falmouth or some other town on the Cape was to launch a fiber broadband business, there is a high likelihood that over time that other communities would want to join in. That means the first community to decide to build fiber would likely take all of the risks and that following communities get to see an operating ISP before deciding to tackle the venture. The initial ISP will see financial benefits if other communities join them since there will be cost savings from the economy of scale of the business growing larger.

Other Communities with Fiber

The RFP asks us to identify other municipalities with fiber-to-the-home networks that are similar to Falmouth. Following are examples in three categories, 1) municipalities with population seasonality, 2) municipalities with no existing electric utility, and 3) municipalities of about the same size as Falmouth. The last category is a little tricky since Falmouth varies from 30,000 residents in the winter to 100,000 people in town in the summer. Since our conclusion of this study is that the network must be self-sufficient based only upon the fulltime residents, we looked at cities with approximately 30,000 residents.

Municipal Networks with Seasonality

Cook County, Minnesota[31]

The city with the closest seasonality issue is Cook County, Minnesota. This county is an hour north of Duluth, MN, and sits on Lake Superior and on the Canadian border. The county seat

[31] https://truenorthbroadband.com/

Grand Marais is a beautiful lakefront tourist location. A large portion of the county is covered by the Superior National Forest. The county also includes a few ski resorts for winter tourism.

The principle economy of the county is tourism, both for the lake and the woods. The fulltime population of the county is less than 6,000 people, but in the summer, there are approximately 10,000 tourists daily.

The county investigated broadband starting in 2008. At that time there was practically no broadband in the community. The local telephone company was CenturyLink and the DSL barely worked. Businesses complained about the inability to take credit cards. Hotels couldn't take online reservations. Even in 2008 tourists were expecting workable broadband while they visited. The county also had terrible cellular coverage, due largely to the rough terrain. The event that really set the county to find an alternative was a fiber cut an hour south near Duluth that knocked out telephone, broadband, and cellular coverage in the entire county for over a week.

The connectivity issue was solved when a non-profit carrier built a middle-mile fiber ring from the Twin Cities that connected throughout northern Minnesota. The local broadband issue was resolved when the local electric cooperative agreed to sponsor and operate a broadband utility, now named True North Broadband. The network was funded from three sources - a combination of a grant and a loan from the federal agency Rural Utility Service (RUS) and a loan provided by the county that was backed by a one cent increase in sales taxes.

The ISP offers fast broadband that starts at $65.94 for 100 Mbps up through 500 Mbps for $120.94 per month. The ISP also offers telephone service. As would be expected of a rural community, the ISP offers seasonal rates. A customer can suspend service for up to six months each year and pay a $10 rate during the suspended period. Service must be connected for the next six months following the end of a suspended period.

Islesboro, Maine[32]

The small island town of Islesboro began exploring ways to improve broadband in 2012. This is a small town with only 350 homes. The residents agreed to fund a fiber network in 2016, and the network was constructed in 2017. The town floated a bond issue to pay for the project that was backed by a small increase in property taxes plus the revenues from subscribers. The town contracts with a nearby ISP in Biddeford, Maine to light the network, connect customers, and maintain and repair the network.

This is a tourist town and the initial installation connected to 600 locations, many of them businesses that cater to tourists. The pricing for broadband is simple. Customers pay $360 per year and are provided with gigabit broadband. They can buy a few optional services like telephone service or WiFi routers. The town does the billing, which further reduces the fees from the ISP.

College Towns

[32] http://townofislesboro.com/committees/islesboro-municipal-broadband/#c681

There are a number of municipal and commercial fiber overbuilders that serve college towns. I'm not aware of any that serve any of the large, nationally known university towns, but there are quite a few ISPs serving the next lower tiers of colleges. This includes universities like University of Louisiana in Lafayette, LA and Western Oregon University in Monmouth Oregon.

College towns are seasonal and generally empty out during the summer. They also have extremely high churn as students move into and out of the community. This seasonality is different than what is Falmouth because there are paying customers for nine months a year instead of your shorter summer season.

The big issue for ISPs in college towns lies in getting paid. Students are notorious for running out of money before the end of a semester or leaving town with an outstanding balance due to the ISP. ISPs in college towns use two different strategies to deal with the payment issue. The predominant strategy is to sell broadband to landlords and not to individual students or apartment units. It's typical to sell broadband to landlords that have multiple living units at a wholesale rate, meaning cheaper than the normal residential rate. For that cheaper rate the landlord must agree to pay for all living units for the whole year and agree to a term contract. Landlords typically include broadband in the rent. Another strategy used by MINET in Oregon is to sell broadband to students that rent houses by providing a discount but requiring a prepayment for the whole school year. Since parents pay most bills, the municipal ISP has had no problem selling this product every year.

Municipal Networks with no Muni Electric Company

Sandy, Oregon[33]

Sandy, Oregon is 25 miles east of Portland at the base of Mt. Hood. It's a city of 11,000 and is somewhat geographically isolated. The city entered the broadband business back in 2002 when the telephone company wouldn't offer DSL. The city built their own DSL network. Over time they transitioned to a wireless technology including a citywide outdoor WiFi network. In 2014, the city started building a citywide fiber network to replace the older technology.

The city does not have a municipal electric company and instead created a city broadband utility. The city borrowed to build the fiber network, but the effort was eased since the city already had over 70% of the residents as broadband customers on the older technologies.

The primary product is affordable fast Internet service. A 300 Mbps connection costs $41.95 per month. Homes can get a gigabit connection for $59.95. The city offers basic telephone service for $20 per month. The city also sells broadband to the rural areas surrounding the city using fixed wireless technology.

EC Fiber, Vermont[34]

[33] https://www.ci.sandy.or.us/sandynet/

[34] https://www.ecfiber.net/

EC Fiber is an ISP created by a consortium of 24 small towns in Vermont. Altogether the towns have a population of around 31,000. The towns do not have municipal fiber. EC Fiber was created in 2008 as a standalone government entity owned by the 24 communities.

EC Fiber tried to get started just as the 2009 recession hit and was unable to raise money from banks. The entity took a unique path to get started. They started by raising $1 million in loans from local residents. After that they issued promissory notes in increments of $2,500 to local residents who were willing to invest in the business and raised over $7 million from 500 local investors by 2015. At that point they got a $600,000 grant from the State of Vermont and was also granted use of some state-owned dark fiber to provide backhaul.

In 2016, legislation was passed that created EC Fiber as the first Communications Union District, which provided them with the legal authority to issue municipal bonds. Since 2016 EC Fiber has raised over $32 million in revenue bonds and is currently expanding fiber outside each of the towns to the surrounding rural areas. By 2018 they had constructed over 1,400 miles of fiber and passed over 20,000 homes.

Broadband prices range from $64 for 25 Mbps broadband up to $156 per month for 800 Mbps service. Installation is $99 and customers must pay extra if they are located more than 400 feet from the nearest fiber terminal along the road.

Marshall, Michigan

Marshall, Michigan is a community of 7,000 in south central Michigan. The city decided to build a fiber network in 2017 since the city's only broadband option was slow DSL in the range of 2 Mbps, and there was no cable provider. Marshall does not own an electric utility and established the Internet Department as a new department of the city. The broadband business is branded as Marshall Fibernet.

Marshall financed the network by interdepartmental loans from other city departments as well as funding raised by Marshall's Local Development Financing Authority. The city did not issue municipal bonds. Now that the network has been built the city is considering extending the network to nearby townships.

Residential broadband prices range from $40 for 50 Mbps service up to $200 for gigabit service. The city claims it will provide speeds up to 10 Mbps per second upon request.

Municipal Fiber Networks in Cities of a Similar Size

Salisbury, North Carolina

Salisbury is a city of 33,500 that is midway between Charlotte and the research triangle in North Carolina. The city began investigating broadband in 2005. After finding significant public support for the effort the city issued $29 million in revenue bonds and created an ISP, branded as

Fibrant, that was associated with the city's electric utility. In 2015, Fibrant announced it would be the first city to offer 10 gigabit service to residents.

In 2018 the city reached an agreement with Hotwire, a large ISP from Florida, to lease the entire network from the city. Hotwire has rebranded the ISP as Fision Fiber.[35] The city continues to own the network and the lease payments are used to pay the revenue bond debt. The city reached this decision because they felt that they were unable to fulfill their original vision. The municipal electric company serves a number of nearby towns and the city had always planned to expand fiber to serve the entire electric footprint. However, the North Carolina Legislature passed a law that forbid any new construction of municipal fiber and the two existing municipal networks in Salisbury and Wilson were allowed to continue service but are not allowed to expand. The city hopes that Hotwire, as a private ISP, will expand the network to the rest of the surrounding communities.

The lease does raise an interesting side note about municipal broadband. In the last few years, several municipal broadband networks in cities like Bristol, Virginia and Opelika, Alabama have been purchased by private investors – and offers have been made to many other municipal systems. Municipalities may decide to sell for any number of reasons, but most cities that have built fiber networks never had a desire to be a competitive ISP. Their goal was always to get better broadband to the community. Once a municipal network is mature and has customers, a network can be easily sold at a price to recover debt or even make a profit, with the city knowing that they now have a fiber ISP to serve the community.

MINET - Monmouth and Independence, Oregon.[36]

Monmouth and Independence are two cities about 15 miles southwest of Salem. Together, the cities have over 20,000 residents. The communities were served by a local cable company that didn't upgrade to broadband service and in 2005 when MINET was formed a lot of residents were still using dial-up. Since then, Charter purchased the cable company, but the cable network was so old that even today the quality on the network is poor.

Under Orgon law the two cities created a municipal non-profit corporation owned by both cities. The project was funded in bits and pieces with small borrowings over the following six years. Monmouth operates a municipal electric utility, but Independence does not. MINET is separate and not related to the municipal electric. Eventually, the cities issued revenue bonds to refinance the smaller series of debts. MINET is possibly the most successful ISP of their size having gotten over 80% of the customers inside the cities. MINET is currently operating a new fiber network for pay in nearby Dallas, Oregon that was funded by a non-profit.

MINET offers a full range of triple-play products including gigabit Internet access. Broadband starts with 150 Mbps service at $54.65 to gigabit service at $129.65.

Morristown, Tennessee[37]

[35] https://salisbury.fision.com/

[36] https://www.minetfiber.com/

Morristown is a city of 30,000 in east Tennessee. The city entered the fiber business in 2006 after recognizing that the poor broadband in the community was killing jobs and blocking economic development. The city had no incumbent cable provider and residents and busineses had no choice other than DSL. The city owns a municipal electric utility which also opeates the broadband budsinesses branded as MUS Fibernet. The city issued general obligation bonds bonds to finance the network. MUS Fibernet reports having over 15,000 customers and claims to be financially solvent.

The city cites a number of examples of businesses that have located or expanded operations in the city due to the fiber network and the low broadband rates. Prices range from $39.95 for 250 Mbps to 99.95 for gigabit service.

Observations about the Selected Cities. Nearly 200 communities have constructed fiber to the whole community and there are hundreds of communities now considering fiber broadband. There a few issues that all of these communities have in common. The most important commonality is that every community felt that their existing broadband was holding the community back. That's an important characteristic, bucause a new ISP in that kind of market is likely to win a higher percentage of the market than ISPs that compete against a quality broadband provider. Some of the ISPs on the list above have won 70% or even much higher market penetration rates.

Every one of the communities listed above had gathered significant residential and business support before building a broadband network. If the town was to decide to move forward, one of the first steps would be to formally gather public support through the customer engagement process described in this report.

It's interesting to note that even this small sampling of cities found different and interesting ways to pay for a broadband network. What is not captured on this kind of list are the many communities that have the need and desire for broadband but that can't find a way to finance such a venture.

One thing is not obvious from this list. Most of the cities on this list have decided to be the retail ISP and to serve customers as a utility. However, it's been our experience that the majority of communities do not want to be a retail ISP. Most cities that are finding broadband solutions today are doing so through some form of a public-private partnership. The only public-private partnership on the list above is Salisbury North Carolina.

[37] http://www.musfiber.net/service/fibernet/index.php

EXHIBIT I: RESULTS OF THE RESIDENTIAL SURVEY

Total Surveys - 378

Residency:

	Number	Percent
I live in the town of Falmouth I DO rent	10	2%
I live in the town of Falmouth I DO NOT rent	359	95%
I live in the town of Falmouth part time and spend 6 months per year	3	1%
I live in the town of Falmouth part time and spend 7 months per year	1	.33%
I live in the town of Falmouth part time and spend 8 months per year	1	.33%
I live in the town of Falmouth part time, spending 9 months per year	1	.33%
I don't live in Falmouth, but I rent my property there to others	3	1%

2. Who provides internet service to your home now?

	Number	Percent
Comcast	314	83%
Verizon	29	8%
Only use my cell phone data	15	4%
Don't have Internet	20	5%
Other	0	0%

3. Who is your current Cable TV provider?

	Number	Percent
Comcast	298	79%
Verizon	18	5%
Satellite dish	16	4%
Only watch on-line	17	4%
Don’t have cable TV	29	8%

4. If you have a telephone landline, who provides your telephone service?

	Number	Percent
Comcast	209	55%
Verizon	18	5%
Don’t have a landline	151	40%
Other	0	0%

5. What do you pay for the following?

Bundle	$183
Standalone Cable TV	$ 92
Standalone Internet	$ 59
Standalone Telephone	$ 72

6. Does anybody in your household use the Internet connection to work from home?

	Number	Percent
Full Time	17	5%
Several Days per Week	32	8%
Occasionally	51	13%
No	278	74%

7. Do you have students in the home that use internet for school assignments?

	Number	Percent
Yes	84	22%
No	294	78%

8. Using a scale from 1 to 5, where 1 is very dissatisfied and 5 is very satisfied, please rate your Internet Service Provider on the following?

Download Speeds

	Number	Percent
1 Very Dissatisfied	30	8%
2 Dissatisfied	67	19%
3 Okay	143	40%
4 Satisfied	54	15%
5 Very Satisfied	64	18%

Customer Service:

	Number	Percent
1 Very Dissatisfied	40	11%
2 Dissatisfied	77	21%
3 Okay	132	37%
4 Satisfied	49	14%
5 Very Dissatisfied	60	17%

Reliability:

	Number	Percent
1 Very Dissatisfied	34	9%
2 Dissatisfied	97	27%
3 Okay	129	36%
4 Satisfied	46	13%
5 Very Satisfied	55	15%

Value I get compared to the price I pay:

	Number	Percent
1 Very Dissatisfied	68	19%
2 Dissatisfied	122	34%
3 Okay	74	21%
4 Satisfied	38	11%
5 Very Satisfied	54	15%

9. Have you experienced any Internet outages in the last 12 months?

	Number	Percent
Yes	182	51%
No	175	49%

9a. Briefly describe the outages

	Number	Percent
Short Period	27	15%
One Day	73	40%
Multiple Days	82	45%

9b. How bothersome were the outages?

	Number	Percent
Not Inconvenient	4	2%
Somewhat Inconvenient	81	45%
Very Inconvenient	97	53%

10. Have you experienced any Internet slowdowns in the last 12 months?

	Number	Percent
Yes	227	63%
No	131	37%

10a. Briefly describe the slowdowns.

	Number	Percent
Random	117	52%
Daily	110	48%

10b. How bothersome were the slowdowns?

	Number	Percent
Not Bothersome	2	1%
Somewhat Bothersome	67	35%
Very Bothersome	122	64%

11. In general, how do you feel about the idea of Falmouth trying to get better Internet access?

	Number	Percent
I support the idea	264	70%
I do not support the idea	53	14%
I might support the idea but need more information	61	16%

12. If you support having Falmouth trying to get better internet access, what are the reasons for your support?

	Number	Percent
I hope a new network will bring competition.	298	92%
I hope a new network would offer lower prices.	257	79%
I hope a new network means better customer service.	132	41%
I hope a new network will bring more reliable service	179	55%

13. If you do not support getting better Internet access in Falmouth, what are the reasons?

	Number	Percent
I'm happy with my current provider	34	66%
Government should not compete in private business	1	2%
Don't want to switch	8	15%
Don't need services	9	17%

14. What factors might influence your decision to become a customer of a new fiber network?

	Number	Percent
Faster internet speeds for the same price I pay today	185	49%
Lower price than I pay today	311	82%
More reliable service	222	59%
Same price but better customer service	74	20%
A locally owned network would keep the dollars I pay in our community	90	24%

15. Would you buy internet service from the new fiber network if they offer faster speeds than the competition at rates similar to what is currently available?

	Number	Percent
Yes, definitely	136	36%
Probably	112	30%
Maybe	60	16%
Probably Not	27	7%
Definitely Not	43	11%

16. Would you buy traditional TV service from a new fiber network if they offered similar channel line-ups and prices as today, and better picture quality than you get today?

	Number	Percent
Yes, definitely	120	32%
Probably	112	29%
Maybe	71	19%
Probably Not	33	9%
Definitely Not	42	11%

17. Would you buy a landline telephone service from a new fiber network if they could offer affordable prices?

	Number	Percent
Yes, definitely	52	14%
Probably	74	19%
Maybe	72	19%
Probably Not	78	21%
Definitely Not	102	27%

The following two questions are only asked of part-time residents (from question 1)

17. Are you able today to get seasonal billing today so that you don't pay for Internet, telephone and TV services while you are not in Falmouth?

	Number	Percent
Yes	5	83%
Not sure	1	17%

18. How important are part-time/seasonal billing rates to you?

	Number	Percent
I wouldn't buy broadband in Falmouth without seasonal rates	5	83%
I would be willing to pay all year for reliable broadband	1	17%
It all depends on the specific products and prices	0	0%

These questions are only asked to those that rent their homes to others (from question 1)

19. Using a scale from 1 to 5, where 1 is very dissatisfied and 5 is very satisfied, how important is it for your tenants to have good broadband?

	Number	Percent
1 Very Dissatisfied	0	0%
2 Dissatisfied	0	0%
3 Okay	0	0%
4 Satisfied	3	23%
5 Very Satisfied	10	77%

20. Have you ever had your tenants complain about broadband?

	Number	Percent
Yes	4	31%
No	9	69%

20a. What kind of problems did they have?

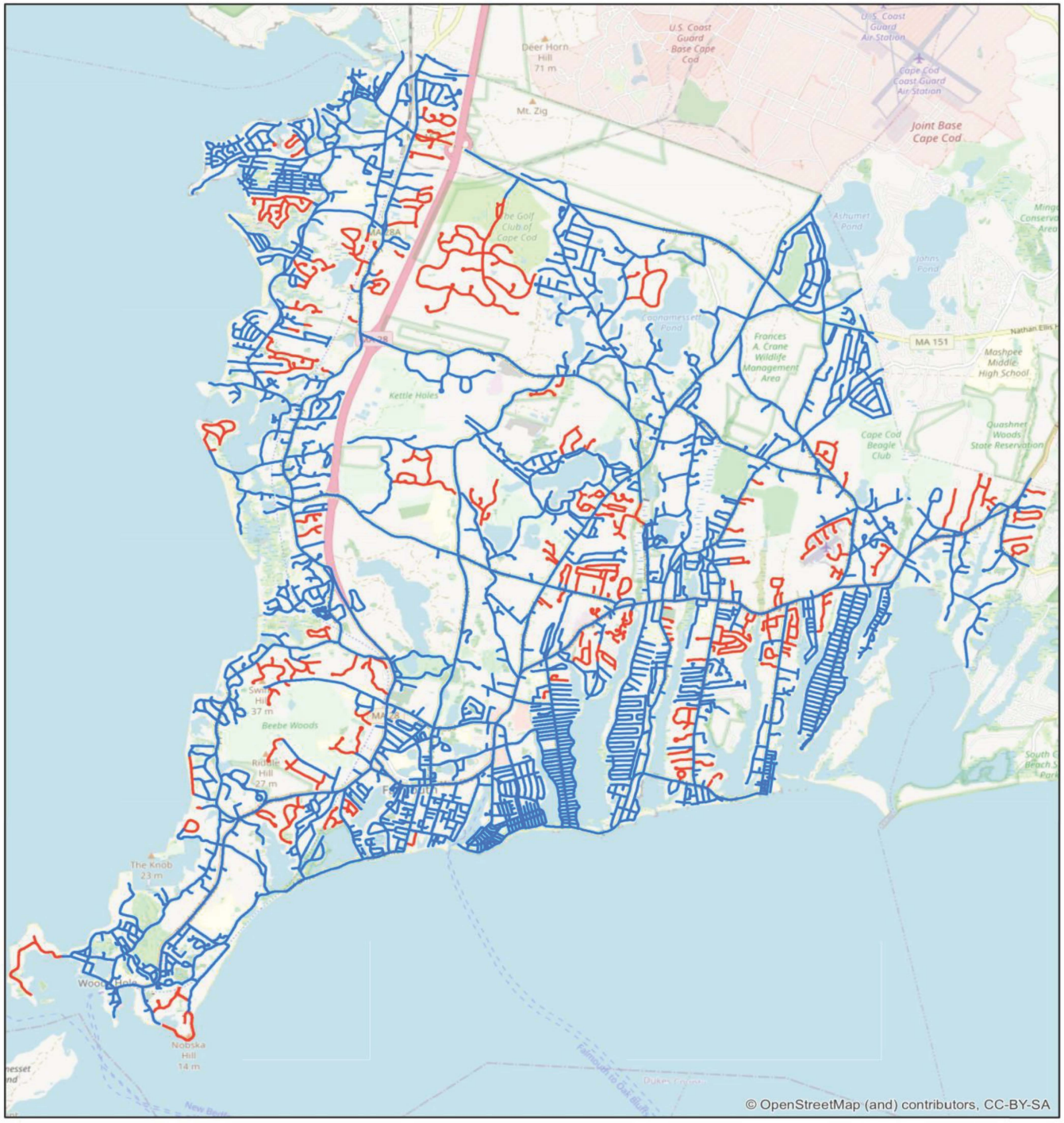
Slow download; Streaming is poor; Internet cuts out

EXHIBIT II: SUMMARY OF FINANCIAL RESULTS

		Assets	Take Rate	Debt	Equity	Total Financing	Cash after 20 Years
Town as the ISP							
1	**General Obligation Bond**	$54.64 M	50%	$62.90 M		$62.90 M	$13.20 M
2	**Revenue Bond**	$54.64 M	50%	$69.40 M		$69.40 M	$ 5.91 M
3	**Higher Interest Rate**	$54.64 M	50%	$71.60 M		$71.60 M	-$ 0.23 M
4	**Lower Interest Rate**	$54.64 M	50%	$66.90 M		$66.90 M	$11.65 M
5	**30-Year Term**	$54.64 M	50%	$66.80 M		$66.80 M	$20.63 M
6	**$5 Higher Prices**	$54.64 M	50%	$69.40 M		$69.40 M	$17.12 M
7	**$5 Lower Prices**	$54.64 M	50%	$69.40 M		$69.40 M	-$ 5.03 M
8	**Rate Increases**	$54.64 M	50%	$69.40 M		$69.40 M	$18.80 M
9	**5% Higher Fiber Cost**	$56.29 M	50%	$71.40 M		$71.40 M	$ 3.53 M
10	**5% Lower Fiber Cost**	$53.29 M	50%	$67.40 M		$67.40 M	$ 8.28 M
11	**55% Penetration**	$55.78 M	55%	$69.00 M		$69.00 M	$19.36 M
12	**60% Penetration**	$56.97 M	60%	$69.70 M		$69.70 M	$32.54 M
13	**Breakeven Penetration**	$54.25 M	48%	$69.10 M		$69.10 M	$ 0.82 M

	Assets	Take Rate	Debt	Equity	Total Financing	Cash after 20 Years
Commercial ISP						
14 **New ISP**	$54.64 M	50%	$52.35 M	$ 7.85 M	$60.20 M	$10.65 M
15 **Existing ISP**	$54.60 M	50%	$50.63 M	$ 7.59 M	$58.22 M	$16.31 M
16 **Higher Interest Rate**	$54.60 M	50%	$51.18 M	$ 7.68 M	$58.85 M	$14.05 M
17 **Lower Interest Rate**	$54.60 M	50%	$50.10 M	$ 7.52 M	$57.62 M	$18.48 M
18 **30-Year Term**	$54.60 M	50%	$49.25 M	$ 7.39 M	$56.64 M	$26.71 M
19 **15-Year Term**	$54.60 M	50%	$53.10 M	$ 7.97 M	$61.07 M	$16.12 M
20 **$5 Higher Prices**	$54.60 M	50%	$49.55 M	$ 7.43 M	$56.98 M	$23.92 M
21 **$5 Lower Prices**	$54.60 M	50%	$51.70 M	$ 7.76 M	$59.46 M	$ 8.69 M
22 **Rate Increases**	$54.60 M	50%	$50.63 M	$ 7.59 M	$58.22 M	$25.25 M
23 **5% Higher Fiber Cost**	$56.24 M	50%	$52.40 M	$ 7.86 M	$60.26 M	$14.75 M
24 **5% Lower Fiber Cost**	$52.95 M	50%	$48.85 M	$ 7.33 M	$56.18 M	$17.86 M
25 **55% Penetration**	$55.73 M	55%	$50.51 M	$ 7.58 M	$58.08 M	$25.38 M
26 **60% Penetration**	$56.92 M	60%	$50.35 M	$ 7.55 M	$57.90 M	$34.43 M
27 **Breakeven Penetration**	$52.77 M	42%	$51.10 M	$ 7.67 M	$58.77 M	$ 1.66 M

EXHIBIT III: MAPS OF THE FIBER NETWORK



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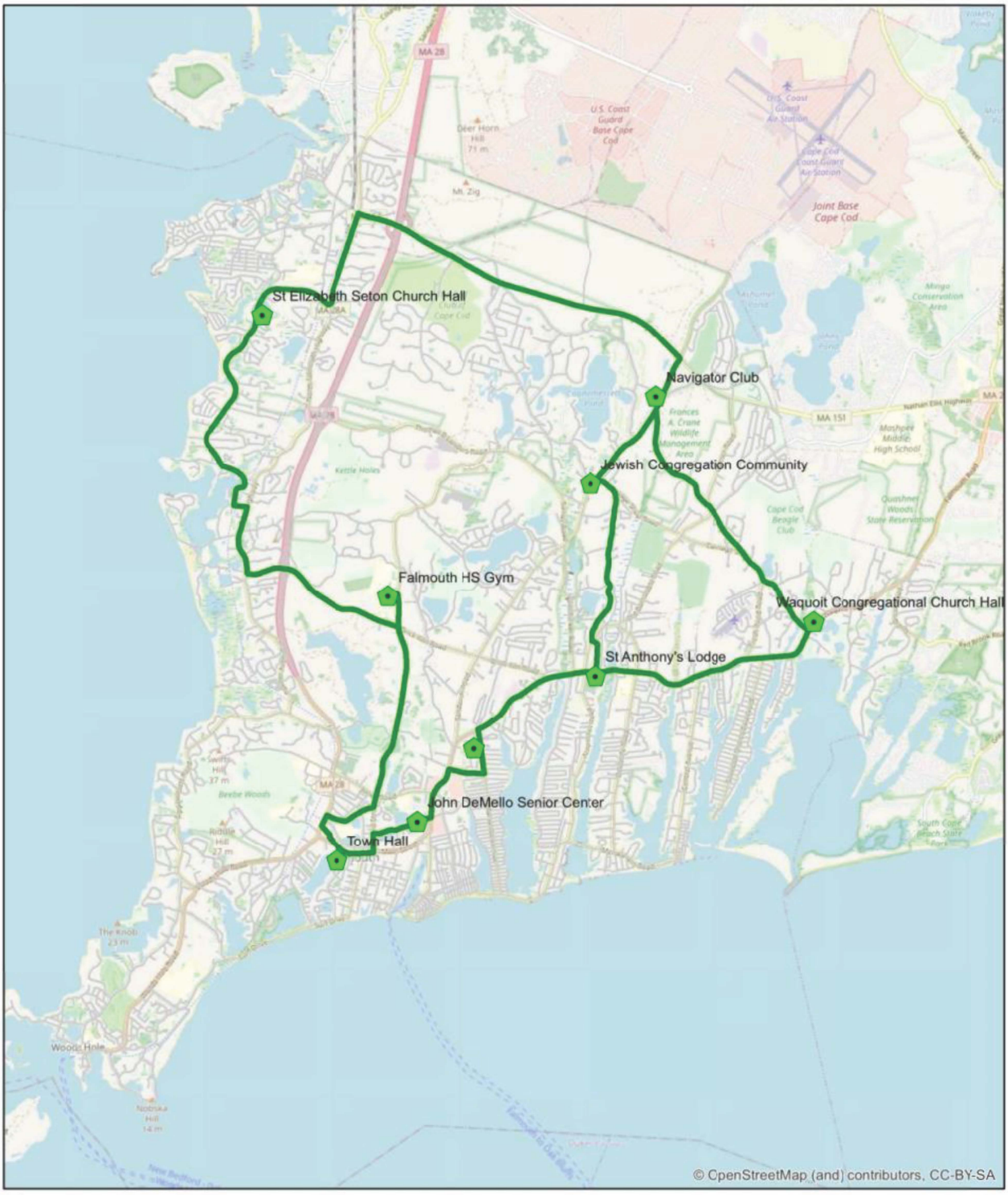
PROPOSED ROUTES

AERIAL

BURIED



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